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2009 SMBSC Research Report

Table of Contents

2009 SMBSC Official Variety Trials Specifications

Trial Location	Cooperator	Entry Designation	Previous Crop	Total Nitrogen	Starter Fertilizer	Planting Date	Stand Counts	Disease	Harvest Date
Hector	Keith Johnson	Official Trial	Soybeans	90	Yes	5/2/09	5/29/09	Heavy Rhizoctonia pressure	10/26/09
Lake Lillian	Schmoll Bros.	Official Trial	Sweet Corn	148	No	5/11/09	6/8/09	Rhizomania susceptible checks yielded 55% of plot ave.	9/28/09
Renville	C&P Haen	Official Trial	Soybeans	105	Yes	4/24/09	5/22/09	Moderate Rhizoctonia pressure Some Aphanomyces present	9/30/09
Murdock	Petersen Farms	Official Trial	Field Corn	118	No	5/5/09	6/3/09	Rhizomania susceptible checks yielded 75% of plot ave.	9/23/09

All trials were sprayed with RoundUp twice for weed control
Quadris was applied to all trials after thinning for rhizoctonia control.
Three leafspot fungicides were applied to all trial locations except Lake Lillian which received four applications.

2009 Disease Nursery Trial Specifications

Disease	Cooperator	Location	Ratings Performed By	Use of Ratings in 2010 Variety Approval
Cercospora	Betaseed	Rosemount	Betaseed	50 % of 2009 CLS Rating
Cercospora	SMBSC Randy Frieborg	Renville	SMBSC Research	50% of 2009 CLS Rating
Aphanomyces	Betaseed	Shakopee	Betaseed & U of M	50% of 2009 Aphanomyces Rating
Aphanomyces	Hilleshog	Glyndon	SMBSC Research	50% of 2009 Aphanomyces Rating
Rhizoctonia	USDA/ARS/BSDF Lee Panella	Ft. Collins, CO	USDA/ARS	Specialty Approval Status
Rhizcotonia	SMBSC Bob Condon	Clara City	SMBSC Research	Specialty Approval Status

SMBSC APPROVED VARIETIES – 2010

FULLY APPROVED
<u>UNLIMITED SALES VARIETIES</u>

- Beta 95RR03
- Beta 97RR17
- Beta 97RR37 (Root Aphid)
- Crystal RR201
- Crystal RR265

SPECIALTY
<u>APPROVED VARIETIES</u>

- Hilleshog 9093RR (Rhizoctonia)
- Hilleshog 4063RR (Rhizoctonia)
- Crystal RR875 (Rhizoc & Root Aphid)
- Beta 99RR33 (Rhizoc & Root Aphid)

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

- Beta 98RR08
- Crystal RR805 (Root Aphid)
- Crystal RR850 (Root Aphid)
- Hilleshog 4017RR
- Hilleshog 4081RR
- Hilleshog 4096RR (Root Aphid)
- SV 36832RR
- SV 36835RR

<u>Conventional Varieties – Available for planting for 2010 crop.</u>

- Beta 1322R
- Hilleshog 3036Rz

Table 3. Comparison of 2010 Approved Varieties to Candidate Test Market Varieties Based on 1 Year Data, 2009

Entry	Specialty	RST+ RSA	*Rec/T (lbs)* 1 yr avg	% of mean	*Rec/A (lbs)* 1 yr avg	% of mean	*Yield (T/A)* 1 yr avg	% of mean	*Sugar %* 1 yr avg	% of mean	*Cercospora Leaf Spot* 1 yr avg	% of mean	*Emerg-ence (%)* 1 yr avg	% of mean	*Aphano-myces* 1 yr avg	% of mean	*Purity (%)* 1 yr avg	% of mean	*Rhizoctonia Root Rating* Clara City	Ft. Collins	*Revenue/ Ton* % of mean	*Revenue/ Acre* % of mean
Beta 95RR03		201.02	256.38	97.43	9427.68	103.59	36.57	106.34	15.13	97.46	4.51	96.73	65.39	96.64	4.02	98.90	91.21	99.95	3.67	5.30	95.25	101.36
Beta 97RR17		195.66	263.05	99.96	8709.24	95.70	33.06	96.13	15.58	100.36	4.06	87.24	71.28	105.35	3.96	97.37	90.99	99.71	3.60	5.00	100.01	96.22
Beta 97RR37		200.54	267.70	101.73	8992.33	98.81	33.26	96.71	15.81	101.84	4.56	97.89	74.88	110.67	4.22	103.71	91.14	99.87	4.38		103.09	99.78
Crystal RR201		198.94	264.22	100.40	8967.41	98.54	33.65	97.85	15.51	99.91	5.25	112.69	62.20	91.93	3.91	96.06	91.60	100.38	5.04		100.67	98.58
Crystal RR265		203.85	264.43	100.48	9406.81	103.36	35.41	102.97	15.59	100.43	4.91	105.44	64.56	95.42	4.23	103.96	91.34	100.09	3.50		100.98	104.06
			<u>263.16</u>	<u>100.00</u>	<u>9100.69</u>	<u>100.00</u>	<u>34.39</u>	<u>100.00</u>	<u>15.52</u>	<u>100.00</u>	<u>4.66</u>	<u>100.00</u>	<u>67.66</u>	<u>100.00</u>	<u>4.07</u>	<u>100.00</u>	<u>91.26</u>	<u>100.00</u>	<u>4.04</u>	<u>5.15</u>	<u>100.00</u>	<u>100.00</u>

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

Beta 98RR08		212.64	273.94	104.10	9877.77	108.54	36.03	104.77	15.98	102.94	4.02	86.31	73.41	108.50	4.19	102.90	91.99	100.80	3.92		107.20	112.40
Crystal RR805		202.37	262.04	99.58	9354.94	102.79	35.82	104.16	15.36	98.94	4.58	98.34	70.49	104.18	4.04	99.40	91.71	100.50	5.22		99.15	103.35
Crystal RR850		200.44	270.23	102.69	8896.37	97.75	32.82	95.43	15.85	102.10	4.89	104.87	74.01	109.38	4.16	102.16	91.62	100.40	3.68		104.74	100.04
Hilleshog 4017RR		203.40	268.37	101.98	9229.92	101.42	34.73	100.99	15.76	101.52	5.54	118.83	72.25	106.78	4.31	105.93	91.48	100.25	4.36		103.34	104.44
Hilleshog 4081RR		199.24	262.27	99.66	9061.91	99.57	34.80	101.19	15.41	99.27	3.82	82.07	59.29	87.63	4.33	106.39	91.57	100.34	2.75	5.20	99.41	100.67
Hilleshog 4096RR		202.24	268.12	101.89	9133.01	100.36	34.12	99.21	15.79	101.71	4.02	86.24	64.54	95.39	4.21	103.50	91.38	100.14	2.94	4.70	103.45	102.71
SV 36832RR		195.54	259.99	98.80	8804.16	96.74	33.83	98.37	15.27	98.36	5.33	114.36	63.93	94.48	4.46	109.64	91.68	100.46	4.00		98.01	96.49
SV 36835RR		201.15	262.38	99.71	9231.97	101.44	35.23	102.44	15.33	98.75	5.00	107.22	70.29	103.88	3.56	87.56	92.04	100.86	3.36		99.57	102.08

2009 SPECIALTY APPROVED VARIETIES (% OF MEAN IS OF APPROVED MEAN)

Beta 99RR33	RZC	196.77	255.49	97.09	9071.42	99.68	35.72	103.87	15.02	96.75	4.68	100.40	73.64	108.84	4.23	103.90	91.65	100.43	2.36	3.50	94.97	98.72
Crystal RR875	RZC	194.78	253.59	96.36	8956.52	98.42	35.52	103.29	14.97	96.43	4.52	96.96	71.64	105.88	4.36	107.15	91.35	100.10	2.92	4.10	93.69	96.84
Hilleshog 4063RR	RZC	202.97	262.55	99.77	9391.52	103.20	36.13	105.06	15.46	99.59	4.93	105.76	74.03	109.41	3.81	93.68	91.39	100.15	2.85	3.70	99.57	104.69
Hilleshog 9093RR	RZC	202.11	261.13	99.23	9363.08	102.88	35.84	104.22	15.40	99.20	4.70	100.89	73.91	109.23	3.53	86.71	91.38	100.14	3.15	3.90	98.84	103.08

Table 2. Comparison of 2010 Approved Varieties to Candidate Test Market Varieties Based on 2 Year Data, 2008 - 2009

Entry	Specialty	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	*Emergence (%)* 2 yr avg	% of mean	*Aphanomyces* 2 yr avg	% of mean	*Purity (%)* 2 yr avg	% of mean	*Revenue/ Ton* % of mean	*Revenue/ Acre* % of mean
2010 APPROVED VARIETIES																				
Beta 95RR03		199.86	258.36	97.88	8588.16	101.98	33.30	104.41	15.34	97.96	4.59	99.01	60.19	91.79	4.19	99.95	90.75	99.96	96.19	100.46
Beta 97RR17		195.41	264.70	100.28	8011.43	95.13	30.31	95.05	15.73	100.41	4.34	93.61	67.46	102.87	4.13	98.40	90.68	99.88	100.49	95.54
Beta 97RR37		201.26	265.98	100.77	8462.69	100.49	31.63	99.19	15.84	101.12	4.56	98.34	72.96	111.26	4.28	102.12	90.54	99.72	101.42	100.62
Crystal RR201		198.61	263.93	99.99	8305.17	98.62	31.40	98.47	15.63	99.78	5.17	111.54	65.73	100.24	3.99	95.19	90.95	100.18	99.99	98.49
Crystal RR265		204.87	266.82	101.08	8740.00	103.78	32.81	102.88	15.78	100.73	4.52	97.50	61.53	93.83	4.38	104.33	91.03	100.26	101.92	104.89
			<u>263.96</u>	<u>100.00</u>	<u>8421.49</u>	<u>100.00</u>	<u>31.89</u>	<u>100.00</u>	<u>15.66</u>	<u>100.00</u>	<u>4.63</u>	<u>100.00</u>	<u>65.58</u>	<u>100.00</u>	<u>4.19</u>	<u>100.00</u>	<u>90.79</u>	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>
TEST MARKET VARIETIES FOR LIMITED SALES WITH 2 YEARS OF DATA (% OF MEAN IS OF APPROVED MEAN)																				
Beta 98RR08		210.55	273.32	103.55	9011.19	107.00	33.02	103.53	16.02	102.30	4.27	92.27	68.07	103.81	4.38	104.30	91.58	100.87	106.15	109.94
Crystal RR805		203.66	265.74	100.68	8672.84	102.98	32.94	103.28	15.66	99.97	4.82	103.95	69.15	105.45	4.73	112.74	91.28	100.53	101.13	104.48
Crystal RR850		201.57	272.16	103.11	8291.79	98.46	30.48	95.58	16.00	102.14	4.87	105.11	69.32	105.71	4.66	111.18	91.40	100.67	105.43	100.79
Hilleshog 4017RR		203.47	269.38	102.05	8541.13	101.42	32.05	100.50	15.93	101.72	5.20	112.12	67.54	102.99	5.01	119.45	90.94	100.17	103.53	104.08
Hilleshog 4081RR		199.94	264.35	100.15	8404.12	99.79	32.11	100.68	15.63	99.81	4.02	86.75	61.16	93.27	4.80	114.36	91.03	100.27	100.25	100.96
Hilleshog 4096RR		202.36	267.50	101.34	8507.31	101.02	31.91	100.07	15.83	101.08	3.97	85.59	62.68	95.58	4.85	115.54	90.97	100.19	102.42	102.52
SV 36832RR		203.42	266.46	100.95	8630.24	102.48	32.48	101.85	15.67	100.03	4.97	107.24	62.66	95.55	5.07	120.93	91.47	100.74	101.70	103.61
SV 36835RR		203.44	266.29	100.88	8637.20	102.56	32.62	102.28	15.62	99.71	5.14	110.93	68.35	104.23	4.22	100.56	91.65	100.94	101.55	103.89
2010 SPECIALTY APPROVED VARIETIES (% OF MEAN IS OF APPROVED MEAN)																				
Crystal RR875	Spec	193.36	253.94	96.20	8181.92	97.16	32.38	101.53	15.04	96.02	4.45	95.99	69.86	106.54	4.54	108.14	91.09	100.33	93.43	94.89
Hilleshog 4063RR	Spec	202.88	262.70	99.52	8704.29	103.36	33.38	104.68	15.56	99.36	4.59	99.16	71.63	109.24	4.46	106.43	90.91	100.14	99.14	103.81
Hilleshog 9093RR	Spec	204.93	262.36	99.39	8887.34	105.53	33.94	106.45	15.54	99.24	4.48	96.71	69.51	105.99	4.17	99.51	90.98	100.21	99.07	105.48

* Revenue per Ton and Revenue per Acre figures were produced using the SMBSC payment forumla for the 2008 crop.

Table 1. Mean of the Three Year 2010 SMBSC Varieties Approved for Unlimited Sales - Based Upon Approval Criteria

Entry	RST+ RSA	*Rec/T (lbs)* 3 yr avg	*Rec/T (lbs)* % of mean	*Rec/A (lbs)* 3 yr avg	*Rec/A (lbs)* % of mean	*Yield (T/A)* 3 yr avg	*Yield (T/A)* % of mean	*Sugar %* 3 yr avg	*Sugar %* % of mean	*Cercospora Leaf Spot* 3 yr avg	*Cercospora Leaf Spot* % of mean	*Emerg-ence (%)* 3 yr avg	*Emerg-ence (%)* % of mean	*Aphano-myces* 3 yr avg	*Aphano-myces* % of mean	*Purity (%)* 3 yr avg	*Purity (%)* % of mean	*Revenue/ Ton* % of mean	*Revenue/ Acre* % of mean
2010APPROVED VARIETIES																			
Beta 95RR03	199.26	259.00	98.14	8315.18	101.12	32.36	103.43	15.43	98.25	4.64	98.17	62.02	97.22	4.30	94.32	90.52	99.96	96.72	100.07
Beta 97RR17	197.79	264.84	100.35	8011.97	97.43	30.37	97.06	15.74	100.25	4.66	98.54	67.03	105.08	4.14	90.86	90.62	100.07	100.61	97.68
Beta 97RR37	200.68	264.74	100.32	8252.96	100.36	31.18	99.66	15.83	100.80	4.68	99.14	69.92	109.61	4.83	105.94	90.21	99.62	100.59	100.28
Crystal RR201	197.00	265.77	100.71	7918.56	96.30	29.88	95.49	15.76	100.34	5.14	108.76	59.62	93.47	4.73	103.75	90.80	100.27	101.22	96.68
Crystal RR265	205.27	265.17	100.48	8616.75	104.79	32.65	104.36	15.76	100.37	4.51	95.39	60.36	94.62	4.80	105.13	90.63	100.08	100.86	105.29
		263.90	**100.00**	**8223.08**	**100.00**	**31.29**	**100.00**	**15.71**	**100.00**	**4.72**	**100.00**	**63.79**	**100.00**	**4.56**	**100.00**	**90.56**	**100.00**	**100.00**	**100.00**

TEST MARKET VARIETIES FOR LIMITED SALES WITH 3 YEARS OF DATA (% of Mean is of Approved Mean)

Entry	RST+ RSA	Rec/T 3 yr avg	Rec/T % of mean	Rec/A 3 yr avg	Rec/A % of mean	Yield 3 yr avg	Yield % of mean	Sugar % 3 yr avg	Sugar % % of mean	Cercospora 3 yr avg	Cercospora % of mean	Emergence 3 yr avg	Emergence % of mean	Aphanomyces 3 yr avg	Aphanomyces % of mean	Purity 3 yr avg	Purity % of mean	Revenue/ Ton % of mean	Revenue/ Acre % of mean
Hilleshog 4017RR	203.12	267.97	101.54	8353.17	101.58	31.49	100.65	15.88	101.11	5.21	110.27	62.68	98.26	5.40	118.40	90.80	100.27	102.64	103.34

* Revenue per Ton and Revenue per Acre figures were produced using the SMBSC payment forumla for the 2008 crop.

2009 SMBSC Strip Trial Results

Agriculturist:	Lonny Buss	Plant date:	5/4/2009
Location:	Hancock	Harvest date:	9/18/2009

Variety	Tons Per Acre	Sugar %	Purity %	Brei Nitrate	ESA lbs/acre
Beta 66RR70	33.85	15.98	92.25	18	9315
Beta 95RR03	30.43	16.26	91.92	24	8491
Beta 97RR17	32.41	16.56	90.27	18	9008
Crystal RR265	31.69	16.18	91.55	26	8752
Crystal RR658	31.36	16.26	92.29	16	8795
Crystal RR811	36.26	15.69	92.27	21	9789
Hilleshog 4017RR	33.31	16.89	92.17	25	9708
Hilleshog 9093RR	32.42	16.55	91.84	13	9207
Average	32.72	16.30	91.82	20.13	9133.13

2009 SMBSC Strip Trial Results

Agriculturist:	Greg Johnson	Plant date:	4/23/2009
Location:	Olivia	Harvest date:	9/16/2009

Variety	Tons Per Acre	Sugar %	Purity %	Brei Nitrate	ESA lbs/acre
Beta 95RR03	30.55	16.27	92.61	8	8610
Beta 97RR17	29.07	16.83	92.42	9	8469
Crystal RR265	31.01	16.89	91.82	11	8995
Crystal RR658	33.03	16.89	92.8	8	9709
Hilleshog 4017RR	29.51	17.29	92.44	14	8848
Hilleshog 9093RR	31.61	16.83	91.69	15	9118
Average	30.80	16.83	92.30	10.83	8958.17

2009 SMBSC Strip Trial Results

Agriculturist:	Jim Radermacher	Plant date:	4/22/2009
Location:	Raymond	Harvest date:	9/18/2009

Variety	Tons Per Acre	Sugar %	Purity %	Brei Nitrate	ESA lbs/acre
Beta 17RR62	24.16	16.66	92.84	20	7003
Beta 66RR70	26.79	17.37	92.71	34	8101
Beta 95RR03	22.45	16.09	93.8	22	6351
Crystal RR265	26.45	15.75	92.5	16	7192
Hilleshog 9093RR	26.95	16.52	93.05	28	7764
SV 36835RR	30.51	17.21	92.98	17	9169
Average	26.22	16.60	92.98	22.83	7596.67

2009 SMBSC Strip Trial Results

Agriculturist:	Les Plumley	Plant date:	
Location:	Bird Island	Harvest date:	9/3/2009

Variety	Tons Per Acre	Sugar %	Purity %	Brei Nitrate	ESA lbs/acre
Holly Exp.14	17.32	14.92	91.25	49	4371
SV 36835RR	19.7	15.1	91.1	28	5024
Hill 9093RR	10.88	15.32	91	26	2814
Crystal RR265	17.49	15	90.39	30	4385
Holly Exp 15	17.05	15.26	91.79	29	4440
SV 36835 P.Beta	22.1	15.13	91.28	27	5663
Beta 95RR03	16.95	15.12	90.56	37	4296
Average	17.36	15.12	91.05	32.29	4427.57

2009 SMBSC Strip Trial Results

Agriculturist: Lonny Buss Plant date: 5/2/2009

Location: Montevideo Harvest date: 9/24/2009

Variety	Tons Per Acre	Sugar %	Purity %	Brei Nitrate	ESA lbs/acre
Beta 17RR62	25.8	18.36	92.69	7	8268
Beta 66RR70	24.07	16.75	91.61	20	6901
Beta 97RR17	21.01	16.84	91.86	6	6079
Crystal RR265	25.26	17.92	91.59	9	7774
Crystal RR658	23.2	16.06	92.47	6	6437
Hilleshog 4017RR	23.97	17.04	92.19	12	7054
Average	23.89	17.16	92.07	10.00	7085.50

2009 SMBSC Strip Trial Results

Agriculturist: Mike Schjenken Plant date: 5/2/2009

Location: Renville Harvest date: 10/26/2009

Variety	Tons Per Acre	Sugar %	Purity %	Brei Nitrate	ESA lbs/acre
Beta 95RR03	27.47	14.82	93.43	32	7088
Crystal RR265	27.47	14.84	94	31	7150
Crystal RR811	33.03	14.57	93.51	36	8378
Hilleshog 9093RR	32.93	15.7	92.59	30	8934
Holly Hybrids 15	32.24	14.75	93.64	32	8300
SV 36835	31.35	15.26	94.24	25	8432
Average	30.75	14.99	93.57	31.00	8047.00

2009 SMBSC Strip Trial Results

Agriculturist: Paul Wallert — Plant date: 5/6/2009

Location: Murdock — Harvest date: 9/18/2009

Variety	Tons Per Acre	Sugar %	Purity %	Brei Nitrate	ESA lbs/acre
Beta 95RR03	25.9	15.78	90.97	38	6909
Beta 97RR17	26.9	15.43	89.32	43	6840
Crystal RR811	25.6	16.71	91.24	40	7283
Hilleshog 9093RR	30	15.75	88.22	50	7666
SES/VDH 36835	27.7	16.98	91.91	17	8090
VDH Exp 15	30.6	16.89	91.84	29	8878
Average	27.78	16.26	90.58	36.17	7611.00

2009 SMBSC Strip Trial Results

Agriculturist: Reynold Hansen — Plant date: 5/2/2009

Location: Maynard — Harvest date: 9/17/2009

Variety	Tons Per Acre	Sugar %	Purity %	Brei Nitrate	ESA lbs/acre
Beta 95RR03	24.83	17.14	91.42	21	7275
Beta 97RR17	22.36	17.52	91.73	14	6733
Crystal RR265	25.75	17.2	91.9	14	7622
Crystal RR658	27.11	15.87	92.43	14	7424
Hilleshog 9093RR	23.69	17.66	92.14	22	7234
Holly Exp 15	29.58	16.29	92.38	16	8322
Average	25.55	16.95	92.00	16.83	7435.00

2009 SMBSC Strip Trial Results

Agriculturist: Jim Rademacher — Plant date: 4/22/2009

Location: Belgrade -early harvest — Harvest date: 9/18/2009

Variety	Tons Per Acre	Sugar %	Purity %	Brei Nitrate	ESA lbs/acre
Beta 66RR70	31.32	14.84	91.83	26	7922
Beta 95RR03	32.66	15.23	91.26	24	8425
Beta 97RR17	29.52	15.6	90.79	18	7760
Crystal RR265	32.01	15.01	91.12	34	8115
Crystal RR658	35.01	15.04	92.1	15	9015
Crystal RR811	27.7	14.66	91.39	23	6874
Hilleshog 4017RR	31.23	15.95	91.3	15	8465
Hilleshog 9093RR	36.24	15.62	91.75	12	9668
Average	31.96	15.24	91.44	20.88	8280.50

2009 SMBSC Strip Trial Results

Agriculturist: Jim Rademacher — Plant date: 4/22/2009

Location: Belgrade-late harvest — Harvest date: 10/28/2009

Variety	Tons Per Acre	Sugar %	Purity %	Brei Nitrate	ESA lbs/acre
Beta 95RR03	38.84	14.91	93.2	25	10056
Hilleshog 9093RR	35.84	15.54	93.42	19	9725
Hilleshog 4017RR	35.65	15.78	93.03	16	9781
Crystal RR265	36.68	14.62	92.85	23	9258
Crystal RR658	37.89	14.67	93.5	21	9680
Crystal RR811	38.43	14.83	92.82	26	9844
Beta 66RR70	39.88	14.64	93.54	22	10172
Beta 97RR17	37.16	15.89	92.85	22	10247
Average	37.55	15.11	93.15	21.75	9845.38

DIFFERENCES IN RESISTANCE BREAKING ISOLATES OF BNYVV FROM MINNESOTA AND CALIFORNIA

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Although most resistance genes (*R*-genes) deployed against virus infections have lasted more than 25 years, the effectiveness of *Rz1* that confers partial resistance against *Beet necrotic yellow vein virus* (BNYVV) was compromised in approximately 10 years in MN/ND by the emergence of resistance breaking (RB) strains of BNYVV (5). Using reverse genetics, Koenig *et al*. (3) demonstrated that for European A type isolates of BNYVV, valine at position 67 of the BNYVV p25 protein was required to overcome *Rz1*-mediated resistance and allow normal virus replication. This amino acid substitution was previously associated with breakdown of *Rz1* mediated resistance in field infected plants from the California Imperial Valley (CIV, 1, 2). However, Liu and Lewellen (4) did not find a correlation between p25 sequences of numerous North American isolates and virus titer in *Rz1*-plants in greenhouse assays. This suggested that BNYVV genetic background may affect the resistance breaking requirements of the p25 gene. Therefore, the objective of this work was to look for correlations between BNYVV p25 gene sequences and severity of rhizomania in *Rz1*-plants in the field.

Materials and Methods

Virus Isolates. BNYVV was baited from field soils, from sugar beet production regions around the USA. These soil samples, some of which had been collected as early as 1991, were from the rhizosphere of symptomatic and asymptomatic *Rz1*-plants, and symptomatic susceptible (*rz1*) plants. For virus quantification and genotyping using TaqMan specific probes, four to six *Rz1*-plants were collected from inside and outside of rhizomania spots, and individually analyzed for virus infection (2). Each sample consisted of around 0.1g of diseased hairy roots, or normal lateral roots from those plants without rhizomania. Samples from Minnesota (MN) were from four fields near Crookston and seven near Willmar.

Total RNA Extraction and Viral RNA Quantification. For RNA extraction, plant root tissue was powdered by immersing microfuge tubes in liquid nitrogen and then shaking them at 1600 rpm for 2 min in a high throughput homogenizer. Total RNA was extracted following the RNeasy Plant Mini Kit (Qiagen, Valencia, CA) protocol. The concentration of nucleic acids in total RNA-preparations was estimated by spectrophotometry and adjusted to 20 ng μL^{-1} for viral RNA quantification. The amount of viral RNA encoding sequences recognized by specific TaqMan probes was estimated by relative quantification (RQ) realtime RT-PCR. To estimate BNYVV RNA-2 titer, specific primers plus the TaqMan probe were incorporated in one-step RT-PCR to target the core of the CP gene. For detection and quantification of BNYVV RNA-3 p25, the allelic discrimination primers were used (2). Realtime reactions were performed by an ABI Prism 7000 system (Applied Biosystems, Inc., Foster City, CA) using the following sequential conditions: reverse transcription at 48ºC for 30 min, reverse transcriptase inactivation at 95ºC for 10 min, and amplification during 40 cycles of denaturing at 95ºC for 15 s and annealing at 60ºC for 1 min.

RT-PCR, cloning, sequencing and sequencing analysis. First strand cDNA was synthesized using the Omniscript® reverse transcriptase kit (Qiagen Inc., Valencia, CA). PCR was performed in a second tube and DNA amplification occurred during 30 cycles of denaturing at 94ºC for 30 s, annealing at 56ºC for 30 s, and extending at 68ºC for 1 min 30 s. Amplicons were cleaned, quantified by spectrophotometry, and submitted for consensus DNA sequencing and/or recombined with pCR-Blunt vector for sequencing individual cDNA clones. Amplicons and plasmid DNA were sequenced by Beckman Coulter Genomics Inc., Beverly MA.

The basic processing of cDNA sequences, such as assembling, correction, and alignment, was performed with Lasergene package v8 (Dnastar Inc., Madison, WI), and the chromatograms were inspected with Sequence Scanner v1.0 (Applied Biosystems, Inc.) to verify the presence of mutations. Genetic relationships were determined by the neighbor-joining algorithm as implemented in MEGA 3.1. This software was also used to calculate genetic distances between individual sequences and groups of sequences. Genetic differentiation between pairs of populations was statistically estimated by the Wright's F_{ST} index of dissimilarity.

Results

The relative titer of p25 with the $A_{67}C_{68}$ motif in relation to total BNYVV titer was estimated in asymptomatic (i.e., green plants generally without rhizomania) and symptomatic (i.e., yellow plants with rhizomania) *Rz1*-plants collected from MN and CA. Specific TaqMan probes, one targeting the RNA-3 p25 region encompassing the codons GCU and UGU for $A_{67}C_{68}$ and another the RNA-2 CP coding region, were used to estimate WT p25 and total virus titers, respectively. In total, 37 green and 50 yellow plants infected by BNYVV were analyzed. As expected, roots from yellow plants typically contained significantly greater viral RNA-2 titer than green plants, even though BNYVV was infecting both groups. The greater RNA-2 titer in yellow plants was usually associated with lower titer or disappearance of the BNYVV RNA-3 $A_{67}C_{68}$ p25 motif in the infecting virus population. This suggested that most of these severely infected *Rz1*-plants were carrying a different, and consequently undetected, BNYVV RNA-3 p25-motif. Furthermore, by targeting the samples from MN with a

TaqMan probe for detection of the RB $V_{67}L_{68}$ p25-motif (2), it was revealed that these isolates were not carrying this specific RB allele. In BNYVV isolates from CA, the situation was different; RNA-3 p25 encoding $V_{67}L_{68}$ predominated in yellow plants and its titer was proportional to total virus content. By contrast, in the surrounding green plants, $V_{67}L_{68}$ p25-motif was generally undetected or in low concentration regardless of virus titer.

Breakdown of Rz1-mediated resistance in MN. Virus titer and consensus DNA sequences of WT and RB isolates from MN were analyzed to investigate the lack of RNA-3 p25 encoding $A_{67}C_{68}$ in yellow *Rz1*plants. Relative BNYVV quantification by realtime RT-PCR revealed that yellow plants contained the highest viral RNA-2 titers and green plants contained the lowest. Furthermore, sequences derived from yellow plants carried the $V_{67}C_{68}$ p25-motif whereas all isolates from green plants coded for WT $A_{67}C_{68}$. The genetic change behind this amino acid shift was a nucleotide transition from C to U at codon 67. Thus, the same mutation at RNA-3 p25 position 67 observed in RB variants from MN and the CIV accounted for the capability of BNYVV to cause rhizomania in the sampled yellow patches from MN-2007.

The phylogenetic differentiation between isolates from CIV and other parts of the USA, along with the high similarity between WT and RB isolates from MN, suggested that the determinant mutation to overcome *Rz1*(p25 V_{67}) occurred in parallel between CIV and MN isolates. To test this, genetic distances between WT and RB isolates from both regions were more precisely estimated. Consensus sequences of isolates from CIV and MN were grouped according to their pathogenicity in *Rz1*-plants to conform the groups WT_{MN}, WT_{CIV}, RB_{MN}, and RB_{CIV}. Then, the average number of nucleotide differences and percent of genetic differences was calculated between these four groups. This populational analysis revealed that WT and RB isolates from MN were more closely related each other than to either of the two groups from CIV. Similarly, RB and WT isolates from CIV were more closely related to each other than to any isolate from MN.

Discussion

The results presented in this paper indicate that BNYVV isolates encoding the amino acids $A_{67}C_{68}D_{135}$ in RNA-3 p25 predominated in most production regions of the USA infecting susceptible sugar beet genotypes lacking the dominant *Rz1* allele. Apparently, the consensus WT BNYVV genotype has been maintained to date with minimal variation since at least 1991, and perhaps before the massive commercialization of *Rz1*-cultivars. Also, WT BNYVV was consistently found in asymptomatic *Rz1*-plants from MN. However, in CIV, most WT isolates encoded $A_{67}L_{68}D_{135}$ instead. At present, it is unknown whether p25 evolved in CIV from $A_{67}C_{68}D_{135}$ to $A_{67}L_{68}D_{135}$ or both have been independently introduced in this region. On average, WT isolates from MN and CIV differentiated from each other by approximately 3.4 fixed nucleotide substitutions. Two of these mutations occurred at codon 68 where they caused an amino acid replacement that is under strong diversifying selection. The expected adaptive contribution that this amino acid change may have on virus fitness is still unknown. Surprisingly, the same nucleotide C to U substitution at codon 67, which confers to the ability of BNYVV to overcome *Rz1* was incorporated in RB variants from two highly variable production systems. The fact that this nucleotide substitution was a C to U transition in a hypervariable region suggests that RB variants could easily originate multiple times by convergent evolution, which may explain the reduced resistance durability of *Rz1* in the field.

Strong selection pressure seems to favor the occurrence of parallel nucleotide substitutions in distant virus populations. Therefore, it is possible that the $A_{67}V$ amino acid substitution in BNYVV p25 might have frequently occurred in parallel during distinct epidemic episodes. The agricultural relevance of this type of study is self explanatory: a high frequency of newly emerging RB variants of BNYVV will drastically limit the useful duration of *Rz1*-cultivars in the field.

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SMBSC Evaluation of Fungicides for control of Cercospora Leaf Spot in Sugarbeet Growth-2009

Objectives

The objectives of the fungicide testing in 2009 for control of cercospora leaf spot was two fold. There were two test conducted to evaluate fungicides for cercospora leaf spot control.

The first 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 (Exp. # 0941).

The second test discussed in this report is an evaluation of program scenarios for control of cercospora leaf spot and the influence on sugarbeet production. This test will be termed as evaluation of fungicide programs (Exp. # 0946).

Methods

Table 1 shows the specifics of activities conducted at the cercospora leaf spot site in 2009. 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 on 10/18/09 with a 2 row research harvester. Two rows of the six row plot were harvested analyzed for quality.

The tests were replicated 6 times. Untreated checks were conducted twice in Exp. 0941 and three times in Exp. 0946 in each replication. Control checks were conducted twice in Exp. 0941 and Exp. 0946 in each replication. The application of multiple checks allow for reduced variability of disease across testing area. The control check is designated by highlighting within the tables presenting data. Due to the multiple checks and controls within each replication the analysis of these data demands multiple least significant differences (LSD) for determination of differences between treatments. For this discussion LSD3 will be used to determined differences between comparisons between treatments and check treatments.

Results and Discussion

Fungicide Single Chemistry evaluation for Cercospora leaf spot control

Tables 3-5 shows the data collected from the testing of fungicides with single chemistry. This test is conducted as basic research to determine the value and efficacy of an individual fungicide. Table 3 presents the results for nutrient analysis to determine treatment of single chemistry fungicides on the presence of the tested nutrients in the leaves. The results of the analysis indicates that the higher the level of disease after treating the sugarbeets with a specific fungicide, the higher the level of NO_3, total N and boron (B). The increased level of NO_3 and total N gives reason for the reduction in quality from increase level of cercospora leaf spot. A higher level of Boron indicates an elevated tie up of B in the leaves. In recent production season a deficiency of B has been discovered in low lying areas in sugarbeet fields in the Southern Minnesota Beet Sugar growing area. One theory may be that the low lying areas which typically propagate a higher level of leaf and root diseases in sugarbeets may cause a deficiency in the sugarbeets due to the potentially higher disease level in the low lying areas.

Table 4 shows the cercospora leaf spot ratings for fungicides with single chemistries.

Table 1. Specifics for 2009 Cercospora Leaf Spot location

DATE	PLANTED	VARIETY	SPACING	SOIL	Innoculation	APPLIED	RATE	PRESSURE	WEATHER
5/9/2009	X	Hill 4017RR	5"	Dry					
5/27/2009						Glyphosate @ 22 oz.	15 gpa	40 psi	5 mph SE, Sunny, 65'
6/5/2009						Quadris @ 30 oz.	14 gpa	30 psi	10 mph NW, Sunny, 70'
6/15/2009						Glyphosate @ 22 oz.	15 gpa	40 psi	5 mph W, Sunny, 72'
7/6/2009					X				
7/16/2009					X				
7/22/2009						**	20 gpa	120 psi	
7/28/2009 CLS evaluation									
8/11/2009 CLS evaluation									
8/28/2009 CLS evaluation									
9/15/2009 CLS evaluation									

Note: ** Sprayed first CLS fungicide applications on 7-22-08
CLS spots observed
All application kept on 14 day spray interval

Table2. 0941 Single chemistry fungicide influence on nutrient uptake evaluated by leaf sample analysis SMSBC program																
Trt	FUNGICIDE	Rate oz/acre	Interval Days between	NO3	Total N	P	K	S	Ca	Mg	Na	Zn	Fe	Mn	Cu	B
1	Check	N/A	N/A	1264	3.5	0.3	4.1	0.5	1.2	0.8	2.3	36.7	99.0	69.7	9.3	41.3
2	PICOXY SC + NIS	6 +2%	14	19	2.6	0.2	5.3	0.7	1.9	1.2	1.8	56.0	101.0	103.0	11.0	29.0
	PICOXY SC + NIS	6 +2%	14													
	PICOXY SC + NIS	6 +2%	14													
3	PICOXY SC + NIS	9 + 2%	14	12	2.0	0.3	5.5	0.5	0.9	0.6	1.3	36.0	56.0	42.0	7.0	20.0
	PICOXY SC + NIS	9 + 2%	14													
	PICOXY SC + NIS	9 + 2%	14													
4	PICOXY SC + NIS	12 + 2%	14	22	1.9	0.2	4.9	0.7	1.3	0.8	2.0	46.0	102.0	71.0	11.0	21.0
	PICOXY SC + NIS	12 + 2%	14													
	PICOXY SC + NIS	12 + 2%	14													
5	EMINENT	13	14	627	2.4	0.2	4.6	0.4	1.0	0.6	2.3	35.0	66.0	52.0	6.0	26.5
	EMINENT	13	14													
	EMINENT	13	14													
6	HEADLINE	9.2	14	12	2.1	0.2	4.4	0.3	1.0	0.4	1.2	22.0	65.0	34.0	5.0	21.0
	HEADLINE	9.2	14													
	HEADLINE	9.2	14													
7	PROLINE+INDUCE	5+0.125	14	12	1.8	0.2	4.7	0.5	1.5	0.7	2.3	30.0	75.0	53.0	3.0	22.0
	PROLINE+INDUCE	5+0.125	14													
	PROLINE+INDUCE	5+0.125	14													
8	GEM 500 SC	3.5	14	167	2.2	0.2	3.2	0.6	1.7	0.9	3.4	39.0	194.0	86.0	5.0	27.0
	GEM 500 SC	3.5	14													
	GEM 500 SC	3.5	14													
9	INSPIRE-XT A8122	7	14	40	2.1	0.3	4.2	0.5	1.4	0.6	2.0	36.0	148.0	49.0	8.0	30.0
	INSPIRE-XT A8122	7	14													
	INSPIRE-XT A8122	7	14													
10	QUADRIS TOPS-A13703	8.5	14	421	3.5	0.2	4.0	0.6	1.1	0.6	3.0	37.0	103.0	50.0	8.0	32.0
	QUADRIS TOPS-A13703	8.5	14													
	QUADRIS TOPS-A13703	8.5	14													
11	TAEGRO	2.6	14	122	2.6	0.2	4.3	0.4	0.7	0.3	2.2	30.0	117.0	30.0	9.0	26.0
	TAEGRO	2.6	14													
	TAEGRO	2.6	14													
12	TAEGRO	5.2	14	1293	3.2	0.2	4.0	0.6	1.2	0.8	2.7	38.0	118.0	89.0	9.0	38.0
	TAEGRO	5.2	14													
	TAEGRO	5.2	14													
14	SUPERTIN	5	14	290	3.1	0.2	3.7	0.5	1.1	0.6	2.3	41.0	72.0	59.0	9.0	25.0
	SUPERTIN	5	14													
	SUPERTIN	5	14													
15	JAU6476&TRIFLOXYSTR OBIN	11	14	1222	4.3	0.2	3.4	0.6	1.4	1.1	2.4	39.0	119.0	56.0	7.0	26.0
	JAU6476&TRIFLOXYSTR OBIN	11	14													
	JAU6476&TRIFLOXYSTR OBIN	11	14													
16	SA-Tin		14	3413	3.7	0.2	3.0	0.4	0.9	0.7	4.1	26.0	80.0	56.0	5.0	34.0
	SA-Tin		14													
	SA-Tin		14													
	-control															
			C.V.%	73	14.5	12.1	16.5	10.3	12.2	18.3	16.7	13.7	12.4	27.1	2.9	18.8
	Notes		LSD 1 (0.05)	805	0.7	0.0	1.2	0.1	0.2	0.2	0.6	8.3	20.2	27.1	0.4	9.1
LSD 1 = comparison of non check treatment			LSD 2 (0.05)	493	0.4	0.0	0.7	0.1	0.1	0.1	0.4	5.1	12.4	16.6	0.2	5.6
LSD 2= comparison of control vs. check			LSD 3 (0.05)	604	0.5	0.0	0.9	0.1	0.2	0.2	0.5	6.2	15.2	20.4	0.3	6.8
D 3 = comparison of non check treatments to check																

Table 4. 0941 Single chemistry fungicide influence on sugarbeet production SMBSC program

Trt	FUNGICIDE	Rate oz/acre	Interval Days between sprays	CLS RATING 9/16/09	Tons Per Acre	Sugar	Purity	PPM Nitrate
1	Check	N/A	N/A	8.3	20.0	13.94	91.23	74
2	PICOXY SC + NIS	6 +2%	14	4.1	24.0	15.32	93.11	36
	PICOXY SC + NIS	6 +2%	14					
	PICOXY SC + NIS	6 +2%	14					
3	PICOXY SC + NIS	9 + 2%	14	8.3	21.3	15.01	92.92	50
	PICOXY SC + NIS	9 + 2%	14					
	PICOXY SC + NIS	9 + 2%	14					
4	PICOXY SC + NIS	12 + 2%	14	8.0	24.2	15.05	92.83	42
	PICOXY SC + NIS	12 + 2%	14					
	PICOXY SC + NIS	12 + 2%	14					
5	EMINENT	13	14	4.1	29.4	15.74	92.78	29
	EMINENT	13	14					
	EMINENT	13	14					
6	HEADLINE	9.2	14	3.9	31.5	15.67	93.09	31
	HEADLINE	9.2	14					
	HEADLINE	9.2	14					
7	PROLINE+INDUCE	5+0.125	14	3.4	31.6	15.31	92.28	34
	PROLINE+INDUCE	5+0.125	14					
	PROLINE+INDUCE	5+0.125	14					
8	GEM 500 SC	3.5	14	3.1	31.5	15.48	92.93	34
	GEM 500 SC	3.5	14					
	GEM 500 SC	3.5	14					
9	INSPIRE-XT A8122	7	14	2.7	31.3	16.01	93.33	23
	INSPIRE-XT A8122	7	14					
	INSPIRE-XT A8122	7	14					
10	QUADRIS TOPS-A13703	8.5	14	2.7	28.6	15.75	92.29	28
	QUADRIS TOPS-A13703	8.5	14					
	QUADRIS TOPS-A13703	8.5	14					
11	TAEGRO	2.6	14	7.0	28.9	15.29	93.03	32
	TAEGRO	2.6	14					
	TAEGRO	2.6	14					
12	TAEGRO	5.2	14	7.6	29.7	14.33	91.40	71
	TAEGRO	5.2	14					
	TAEGRO	5.2	14					
14	SUPERTIN	5	14	6.8	31.0	15.04	92.57	34
	SUPERTIN	5	14					
	SUPERTIN	5	14					
15	JAU6476&TRIFL.	11	14	2.9	29.1	15.58	92.92	32
	JAU6476&TRIFL.	11	14					
	JAU6476&TRIFL.	11	14					
16	SA-Tin	5	14	7.9	28.6	14.74	92.46	60
	SA-Tin	5	14					
	SA-Tin	5	14					

	CLS RATING	Tons Per Acre	Sugar	Purity	PPM Nitrate
C.V%	12.8	9.8	4.3	0.7	40.3
LSD 1 (0.05)	1.2	4.4	0.33	1.09	29
LSD 2 (0.05)	0.7	2.7	0.21	0.67	18
LSD 3 (0.05)	0.9	3.3	0.25	0.82	22

-control

Notes:
LSD 1 = comparison of non check treatment
LSD 2= comparison of control vs. check
LSD 3 = comparison of non check treatments to check

Table 5. 0941 Single chemistry fungicide influence on sugarbeet productionand revenue

Trt	FUNGICIDE	Rate oz/acre	Interval Days between sprays	CLS RATING 9/16/09	Ext. Percent Sucrose	Ext. Suc.Per Ton	Ext. Suc.Per Acre	Rev -Percent of Means
1	Check	N/A	N/A	8.3	11.73	235	4691	72.9
2	PICOXY SC + NIS	6 +2%	14	4.1	13.31	266	6394	83.9
	PICOXY SC + NIS	6 +2%	14					
	PICOXY SC + NIS	6 +2%	14					
3	PICOXY SC + NIS	9 + 2%	14	8.3	12.99	260	5522	81.1
	PICOXY SC + NIS	9 + 2%	14					
	PICOXY SC + NIS	9 + 2%	14					
4	PICOXY SC + NIS	12 + 2%	14	8.0	13.01	260	6301	95.8
	PICOXY SC + NIS	12 + 2%	14					
	PICOXY SC + NIS	12 + 2%	14					
5	EMINENT	13	14	4.1	13.63	273	8011	107.1
	EMINENT	13	14					
	EMINENT	13	14					
6	HEADLINE	9.2	14	3.9	13.62	272	8582	114.8
	HEADLINE	9.2	14					
	HEADLINE	9.2	14					
7	PROLINE+INDUCE	5+0.125	14	3.4	13.15	263	8310	115.2
	PROLINE+INDUCE	5+0.125	14					
	PROLINE+INDUCE	5+0.125	14					
8	GEM 500 SC	3.5	14	3.1	13.42	268	8434	114.6
	GEM 500 SC	3.5	14					
	GEM 500 SC	3.5	14					
9	INSPIRE-XT A8122	7	14	2.7	13.99	280	8783	114.0
	INSPIRE-XT A8122	7	14					
	INSPIRE-XT A8122	7	14					
10	QUADRIS TOPS-A13703	8.5	14	2.7	13.56	271	7773	104.3
	QUADRIS TOPS-A13703	8.5	14					
	QUADRIS TOPS-A13703	8.5	14					
11	TAEGRO	2.6	14	7.0	13.27	265	7688	105.4
	TAEGRO	2.6	14					
	TAEGRO	2.6	14					
12	TAEGRO	5.2	14	7.6	12.12	242	7201	108.4
	TAEGRO	5.2	14					
	TAEGRO	5.2	14					
14	SUPERTIN	5	14	6.8	12.96	259	8026	112.9
	SUPERTIN	5	14					
	SUPERTIN	5	14					
15	JAU6476&TRIFL.	11	14	2.9	13.51	270	7864	106.1
	JAU6476&TRIFL.	11	14					
	JAU6476&TRIFL.	11	14					
16	SA-Tin	5	14	7.9	12.67	253	7219	104.2
	SA-Tin	5	14					
	SA-Tin	5	14					

	C.V%	12.8	4.8	4.8	11.3	9.8
-control	LSD 1 (0.05)	1.19	1.03	20.68	1337.27	16.2
	LSD 2 (0.05)	0.73	0.63	12.67	818.91	9.9
Notes:	LSD 3 (0.05)	0.89	0.77	15.51	1002.95	12.1

LSD 1 = comparison of non check treatment
LSD 2= comparison of control vs. check
LSD 3 = comparison of non check treatments to check

Table 6. Ceracospora leaf spot rating Comparing Fungicide programs for control of cercopsra leaf spot. Renville, Mn location 2009

TRT	FUNGICIDE	Rate oz/acre	Interval Days	CLS Rating 7/28/2009	CLS Rating 8/11/2009	CLS Rating 8/25/2009	CLS Rating 9/16/2009
1	UNTREATED CHECK		14	1.6	2.2	6.9	9.0
2	PROLINE SC + Induce XL	5oz /A+0.125% V/V	14	1.4	1.6	1.9	4.5
	SUPER-TIN 80WP	3.75oz/A	14				
	GEM 500 SC	3.5oz/A	14				
3	PROLINCE SC+ INDUCE XL	5oz /A+0.125% V/V	14	1.5	1.7	1.9	3.9
	SUPER-TIN 80WP	3.75oz/A	14				
	HEADLINE	7oz /A	14				
4	PROLINE SC + INDUCE XL	5oz /A + 0.125% V/V	14	1.4	1.5	1.5	3.1
	SUPER-TIN 80WP+ TOPSIN M	3.75oz/A +6.1oz./A	14				
	GEM 500 SC	3.5oz/A	14				
5	PROLINE SC+INDUCE XL	5oz /A+0.125% V/V	14	1.5	1.4	1.6	3.8
	SUPER-TIN 80WP +TOPSIN M	3.75oz/A+6.1 oz./A	14				
	HEADLINE	7oz /A	14				
6	JAU647 & TRIFLOXYSTROBIN	11 oz/A	14	1.5	1.4	1.6	3.0
	SUPER-TIN 80 WP	3.75oz/A	14				
	GEM 500 SC	3.5oz/A	14				
7	PROLINE SC + INDUCE	5oz /A + 0.125% V/V	14	1.3	1.7	2.2	5.8
	PROLINE SC + INDUCE	5oz /A +0.125% V/V	14				
	SUPER-TIN 80 WP	3.75oz/A	14				
	GEM 500 SC	3.5oz/A	14				
8	Inspire XT	7 oz./A	14	1.3	1.4	1.4	2.9
	Supertin	5 oz/A	14				
	Headline	9 oz/A	14				
9	EMINENT	13	14	1.3	1.6	1.7	3.4
	SUPER TIN 80 WP	5	14				
	HEADLINE	9.2	14				
10	Eminent	13	14	1.3	1.5	1.5	3.6
	SA-140301	5	14				
	HEADLINE 2.09	9	14				
11	Eminent	13	14	1.3	1.6	1.7	3.6
	HEADLINE 2.09	9	14				
	SA-140301	5	14				
12	QUADRIS TOPS-A13703	8.5	14	1.5	1.6	1.4	3.1
	SUPER TIN	5	14				
	QUADRIS TOPS-A13703	8.5	14				
13	QUADRIS TOPS-A13703	8.5		1.5	1.3	1.5	3.2
	PROLINE SC+INDUCE	5+0.125%	14				
	SUPER-TIN 80WP	3.75	14				
	GEM 500 SC	3.5	14				
14	SUPER TIN 80 WP	5	14	1.5	1.6	1.5	3.1
	EMINENT	13	14				
	SUPER TIN 80 WP	5	14				
	HEADLINE	9.2	14				
15	PROLINE SC + INDUCE	5oz /A + 0.125% V/V	14	1.3	1.6	1.6	3.6
	SUPER TIN 80 WP	5	14				
	HEADLINE	9.2	14				
16	EMINENT	13	14	1.5	1.9	1.9	4.1
	SUPER TIN 80 WP	5	14				
	HEADLINE	9.2	14				
	SUPER TIN 80 WP	5	14				
17	EMINENT	13	14	1.5	1.7	1.8	3.9
	SUPER TIN 80 WP	5	needs				
	HEADLINE	9.2	needs				
18	EMINENT	13	needs	1.3	1.7	1.6	3.2
	SUPER TIN 80 WP	5	needs				
	HEADLINE	9.2	needs				

control-

C.V.%	10.5	15.1	15.7	23.8
LSD 1 (0.05)	0.2	0.4	0.6	1.6
LSD 2 (0.05)	0.2	0.2	0.3	1.0
LSD 3 (0.05)	0.2	0.3	0.4	1.2

Notes:

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

LSD 1 = comparison of non check treatment
LSD 2= comparison of control vs. check
LSD 3 = comparison of non check treatments to check

Table 7. Comparison of Fungicide programs for control of cercopsra leaf spot and there influence on sugarbeet yield. Renville, Mn location 2009

TRT	FUNGICIDE	Rate oz/acre	Spray Interval	CLS RATING 9/16/09	Tons Per Acre	Sugar	Purity	PPM Nitrate
1	UNTREATED CHECK		N/A	9.0	22.4	13.9	91.6	87.8
2	PROLINE SC + Induce XL	5oz /A+0.125% V/V	14	4.5	26.4	15.9	93.1	29.8
	SUPER-TIN 80WP	3.75oz/A	14					
	GEM 500 SC	3.5oz/A	14					
3	PROLINCE SC+ INDUCE XL	5oz /A+0.125% V/V	14	3.9	31.8	15.5	93.5	23.5
	SUPER-TIN 80WP	3.75oz/A	14					
	HEADLINE	7oz /A	14					
4	PROLINE SC + INDUCE XL	5oz /A + 0.125% V/V	14	3.1	30.3	15.9	93.1	33.5
	SUPER-TIN 80WP+ TOPSIN M	3.75oz/A +6.1oz./A	14					
	GEM 500 SC	3.5oz/A	14					
5	PROLINE SC+INDUCE XL	5oz /A+0.125% V/V	14	3.8	30.6	15.9	93.6	26.2
	SUPER-TIN 80WP +TOPSIN M	3.75oz/A+6.1 oz./A	14					
	HEADLINE	7oz /A	14					
6	AU647 & TRIFLOXYSTROBIN	11 oz/A	14	3.0	29.9	15.8	93.3	27.0
	SUPER-TIN 80 WP	3.75oz/A	14					
	GEM 500 SC	3.5oz/A	14					
7	PROLINE SC + INDUCE	5oz /A + 0.125% V/V	pre canopy	5.8	32.1	15.9	93.2	22.5
	PROLINE SC + INDUCE	5oz /A +0.125% V/V	14					
	SUPER-TIN 80 WP	3.75oz/A	14					
	GEM 500 SC	3.5oz/A	14					
8	Inspire XT	7 oz./A	14	2.9	32.3	15.9	92.8	27.5
	Supertin	5 oz/A	14					
	Headline	9 oz/A	14					
9	EMINENT	13 oz./A	14	3.4	34.7	15.7	93.0	33.1
	SUPER TIN 80 WP	5 oz./A	14					
	HEADLINE	9.2 oz./A	14					
10	Eminent	13 oz./A	14	3.6	30.2	15.4	92.7	37.0
	SA-140301	5 oz./A	14					
	HEADLINE 2.09	9.2 oz./A	14					
11	Eminent	13 oz./A	14	3.6	36.6	15.6	92.8	27.1
	HEADLINE 2.09	9.2 oz./A	14					
	SA-140301	5 oz./A	14					
12	QUADRIS TOPS-A13703	8.5 oz./A	14	3.1	33.4	15.7	93.7	34.6
	SUPER TIN	5 oz./A	14					
	QUADRIS TOPS-A13703	8.5 oz./A	14					
13	QUADRIS TOPS-A13703	8.5 oz./A	pre canopy	3.2	35.2	16.1	93.8	29.9
	PROLINE SC+INDUCE	8.5 oz./A	14					
	SUPER-TIN 80WP	3.75 oz./A	14					
	GEM 500 SC	3.5 oz./A	14					
14	SUPER TIN 80 WP	5 oz./A	14	3.1	34.5	15.7	93.2	41.4
	EMINENT	13 oz./A	14					
	SUPER TIN 80 WP	5 oz./A	14					
	HEADLINE	9.2 oz./A	14					
15	PROLINE SC + INDUCE	5oz /A + 0.125% V/V	14	3.6	28.4	15.9	92.6	27.5
	SUPER TIN 80 WP	5 oz./A	14					
	HEADLINE	9.2 oz./A	14					
16	EMINENT	13 oz./A	14	4.1	30.7	16.0	92.9	29.5
	SUPER TIN 80 WP	5 oz./A	14					
	HEADLINE	9.2 oz./A	14					
	SUPER TIN 80 WP	5 oz./A	14					
17	EMINENT	13 oz./A	14	3.9	28.7	15.7	92.2	24.2
	SUPER TIN 80 WP	5 oz./A	as needs					
	HEADLINE	9.2 oz./A	as needs					
18	EMINENT	13 oz./A	as needs	3.2	30.2	15.7	92.2	39.5
	SUPER TIN 80 WP	5 oz./A	as needs					
	HEADLINE	9.2 oz./A	as needs					

-control

C.V. %	23.8	9.6	3.6	1.0	72.4
LSD 1 (0.05)	1.6	4.9	0.9	1.5	42.8
LSD 2 (0.05)	1.0	3.0	0.6	0.9	26.2
LSD 3 (0.05)	1.2	3.6	0.7	1.1	32.1

Notes:

LSD 1 = comparison of non check treatment

LSD 2= comparison of control vs. check

LSD 3 = comparison of non check treatments to check

Table 8. Comparison of Fungicide programs for control of cercopsra leaf spot and there influence on sugarbeet yield. Renville, Mn location 2009

TRT	FUNGICIDE	Rate oz/acre	Spray Interval	CLS RATING 9/16/09	Ext. Percent Sucrose	Ext. Suc.Per Ton	Ext. Suc.Per Acre	Rev - Percent of Means
1	UNTREATED CHECK		N/A	9.0	11.8	235.1	5310.8	72.9
2	PROLINE SC + Induce XL	5oz /A+0.125% V/V	14	4.5	13.9	277.1	7296.0	86.2
	SUPER-TIN 80WP	3.75oz/A	14					
	GEM 500 SC	3.5oz/A	14					
3	PROLINCE SC+ INDUCE XL	5oz /A+0.125% V/V	14	3.9	13.6	271.9	8623.3	103.6
	SUPER-TIN 80WP	3.75oz/A	14					
	HEADLINE	7oz /A	14					
4	PROLINE SC + INDUCE XL	5oz /A + 0.125% V/V	14	3.1	13.8	276.6	8384.0	99.0
	SUPER-TIN 80WP+ TOPSIN M	3.75oz/A +6.1oz./A	14					
	GEM 500 SC	3.5oz/A	14					
5	PROLINE SC+INDUCE XL	5oz /A+0.125% V/V	14	3.8	14.0	279.4	8545.6	100.0
	SUPER-TIN 80WP +TOPSIN M	3.75oz/A+6.1 oz./A	14					
	HEADLINE	7oz /A	14					
6	AU647 & TRIFLOXYSTROBIN	11 oz/A	14	3.0	13.8	276.0	8251.9	97.6
	SUPER-TIN 80 WP	3.75oz/A	14					
	GEM 500 SC	3.5oz/A	14					
7	PROLINE SC + INDUCE	5oz /A + 0.125% V/V	pre canopy	5.8	13.9	277.1	8891.1	104.7
	PROLINE SC + INDUCE	5oz /A +0.125% V/V	14					
	SUPER-TIN 80 WP	3.75oz/A	14					
	GEM 500 SC	3.5oz/A	14					
8	Inspire XT	7 oz./A	14	2.9	13.7	274.9	8877.9	105.5
	Supertin	5 oz/A	14					
	Headline	9 oz/A	14					
9	EMINENT	13 oz./A	14	3.4	13.6	272.5	9438.5	113.1
	SUPER TIN 80 WP	5 oz./A	14					
	HEADLINE	9.2 oz./A	14					
10	Eminent	13 oz./A	14	3.6	13.3	265.8	8037.1	98.5
	SA-140301	5 oz./A	14					
	HEADLINE 2.09	9.2 oz./A	14					
11	Eminent	13 oz./A	14	3.6	13.5	270.7	9901.8	119.4
	HEADLINE 2.09	9.2 oz./A	14					
	SA-140301	5 oz./A	14					
12	QUADRIS TOPS-A13703	8.5 oz./A	14	3.1	13.8	275.2	9192.9	108.9
	SUPER TIN	5 oz./A	14					
	QUADRIS TOPS-A13703	8.5 oz./A	14					
13	QUADRIS TOPS-A13703	8.5 oz./A	pre canopy	3.2	14.1	282.4	9951.1	114.9
	PROLINE SC+INDUCE	8.5 oz./A	14					
	SUPER-TIN 80WP	3.75 oz./A	14					
	GEM 500 SC	3.5 oz./A	14					
14	SUPER TIN 80 WP	5 oz./A	14	3.1	13.6	272.8	9402.7	112.5
	EMINENT	13 oz./A	14					
	SUPER TIN 80 WP	5 oz./A	14					
	HEADLINE	9.2 oz./A	14					
15	PROLINE SC + INDUCE	5oz /A + 0.125% V/V	14	3.6	13.7	274.0	7762.9	92.7
	SUPER TIN 80 WP	5 oz./A	14					
	HEADLINE	9.2 oz./A	14					
16	EMINENT	13 oz./A	14	4.1	13.9	277.1	8514.6	100.1
	SUPER TIN 80 WP	5 oz./A	14					
	HEADLINE	9.2 oz./A	14					
	SUPER TIN 80 WP	5 oz./A	14					
17	EMINENT	13 oz./A	14	3.9	13.5	270.6	7746.8	93.5
	SUPER TIN 80 WP	5 oz./A	as needs					
	HEADLINE	9.2 oz./A	as needs					
18	EMINENT	13 oz./A	as needs	3.2	13.5	270.8	8166.7	98.4
	SUPER TIN 80 WP	5 oz./A	as needs					
	HEADLINE	9.2 oz./A	as needs					

-control

C.V. %	23.8	4.4	4.4	9.8	9.6
LSD 1 (0.05)	1.6	1.0	19.5	1344.8	15.8
LSD 2 (0.05)	1.0	0.6	11.9	823.5	9.7
LSD 3 (0.05)	1.2	0.7	14.6	1008.6	11.9

Notes:

LSD 1 = comparison of non check treatment

LSD 2= comparison of control vs. check

LSD 3 = comparison of non check treatments to check

EFFECT OF FUNGICIDES ON SUGARBEET YIELD AND QUALITY IN THE ABSENCE OF DISEASE

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Fungicides are commonly used by sugarbeet (*Beta vulgaris* L.) growers in North Dakota and Minnesota to control Cercospora leaf spot, caused by the fungus *Cercospora beticola* Sacc. Cercospora leaf spot is the most devastating foliar disease of sugarbeet and results in significant economic losses when the disease is not controlled (Khan and Smith, 2005). In England, sugarbeet growers are advised to always use a fungicide application because they always have low to moderate levels of foliar diseases such as powdery mildew, rust and Ramularia leaf spot that start early in the season. English growers are encouraged to use either a triazole or strobilurin fungicide since these will result in effective disease control and yield gains (May and Stevens, 2008). The use of Headline has been recommended, even in the absence of disease, to increase sugarbeet yield and quality in North Dakota and Minnesota. It is very important that we determine whether the widely used strobilurin and triazole fungicides do result in increased yield in the absence of disease.

The objective of this research was to determine the effect of fungicides on sugarbeet yield, quality, and respiration rate in the absence of disease.

MATERIALS AND METHODS

Field trial was conducted in Prosper, ND, and Foxhome, MN in 2009. 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 with Beta 87RR38 which was resistant to Rhizomania, and had good resistance to Cercospora leaf spot (KWS rating of 4.1). Seed were also treated with Tachigaren at 20 g/kg seed to provide early season protection against *Aphanomyces cochlioides*. Planting was done on 18 and 27 May at Foxhome and Prosper, respectively. At Prosper, Terbufos (Counter 15G) was applied modified in-furrow at 12 lbs/A during planting to control sugarbeet root maggot (*Tetanops myopaeformis* von Röder; Diptera: Ulidiidae). Plots were thinned manually to 175 plants per 100’ of row on 16 June at Prosper and 30 June at Foxhome. Weeds were controlled with recommended herbicides (Khan, 2009), and hand weeding.

The fungicides used were Headline, Eminent, Proline mixed with Premier 90 NIS, and Inspire at rates indicated in Table 1. Fungicide application dates were 22 July and 25 August; and 23 July and 25 August, at Prosper and Foxhome, respectively. A non-treated check was also included in the treatments. Fungicides were applied with a 4-nozzle (TT TWINJT 11002) boom sprayer calibrated to deliver 17 gpa of solution at 60 p.s.i pressure to the middle four rows of plots.

The chlorophyll content (NDIV) of leaves of each plot was determined using a Greenseeker® three times during the season.

At Prosper and Foxhome, plots were defoliated mechanically and harvested using a mechanical harvester on 12 and 13 October, respectively. 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 7.5 software package (Gylling Data Management Inc., Brookings, South Dakota, 1999). 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

At Prosper, the plants did not show any symptoms of root rot or Cercospora leaf spot. There were no significant differences in chlorophyll content as determined by NDIV of the leaves of any of the fungicide treatments and the nontreated control during season. There were no significant differences in tonnage, sugar concentration, sugar loss to molasses, or recoverable sucrose per acre of plots treated with fungicides compared to the nontreated control.

At Foxhome, none of the plants showed any symptoms of root rot. There were some plants with a few leaf lesions symptomatic of Cercospora leaf spot late in the season but disease severity level was very low (less than 2 on the KWS scale). There were no significant differences in NDIV of the leaves of plants treated with fungicides compared to the nontreated check. Eminent applied early resulted in significantly higher tonnage than the nontreated control. However, there were no significant differences in sucrose concentration, sugar loss to molasses, or recoverable sucrose between any of the fungicide treatments, including early application of Eminent, and the nontreated check. Please note that treatments where fungicides were applied twice without alternating with a fungicide having a different mode of action were not included in the tables.

The sucrose concentration and recoverable sucrose were similar for both Foxhome and Prosper although the latter was planted 10 days later. 'Greening' (where plants in a plot looked distinctly greener as if it had extra nitrogen), a common characteristic of the effect of strobilurin and triazole fungicides in England (May and Stevens, 2008) was not observed in any of the treatments at any of the sites during the season and before a frost. Since there was no 'greening', it was not surprising that none of the fungicide treatments resulted in a significant increase in chorophyll content compared to the nontreated check. The NDVI range was consistent with what would be expected of healthy, well fertilized plants. Both sites were impacted by frost just prior to harvest. At Prosper, foliage of fungicide treated plots was similar in appearance to the nontreated plots. At Foxhome, the petioles in the nontreated plots were generally more erect and the top leaves became brown and scorched in appearance compared to the fungicide treated plots where the petioles were more flaccid or stooped (curved) but the leaves remained green. At both sites, the beet roots were not affected by the frost. There were no problems encountered during defoliation.

This research suggested that triazole and strobilurin fungicide applications in the absence of disease, may result in plants retaining green leaves after a frost, but did not significantly increase sugarbeet yield or quality.

References

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May, M; Stevens, M. 2008. Fungicides for 2008. In: British Sugar Beet Review 76(2):14-19.

Table 1. Effect of fungicides on sugarbeet leaf greenness, yield and quality at Prosper, ND, 2009.

Treatment and rate/A	Application date	NDVI* 7/17	NDVI* 8/4	NDVI* 9/1	Root yield	Sucrose concentration (%)	SLM** (%)	Recoverable sucrose (lb/A)
Nontreated check		0.7452	0.8240	0.8383	33.8	15.3	1.16	9528
Headline 9 oz	22 July	0.7628	0.8325	0.8424	33.2	15.2	1.14	9303
Headline 9 oz	25 August	0.7956	0.8411	0.8400	34.9	15.3	1.11	9876
Eminent 13 fl oz	22 July	0.7882	0.8332	0.8377	34.9	15.5	1.06	10066
Eminent 13 fl oz	25 August	0.8001	0.8323	0.8382	35.0	15.5	1.13	10093
Proline 5oz + Premier 90 NIS 0.125% v/v	22 July	0.8038	0.8346	0.8361	34.3	15.4	1.08	9791
Proline 5oz + Premier 90 NIS 0.125% v/v	25 August	0.8080	0.8372	0.8412	35.1	15.6	1.11	10185
Inspire 7 oz	22 July	0.7911	0.8386	0.8463	34.9	15.0	1.23	9578
Inspire 7 oz	22 August	0.7218	0.8149	0.8355	31.7	14.8	1.16	8656
LSD (P=0.05)		NS†	NS	NS	NS	NS	NS	NS
CV		6.4	2.72	0.77	8.03	3.05	10.8	8.19

*NDVI – Normalized difference vegetative index was measured using a Greenseeker®
** SLM – Sugar lost to molasses
† NS – not statistically significant

Table 2. Effect of fungicides on sugarbeet leaf greenness, yield and quality at Foxhome, MN, 2009.

Treatment and rate/A	Application date	NDVI* 7/17	NDVI* 8/6	NDVI* 9/1	Root yield	Sucrose concentration (%)	SLM** (%)	Recoverable sucrose (lb/A)
Nontreated check		0.8585	0.8608	0.8180	32.7	15.9	1.24	9560
Headline 9 oz	23 July	0.8638	0.8678	0.8238	34.2	15.5	1.21	9819
Headline 9 oz	25 August	0.8599	0.8619	0.8223	34.4	15.8	1.15	10066
Eminent 13 fl oz	23 July	0.8628	0.8677	0.8333	37.4	15.5	1.29	10622
Eminent 13 fl oz	25 August	0.8577	0.8613	0.8206	34.1	15.7	1.13	9948
Proline 5oz + Premier 90 NIS 0.125% v/v	23 July	0.8636	0.8626	0.8277	32.2	15.8	1.12	9415
Proline 5oz + Premier 90 NIS 0.125% v/v	25 August	0.8564	0.8633	0.8272	33.3	15.7	1.21	9634
Inspire XT 7 oz	23 July	0.8620	0.8684	0.8265	34.5	16.0	1.18	10219
Inspire XT 7 oz	25 August	0.8648	0.8706	0.8313	34.5	15.7	1.23	9982
LSD (P=0.05)		NS†	NS	NS	2.40	NS	NS	NS
CV		1.1	0.96	0.98	4.87	3.49	9.9	5.92

*NDVI – Normalized difference vegetative index was measured using a Greenseeker®
**SLM – Sugar lost to molasses

† NS – not statistically significant

EFFECT OF FUNGICIDES ON CONTROLLING RHIZOCTONIA CROWN AND ROOT ROT IN SUGARBEET

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Rhizoctonia root and crown rot, caused by *Rhizoctonia solani* Kühn, is one of the most damaging soilborne diseases of sugarbeet (*Beta vulgaris* L.) in the US. In North Dakota and Minnesota, *R. solani* AG-1, AG-2-2, AG-4, and AG-5 cause damping off and AG-2-2 causes and root and crown rot of sugarbeet (Windels and Nabben 1989). The fungus survives as thickened hyphae (sclerotia) and is endemic in soils where sugar beet 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 sugar beet follows beans or potato (Baba and Abe 1966; Johnson et al. 2002). Crop rotations of 3 or more years with small grains planted before sugar beet 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 (Jacobsen et al. 2002; Brantner and Windels, 2002).

The objective of this research therefore, was to determine the best time to apply fungicides for controlling Rhizoctonia crown and root rot (RCRR) of sugarbeet.

MATERIALS AND METHODS

Field trial was conducted in Foxhome, MN in 2009. 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 18 May with Crystal 539RR which was resistant to Rhizomania and very susceptible to *Rhizoctonia solani*. Seeds were also treated with Tachigaren at 45 g/kg seed to provide early season protection against *Aphanomyces cochlioides*. Weeds were controlled with recommended herbicides.

Treatments were applied on 16 June, or 16 and 29 June. Fungicides were applied with a 4-nozzle (Flat Fan 4002E) bike sprayer calibrated to deliver 17 gpa of solution at 40 p.s.i pressure to the middle four rows of plots. Treatments were applied in a 7-inch band. Symptoms included wilting of individual plants and yellowing of leaves were observed. Eventual death of individual plants was observed and recorded. Blackening of petioles was not observed. First symptoms appeared in July and plants became brown to black carcasses after warm and dry weather conditions in September.

Both Quadris and Proline provided effective control of RCRR. The single application was as effective as two applications. There was no phytotoxicity when the fungicides were mixed with glyphosate and RCRR control was not compromised.

Table 1. Effect of fungicides applied at different application dates on Rhizoctonia crown and root rot control at Foxhome, MN, 2009.

Treatment and rate/A	Application date	Dead Plants/ 60 ft row
Nontreated check		22
Quadris 9.2 fl oz/A	16 June	1
Quadris 9.2 fl oz/A	16, 29 June	1
Proline 5.7 fl oz/A + Premier 90 NIS 0.125% v/v	16 June	4
Proline 5.7 fl oz/A + Premier 90 NIS 0.125% v/v	16, 29 June	3
Proline 5.7 fl oz/A + Premier 90 NIS 0.125% v/v + Powermax 22 fl oz/A + Amstik 2.5 lb ai/100 gal	16, 29 June	1
Quadris 9.2 fl oz/A + Powermax 22 fl oz/A + Amstik 2.5 lb ai/100 gal	16, 29 June	1
LSD (P=0.05)		7

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SMBSC Evaluation of Fungicides for control of Rhizoctonia solani in Sugarbeet Growth-2009

The following report is a summarization of testing fungicides for controlling rhizoctonia solani during the growing seasons of 2008 and 2009.

Objectives

The objective of these trials was to evaluate fungicides for control of rhizoctonia solani (rhizoctonia root rot).

Methods

Table 1 shows the specifics of activities conducted at the rhizoctonia testing sites in 2008 and 2009. The test are designated by there experiment numbers of 0856 (Milan location 2008), 0857 (Clara City location 2008) and 0957 (Milan location 2009). A site was conducted at the Clara City location 2009 but was determined to have too much variability with in the data and thus was discarded. Plots were 11 ft. (6 rows) wide and 20 ft long. Sugarbeet plots were inoculated with the rhizoctonia solani fungus at the 4 leaf stage of the sugarbeets. The rhizoctonia strain inoculated was the AG-22 IIIB. The inoculum was prepared on barley grain by Dr. Carol Windels and her staff. The inoculum was applied by hand in 2008 and via a Gandy band applicator in 2009. Sugarbeet stands were counted at 4 leaf sugarbeet stage 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 4 row research harvester plow. The harvester plow lifted the sugarbeets out of the soil and places the sugarbeets on the soil surface. The sugar beets are then placed in a row for 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 be combined. The sugarbeets were collected and measured for yield and analyzed for quality.

TABLE 1. Site specifics for Rhizoctonia fungicide study.

Location			
Task	**Milan**	**Milan**	**Clara City**
Sugarbeet-Varity	H4017	4017RR	95RR03
Planting-date	5/8/2009	5/16/2008	5/16/2008
Harvest	9/9/2009	9/20/08	9/22/2008

Results and discussion

A test of the mean square errors for measured variables was reviewed and the factor of 10 was used to determine homogeneity of the data. The data from sites 0856, 0857 and 0956 were determined to be combinable. The data from the different location is presented in this report for historical and regional importance. The discussion of the results will concentrate on the combined analysis presented in tables 5a, 5b and 5c. Applications of the fungicides were conducted in a 7 inch (7") band and Broadcast (Bcast). The 7 inch band application was applied to 6-8 leaf sugarbeets and the broadcast application was made 1-2 weeks prior to canopy closure.

In table 5a the data presented shows the influence of treatments tested on harvest stand and rhizoctonia rating (1-7 scale, 1 being good and 7 being bad). Treatments 9 and 12 were the only fungicide treatments that gave significantly less sugarbeet stand than the best treatment. Rhizoctonia rating had greater separation between treatments. The best application was with Quadris applied in a 7 inch band and at the broadcast application timing.

Tons per acre (table 5b) was significantly increased by fungicide applications. The highest tons per acre was achieved with Quadris applied at the 7 inch band timing and Proline applied at the broadcast timing.

Extractable Sugar per acre and relative revenue percent of mean tended to be the highest when Quadris was applied at the 7 inch band and broadcast timing or Quadris was applied at the 7 inch band timing and Proline was applied at the broadcast timing.

TABLE 2-a. 0956 Rhizoctonia Fungicide Study Influenced by Sugar Beet Stand and Root Ratings

Trt	Treatment	Application type	Timing	Productoz./acre	Harvest Stand	Rizoctonia Rating
1	check	N/A			121	4.0
2	QUADRIS	7" band	6 LF	14.3	135	2.9
3	QUADRIS	7" band	12 LF	14.3	106	3.7
4	QUADRIS	7" band	6 LF	14.3	128	2.5
	QUADRIS	7" band	12 LF	14.3		
5	QUADRIS	7" band	6 LF	14.3	131	2.6
	QUADRIS	Bcast	Canopy	14.3		
6	QUADRIS	Bcast	Canopy	14.3	120	3.7
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	111	2.9
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	124	3.5
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	85	3.1
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v		
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	114	3.8
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v		
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	111	4.4
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	103	3.8
13	QUADRIS	7" band	6 LF	14.3	110	2.9
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre		
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	124	3.1
	QUADRIS	Bcast	Canopy	14.3		
15	QUADRIS	7" band	12 LF	14.3	143	2.8
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre		
				C.V. %	24	19.4
				LSD (0.05)	40	0.9

TABLE 2-b. 0956 Rhizoctonia Fungicide treatment Influenced on Sugar Beet Production

Trt	Treatment	Application type	Timing	Productoz./acre	Tons	Sugar	APP PURITY	PPM Nitrate
1	check	N/A			29.5	12.7	86.9	202.6
2	QUADRIS	7" band	6 LF	14.3	33.6	13.2	88.0	201.8
3	QUADRIS	7" band	12 LF	14.3	31.0	13.1	87.3	224.3
4	QUADRIS	7" band	6 LF	14.3	32.1	14.1	89.5	168.8
	QUADRIS	7" band	12 LF	14.3				
5	QUADRIS	7" band	6 LF	14.3	40.3	13.2	88.0	225.9
	QUADRIS	Bcast	Canopy	14.3				
6	QUADRIS	Bcast	Canopy	14.3	34.6	13.0	87.2	217.4
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	30.2	13.4	88.3	190.0
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	33.8	13.0	87.2	222.1
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	30.1	13.1	87.1	243.0
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v				
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	29.2	13.3	88.1	195.1
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v				
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	32.2	12.4	86.2	192.0
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	36.1	12.9	87.0	214.0
13	QUADRIS	7" band	6 LF	14.3	33.3	13.4	88.2	208.3
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	35.3	13.5	88.3	180.3
	QUADRIS	Bcast	Canopy	14.3				
15	QUADRIS	7" band	12 LF	14.3	41.3	13.4	88.4	183.5
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
				C.V. %	14.3	4.8	1.4	22.8
				LSD (0.05)	6.8	0.9	1.8	66.7

TABLE 2-c. 0956 Rhizoctonia Fungicide Study Influenced by Sugar Beet Revenue

Trt	Treatment	Application type	Timing	Productoz./acre	Ex. Suc	Ext. Suc Per Ton	Ext. SucPer Acre	Rev. Percent of Means
1	check	N/A			9.9	198.9	5870.7	79.36
2	QUADRIS	7" band	6 LF	14.3	10.6	211.6	7127.3	106.31
3	QUADRIS	7" band	12 LF	14.3	10.4	207.2	6479.9	94.30
4	QUADRIS	7" band	6 LF	14.3	11.6	231.6	7481.9	125.20
	QUADRIS	7" band	12 LF	14.3				
5	QUADRIS	7" band	6 LF	14.3	10.6	211.6	8488.7	125.17
	QUADRIS	Bcast	Canopy	14.3				
6	QUADRIS	Bcast	Canopy	14.3	10.2	204.9	7054.9	98.97
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	10.7	214.5	6516.2	99.16
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	10.2	204.5	6909.1	97.64
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	10.3	205.6	6148.7	86.80
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v				
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	10.7	214.1	6207.0	92.70
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v				
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	9.5	190.9	6122.5	76.74
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	10.1	202.2	7325.5	102.03
13	QUADRIS	7" band	6 LF	14.3	10.8	215.4	7116.4	107.18
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	10.9	217.5	7664.1	117.70
	QUADRIS	Bcast	Canopy	14.3				
15	QUADRIS	7" band	12 LF	14.3	10.8	216.3	8952.9	137.36
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
				C.V. %	7.1	7.1	14.9	20.22
				LSD (0.05)	1.1	21.4	1497.1	29.74

TABLE 3-a. 0857 Rhizoctonia Fungicide Study Influenced by Sugar Beet Stand and Root Ratings

Trt	Treatment	Application type	Timing	Productoz./acre	Harvest Stand	Rizoctonia Rating
1	check	N/A			230	4.4
2	QUADRIS	7" band	6 LF	14.3	220	2.9
3	QUADRIS	7" band	12 LF	14.3	240	3.2
4	QUADRIS	7" band	6 LF	14.3	210	2.4
	QUADRIS	7" band	12 LF	14.3		
5	QUADRIS	7" band	6 LF	14.3	230	2.4
	QUADRIS	Bcast	Canopy	14.3		
6	QUADRIS	Bcast	Canopy	14.3	220	2.5
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	190	4.5
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	220	4.2
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	200	3.6
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v		
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	210	3.3
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v		
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	220	2.3
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	190	3.9
13	QUADRIS	7" band	6 LF	14.3	280	2.3
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre		
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	210	2.9
	QUADRIS	Bcast	Canopy	14.3		
15	QUADRIS	7" band	12 LF	14.3	250	2.9
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre		
				C.V. %	24	22.3
				LSD (0.05)	75	1.0

TABLE 3-b. 0857 Rhizoctonia Fungicide treatment Influence on Sugar Beet Production

Trt	Treatment	Application type	Timing	Productoz./acre	Tons	Sugar	APP PURITY	PPM Nitrate
1	check	N/A			7.9	15.3	88.2	24.4
2	QUADRIS	7" band	6 LF	14.3	14.5	14.7	87.6	21.0
3	QUADRIS	7" band	12 LF	14.3	23.3	14.9	88.5	25.7
4	QUADRIS	7" band	6 LF	14.3	20.3	15.9	88.9	22.9
	QUADRIS	7" band	12 LF	14.3				
5	QUADRIS	7" band	6 LF	14.3	24.5	15.1	88.6	22.5
	QUADRIS	Bcast	Canopy	14.3				
6	QUADRIS	Bcast	Canopy	14.3	15.6	15.4	88.3	17.0
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	17.0	14.0	86.5	26.6
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	14.1	13.9	86.1	27.3
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	15.6	15.2	88.6	16.3
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v				
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	17.1	14.5	88.0	35.5
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v				
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	20.9	15.1	88.9	22.5
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	20.2	14.5	86.8	27.1
13	QUADRIS	7" band	6 LF	14.3	18.7	15.6	88.9	22.4
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	20.1	15.0	88.2	28.7
	QUADRIS	Bcast	Canopy	14.3				
15	QUADRIS	7" band	12 LF	14.3	22.1	14.9	88.3	18.4
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
				C.V. %	22.9	6.3	1.8	48.2
				LSD (0.05)	5.9	1.3	2.3	16.4

TABLE 3-c. 0857 Rhizoctonia Fungicide Study Influenced by Sugar Beet Revenue

Trt	Treatment	Application type	Timing	Productoz./acre	Ext. Suc	Ext.Suc Per Ton	Ext. Suc Per Acre	Rev. Percent of Means
1	check	N/A			12.4	247.6	1930.6	44.2
2	QUADRIS	7" band	6 LF	14.3	11.8	236.5	3573.3	82.3
3	QUADRIS	7" band	12 LF	14.3	12.1	242.6	5627.3	127.3
4	QUADRIS	7" band	6 LF	14.3	13.0	260.1	5297.5	128.7
	QUADRIS	7" band	12 LF	14.3				
5	QUADRIS	7" band	6 LF	14.3	12.3	245.9	6060.3	140.3
	QUADRIS	Bcast	Canopy	14.3				
6	QUADRIS	Bcast	Canopy	14.3	12.4	248.9	3897.8	90.8
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	11.0	220.2	3791.4	78.2
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	10.8	217.0	3114.5	63.6
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	12.4	248.3	3884.2	90.2
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v				
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	11.7	233.2	3996.0	87.1
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v				
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	12.4	247.8	5145.0	118.3
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	11.4	228.7	4755.1	104.6
13	QUADRIS	7" band	6 LF	14.3	12.8	256.1	4785.2	114.3
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	12.1	242.8	4858.9	109.8
	QUADRIS	Bcast	Canopy	14.3				
15	QUADRIS	7" band	12 LF	14.3	12.1	241.6	5333.8	120.2
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
				C.V. %	8.9	8.9	36.0	39.13
				LSD (0.05)	1.5	30.5	3936.4	63.41

TABLE 4-a. 0856 Rhizoctonia Fungicide Study Influenced by Sugar Beet Stand and Root Ratings

Trt	Treatment	Application type	Timing	Productoz./acre	Harvest Stand	Rizoctonia Rating
1	check	N/A			240	2.6
2	QUADRIS	7" band	6 LF	14.3	180	3.5
3	QUADRIS	7" band	12 LF	14.3	220	2.6
4	QUADRIS	7" band	6 LF	14.3	210	3.3
	QUADRIS	7" band	12 LF	14.3		
5	QUADRIS	7" band	6 LF	14.3	240	2.1
	QUADRIS	Bcast	Canopy	14.3		
6	QUADRIS	Bcast	Canopy	14.3	210	3.5
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	160	5.3
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	220	2.8
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	190	4.3
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v		
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	200	3.5
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v		
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	250	2.2
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	140	4.9
13	QUADRIS	7" band	6 LF	14.3	230	2.8
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre		
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	210	2.9
	QUADRIS	Bcast	Canopy	14.3		
15	QUADRIS	7" band	12 LF	14.3	230	2.1
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre		

	C.V. %	14	18.3
	LSD (0.05)	42	0.8

TABLE 4-b. 0856 Rhizoctonia Fungicide treatment Influence on Sugar Beet Production

Trt	Treatment	Application type	Timing	Productoz./acre	Tons	Sugar	APP PURITY	PPM Nitrate
1	check	N/A			13.7	14.0	87.5	36.2
2	QUADRIS	7" band	6 LF	14.3	18.2	14.0	86.8	25.9
3	QUADRIS	7" band	12 LF	14.3	18.9	15.2	89.2	28.1
4	QUADRIS	7" band	6 LF	14.3	20.3	15.3	88.6	64.0
	QUADRIS	7" band	12 LF	14.3				
5	QUADRIS	7" band	6 LF	14.3	24.4	14.9	88.5	47.2
	QUADRIS	Bcast	Canopy	14.3				
6	QUADRIS	Bcast	Canopy	14.3	15.8	15.3	89.2	37.8
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	10.5	13.8	86.4	53.2
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	19.3	15.1	89.0	38.2
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	13.5	14.8	87.6	63.1
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v				
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	18.3	15.4	88.7	60.8
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v				
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	22.2	15.3	89.9	55.4
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	8.6	12.5	84.5	89.7
13	QUADRIS	7" band	6 LF	14.3	21.0	15.3	89.4	48.0
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	21.8	15.0	88.5	54.9
	QUADRIS	Bcast	Canopy	14.3				
15	QUADRIS	7" band	12 LF	14.3	21.2	16.0	89.0	26.6
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				

	Tons	Sugar	APP PURITY	PPM Nitrate
C.V. %	9.1	4.6	2.2	61.3
LSD (0.05)	2.3	1.0	2.7	42.5

TABLE 4-c. 0856 Rhizoctonia Fungicide Study Influenced by Sugar Beet Revenue

Trt	Treatment	Application type	Timing	Productoz./acre	Ext. Suc	Ext.Suc Per Ton	Ext. Suc Per Acre	Rev. Percent of Means
1	check	N/A			11.2	223.1	3040.4	63.7
2	QUADRIS	7" band	6 LF	14.3	11.0	220.0	3975.9	81.5
3	QUADRIS	7" band	12 LF	14.3	12.5	249.2	4702.5	111.5
4	QUADRIS	7" band	6 LF	14.3	12.5	250.2	5065.8	120.5
	QUADRIS	7" band	12 LF	14.3				
5	QUADRIS	7" band	6 LF	14.3	12.1	241.3	5871.1	134.5
	QUADRIS	Bcast	Canopy	14.3				
6	QUADRIS	Bcast	Canopy	14.3	12.6	252.4	3990.5	95.6
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	10.7	214.9	2236.9	44.4
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	12.4	247.8	4781.1	112.9
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	11.9	237.2	3214.3	72.8
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v				
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	12.6	252.1	4627.3	111.0
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v				
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	12.7	253.4	5627.1	135.7
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	9.4	188.5	1648.7	27.7
13	QUADRIS	7" band	6 LF	14.3	12.6	252.4	5307.4	127.4
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	12.1	242.9	5293.9	122.6
	QUADRIS	Bcast	Canopy	14.3				
15	QUADRIS	7" band	12 LF	14.3	13.1	262.5	5561.8	138.3
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
				C.V. %	7.2	7.2	10.5	14.55
				LSD (0.05)	1.2	24.6	651.7	24.02

TABLE 5-a. 2008-2009 Rhizoctonia Fungicide Study Influenced by Sugar Beet Stand and Root Ratings combined over locations.

Trt	Treatment	Application type	Timing	Productoz./acre	Harvest Stand	Rizoctonia Rating
1	check	N/A			197	3.7
2	QUADRIS	7" band	6 LF	14.3	178	3.1
3	QUADRIS	7" band	12 LF	14.3	189	3.2
4	QUADRIS	7" band	6 LF	14.3	183	2.7
	QUADRIS	7" band	12 LF	14.3		
5	QUADRIS	7" band	6 LF	14.3	200	2.4
	QUADRIS	Bcast	Canopy	14.3		
6	QUADRIS	Bcast	Canopy	14.3	183	3.2
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	154	4.2
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	188	3.5
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	158	3.6
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v		
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	175	3.5
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v		
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	194	3.0
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	144	4.2
13	QUADRIS	7" band	6 LF	14.3	207	2.7
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre		
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	181	3.0
	QUADRIS	Bcast	Canopy	14.3		
15	QUADRIS	7" band	12 LF	14.3	208	2.6
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre		
				C.V. %	34	25.3
				LSD (0.05)	51	0.7

TABLE 5-b. 2008-2009 Rhizoctonia Fungicide treatment Influence on Sugar Beet Production

Trt	Treatment	Application type	Timing	Productoz./acre	Tons	Sugar	APP PURITY	PPM Nitrate
1	check	N/A			17.0	14.0	87.5	87.7
2	QUADRIS	7" band	6 LF	14.3	22.1	14.0	87.5	82.9
3	QUADRIS	7" band	12 LF	14.3	24.4	14.4	88.3	92.7
4	QUADRIS	7" band	6 LF	14.3	24.2	15.1	89.0	85.3
	QUADRIS	7" band	12 LF	14.3				
5	QUADRIS	7" band	6 LF	14.3	29.7	14.4	88.4	98.5
	QUADRIS	Bcast	Canopy	14.3				
6	QUADRIS	Bcast	Canopy	14.3	22.0	14.6	88.2	90.7
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	19.2	13.7	87.0	89.9
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	22.4	14.0	87.5	95.9
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	19.7	14.4	87.8	107.4
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v				
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	21.5	14.4	88.3	97.1
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v				
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	25.1	14.3	88.3	90.0
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	21.6	13.3	86.1	110.3
13	QUADRIS	7" band	6 LF	14.3	24.3	14.8	88.8	92.9
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	25.7	14.5	88.3	88.0
	QUADRIS	Bcast	Canopy	14.3				
15	QUADRIS	7" band	12 LF	14.3	28.2	14.8	88.6	76.2
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				

	Tons	Sugar	APP PURITY	PPM Nitrate
C.V. %	38.0	8.4	1.9	97.9
LSD (0.05)	7.1	1.0	1.4	72.9

TABLE 5-c. 2008-2009 Rhizoctonia Fungicide Study Influenced by Sugar Beet Revenue

Trt	Treatment	Application type	Timing	Productoz./acre	Ext. Suc	Ext.Suc Per Ton	Ext. Suc Per Acre	Rev. Percent of Means
1	check	N/A			11.2	223.2	3613.9	62.41
2	QUADRIS	7" band	6 LF	14.3	11.1	222.7	4892.2	90.04
3	QUADRIS	7" band	12 LF	14.3	11.6	233.0	5603.3	111.03
4	QUADRIS	7" band	6 LF	14.3	12.4	247.3	5948.4	124.81
	QUADRIS	7" band	12 LF	14.3				
5	QUADRIS	7" band	6 LF	14.3	11.6	232.9	6806.7	133.35
	QUADRIS	Bcast	Canopy	14.3				
6	QUADRIS	Bcast	Canopy	14.3	11.8	235.4	4981.1	95.13
7	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	10.8	216.6	4181.5	73.93
8	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v	11.2	223.1	4934.9	91.37
9	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	11.5	230.4	4415.7	83.26
	PROLINE + NIS	7" band	12 LF	5.7 oz/acre+0.125%v/v				
10	PROLINE + NIS	7" band	6 LF	5.7 oz/acre+0.125%v/v	11.7	233.1	4943.4	96.93
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v				
11	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre+0.125%v/v	11.5	230.7	5631.5	110.25
12	JAU6476 & Trifloxystrobin + NIS	7" band	6 LF	11 oz/acre+0.125%v/v	10.3	206.4	4576.5	78.10
13	QUADRIS	7" band	6 LF	14.3	12.1	241.3	5736.3	116.30
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
14	PROLINE + NIS	7" band	6 LF	5.7 oz/acre	11.7	234.4	5938.9	116.68
	QUADRIS	Bcast	Canopy	14.3				
15	QUADRIS	7" band	12 LF	14.3	12.0	240.1	6616.2	131.96
	PROLINE + NIS	Bcast	Canopy	5.7 oz/acre				
				C.V. %	10.9	10.9	36.0	29.87
				LSD (0.05)	1.0	20.2	1839.8	26.68

RHIZOCTONIA CROWN AND ROOT ROT ON SUGARBEET FOLLOWING CORN

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Rhizoctonia crown and root rot (RCRR) of sugarbeet is caused by the soilborne fungus *Rhizoctonia solani*. The fungus is composed of genetically isolated populations called anastomosis groups or AGs (3). The AG population causing RCRR of sugarbeet is *R. solani* AG 2-2, which is further divided into the intraspecific groups (ISGs) AG 2-2 IIIB and AG 2-2 IV (3,5). Both ISGs cause RCRR with identical symptoms on sugarbeet (3, 4).

Reports from Europe (2) indicate *R. solani* AG 2-2 IIIB is an aggressive root rot pathogen in rotations of corn and sugarbeet. In the southeastern United States, *R. solani* AG 2-2 IIIB causes a crown root and brace root rot on corn. This disease has not been reported on corn in the North Central regions of the United States. In recent field trials in the Red River Valley (RRV), *R. solani* AG 2-2 IIIB caused lesions on roots of a conventional corn variety that displayed no aboveground symptoms of disease or effects on yield, while *R. solani* AG 2-2 IV rarely infected corn roots (8,9,10). Consequently, these reports have raised concerns about the presence and role of *R. solani* AG 2-2 IIIB and *R. solani* AG 2-2 IV in corn and sugarbeet rotations in the RRV and southern Minnesota.

A wide range of commercial corn varieties are sold including conventional and transgenic (Roundup Ready, insect resistance) - for either feed or ethanol production. In southern Minnesota, sugarbeet frequently follows field corn (75% acres), sweet corn (10%), soybean (10%), and other crops (5%). Producers in southern Minnesota are reporting increases in RCRR of sugarbeet. The relationship of this disease to corn varieties grown the previous season is unknown. Previous reports of the research have been published (1,11).

OBJECTIVES

Field trials were established in southern Minnesota to determine 1.) pathogenicity and survival of *R. solani* AG 2-2 IIIB and *R. solani* AG 2-2 IV on varieties of corn with different genetic traits, and 2.) effects on a subsequent sugarbeet crop.

MATERIALS AND METHODS

Two adjacent field trials were established in 2007 and 2008, respectively, by the Southern Minnesota Beet Sugar Cooperative in a field near Gluek, Minnesota. Main plots included a non-inoculated control and inoculation with *R. solani* AG 2-2 IV and AG 2-2 IIIB (inoculum of *R. solani* was grown for 3 weeks on sterilized barley grain). Transgenic corn varieties (Roundup Ready, resistance to corn borer and root worm) with traits for feed or ethanol production were sown as subplots in each main plot (Table 1). Trials were arranged in a split-plot design with four replicates. Trials were sown to sugarbeet in 2008 and 2009.

Field trial establishment. Main plots were 66 feet wide by 35 feet long. Plots were fertilized, as recommended for the region. On May 15, 2007 main plots were inoculated with 26.4 oz of barley infested with *R. solani* AG 2-2 IV or AG 2-2 IIIB. *Rhizoctonia*-infested grains were sprinkled on the soil surface and incorporated; control plots were not inoculated. Then, main plots were divided into six, 11-ft wide subplots (6 rows, 22 inches apart), which were sown with six transgenic corn varieties (Table 1). Plots were treated with glyphosate to control weeds. The trial was repeated in 2008. Plots were inoculated and sown to corn, as described above, on May 22, 2008. Corn varieties were the same except DKC 43-31 and DKC 48-46 replaced DKC 41-64 and DKC 48-52, respectively.

Table 1. Corn varieties planted in field experiments near Gluek, MN on May 15, 2007 and May 22, 2008 (each year, plots were inoculated with *Rhizoctonia solani* AG 2-2 IV and AG 2-2 IIIB a few hours before planting; a control was not inoculated).

Variety [X]	Maturity (days)	Genetics [XY]	End use [Z]
DKC 38-92	88	RR	Feed
DKC 41-64 (43-31)	91 (93)	RR + Bt	Feed
DKC 41-57	91	RR + Bt + CRW	Feed
DKC 48-52 (48-46)	98	RR (RR + Bt)	Ethanol
DKC 42-95	92	RR + Bt	Ethanol
DKC 42-91	92	RR + Bt + CRW	Ethanol

[X] Some varieties were not available in 2008, so changes for 2008 are shown in parenthesis.

[Y] RR = Roundup Ready, Bt = Bt gene for corn borer resistance, CRW = gene for corn root worm resistance.

[Z] Feed varieties have no special processing characteristics; ethanol varieties are highly fermentable for ethanol processing.

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Corn disease assessment and yield. To determine disease indices and to isolate *R. solani* AG 2-2 from corn roots, 20 plants were dug within two rows of each corn variety on October 3, 2007 and September 10, 2008. Roots were washed with a pressure washer and rated for disease with a 1 to 5 scale where 1 = < 2% of roots were discolored or decayed and 5 = root system was rotted and plant dead or dying (6). Three, 1-inch length segments of roots from each plant were surface-treated in 10% bleach for 15 sec, rinsed twice in sterile deionized water, and placed on a semi-selective medium for isolation of *R. solani*. Cultures of *R. solani* were transferred to potato dextrose agar for further identification.

Corn yield estimates were made by hand-harvesting all ears in 10 feet of the two center rows per plot on October 3, 2007 and October 22, 2008. Ears were placed in a bin dryer. Yield was adjusted to 15.5% moisture and calculated based on 56 pounds per bushel.

Sugarbeet disease assessment and yield. In 2008 (plots previously inoculated and sown to corn in 2007) were fertilized to recommended levels and sown to sugarbeet 'HM 2467' at 2.5-inch spacing on May 21. Plots consisted of six, 35-ft rows spaced 22 inches apart. Microrates of the herbicides Betamix (0.5-1.5 pt/A) + UpBeet (1/8 oz/A) + Stinger (30 ml/A) + clethodim (70-130 ml/A) + MSO (1-1.25 pt/A) were applied on May 26, June 6, and 17 with a tractor-mounted sprayer and TeeJet 8003 flat fan nozzles at 40 psi. Stands were thinned to the equivalent of 190 plants per 100 feet of row on June 20. Cercospora leaf spot was controlled by applications of Eminent (13 oz/A), SuperTin (5 oz/A), and Headline (9 oz/A) on August 8, 20, and September 4, respectively.

In 2009 (plots previously inoculated and sown to corn in 2008) were fertilized to recommended levels and sown to sugarbeet 'HM 4017RR' at 4 3/8-inch spacing on May 22. Plots consisted of six, 35-ft rows spaced 22 inches apart. Roundup was applied at 22 oz/A on June 4 and July 11 using a tractor-mounted sprayer and TeeJet 8003 flat fan nozzles at 40 psi. Cercospora leaf spot was controlled by applications of Eminent (13 oz/A) and SuperTin (5 oz/A) on July 20 and August 5, respectively.

In 2008 and 2009, stands were counted at regular intervals after emergence until plots were thinned. The two middle rows of each plot were harvested October 15, 2008 and September 29, 2009. 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.

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

RESULTS

Corn disease assessment and yield. For both years, there were no significant interactions between soil inoculum and corn variety, so these main treatments will be presented separately.

In 2007, corn root rot ratings were low and similar among plots inoculated with either population of *R. solani* and the non-inoculated control. Rating was difficult because an early killing frost occurred about 4 weeks before plots were assessed for disease, so corn roots were discolored and senesced earlier than expected. Despite this problem, isolation of *R. solani* from roots was significantly higher in plots inoculated with *R. solani* AG 2-2 IIIB (19%) compared to plots inoculated with AG 2-2 IV (4%) and the non-inoculated control (6%) (Table 2). In 2008, root rot ratings and recovery of *R. solani* from roots were low and there were no significant differences among inoculum treatments (Table 2). In both years, corn yields were unaffected by inoculation of soil with *R. solani* compared to non-inoculated soil (Table 2).

In 2007 and 2008, root rot ratings were significantly different among corn varieties, and tended to follow similar trends in both years (Table 2). Disease was significantly highest in the two feed varieties, (one Roundup Ready and the other Roundup Ready + Bt). Isolation of *R. solani* from roots varied from 4 to 18% in 2007 and from 4 to 7% in 2008, but for each year, there were no significant differences among varieties (Table 2). Corn yields varied in both years, but were not statistically different among varieties (Table 2).

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Table 2. Disease ratings, isolation of *Rhizoctonia solani* from roots, and yields of corn planted on May 15, 2007 and May 22, 2008 within 24 hours of inoculation with *R. solani* AG 2-2 IV, AG 2-2 IIIB, or not inoculated. The experiment was located in a field near Gluek, MN.

	Root rot rating[W]		% Plants with *R. solani* [X]		Yield (bu/A)[Y]	
Main treatment[V]	2007	2008	2007	2008	2007	2008
Inoculum						
Non-inoculated (control)	2.2	1.9	6	2	145	144
R. solani AG 2-2 IV	2.3	1.8	4	3	152	145
R. solani AG 2-2 IIIB	2.4	2.0	19	4	138	136
LSD (P = 0.05)[Z]	NS	NS	5	NS	NS	NS
Corn Variety						
DKC 38-92	2.6 a	2.3 a	10	4	139	140
DKC 41-64 (43-31)	2.4 ab	2.1 a	14	3	129	159
DKC 41-57	2.2 cd	1.8 b	18	3	142	135
DKC 48-52 (48-46)	2.4 bc	1.8 b	8	7	161	134
DKC 42-95	2.2 d	1.7 b	4	1	151	132
DKC 42-91	2.1 d	1.7 b	4	3	148	149
LSD (P = 0.05)[Z]	0.17	0.21	NS	NS	NS	NS

[V] *R. solani* AG 2-2 IV and AG 2-2 IIIB were grown on sterile barley grains for 3 weeks and air-dried. Separate experiments were inoculated on May 15, 2007 and May 22, 2008 by sprinkling infested barley grains onto the soil surface (26.4 oz per 2,310 ft^2; the control was not inoculated) and incorporated. Plots were arranged in a randomized block design with four replicates. Corn varieties were sown May 15, 2007 and May 22, 2008 as subplots (6 rows, 22 inches apart and 35 feet long) within each main treatment.

[W] Corn plants were dug from plots on October 3, 2007 and September 10, 2008; roots were washed and rated with a 1 to 5 scale where 1 = < 2% root surface with lesions and 5 = roots completely rotted and plant dead (6).

[X] Segments of roots (three, ~1-inch long per plant) were excised after disease assessment, surface-treated with bleach, and cultured on a semi-selective medium for isolation of *R. solani*.

[Y] Plots were harvested October 3, 2007 and October 22, 2008; yields were adjusted to 15.5% moisture and calculated based on 56 pounds per bushel.

[Z] LSD = Least significant difference, P = 0.05; for each column, values followed by the same letter are not significantly different; NS = not significantly different.

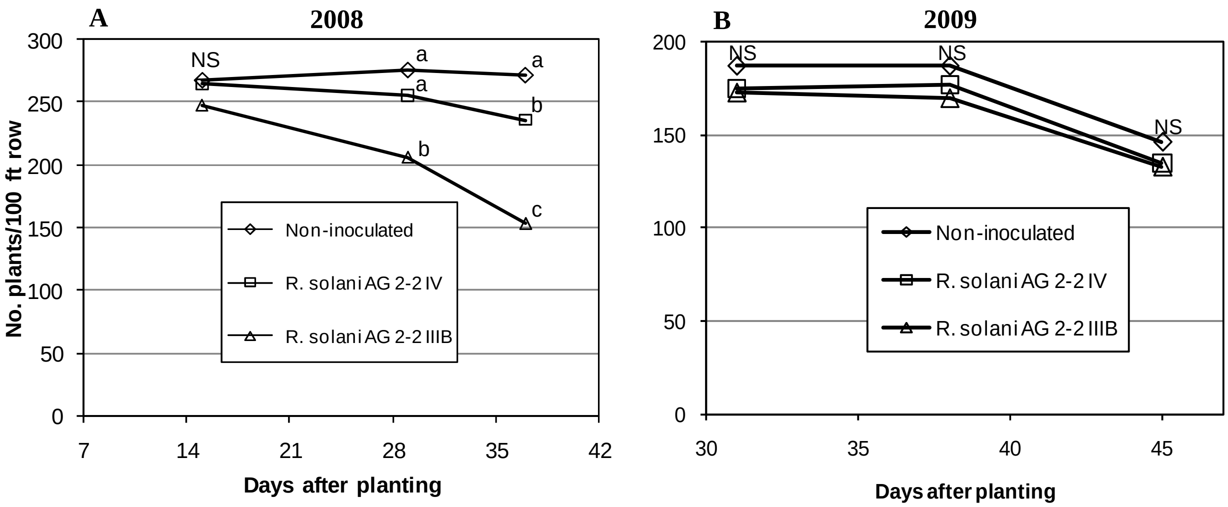

Fig. 1. Sugarbeet stand in field trials near Gluek, MN sown **A**) May 21, 2008 and **B**) May 22, 2009 that had been inoculated with *Rhizoctonia solani* AG 2-2 IV, AG 2-2 IIIB, or not inoculated and planted to corn (six varieties representing different variety traits) the previous year.

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Sugarbeet disease assessment and yield. For both years, there were no significant interactions between soil inoculum and previous corn variety, so these main treatments will be presented separately.

In 2008, at 2 weeks after planting, sugarbeet reached equally high and maximum stands in plots previously inoculated with *R. solani* AG 2-2 IIIB, AG 2-2 IV, or not inoculated in 2007 (Fig. 1A). Over the next 3 weeks, plants began to die in plots previously inoculated with *R. solani* AG 2-2 IIIB and AG 2-2 IV so by 5 weeks after planting, seedling stands were lowest in plots inoculated with *R. solani* AG 2-2 IIIB, intermediate in plots inoculated with AG 2-2 IV, and highest in non-inoculated plots (Figure 1A).

At harvest in 2008, plots previously inoculated in 2007 with *R. solani* AG 2-2 IIIB had more severe RCRR and lower root and sucrose yields than when inoculated with AG 2-2 IV and the non-inoculated control (Table 3). Plots inoculated in 2007 with AG 2-2 IV were significantly lower than the non-inoculated control for root yield and recoverable sucrose per acre but were equal to the non-inoculated control for RCRR, percent sugar and pounds of sugar per ton (Table 3).

In 2009, sugarbeet stands were lower than in 2008 because seed was sown at 4 3/8-inch spacing rather than at a 2.5-inch spacing. By 6 weeks after planting, stand was declining (Figure 1B). The reason for this stand loss is unknown. Stands were not significantly different among plots inoculated with *R. solani* AG 2-2 IV, AG 2-2 IIIB, or not inoculated, but stands tended to be slightly higher in the non-inoculated plots (Figure 1B).

At harvest in 2009, plots inoculated in 2008 with *R. solani* AG 2-2 IIIB had significantly higher RCRR and lower percent sugar and pounds sugar per ton than plots inoculated with *R. solani* AG 2-2 IV or not inoculated, which were equal (Table 3). Root yields and pounds of recoverable sucrose per acre were not significantly different among inoculation treatments.

The corn varieties sown in 2007 and 2008 experiments had no significant effect on sugarbeet in 2008 and 2009, respectively, for RCRR or any harvest parameters (Table 3).

Table 3. Root rot ratings, yield, and quality of sugarbeet sown May 21, 2008 and May 22, 2009 in experiments previously inoculated with *Rhizoctonia solani* AG 2-2 IV, AG 2-2 IIIB, or not inoculated and planted to corn varieties the previous year in a field near Gluek, MN.

					Sucrose					
	RCRR (0-7) [Y]		Yield (Ton/A)		%		lb/T		lb recov./A	
Main treatments [X]	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Inoculum										
Non-inoculated (control)	2.5 a	4.2 a	23.7 a	18.8	17.5 a	16.6 a	296 a	285 a	6994 a	5357
R. solani AG 2-2 IV	2.9 a	4.0 a	21.1 b	18.3	16.9 a	16.7 a	284 a	285 a	6002 b	5211
R. solani AG 2-2 IIIB	6.2 b	4.6 b	14.8 c	18.8	14.5 b	16.3 b	226 b	277 b	3385 c	5183
LSD (P = 0.05) [Z]	0.6	0.3	2.2	NS	0.9	0.3	20	6	649	NS
Previous Corn Variety										
RR, feed	4.0	4.3	19.1	19.2	16.4	16.4	271	280	5329	5400
RR+Bt, feed	3.9	4.2	20.2	18.6	16.2	16.4	267	281	5525	5218
RR+Bt+CRW, feed	3.8	4.3	20.2	18.5	16.4	16.6	270	283	5554	5222
RR, ethanol	3.8	4.1	19.3	18.9	16.1	16.6	264	284	5284	5348
RR+Bt, ethanol	3.8	4.3	20.3	18.4	16.3	16.5	270	280	5556	5154
RR+Bt+CRW, ethanol	3.7	4.4	20.1	18.2	16.4	16.6	271	284	5515	5160
LSD (P = 0.05) [Z]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

[X] Inoculum of *R. solani* AG 2-2 was grown on sterile barley grain; separate experiments were inoculated on May 15, 2007 and May 22, 2008 by sprinkling infested barley grains onto the soil surface (26.4 oz per 2,310 ft^2; the control was not inoculated) and incorporating. Plots were arranged in a randomized block design with four replicates. Corn varieties were sown the same day as subplots (6 rows, 22 inches apart and 35 feet long) within each main treatment. Sugarbeet plots were harvested October 15, 2008 and September 25, 2009.

[Y] Rhizoctonia crown and root rot rating (0 to 7 scale, 0 = root healthy, 7 = root completely rotted and foliage dead).

[Z] LSD = Least significant difference, P = 0.05; for each column, numbers followed by the same letter are not significantly different; NS = not significantly different.

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DISCUSSION

In both years, *R. solani* AG 2-2 IV and AG 2-2 IIIB caused no aboveground symptoms on corn and did not affect yields compared to a non-inoculated control, which confirms results of previous trials in the RRV (8,9,10). The significantly higher isolation of *R. solani* from roots in plots inoculated with *R. solani* AG 2-2 IIIB than in plots inoculated with AG 2-2 IV and the non-inoculated control in the 2007 trial also confirms results of previous trials at Crookston (9,10). There were no differences, however, in isolation of *R. solani* from corn in plots inoculated with *R. solani* AG 2-2 IV, AG 2-2 IIIB, or and the non-inoculated control in the 2008 trial. It is unknown why these inconsistencies occurred between years, but could be related to weather conditions that affect infection of roots by *R. solani*. Recovery of the fungus from corn roots also is very difficult because of numerous competitive microbes in soil.

Soil inoculation with *R. solani* AG 2-2 IIIB prior to growing corn in 2007 had a tremendous effect on the following (2008) sugarbeet crop, but the effect was much smaller in the 2008/2009 experiment. Results from the 2007/2008 experiment confirm previous trial results in Crookston (9,10) where growing corn in soil inoculated with *R. solani* AG 2-2 IIIB resulted in high levels of RCRR in a following sugarbeet crop compared to soil inoculated with *R. solani* AG 2-2 IV and the non-inoculated control. The lack of significant disease on sugarbeet in 2009 following 2008 soil inoculation with *R. solani* AG 2-2 IIIB and growing corn is contrary to previous trial results. Isolation of *R. solani* from corn roots in plots inoculated with *R. solani* AG 2-2 IIIB in 2007 was much higher than in 2008 and averaged 19 and 4%, respectively. The low ratings of RCRR on sugarbeet in 2009 compared to 2008 may be attributable to differences in infection of corn roots and to differences in environmental conditions affecting survival of the fungus, infection, and/or disease development.

Severe RCRR in sugarbeet following corn inoculated with *R. solani* AG 2-2 IIIB compared to AG 2-2 IV may not be solely due to the differences in percent of corn roots infected. Perhaps, *R. solani* AG 2-2 IIIB has a greater ability to survive the winter (on corn root stubble or in soil) compared to AG 2-2 IV. In addition, *R. solani* AG 2-2 IIIB grows at warmer temperatures (up to 95°F) than AG 2-2 IV, which may give it the ability to infect sugarbeet and favor disease development over a wider range of soil temperatures.

The effects of corn variety on root rot ratings, percent recovery of *R. solani*, and corn yields were variable for the two years and showed no conclusive trends. Overall, results followed previous reports where no aboveground symptoms or yield losses occurred on corn in *Rhizoctonia*-inoculated plots compared to the non-inoculated control. In contrast, Sumner (7) reported that all varieties of dent corn evaluated in the southeastern USA were susceptible to *R. solani* AG 2-2 IIIB.

CONCLUSIONS

1. *R. solani* AG 2-2 IIIB infects corn roots without causing aboveground symptoms or yield loss.
2. *R. solani* AG 2-2 IIIB can maintain soil inoculum levels during a corn rotation crop and may result in disease on the following sugarbeet crop.
3. When high inoculum levels of *R. solani* AG 2-2 IIIB occur, caution should be taken in growing corn in rotation with sugarbeet.

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Lime and Manure influence on Rhizoctonia Solani

The following report is a summarization of testing fungicides for controlling rhizoctonia solani during the growing seasons of 2008 and 2009.

Objectives

The objective of these trials was to evaluate application of factory lime (PCC) and/or turkey manure for suppression of rhizoctonia solani (rhizoctonia root rot).

Methods

This test was conducted at the conclusion evaluating field corn as a host to Rhizoctonia solani Ag 2-2 IIIB and IVA. In the spring of 2007 the testing area was inoculated with inoculum of Rhizoctonia solani Ag 2-2 IIIB and IVA. The inoculation was conducted in cooperation with Dr. Carol Windels project evaluating field corn as a host to Rhizoctonia solani Ag 2-2 IIIB and IVA. Sugarbeets were planted in the testing area in 2008 and evaluated for rhizoctonia root rot. In 2009 sugarbeets were planted again in the testing area to evaluate PCC and turkey manure influence on Rhizoctonia solani Ag 2-2 IIIB and IVA in sugarbeets. PCC and Turkey manure treatments were applied in the fall of 2008 and incorporated with a plowing disk. Table 1 shows the specifics of activities conducted at the rhizoctonia testing sites in 2008 and 2009. Plots were 11 ft. (6 rows) wide and 35 ft long. Sugarbeet stands were counted at 4 leaf sugarbeet stage and at harvest for the whole plot and factored to a 100 ft relative stand. The test was replicated 4 times. Sugarbeets were harvested with a 4 row research harvester plow. The harvester plow lifted the sugarbeets out of the soil and places the sugarbeets on the soil surface. The sugar beets are then placed in a row for 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 be combined. The sugarbeets were collected and measured for yield and analyzed for quality.

Results and Discussion

The data collected from the testing site is summarized in tables 2 a-c. Sugarbeet stand were the lowest and root rot ratings were the highest in the presence of AG 2-2 IIIB. The AG 2-2 IIIB rhizoctonia strain is a very aggressive strain and this data indicates the persistence in the soil over time.

The sugarbeet yield and revenue presented as a percent of the mean was directly related to the sugarbeet stand and root ratings.

Sugarbeet yield and revenue presented as a percent of the mean tended to be best when lime-PCC was applied to the treatment.

This indicates an advantage to the application of PCC prior to sugarbeets production. Further research will need to be conducted to determine if the benefit from PCC is from disease suppression or added nutrients within the PCC.

Table 1 . Site specifics for Lime and Manure influence on rhizoctonia solani (AG 2-2 IIIB and IVA)

DATE	PLANTED	SPACING	SOIL	APPLIED	RATE	PRESSURE	WEATHER
2008							
5/21/2008	X	2.2 in	cool and wet	10-34-0 starter infurrow	3 GPA		
6/4/2008				Progress 8.5 oz.			Not reported
				Stinger 1.3oz.			
				Upbeet .125oz.			
				Nortron 4oz.			
				MSO 1.5%			
6/8/2008				Broadcast fert incorp.			
				60-50-50			
6/10/2008				Progress 8.5 oz.			not reported
				Stinger 1.3oz.			
				Upbeet .125oz.			
				Nortron 4oz.			
				MSO 1.5%			
2009							
5/22/2009	X	4 3/8 in					
6/30/2009				Broadcast fert incorp.			
				50-40-0			
7/10/2009				Glyphosate	14 GPA	40psi	N 5, 70', Cloudy
7/20/2009				Eminent 13oz.	14 GPA	40psi	S 10-15, 65', Cloudy
8/5/2009				Supertin 5oz.	14 GPA	40psi	NW, 70', Sunny

Table 2-a.Exp# 0955, 2009 Rhizoc infulenced by Lime and manure for Stand Counts and Root Ratings

Trt #	Rhizoctonia Strain	Treatment Description	Stand Counts 6/22/09	Stand Counts 6/29/09	Stand Counts 7/27/09	Root Ratings (1-7 scale)
1	Non Inoculated (1)	Lime Check (A)	79	78	90	2.5
2	Non Inoculated (1)	Lime (PCC) 4 ton	86	89	80	2.2
3	Non Inoculated (1)	Manure 4 ton	91	88	83	2.4
4	Non Inoculated (1)	Lime (PCC) 4 ton + Manure (TM) 4 ton	50	50	49	2.3
5	Non Inoculated (1)	Lime (PCC) 8 ton	70	69	69	2.9
6	Non Inoculated (1)	Manure Check	79	72	63	2.9
7	AG 2-2 IV	Lime Check (A)	56	55	56	2.6
8	AG 2-2 IV	Lime (PCC) 4 ton	56	62	41	2.4
9	AG 2-2 IV	Manure 4 ton	66	69	60	2.7
10	AG 2-2 IV	Lime (PCC) 4 ton + Manure (TM) 4 ton	65	70	65	2.5
11	AG 2-2 IV	Lime (PCC) 8 ton	41	43	32	2.5
12	AG 2-2 IV	Manure Check	58	55	65	2.9
13	AG 2-2 IIIB	Lime Check (A)	48	47	43	3.0
14	AG 2-2 IIIB	Lime (PCC) 4 ton	58	59	51	2.9
15	AG 2-2 IIIB	Manure 4 ton	58	56	56	3.0
16	AG 2-2 IIIB	Lime (PCC) 4 ton + Manure (TM) 4 ton	43	43	42	3.1
17	AG 2-2 IIIB	Lime (PCC) 8 ton	51	49	48	2.5
18	AG 2-2 IIIB	Manure Check	41	40	35	3.0
		C.V%	46.49	46.72	49.48	26.73
		LSD (0.05)	6.9	6.9	6.8	1.0

Table 2-b.Exp# 0955, 2009 Rhizoc infulenced by Lime and Manure for Sugar Beet Production

Trt #	Rhizoctonia Strain	Treatment Description	Tons Per Acre	Sugar	Purity	PPM Nitrate
1	Non Inoculated (1)	Lime Check (A)	21.7	14.4	90.0	104.3
2	Non Inoculated (1)	Lime (PCC) 4 ton	24.0	14.6	90.4	120.5
3	Non Inoculated (1)	Manure 4 ton	19.3	14.3	89.8	162.3
4	Non Inoculated (1)	Lime (PCC) 4 ton + Manure (TM) 4 ton	14.1	14.9	90.8	75.2
5	Non Inoculated (1)	Lime (PCC) 8 ton	21.6	15.1	90.5	85.6
6	Non Inoculated (1)	Manure Check	17.1	14.3	89.4	131.4
7	AG 2-2 IV	Lime Check (A)	19.1	14.3	89.2	133.8
8	AG 2-2 IV	Lime (PCC) 4 ton	22.7	14.1	89.1	176.6
9	AG 2-2 IV	Manure 4 ton	24.6	14.1	88.8	116.7
10	AG 2-2 IV	Lime (PCC) 4 ton + Manure (TM) 4 ton	22.9	14.3	89.3	138.4
11	AG 2-2 IV	Lime (PCC) 8 ton	16.3	11.8	76.3	203.2
12	AG 2-2 IV	Manure Check	21.7	14.7	89.6	99.1
13	AG 2-2 IIIB	Lime Check (A)	17.8	13.1	87.8	143.2
14	AG 2-2 IIIB	Lime (PCC) 4 ton	21.0	13.7	88.2	156.6
15	AG 2-2 IIIB	Manure 4 ton	19.6	13.8	88.4	126.4
16	AG 2-2 IIIB	Lime (PCC) 4 ton + Manure (TM) 4 ton	23.6	13.6	87.7	141.4
17	AG 2-2 IIIB	Lime (PCC) 8 ton	20.7	14.4	89.0	90.9
18	AG 2-2 IIIB	Manure Check	16.6	13.9	89.4	114.1
		C.V%	24.2	7.9	1.9	57.2
		LSD (0.05)	2.2	1.6	2.4	114.1

Table 2-c.Exp# 0955, 2009 Rhizoc infulenced by Lime and Manure For Revenue

Trt #	Rhizoctonia Strain	Treatment Description	Ext. Percent Sucrose	Ext. Suc.Per Ton	Ext. Suc.Per Acre	Revenue Per Acre	Rev - % of Mean
1	Non Inoculated (1)	Lime Check (A)	12.0	239.5	5314.8	577.6	114.47
2	Non Inoculated (1)	Lime (PCC) 4 ton	12.2	243.4	5882.0	638.1	126.47
3	Non Inoculated (1)	Manure 4 ton	11.9	237.0	4616.6	488.7	96.84
4	Non Inoculated (1)	Lime (PCC) 4 ton + Manure (TM) 4 ton	12.5	250.1	3602.4	406.0	80.46
5	Non Inoculated (1)	Lime (PCC) 8 ton	12.6	252.4	5457.3	609.3	120.75
6	Non Inoculated (1)	Manure Check	11.8	235.8	4156.3	446.9	88.56
7	AG 2-2 IV	Lime Check (A)	11.8	235.0	4604.1	492.6	97.62
8	AG 2-2 IV	Lime (PCC) 4 ton	11.5	230.7	5268.0	539.6	106.93
9	AG 2-2 IV	Manure 4 ton	11.5	230.2	5484.2	536.1	106.25
10	AG 2-2 IV	Lime (PCC) 4 ton + Manure (TM) 4 ton	11.8	235.0	5389.8	560.9	111.16
11	AG 2-2 IV	Lime (PCC) 8 ton	25.4	507.9	4399.3	523.4	103.73
12	AG 2-2 IV	Manure Check	12.1	242.3	5214.8	553.6	109.71
13	AG 2-2 IIIB	Lime Check (A)	10.5	209.2	3881.5	368.3	72.99
14	AG 2-2 IIIB	Lime (PCC) 4 ton	11.1	221.1	4762.8	474.0	93.93
15	AG 2-2 IIIB	Manure 4 ton	11.2	223.5	4460.6	445.7	88.33
16	AG 2-2 IIIB	Lime (PCC) 4 ton + Manure (TM) 4 ton	10.9	217.7	5226.9	506.9	100.46
17	AG 2-2 IIIB	Lime (PCC) 8 ton	11.7	234.8	4899.2	512.0	101.46
18	AG 2-2 IIIB	Manure Check	11.4	228.1	3893.7	403.1	79.89
		C.V%	10.6	10.6	27.2	33.5	33.5
		LSD (0.05)	1.7	34.4	568.4	72.3	47.5

SMBSC Evaluation of Lime Product Influence on Sugarbeet Growth-2009

Sugarbeets were planted at one location to test different lime products on sugarbeet production. The location was at Hector, MN.

Methods

Table 1 shows the specifics of activities conducted at this site. Plots were 22 ft. (12 rows) wide and 50 ft long. The lime products tested were quarry, PCC and pelletized. Fertilizer source 0-46-0 was used so that only phosphorus could be applied in the fertilizer analysis. Total nitrogen in the 4 foot depth was adjusted with urea 46-0-0 to current SMBSC recommendations. Phosphorus fertilizer, TM and NAF were applied prior to planting time and field cultivated in to the soil. Sugarbeets were planted with a 6 row planter. Plots were not thinned as the sugarbeet stands did not warrant thinning. Research trials were harvested on 10/21/09 with a 2 row research harvester. Four rows were harvested and two subsamples were collected and analyzed for quality. Table 2 shows the yield and quality data for each treatment.

Table 1.

Task	Hector
Sugarbeet-Varity	RR 201
Planting-date	4/23/2009
Fertility	
Nitrogen	53
Phosphorus	7
Potassium	123
OM.	5
Fertilizer Applied	
Nitrogen	60 lbs.
Harvest	10/21/2009

Results and Discussion

1. Sugarbeet yield and quality were not influenced by the lime treatments. Treatment 5 appears to have a response but there is no plot replication to prove it.

2. The study was conducted in one plot in one location. Management decisions should not be made based on one year of data.

3. This test will be conducted on three sites in 2010. Combined results will be reported at the conclusion of the research season.

Table 2: Lime Product Yield, Quality and Revenue

Trt #	Product	Rate	Trt. Description	Harvest stand est.	Tons	Sugar	PURITY	Nitrate	ES	EST	ESA	Revenue - % of Mean
1	Quarry	1 ton	ENP	123	26.5	**14.8**	93.3	**38**	12.9	257	6813	93.9%
2	Pell Lime	400 lbs	Rec.	**148**	29.8	14.4	92.4	**36**	12.3	247	7335	97.0%
3	Pell Lime	600 lbs	ENP	143	26.4	14.4	93.3	54	12.5	249	6649	89.8%
4	PCC	4 Ton	4 Ton	136	27.9	14.7	93.1	46	12.7	255	7138	97.9%
5	PCC	2 Ton	ENP	**160**	**33.2**	14.7	92.9	41	12.7	253	**8415**	**114.3%**
6	CK	0	0	141	30.9	14.6	93.1	41	12.7	254	7848	106.9%
			C.V	13.33	13.66	2.25	1.56	26.97	3.71	3.64	14.50	16.33
			LSD(0.5)	22.5	4.9	0.4	1.8	14.1	0.6	11.1	1315.3	19.7%

SMBSC Evaluation of Lime Application During a Whole Rotation-2009

Lime was added at varying rates at different stages during a cropping rotation. One test has been completed in a field near Raymond, MN

Methods

1. Table 2 shows the specifics of activities conducted at each site. Plots were 11 ft. (6 rows) wide and 50 ft long. Factory PCC lime was used for the study. The PCC lime was analyzed at a soil laboratory, Table 1. All lime applications were made in the fall previous to the growing season. Stand count and harvest data were collected from the middle two rows of a 6 row plot. Soybeans were harvested with a research combine. The total length of the center four rows of the six row plot were harvested and measured for yield and moisture. Corn was hand harvested. Ten feet of row was harvested from rows 2 and 3. The corn was shelled with a stationary sheller and measured for yield and moisture. Sugarbeets were harvested with a 2 row research harvester and the whole plot length was harvested. One quality sub-sample was collected from each plot and analyzed for quality. Plots were not thinned as the sugarbeet stands did not warrant thinning. Soybean yield was adjusted to 13.5% moisture. Soybean value was estimated using the November futures price as of 11/1/2007. The price was $9.80 and a $0.40 basis was assumed. Corn yield was adjusted to 15.5% moisture. Corn value was estimated using December futures price as of 12/3/2008. The price was $3.86 and a $0.40 basis was assumed. The whole rotation revenue in Table 4 was calculated using the gross revenue from the three crops harvested in the study. In tables 3 & 4 the LSD was added to the least desirable value and any number above the calculation is highlighted in bold type.

Table 1. Lime analysis, Fall 2007

Nutrient	lb/ton
Total Nitrogen (N):	42
Phosphate (P2O5):	44
Potash (K20):	27
Sodium:	4.0
Calcium:	37
Magnesium:	8.8
Zinc:	0.7
Iron:	1.02
Manganese:	0.7
Copper:	0.4
Sulfur:	8.7

Table 2: Factory PCC Lime Treatment List

	2007	2008	2009
Trt Number	Soybean	Corn	Beet
1	no fert. No lime	no fert. No lime	no fert. No lime
2	4 ton lime	140 N Rec P	110 N Rec P
3	8 ton lime	140 N Rec P	110 N Rec P
4	12 ton lime	140 N Rec P	110 N Rec P
5	no N Rec P	140 N Rec P 4 ton lime	110 N Rec P
6	no N Rec P	140 N Rec P 8 ton lime	110 N Rec P
7	no N Rec P	140 N Rec P 12 ton lime	110 N Rec P
8	no N Rec P	140 N Rec P	110 N Rec P 4 ton lime
9	no N Rec P	140 N Rec P	110 N Rec P 8 ton lime
10	no N Rec P	140 N Rec P	110 N Rec P 12 ton lime
11	no N Rec P	140 N Rec P	110 N Rec P
12	no N Rec P	140 N Rec P	no fert. No lime
13	4 ton TM 4 t lime	140 N Rec P	110 N Rec P
14	no N Rec P	4 ton TM 4 ton lime 60 N	110 N Rec P
15	no N Rec P	140 N Rec P	4 ton TM 4 ton lime
	TM = Turkey Manure		

Results and Discussion:

1. Lime application should be made after soybeans and before corn. Sugarbeet revenue may be maximized and corn yield should not be negatively affected.

2. The combination of turkey manure and lime may be beneficial to all crops if applied early in the cropping rotation.

3. As lime application rate increases crop revenue also trends higher.

4. This study is scheduled to be complete in 2012. One rotation study has been completed. Conclusions should not be made on one year of data alone. Future reports will detail this experiment more in depth

Table 3: Sugarbeet Yield, Quality and Revenue

Trt Number	Sugarbeet Stand	Tons	Sugar	Purity	Nitrate	ES	EST	ESA	Sugarbeet Revenue % of Mean
1	110	30.6	15.1	**93.9**	32.7	**13.2**	**264**	8087	94.5%
2	**123**	28.3	14.4	93.6	27.9	12.5	251	7135	79.9%
3	**115**	32.8	14.8	93.2	35.9	12.8	256	8408	95.6%
4	**120**	30.7	14.8	93.6	30.6	12.9	259	7961	91.4%
5	108	**34.6**	14.9	93.3	30.7	13.0	260	**8983**	**103.3%**
6	110	**38.8**	14.6	93.6	34.9	12.7	254	**9847**	**110.9%**
7	108	**38.2**	**15.0**	93.5	35.9	**13.1**	261	**9975**	**115.3%**
8	108	32.4	14.7	93.6	30.3	12.8	256	8296	94.3%
9	**120**	34.4	14.9	93.2	30.0	13.0	260	**8910**	**102.4%**
10	**120**	32.9	14.7	92.9	27.1	12.7	255	8410	95.3%
11	110	32.1	14.9	93.2	36.4	13.0	259	8328	95.7%
12	**118**	33.4	**15.1**	**93.7**	**23.4**	**13.2**	**264**	**8824**	**103.1%**
13	**115**	**36.7**	**15.0**	93.2	37.6	13.0	260	**9530**	**109.7%**
14	98	32.8	**15.0**	93.0	45.2	13.0	259	8491	97.5%
15	103	**37.0**	14.9	93.2	**21.5**	13.0	260	**9630**	**111.1%**
CV%	8.90	12.21	2.78	0.58	42.24	3.11	3.12	12.64	13.70
LSD (.05)	14.25	5.9	0.6	0.8	19.2	0.6	11.5	1573.5	19.5%

Table 4: Corn and Soybean Yield and Revenue

Trt Number	Soybean Yield	Soybean Revenue % of Mean	Corn Yield	Corn Revenue % of Mean	Whole rotation Revenue % of Mean
1	51.80	102.9%	118.48	83.7%	93.0%
2	**53.46**	**106.2%**	146.13	103.2%	94.4%
3	49.26	97.4%	145.79	103.0%	98.2%
4	49.65	98.6%	**175.92**	**124.2%**	**113.1%**
5	49.40	98.2%	139.32	98.4%	99.9%
6	49.75	98.8%	144.19	101.8%	100.0%
7	50.17	99.7%	155.25	109.7%	104.9%
8	49.11	97.6%	154.55	**109.2%**	97.8%
9	50.45	100.2%	141.74	100.1%	93.4%
10	52.24	103.8%	141.78	100.1%	102.8%
11	49.70	98.7%	155.56	109.9%	104.7%
12	49.47	98.3%	145.32	102.6%	105.8%
13	50.75	100.8%	155.37	**109.7%**	**115.4%**
14	49.45	98.2%	105.05	74.2%	93.2%
15	50.60	100.5%	99.38	70.2%	83.2%
CV%	5.24	5.21	17.62	17.61	12.89
LSD (.05)	3.342	6.6%	31.6	22.3%	16.3%

EFFECT OF AGZYME ON SUGARBEET YIELD AND QUALITY

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

MATERIALS AND METHODS

Field trial was conducted in Prosper ND, in 2009. 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 28 May, using Beta 87RR38 with 20 g of Tachigaren/kg seed. Terbufos (Counter 15G) was applied modified in-furrow at 12 lbs/A during planting to control sugarbeet root maggot (*Tetanops myopaeformis* von Röder; Diptera: Ulidiidae). Plots were thinned manually on 30 June to 41,580 plants per acre. Weeds were controlled with recommended herbicides (Khan, 2009), and hand weeding.

Treatments were applied with a 4-nozzle (8002) sprayer calibrated to deliver 23 gpa of solution at 15 p.s.i pressure to the middle four rows of plots. Treatments were applied in-furrow at planting at rates indicated in Table 1.

Plots were defoliated mechanically and harvested using a mechanical harvester on 21 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 6.0 software package (Gylling Data Management Inc., Brookings, South Dakota, 1999). 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 vigor of seedlings treated with AgZyme compared to the control. The data indicated that there were no significant differences in tons per acre, sucrose concentration, sugar loss to molasses, or recoverable sucrose per acre in the treated plots 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 and 2009, AgZyme did not result in a significant increase in any of the parameters evaluated.

Table 1. Effect of AgZyme on seedling vigor, sugarbeet yield and quality at Prosper in 2009

TREATMENTS* AND RATE/A	PLANT STAND/60 FT	VIGOR**	ROOT YIELD (T/A)	SUCROSE CONCEN-TRATION (%)	LTM*** (%)	RECOVERABLE SUCROSE (LB/A)
Control 10-34-0 (1 gal)	104	10	32.4	15.3	1.19	9080
AgZyme (12.8 fl oz) + 10-34-0 (1 gal)	103	10	32.2	15.3	1.26	9001
AgZyme (25.6 fl oz) + 10-34-0 (1 gal)	103	10	32.6	15.1	1.31	8955
LSD (P= 0.05)	†NS	NS	NS	NS	NS	NS

*Treatments were applied on 28 May; control was treated with 10-34-0.
**Vigor was evaluated 21 days after planting when plants were in the cotyledonary to 2-lf stage; a rating of 1 to 10 was used with 1 indicating unhealthy and weak seedlings, and 10 healthy, vigorous seedlings.
***Sugar loss to molasses.
†NS – treatment means in the column were not significantly different.

NITROGEN RESPONSES WITH GLYPHOSATE TOLERANT SUGARBEET

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Glyphosate tolerant sugarbeet varieties are available to the growers. Nitrogen management has been and continues to be top priority for efficient and profitable sugar production. Little is known about the new varieties and their response to nitrogen fertilizer. Some observations have been since the glyphosate tolerant sugar beet plant will not be set back by conventional herbicide applications, the yield potential will be greater. Will sugar beet plant need more nitrogen to maximize the sugar beet plant's yield and quality? or will the plant be more efficient at using nitrogen and thus have a larger yield without additional nitrogen? The most recent N response research used in Minnesota nitrogen guidelines was before 2000, (Lamb et. al 2001) using non-glyphosate tolerant sugar beet varieties. At that time the optimum N guideline was 130 pounds per acre. The 130 pounds per acre was from the combination of soil nitrate-N to a depth of 4 feet and applied nitrogen fertilizer. The objective of this study is to determine the response of glyphosate tolerant sugar beet to nitrogen application.

Materials and Methods:

An experiment at four locations in the Southern Minnesota Beet Sugar Cooperative growing area was conducted in 2009. The soil test information is listed in Table 1. The treatments were five nitrogen fertilizer rates (0, 20, 40, 60, and 80 lb N/A) applied during the fall prior to the 2009 growing season. The nitrogen source was urea which was incorporated into the soil after application. Phosphorus and potassium were applied to the sites if the soil test indicated a need. The study was planted to a glyphosate tolerant variety in 2009. Sugarbeet roots were hand harvested and quality was determined at the Southern Minnesota Beet Cooperative Quality Laboratory.

Table 1. Soil test information for the four sites with glyphosate tolerant sugar beet in 2009.

	Site number			
Soil test	901	902	903	904
Organic matter 0-6" (%)	3.0	3.9	4.5	4.8
pH	7.5	8.0	7.9	7.5
Nitrate-N 0-4' (lb/A)	74	30	36	64
Olsen-P 0-6" (ppm)	3.6	3.6	3.4	10
K 0-6" (ppm)	97	116	125	129

Results and Discussion

The four sites had soil test nitrate-N for the surface four feet that ranged from 30 to 74 lb nitrate-N per acre. The data for the four sites is listed in Tables 2, 3, 4, and 5. Sugar beet root yield, extractable sucrose per acre, and revenue were increased with the application of nitrogen at 3 of the 4 sites. The quality parameter, extractable sucrose per ton of sugar beet was not affected by the application of nitrogen at any of the sites. Normally nitrogen application reduces the amount of sucrose extracted from the beet root. This has occurred in other studies with non-glyphosate tolerant varieties but is not the norm.

Table 2. Treatment means and statistics for sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue for site 901 in 2009.

N rate	Root yield	Extractable sucrose		Revenue
lb/A	ton/A	lb/ton	lb/A	$/A
0	38.5	277	10652	1289
20	39.1	276	10766	1300
40	35.9	281	10063	1233
60	39.4	275	10844	1307
80	36.6	279	10225	1247
Statistics				
N rate	NS	NS	NS	NS
N rate linear	NS	NS	NS	NS
N rate quadratic	NS	NS	NS	NS

Table 3. Treatment means and statistics for sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue for site 902 in 2009.

N rate	Root yield	Extractable sucrose		Revenue
lb/A	ton/A	lb/ton	lb/A	$/A
0	30.0	266	7996	938
20	31.1	271	8433	1004
40	34.4	267	9195	1083
60	33.5	268	8969	1058
80	32.5	269	8727	1033
Statistics				
N rate	0.01	NS	0.04	0.12
N rate linear	0.01	NS	0.03	0.06
N rate quadratic	0.01	NS	0.03	0.06

Table 4. Treatment means and statistics for sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue for site 903 in 2009.

N rate	Root yield	Extractable sucrose		Revenue
lb/A	ton/A	lb/ton	lb/A	$/A
0	28.5	305	8725	1138
20	27.7	297	8250	1055
40	30.3	298	9034	1158
60	30.8	300	9229	1187
80	31.8	297	9470	1212
Statistics				
N rate	0.22	NS	NS	NS
N rate linear	0.04	NS	0.10	0.20
N rate quadratic	NS	NS	NS	NS

Table 5. Treatment means and statistics for sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue for site 904 in 2009.

N rate	Root yield	Extractable sucrose		Revenue
lb/A	ton/A	lb/ton	lb/A	$/A
0	24.3	276	6753	819
20	24.0	286	6871	855
40	29.2	291	8514	1071
60	25.5	274	7021	847
80	20.6	275	5856	724
Statistics				
N rate	0.03	NS	0.09	0.17
N rate linear	NS	NS	NS	NS
N rate quadratic	0.01	NS	0.03	0.05

How do the results of this study with glyphosate tolerant sugar beet varieties compare to the results of other nitrogen response studies with non-glyphosate tolerant varieties? If the relative revenue for these sites from 2009 is compared with the 2001 nitrogen guideline data, they are very similar. The optimum N guideline from the 2001 data, Figure 1, is from 110 to 150 pounds per acre. In Figure 2, the relative revenues are graphed with the respective soil nitrate-N from 0 to 4 feet plus the fertilizer N applied. For sites 901, 902, and 903, the results are similar. Site 904 does not fit. The root yields at this site were less than the root yields at the other sites. At this time with only one year of data, it looks like the glyphosate tolerant varieties are responding to nitrogen similarly to the non-glyphosate tolerant varieties. At this time, N guidelines do not need to be modified because of sugar beet variety.

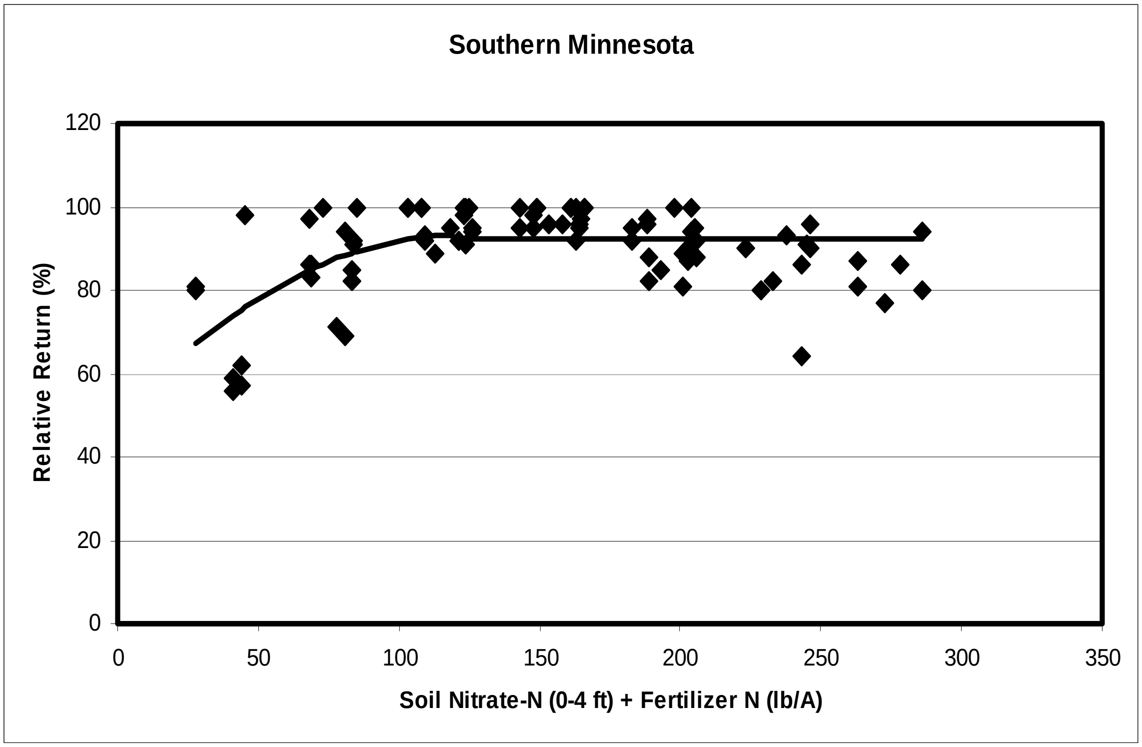

Figure 1. Nitrogen guidelines developed from non-glyphosate tolerant varieties, Lamb et al. 2001.

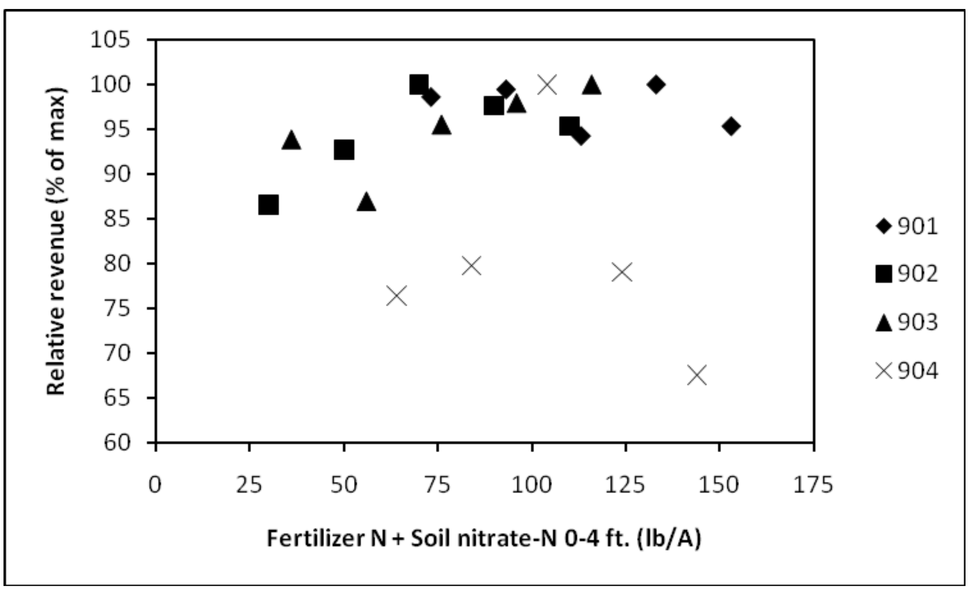

Figure 2. Relative revenue for the four sites in 2009.

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Differences in Nitrogen Mineralization Across a Landscape

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Nitrogen management is an important aspect for economic production of sugar beet. Nitrogen in the organic matter contributes over 50 % of the nitrogen used to raise sugar beet. Yet this information is not used for making fertilizer N guidelines. Soils in the Southern Minnesota Beet Sugar Cooperative growing area vary in organic matter concentrations from 2 to 10 % within a single production field. Little information exists on the within field variability of N mineralization from soil organic matter. There is a need to at least acquire knowledge of organic matter N mineralization variability to determine if within field N rates should be altered based management zones delineated by soil organic matter content.

Nitrogen (N) for the production of sugar beet comes primarily from three sources: 1) Residual soil nitrate-N left after the previous crop; 2) Nitrogen fertilizer application; and 3) Nitrogen mineralization from previous crop residue and soil organic matter. Current N fertilizer recommendations for sugar beet account for sources 1 and 2 (Lamb et al., 2001). Adjustments to the N fertilizer recommendations to account for some previous crops, such as legumes, are suggested in many situations. However, N mineralization from soil organic matter, which may include previous crop residues, is not specifically accounted for.

Nitrogen mineralization has been difficult to access and include in N recommendations (Rice and Havlin, 1994). Many attempts have been made to develop an indices of N mineralization, but the methodologies to do so have been elusive. These attempts have included laboratory methods of chemical extractions (Keeney, 1982) and incubation studies (Stanford and Smith, 1972); field methods of buried bag (Eno, 1960), ion exchange resins or membranes (Schnabel, 1983; Qien et al., 1993), and soil nitrate-N testing (Magdoff et al., 1984); and plant tissue testing during the growing season (Rice and Havlin, 1994). Laboratory incubations have been invaluable in describing the relationship of N mineralization to temperature and moisture (Stanford et al., 1973; Stanford and Epstein, 1974), but their applicability to field conditions is questioned. Plant tissue testing can be very labor intensive and expensive. Gelderman et al. (1988) reported poor correlations between laboratory chemical extractions and field estimates of N mineralization in 69 winter wheat fields in North Dakota and South Dakota.

Ion exchange resin and membranes have shown promise in estimating N mineralization under actual soil and field conditions. Ion exchange membranes have been useful in measuring relative N mineralization among treatments, but absolute N mineralization is not possible because there is no specific soil volume associated with them (Kolberg et al., 1997). DiStefano and Gholz (1986) combined intact soil cores with ion exchange resin (IER) to measure in situ N mineralization in natural field conditions. The method was adapted for use in forest and rangeland ecosystems (Binkley et al., 1992; Hook and Burke, 1995). Kolberg et al., (1999) adapted this method for use in a dry land agroecosystem in Colorado. One of the issues with IER and intact soil cores is how many samples are needed to achieve an acceptable level of precision. Kolberg et al. (1997) found that 5-7 cores were necessary to achieve a precision of +/- 1.5 mg N kg^{-1} soil at a 20% confidence level. The primary limitation to the number of samples to use is the labor and time in the laboratory analysis of the IER.

This report will concentrate on the process to evaluate the mineralization of nitrogen from soils located in different parts of a grower's field.

Materials and Methods

To meet the objective, a technique was used that was developed by Dr. Albert Sims for Minnesota conditions that measures, in situ, inorganic nitrogen released from organic matter. This technique involves taking a 2 inch diameter soil cores to a depth of 10 inches with a plastic lined sampler. The soil cores contained inside the plastic liner were removed from the soil, a bag of ion exchange resin was placed in the bottom of the core, but inside the plastic liner and the entire unit, soil core, plastic sleeve, and resin bag, were put back in the ground hole. The plastic sleeve eliminates lateral movement of mineralized N and kept plant roots from accessing the N. Water percolating through the soil core leaches soluble N, mostly nitrate-N, passing through the resin bag where nitrate-N and ammonium-N was captured by the ion exchange resin.

To understand how mineralization changes across the soil organic matter delineated zones through the growing season, several sets of soil cores plus resin bags were installed in several zones in the spring immediately after planting in three production fields in the Southern Minnesota Beet Sugar Cooperative growing area. Periodically through the growing season (6-7 week intervals), soil cores were retrieved and analyzed for nitrate- and ammonium-N, Table 1. Resin bags from the soil cores were retrieved along with resin bags associated with soil cores still remaining in the field and analyzed for nitrate- and ammonium-N. For those soil cores left in the field, fresh resin bags replaced those removed during the retrieval process. At each of four sampling times during the growing season nine soil cores plus resin bags were harvested.

Table 1. Field and sampling dates for mineralization cores in 2009.

Field	Initial	Date 1	Date 2	Date 3	Date 4
P09	May 19	June 19	July 17	August 18	Sept. 21
M09	May 19	June 19	July 17	August 18	Oct. 1
J09	May 19	June 19	July 17	August 18	Sept. 29

Results and Discussion

Three production fields in the Southern Minnesota Beet Sugar Cooperative growing area were use for this study. The fields were grid soil sampled and management zones were developed based on organic matter. The criteria for the zones were zone 1 < 3.0 %, zone 2 = 3.0 to 4.0 %, zone 3 = 4.01 to 5.0 %, zone 4 = 5.01 to 7.0 %, and zone 5 = > 7.0 %. Each field had different number of management zones, Table 2. The soil test information indicates that there is little relationship between organic matter and soil test nitrate-N, P, and K.

Table 2. Soil test results for each field and organic matter zone in fall 2008.

		Organic matter	pH	Nitrate-N 0-4 ft.	Olsen P	K
Field	OM zone	%		lb/A	ppm	Ppm
P09	1	2.8	7.9	92	6	116
P09	2	4.5	7.2	26	39	155
P09	3	4.5	8.0	31	4	135
M09	1	3.2	7.1	36	4	64
M09	2	3.1	7.2	37	4	65
M09	3	3.7	7.2	38	5	75
M09	4	5.8	7.8	44	5	90
M09	5	16.1	7.3	171	6	158
J09	3	4	7.7	21	4	171
J09	4	5.1	7.7	103	6	154

The P09 field had 3 zones mapped in it. Zones 2 and 3 had similar organic matter concentrations. At the P09 field N mineralized during 2009 increased over the growing season, Figure 1. Zone 3 mineralized approximately 60 lb N/A from the initial sampling, May 19, to the first sampling, June 19. After June 19, the rate of mineralization slowed. Zone 2 did not mineralize much between the initial sampling and June 19. After that time 60 lb N/A was found between sampling 1 and 3. For some unknown reason the amount of mineralization decreased between sampling dates 3 and 4. This could be caused by the variability in this procedure. Zone 1, the zone with the lowest organic matter concentration in this field, only mineralized 20 lb N/A during the growing season.

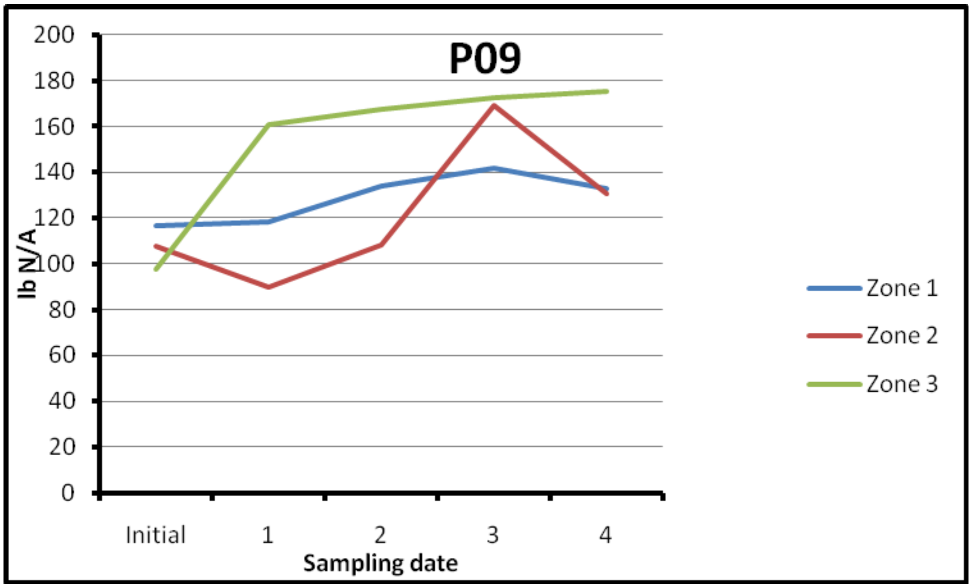

Figure 1. In-situ mineralization of nitrogen in Zones 1 – 3 at the P09 field in 2009.

The M09 site had 5 zones in it. The organic matter ranged from 3.2 to 16.1 % in this field. Zones 1 through 3 mineralized similar amounts from the initial sampling to sampling date 2, Figure 2. After sampling date 3 zones 1 and 2 did not mineralize any more nitrogen. The soils in Zones 1 and 2 mineralized 40 lb N/A in 2009. The core sites for zones 1 and 2 had similar measured organic matter concentrations and thus a similar mineralization. Zone 3 mineralized 95 lb N/A while zone 4 cores mineralized 94 lb N/A but started at a greater level of nitrogen in the cores. Zone 5 had a very high organic matter of 16.1 %. This increase in organic matter caused a greater initial mineralization rate and level but during the growing season the mineralization was reduced. At this time there is no explanation for this.

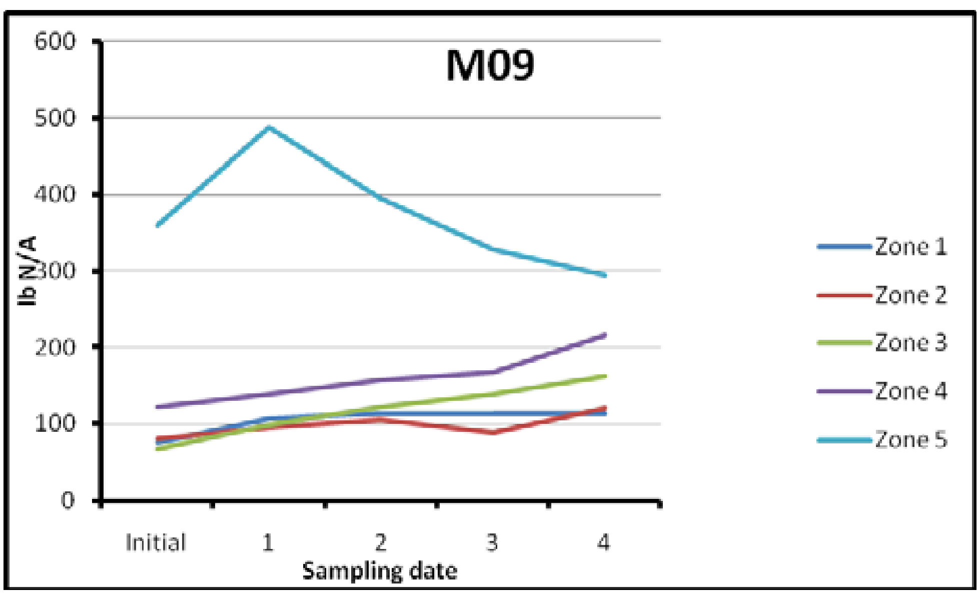

Figure 2. In-situ mineralization of nitrogen in Zones 1 – 5 at the M09 field in 2009.

The J09 field had two management zones in it. Zone 3 mineralized 41 lb N/A during the 2009 growing season while zone 4 mineralized 78 lb N/A. This indicates that in the J09 field the concentration of organic matter did affect the about N mineralized.

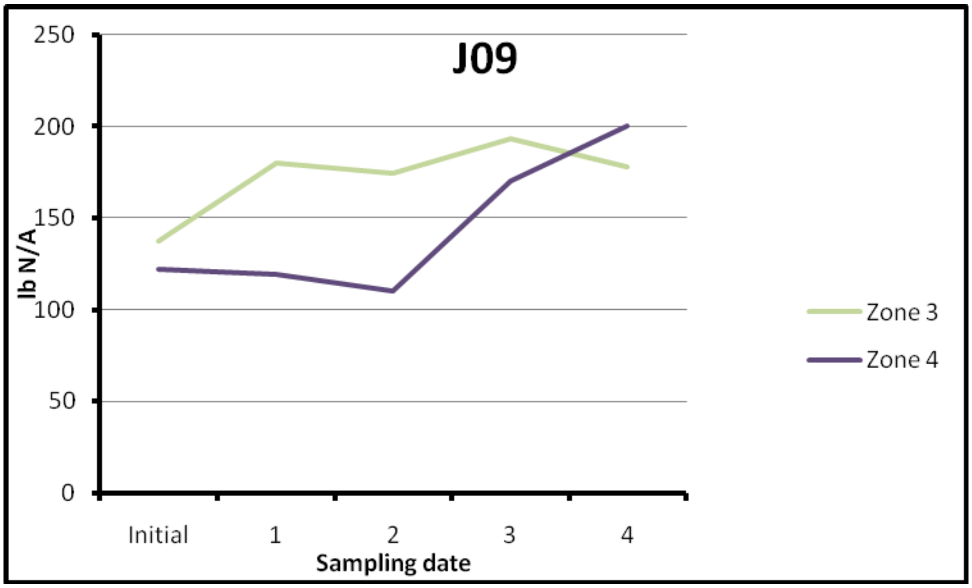

Figure 3. In-situ mineralization of nitrogen in Zones 3 -4 at the J09 field in 2009.

Summary

The data from the 2009 growing season suggests that organic matter concentration does influence the amount of nitrogen mineralized during the growing season particular if the organic is greater than 4.5 to 5 %. Another year of field measurement will be needed to confirm this. If this continues to be true, then adjusting N guidelines for sugarbeet grown in South Central Minnesota should be investigated.

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SMBSC Evaluation of Phosphorus, Turkey Ash and Turkey Manure Influence on Sugarbeet Growth-2009

Sugarbeets were planted at 2 locations in 2008 and 2 locations in 2009 to test phosphorus, turkey manure (TM) and turkey manure ash (NAF) on sugarbeet production. 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 3 shows the specifics of activities conducted at each site. Plots were 11 ft. (6 rows) wide and 50 ft long. Phosphorus fertilizer source 0-46-0 was used so that only phosphorus could be applied in the fertilizer analysis. Phosphorus fertilizer, TM and NAF were applied prior to planting time and field cultivated in to the soil. Sugarbeets were planted with a 6 row planter. Stand count and harvest data were collected from the middle two rows of a 6 row plot. The research trial was harvested with a 1 row research harvester at 3 of the 4 plots. 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. Research trials were harvested with a 2 row research harvester at one plot and the whole plot length was harvested. One quality sub-sample was collected from each plot and analyzed for quality. Plots were not thinned as the sugarbeet stands did not warrant thinning.

Table 1. Turkey Manure analysis, Spring 2008

Nutrient	lb/ton
Total Nitrogen (N):	36
Phosphate (P2O5):	42
Potash (K20):	22
Sodium:	3.7
Calcium:	20
Magnesium:	7.5
Zinc:	0.24
Iron:	0.53
Manganese:	0.34
Copper:	0.42
Sulfur:	5.3

Table 2. Turkey Ash (NAF) analysis spring 2008

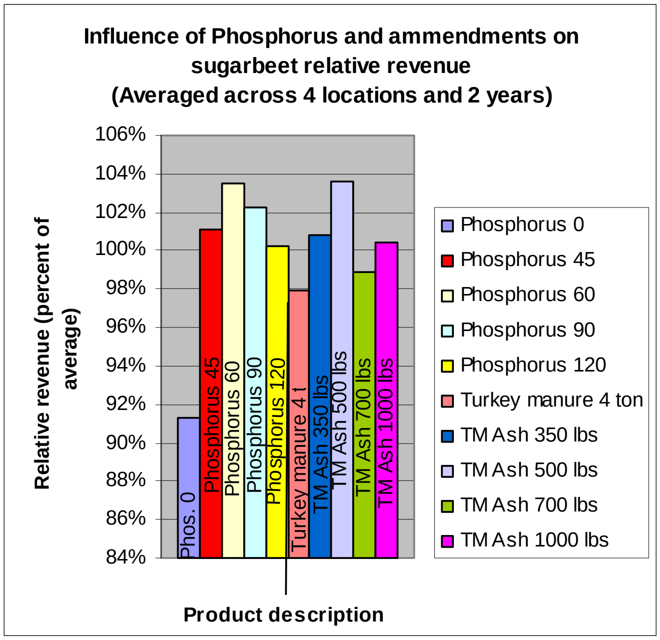
Guaranteed Analysis

Available Phosphate (P_2O_5)	8%
14% Total Phosphate (P_2O_5)	
Soluble Potash (K_2O)	5%
8% Total Potash (K_2O)	
Sulfur (S)	1.3%
Zinc (Zn)	.05%

Table 3: Combined Analysis of Sugarbeet Quality and Yield

Location - COMBINED									
PRODUCT	RATE	Tons per acre	Percent Sucrose	Purity	PPM Nitrate	ES	EST	ESA	revenue - % of Mean
Phosphorus	0	26.7	16.9	90.8	15	14.3	286	7673	91.3%
Phosphorus	45	28.4	17.2	90.9	12	14.6	292	8276	**101.1%**
Phosphorus	60	**29.2**	17.1	91.1	16	14.6	291	**8491**	**103.5%**
Phosphorus	90	**29.0**	17.1	90.9	14	14.5	290	**8401**	**102.2%**
Phosphorus	120	**29.4**	16.9	90.8	15	14.3	286	**8358**	**100.3%**
Turkey manure	4 ton	28.1	17.1	90.6	13	14.4	288	8089	97.9%
TM Ash	350 lbs	**29.0**	17.0	90.8	11	14.4	287	8331	**100.8%**
TM Ash	500 lbs	**29.6**	17.0	90.8	14	14.4	289	**8542**	**103.6%**
TM Ash	700 lbs	28.8	16.9	91.0	13	14.3	286	8215	98.9%
TM Ash	1000 lbs	28.7	17.0	90.9	11	14.4	289	8278	**100.5%**
	LSD (0.05)	2.32	0.59	0.66	7.30	0.47	9.38	673.02	9.0%
	C.V. %	15.9	6.8	1.4	107.0	6.4	6.4	16.0	17.8

Figure 1:



Results and Discussion

1. Revenue per acre was significantly influenced by phosphorus commercial fertilizer rate, turkey manure and NAF.

2. Phosphorus commercial fertilizer rates of 45, 60, 90, and 120 statistically influenced revenue per acre similarly.

3. Revenue per acre was influenced by NAF at rates of 500, 750 and 1000 lbs. per acre. These rates of NAF performed statistically similar and were statistically greater than 350 lbs. per acre.

4. Turkey Manure at 4 ton per acre gave statistically similar results compared to commercial phosphorus fertilizer at 45 lbs. per acre or greater and NAF at 500 lbs. or greater.

SMBSC Evaluation of Turkey Manure Application During a Whole Rotation-2009

Turkey manure (TM) was added at varying rates at different stages during a cropping rotation. One test has been completed in a field near Raymond, MN

Methods

1. Table 2 shows the specifics of activities conducted at each site. Plots were 11 ft. (6 rows) wide and 50 ft long. (TM) was analyzed at a soil laboratory, Table 1. All applications were made in the fall previous to the growing season. Stand count and harvest data were collected from the middle two rows of a 6 row plot. Soybeans were harvested with a research combine. The total length of the center four rows of the six row plot were harvested and measured for yield and moisture. Corn was hand harvested. Ten feet of row was harvested from rows 2 and 3. The corn was shelled with a stationary sheller and measured for yield and moisture. The center 2 rows of sugarbeets in the plot were harvested with a 2 row research harvester and the whole plot length was harvested. One quality sub-sample was collected from each plot and analyzed for quality. Plots were not thinned as the sugarbeet stands did not warrant thinning. Soybean yield was adjusted to 13.5% moisture. Soybean value was estimated using the November futures price as of 11/1/2007. The price was $9.80 and a $0.40 basis was assumed. Corn yield was adjusted to 15.5% moisture. Corn value was estimated using December futures price as of 12/3/2008. The price was $3.86 and a $0.40 basis was assumed. The whole rotation revenue in Table 4 was calculated using the gross revenue from the three crops harvested in the study. In tables 3 & 4 the LSD was added to the least desirable value and any number above the calculation is highlighted in bold type.

Table 1: Turkey Manure Analysis, Fall 2006

Nutrient	lb/ton
Total Nitrogen (N):	54
Phosphate (P2O5):	38
Potash (K20):	26

Table 2: Turkey Manure Treatment List

	2007	2008	2009
Trt Number	Soybean	Corn	Beet
1	no fert. No lime	no fert. No lime	no fert. No lime
2	4 ton lime	140 N Rec P	110 N Rec P
3	8 ton lime	140 N Rec P	110 N Rec P
4	12 ton lime	140 N Rec P	110 N Rec P
5	no N Rec P	140 N Rec P 4 ton lime	110 N Rec P
6	no N Rec P	140 N Rec P 8 ton lime	110 N Rec P
7	no N Rec P	140 N Rec P 12 ton lime	110 N Rec P
8	no N Rec P	140 N Rec P	110 N Rec P 4 ton lime
9	no N Rec P	140 N Rec P	110 N Rec P 8 ton lime
10	no N Rec P	140 N Rec P	110 N Rec P 12 ton lime
11	no N Rec P	140 N Rec P	110 N Rec P
12	no N Rec P	140 N Rec P	no fert. No lime
13	4 ton TM 4 t lime	140 N Rec P	110 N Rec P
14	no N Rec P	4 ton TM 4 ton lime 60 N	110 N Rec P
15	no N Rec P	140 N Rec P	4 ton TM 4 ton lime
	TM = Turkey Manure		

Results and Discussion:

1. If TM is applied before soybeans or corn, N will be needed for the sugarbeet crop. Soil testing is necessary to determine application rate.

2. As shown in other studies N should be adjusted to no more than 100 lbs for the sugarbeet crop.

3. TM application early in the rotation may be advantageous to all crops.

4. This study is scheduled to be complete in 2012. One rotation study has been completed. Conclusions should not be made on one year of data alone. Future reports will detail this experiment more in depth

Table 3: Sugarbeet Yield, Quality and Revenue

Treatment	Sugarbeet Stand	Tons	Sugar	Purity	Nitrate	ES	EST	ESA	Revenue % of Mean
1	114	27.3	13.9	93.4	30	12.0	241	6574	86.2%
2	110	**30.4**	14.4	93.2	33	12.5	250	**7560**	102.3%
3	113	26.3	14.1	**93.7**	29	12.3	246	6496	87.3%
4	116	**31.7**	14.6	93.0	29	12.6	253	8003	**109.8%**
5	114	**35.1**	14.5	93.1	39	12.6	252	**8816**	**120.7%**
6	110	**30.4**	14.4	93.2	33	12.5	250	**7560**	102.3%
7	112	27.0	14.6	93.4	35	12.7	254	6884	95.4%
8	114	25.7	14.6	**93.6**	34	12.7	254	6554	91.0%
9	114	28.2	14.6	93.4	37	12.7	254	7151	98.9%
10	104	35.1	**14.6**	**93.5**	35	**12.7**	**255**	8985	**125.0%**
11	112	**30.5**	**14.9**	93.1	31	**12.9**	**259**	**7871**	**110.6%**
12	106	**30.6**	**14.7**	93.3	31	**12.7**	255	**7781**	**107.7%**
13	104	**31.3**	14.4	92.8	37	12.4	248	**7754**	**104.6%**
14	113	23.1	14.4	93.2	29	12.5	249	5721	77.3%
15	118	23.8	14.3	93.2	38	12.3	247	5883	79.1%
CV%	12.14	18.64	3.96	0.56	40.04	4.27	4.30	19.07	20.43
LSD (.05)	17	6.9	0.7	0.7	17	0.7	14	1775	26.0%

Table 4: Corn and Soybean Yield and Revenue

Treatment	Soybean Yield	Corn Yield	Soybean Revenue % of Mean	Corn Revenue % of Mean	Whole rotation Revenue % of Mean
1	51.8	118	102.9%	83.7%	90.0%
2	**53.5**	146	**106.2%**	103.2%	103.7%
3	49.0	146	97.4%	103.0%	94.3%
4	49.7	176	98.7%	**124.2%**	**110.9%**
5	49.4	139	98.2%	98.4%	**108.6%**
6	49.7	144	98.8%	101.8%	101.3%
7	50.2	155	99.7%	109.7%	100.5%
8	49.1	155	97.5%	109.2%	97.8%
9	50.5	142	100.2%	100.1%	99.6%
10	52.2	142	**103.8%**	100.1%	**112.6%**
11	49.7	156	98.7%	109.9%	**107.3%**
12	49.5	145	98.3%	102.6%	103.9%
13	50.7	155	100.8%	109.7%	**105.1%**
14	49.4	105	98.2%	74.2%	82.1%
15	50.6	99	100.5%	70.2%	82.4%
CV%	5.24	17.67	5.20	17.67	11.62
LSD (.05)	3.3	32	6.5%	22.3%	14.7%

Turkey Litter Effects on Sugar beet Production

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University of Minnesota and Southern Minnesota Beet Sugar Cooperative

Livestock operations, mainly poultry and swine, are increasing in size and impact in the Southern Minnesota sugar beet growing area. Many sugar beet producers own or have interest in these operations; thus have manure available to use on their fields. Manure research data concludes that manure has a positive effect on crop production from its effects on soil nutrient availability and soil physical properties. A concern has been raised about the effect of late season nitrogen mineralized from the manure on sugar beet quality. Grower observations indicate better growth in fields that have had manure applied. With the large amount of manure available, the question has changed from whether to use manure but when in the sugar beet crop rotation should manure be applied to minimize quality concerns and realize benefits? Turkey manure has a considerable amount of litter in it, thus slowing initial release of poultry manure-N. The implication of the manure-N release is critical, especially to sugar beet growers. Therefore, recommendations need to be evaluated with sugar beets. This research project has been designed to: 1) determine when in a three-year rotation, should turkey litter be applied and 2) determine nitrogen fertilizer equivalent of turkey litter applied two and three years in advance of sugar beet production.

Materials and Methods

To meet the objectives of this experiment, the first of three sites was established near Raymond, Minnesota in the fall of 2006. A second site was established in the fall of 2007 near Olivia, Minnesota and a third site was established near Bird Island in 2009. The Bird Island site was lost because of an errant manure application by the cooperator.

The Raymond site was cropped to soybean in 2007. Turkey manure was applied fall 2006 and soybean grain yields were harvested by a plot combine and soil samples taken in the fall of 2007. The treatments for the second year were applied to the first site near Raymond in the fall of 2007 with corn grown in 2008. The corn was harvested, soil samples taken, and the third year treatments were applied late fall 2008 and sugar beet was grown in 2009.

The second site near Olivia, Minnesota had the first manure treatment applied in the fall of 2007 with soybean grown in 2008. The soybeans were harvested with a research combine, soil samples taken, and the second year's treatments were applied fall 2008. Corn was grown in 2009 and hand harvested for grain yield fall 2009. After corn harvest, soil samples were taken and the third year treatments were applied and sugar beet will be grown in 2010.

At each site of this study there were five replications of the treatments listed in Table 1. Turkey litter treatments of 3 and 6 tons per acres were applied 2 and 3 years ahead of sugar beet production in the three year rotation of soybean/corn/sugar beet. This rotation is the most common rotation in the Southern Minnesota Sugar Cooperative growing area. Treatment 5 is the check treatment for the whole experiment while treatments 8 and 15 are checks for different parts of the rotation. Treatments 6 through 14 are the N fertilizer rates plus the two turkey litter rate applied the fall before the sugar beet production year. During the corn production year, 120 lb N per acre will be applied for treatments 6 through 14. This is the current U of MN N guideline for corn following soybean. In the soybean production year, grain yield was measured with a research combine. Soil samples were taken in fall to a depth of 4 feet and analyzed for nitrate-N while soil samples to a 6 inch depth were analyzed for phosphorous, potassium, organic matter, and pH. The year 2 manure and fertilizer treatments were applied in the late fall. Corn grain was hand harvested in the fall. Similar to year 1 soil samples were taken. The year 3 treatments were applied late fall of year 2. Root yield and quality were determined in the fall. In each of the production years, optimum production practices for pests control and nutrient management besides nitrogen were used.

Table 1. Treatment List

Treatment Number	Year 1 (soybean)	Year 2 (corn)	Year 3 (sugar beet)
1	3 ton litter	0 N	0 N
2	6 ton litter	0 N	0 N
3	0 N	3 ton litter	0 N
4	0 N	6 ton litter	0 N
5	0 N	0N	0 N
6	0 N	120 N	3 ton litter
7	0 N	120 N	6 ton litter
8	0 N	120 N	0 N
9	0 N	120 N	30 N
10	0 N	120 N	60 N
11	0 N	120 N	90 N
12	0 N	120 N	120 N
13	0 N	120 N	150 N
14	0 N	120 N	180 N
15	0 N	0 N	90 N

Table 2. Timeline for crops at each of three locations.

2007-08	2008-09	2009-10	2010-2011	2011-2012
Location 1 - soybean	Location 1 - corn	Location 1 – sugar beet		
	Location 2 - soybean	Location 2 - corn	Location 2 – sugar beet	
		Location 3 - soybean	Location 3 - corn	Location 3 - sugarbeet

Results and Discussion

Raymond Site:

Soybean grain yields where significantly increased by the application of manure in 2007 at the Raymond site, Table 3. This increase was small. There were no differences in grain yield between 3 and 6 tons of turkey litter application. Soil samples were taken after the soybean production year in the fall of 2007. The application of 3 and 6 tons of turkey litter, fall 2006, increased the soil residual nitrate-N and soil test P in the sample taken fall 2007, Table 4.

Table 3. Soybean grain yields as affected by the application of 3 and 6 tons of turkey litter in fall 2006 at Raymond, Minnesota in 2007.

Treatment	Soybean grain yield (bushels per acre)
Zero (check)	50.0
3 tons turkey litter	51.8
6 tons turkey litter	53.5
Statistics	P>F
Zero vs turkey litter application	0.005
Manure (3 vs 6 tons turkey litter)	NS
C.V. (%)	5.3

Table 4. Soil test results fall 2006, fall 2007, and fall 2008 at Raymond, Minnesota.

	Nitrate-N 0-4 ft. (lb/A)			Olsen-P (ppm)			Soil test K (ppm)		
Treatment	Fall 06	Fall 07	Fall 08	Fall 06	Fall 07	Fall 08	Fall 06	Fall 07	Fall 08
3 tons turkey litter fall 06	24	98	37	35	38	34	206	178	136
6 tons turkey litter fall 06	22	172	71	34	45	41	196	187	146
3 tons turkey litter fall 07			29			28			135
6 tons turkey litter fall 07			79			43			169
120 lb N/A fall 07			40			35			143
Check	23	44	26	27	29	31	165	157	141

Corn grain yields in 2008 were measured at the Raymond site, Table 5. The only significant difference in corn grain yield was between the check, with no N fertilizer or turkey litter applied and the corn grain yield from the rest of the treated plots. There were no differences between yields from the 120 pounds N per acre as urea fertilizer and the turkey litter treatments from applied either Fall 2006 of Fall 2007, Table 4. In the Fall of 2008, soil nitrate-N was increase over the check in plots that were treated with 6 tons of turkey litter fall 2006 or fall 2007. The 3 tons of turkey applied in fall 2006 or fall 2007 had similar soil nitrate-N values as the check.

Table 5. Corn grain yields as affected by the application of 120 pounds N per acre, 3 and 6 tons of turkey litter in fall 2006, and 3 and 6 tons of turkey litter in fall 2007 at Raymond, Minnesota in 2008.

Treatment	Corn grain yield (bushels per acre)
Zero N (check)	102
120 pounds N per acre applied fall 2007	150
3 tons turkey litter applied fall 2006	130
6 tons turkey litter applied fall 2006	146
3 tons turkey litter applied fall 2007	150
6 tons turkey litter applied fall 2007	144
Statistics	P > F
Check vs rest	0.0001
120 lb N per acre vs turkey litter	NS
2006 vs 2007 turkey litter	NS
2006 3 ton vs 6 ton turkey litter	NS
2007 3 ton vs 6 ton turkey litter	NS

Sugar beets were planted in 2009 with N rate treatments and 3 and 6 turkey litter applications made fall 2008. The root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue for the turkey litter treatments are reported in Table 6 while the statistical analysis is reported in Table 7. Root yield was increased with the use of litter application. The increase was greatest with the Fall 2008 litter application. This application was confounded with an application of 120 pounds of fertilizer N per acre. The sugar beet root yield greater with 6 tons litter per acre applied compared to the 3 tons per acre when the litter was applied fall 2007. Sugar beet quality, as measured by the extractable sucrose per ton of processed sugar beet was not affected by the manure treatments. Because of the lack of response in sugar beet quality, extractable sucrose per acre and revenue was affected by the litter treatments the same as root yield was.

Table 6. Sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue as affected by the application of turkey litter since 2006 at Raymond, MN in 2009.

Treatments			Root yield	Extractable sucrose		Revenue
Fall 06	Fall 07	Fall 08	ton/A	lb/ton	lb/A	$/A
Check	Check	Check	23.1	248	5721	629
3 ton turkey litter			27.3	241	6574	701
6 ton turkey litter			27.6	250	6994	786
	3 ton turkey litter		25.1	247	6207	680
	6 ton turkey litter		33.9	253	8527	949
	120 lb N/A	3 ton turkey litter	35.1	252	8816	982
	120 lb N/A	6 ton turkey litter	39.3	258	10102	1149

Table 7. Statistical analysis for sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue at Raymond, MN in 2009.

		Extractable sucrose		
Contrast	Root yield	lb/ton	lb/A	Revenue
	P>F			
Check vs rest	0.0007	NS	0.0005	0.0008
Turkey litter fall 06 and 07 vs 08	0.0001	0.12	0.0001	0.0001
Turkey litter fall 06 vs fall 07	NS	NS	NS	NS
Turkey litter 06, 3 vs 6 tons	NS	0.17	NS	NS
Turkey litter 07, 3 vs 6	0.002	NS	0.002	0.003
Turkey litter 08, 3 vs 6	NS	NS	0.20	0.17
N rate fertilizer	0.02	NS	0.04	0.08

To compare litter treatments with fertilizer, a nitrogen rate study was conducted within the litter treatments, Table 8. There was a significant response to nitrogen application at the Raymond, MN site in 2009 for root yield, extractable sucrose per acre, and revenue. Sugar beet quality was not affect by N fertilizer application. The optimum nitrogen rate was 90 pounds per acre. The residual nitrate-N in the surface 4 feet was 40 pounds per acre. With both soil nitrate-N and fertilizer N, this would make the optimum of 130 pounds per acre. The optimum fertilizer application was similar statistically to the best litter application for revenue. This would suggest that the time of turkey litter application in the sugar beet rotation is not important at this location. Remember that this observation is based on one location in one year!

Table 8. Sugar beet root yield, extractable sucrose per ton, extractable sucrose per acre, and revenue as affected by the application of nitrogen fertilizer fall 2008 at Raymond, MN in 2009.

Fall 07	Fall 08	Root yield	Extractable sucrose		Revenue
lb nitrogen/A		ton/A	lb/ton	lb/A	$/A
120	0	27.0	254	6884	776
120	30	25.7	254	6553	740
120	60	33.2	254	8448	950
120	90	35.1	255	8985	1017
120	120	30.5	259	7871	899
120	150	33.4	255	8484	955
120	180	31.3	248	7754	850

<u>Olivia Site:</u>

A second site was established south of Olivia fall of 2007. Soybean was planted and harvested in 2008. The soybean grain yields were not affected by the 3 and 6 tons turkey litter application in the fall of 2007, Table 9.

Table 9. Soybean grain yields as affected by the application of 3 and 6 tons of turkey litter in fall 2007 at Olivia, Minnesota in 2008.

Treatment	Soybean grain yield (bushels per acre)
Zero (check)	49.8
3 tons turkey litter	50.1
6 tons turkey litter	50.7
Statistics	P>F
Zero vs turkey litter application	NS
Manure (3 vs 6 tons turkey litter)	NS
C.V. (%)	6.0

Corn was grown in 2009 with treatments added of 120 pounds N per acre and 3 and 6 tons turkey litter applied fall 2008. Corn grain yields from 2009 are reported in Table 10. There was a significant increase in grain yield over no nitrogen from the application of turkey litter and nitrogen fertilizer in 2009. The 120 pounds of N per acre as urea and the 6 tons of turkey litter per acre applied fall 2008 had the greatest grain yields of 218 bushels per acre. Statistically, there was no difference in grain yield between the 2007 and 2008 turkey litter applications. Each year, the 6 ton per acre application produced greater grain yields than the 3 ton per acre application. This site will be planted to sugar beet in 2010.

Table 10. Corn grain yields as affected by the application of 120 pounds N per acre, 3 and 6 tons of turkey litter in fall 2007, and 3 and 6 tons of turkey litter in fall 2008 at Olivia, Minnesota in 2009.

Treatment	Corn grain yield (bushels per acre)
Zero N (check)	149
120 pounds N per acre applied fall 2008	218
3 tons turkey litter applied fall 2007	180
6 tons turkey litter applied fall 2007	208
3 tons turkey litter applied fall 2008	185
6 tons turkey litter applied fall 2008	218
Statistics	P > F
Check vs rest	0.0001
120 lb N per acre vs turkey litter	0.0013
2007 vs 2008 turkey litter	NS
2007 3 ton vs 6 ton turkey litter	0.05
2008 3 ton vs 6 ton turkey litter	0.03

Factory tare soil influence on crop production-2009

Sugarbeets, corn and soybeans were planted at one location near Sacred Heart on fall applied factory tare soil to test if the tare soil had any impact on crop yield.

Methods

This is year one of a three year study. Factory tare soil was applied during the fall of 2008 at the rate of 0, 100 and 200 tons per acre. The tare soil is a blend of dry belt soil, wash house soil and soil filtered in the Wastewater Treatment Plant. The soil was incorporated using a deep tillage chisel. Previous to soil application soil samples were collected to the 4 foot depth and tested for Nitrate N and Ammonium N. Each crop was fertilized according to University of Minnesota guidelines. The applied soil was also tested for both N levels. Sugarbeets, corn and soybeans were planted in each of the three soil applications at all possible rotations, Table 1. All seed was transgenic allowing the whole plot to be sprayed with the same herbicide. Stand counts were taken on all crops. During the growing season 6 inch soil samples were collected from the soybean treatments and tested for Nitrate N and Ammonium N. Crops were harvested in the fall and measured for yield. Sugarbeets were also lab tested for quality. Following harvest the plot was soil sampled to the 4 foot depth and analyzed. Table 2 shows the average sugarbeet yield by soil application rate. Table 3 shows the average corn and soybean yields by application.

Table 1:

Treatment	Ton Soil	Dry fertilizer	2009 Crop	2010 Crop	2011 Crop
1	0	Y	Corn	Soybean	Sugarbeet
2	100	Y	Corn	Soybean	Sugarbeet
3	200	Y	Corn	Soybean	Sugarbeet
4	0	Y	Soybean	Corn	Sugarbeet
5	100	Y	Soybean	Corn	Sugarbeet
6	200	Y	Soybean	Corn	Sugarbeet
7	0	Y	Sugarbeet	Corn	Soybean
8	100	Y	Sugarbeet	Corn	Soybean
9	200	Y	Sugarbeet	Corn	Soybean
10	0	N	Corn	Soybean	Sugarbeet
11	0	N	Soybean	Corn	Sugarbeet
12	0	N	Sugarbeet	Corn	Soybean

Results and Discussion

1. Tare soil did not statically affect sugarbeet yield or quality.

2. Tare soil did not statically affect corn or soybean yield.

3. This is year one of this project. Conclusions should not be made on one year of data alone. Future reports will detail this experiment more in depth.

Table 2: Sugarbeet Yield, Quality and Revenue

Treatment	Stand	Tons	Sugar	Purity	Nitrate	ES	EST	ESA	Revenue % of Mean
7	149	33.5	14.8	90.9	26	12.5	249	8218	93.6%
8	176	32.0	15.4	92.5	29	13.3	267	8512	104.7%
9	**183**	32.4	15.0	91.0	39	12.6	252	8110	94.2%
12	148	34.2	15.2	92.4	32	13.0	261	8912	107.4%
C.V. %	20.61	13.17	4.43	2.31	31.44	6.87	6.87	14.63	16.42
LSD (0.05)	34.8	4.5	0.7	2.2	10.2	0.9	18.2	1271.6	16.9%

Table 3: Corn and Soybean Yield

Treatment	Yield	Yield
1	**149**	
2	100	
3	145	
4		47.8
5		46.1
6		41.8
10	112	
11		42.4
C.V. %	23.31	8.31
LSD (0.05)	47	5.9

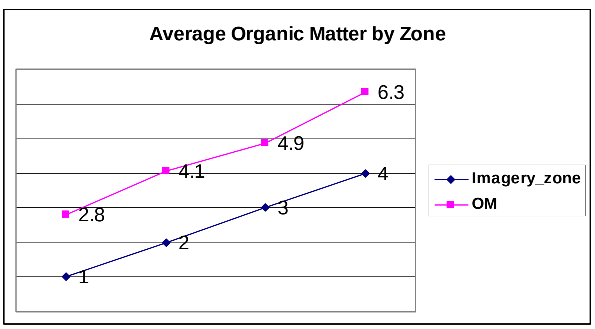
Fertility Zones Generated Using Satellite Imagery to Predict Organic Matter

Satellite imagery can be a useful tool to manage crops and identify organic matter (Om) zones within a field. Information relating satellite imagery to organic matter is limited. A study was established in 2008 to determine if available bare soil imagery can be used to identify organic matter and fertility zones in the SMBSC growing area.

Methods and Materials:
Satellite imagery of the SMBSC growing was acquired from the US Geological Survey (USGS) with assistance from South Dakota State University (SDSU) for the years, 2000, 2003 and 2008. Imagery was acquired using LandSat satellites. For those three years imagery was available that were free of clouds, snow and growing crops. For each year there were seven different color bands of imagery available for use. Image maps are gridded into 93.5 foot cells. Using geo-referenced soil test information from current zone research, organic matter levels were compared to the corresponding pixel values for each of the seven color bands and differing combinations of those bands. Organic matter, nitrogen and crop rotation research data was included in the study. In 2008 there were 2 fields used for the study. In 2009 there were 3 fields used. Results from the five fields were combined.

Results and Discussion:
The relationship of organic matter to satellite imagery is encouraging. Using the LandSat imagery, current data analysis shows organic matter can be predicted accurately 97 percent of the time (Table 1).
Table 1. Probability of accurate estimation of Om using pixel values from LandSat imagery.

	Om
R2	0.9784
Prob >F	0.0216



Summary
The combination of research conducted for 2008 and 2009 was encouraging. A pilot program has been developed for the 2010 production season. 12 fields have been sampled and fertilized using a model generated from the data. Each field has had samples taken from the zone portion of the field as well as from conventional and grid test strips.

SMBSC popup fertilizers influence on nitrogen efficiency for enhancement of sugarbeet growth-2009

Sugarbeets were planted at three locations to test nitrogen use efficiency (NUE) for sugarbeet production as influenced by popup fertilizer. Popup fertilizer is the term used in this report to describe the generic term of starter fertilizer. Popup fertilizer in this report is fertilizer 10-34-0 applied in furrow on the sugarbeet seed. In 2008 the tests were conducted in Olivia, Clara City and Gluek, MN. In 2009 there was one location at Clara City, MN and two at Hector, MN. The data will be presented combined over the six locations. Analysis of the data was conducted for homogeneity of combinability and determined that the data could be combined across environments or locations

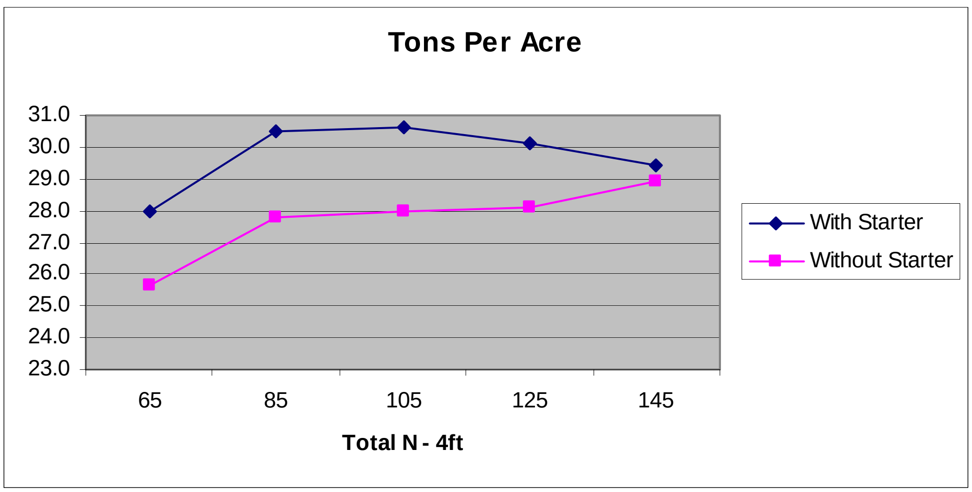
Methods:
Table 1 shows the specifics of activities conducted at all sites. Plots were 11 ft. (6 rows) wide and 50 ft long. Phosphorus fertilizer source 10-34-0 was used as a popup fertilizer. Phosphorus fertilizer 10-34-0 was applied in furrow on seed at 3 gal per acre. Popup was combined with water 50/50 and the mix was applied at a rate of 6 gal per acre. Treatments included were with and without popup fertilizer. Nitrogen rates were applied with and without popup fertilizer. Sugarbeets were planted with a 6 row planter. Harvest data was collected from the middle two rows of a 6 row plot. Plots were not thinned as the sugarbeet stands did not warrant thinning. Research trials were harvested at Clara City, Olivia and Gluek with a 1 row research harvester and at both Hector sites with a 2 row research harvester. Two quality sub-samples were collected at Clara City, Olivia and Gluek from each plot and analyzed for quality and weighed for yield calculation. Each sample was collected from 10 feet of row. One quality sub-sample was collected at both Hector sites from each plot and analyzed for quality. At Hector, the weights were collected and weighed on the harvester for yield calculation and a subsample was analyzed in the SMBSC quality lab.

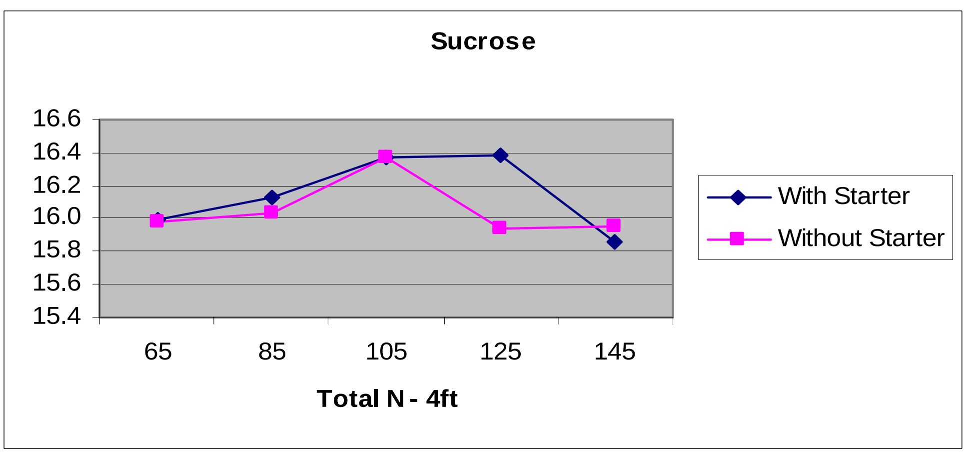
Results and Discussion:
The rate of nitrogen will discussed as total nitrogen. The total nitrogen is the soil test or residual nitrogen to the 4 foot depth plus applied nitrogen. Data presented is tons per acre, sugar per acre, purity and extractable sugar per acre combined across all locations.

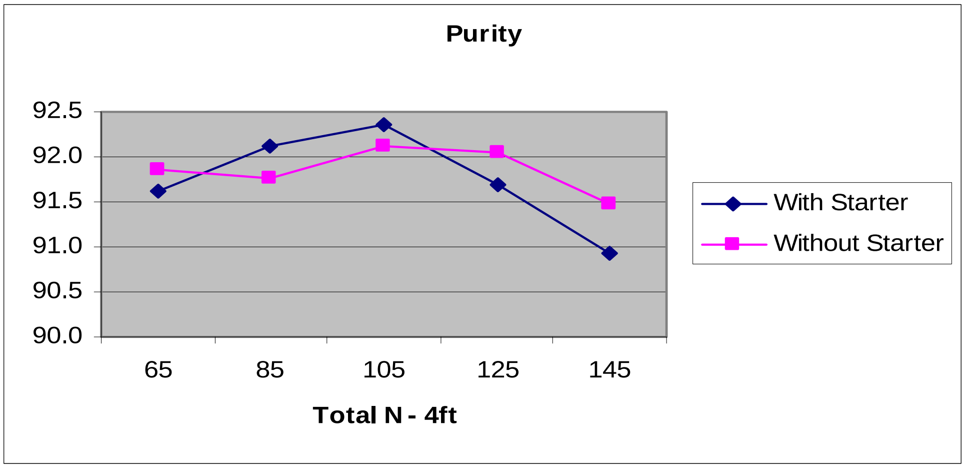
Table 1: Starter by Applied N Sugarbeet Yield, Quality and Revenue

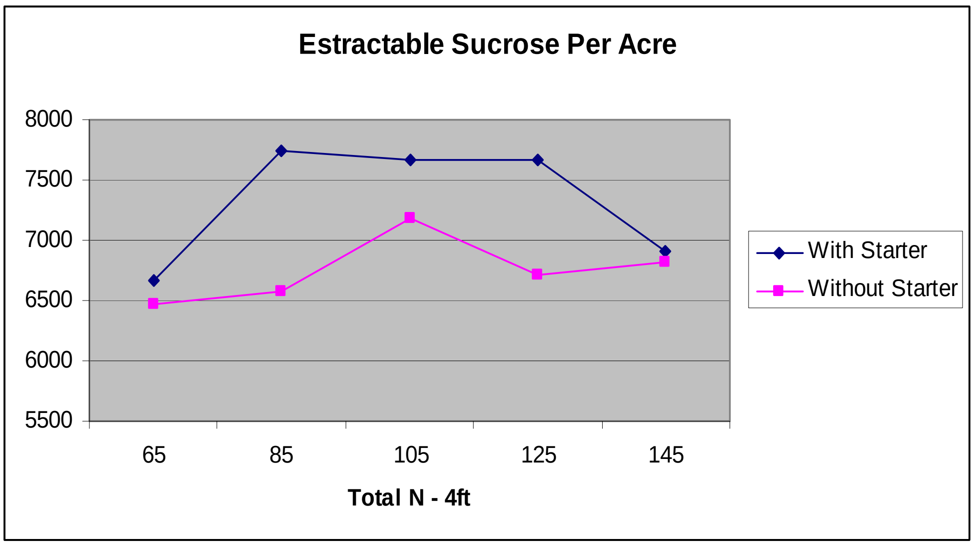
TRT	Starter	Applied N	Total N - 4ft	Tons	Sugar	Purity	ES	ESA	EST	Revenue % of Mean
1	No	0	65	25.6	16.0	91.9	13.6	6462	273	88.4%
2	No	20	85	27.8	16.0	91.8	13.7	6576	274	95.5%
3	No	40	105	28.0	16.4	**92.1**	**14.1**	7179	**281**	**101.4%**
4	No	60	125	28.1	15.9	92.1	13.7	6713	273	96.2%
5	No	80	145	28.9	16.0	91.5	13.5	6815	271	97.7%
6	Yes	0	65	28.0	16.0	91.6	13.6	6670	273	96.2%
7	Yes	20	85	**30.5**	16.1	**92.1**	13.8	**7744**	277	**107.8%**
8	Yes	40	105	**30.6**	16.4	**92.3**	**14.1**	**7660**	**282**	**111.7%**
9	Yes	60	126	**30.1**	**16.4**	91.7	**14.0**	**7668**	**280**	**107.9%**
10	Yes	80	145	29.4	15.9	90.9	13.4	6904	268	97.1%

	Tons	Sugar	Purity	ES	ESA	EST	Revenue % of Mean
CV	22.59	11.59	1.92	11.11	41.10	11.08	25.57
LSD (.05)	2.3	0.7	0.6	0.5	1041	11	9.2%









1. Starter can significantly increase sugarbeet yield, quality and revenue.

2. When total nitrogen to the 4 ft depth is greater than 115 lbs starter can negatively affect sugarbeet quality.

3. Whether starter is or is not applied the 4 ft nitrogen should be adjusted to the current recommendation of 100 lbs.

SMBSC In-furrow Application of Pop-up Fertilizers and Amendment Products for Enhancement of Sugarbeet Growth

Sugarbeets were planted at three locations in 2008 and two locations in 2009 to test the influence of pop-up fertilizer and amendment products on sugarbeet production. The locations were at Bird Island, Wood Lake and Clara City, MN in 2008 and Clara City and Hector, MN in 2009. Analysis of the data for homogeneity of combinability was determined that the data could not be combined across environments but could be combined across locations

Methods

Table 1 and 2 show the specifics of activities conducted at each site. Plots were 11 feet (6 rows) wide and 50 feet long. Pop-up fertilizers and amendments were applied at planting time with a 6 row planter. Harvest data was collected from rows 3 and 4 of a 6 row plot. Five of the research trials were 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. At Hector in 2009 research trials were harvested with a 2 row research harvester and the whole plot length was harvested. One quality sub-sample was collected from each plot and analyzed for quality.

Table 1: 2008 Starter Products

Product	Rate oz/acre	Timing	Stand	Tons	Sugar	APP Purity	PPM Nitrate	ES	EST	ESA	Revenue - % of Mean
Soygreen	1 lbs.	at planting in furrow	221	**30.9**	17.0	90.4	10	14.3	286	**8858**	102.3%
Broadcast P	45 lbs	at planting incorporated	227	29.4	17.3	**90.9**	13	14.7	295	8666	102.9%
Soygreen	2 lbs.	at planting in furrow	231	28.8	17.1	90.4	12	14.4	288	8280	96.5%
Pop-up (10-34-0)	3 gal	at planting in furrow	218	29.2	17.1	90.2	13	14.3	287	8432	97.7%
Untreated	N/A	N/A	238	29.0	17.1	90.5	13	14.5	289	8372	97.8%
Nutriplant (4-15-12)	4/100lb seed	at planting in furrow	243	29.5	17.3	90.3	13	14.6	292	8630	101.7%
Jump Start	seed treated	at planting	**265**	29.8	17.2	90.2	9	14.4	288	8606	101.1%
ManGro DF	2 lbs	In-Furrow	226	28.9	16.9	90.4	12	14.3	285	8242	95.4%
ManGro DF	3 lbs	In-Furrow	217	30.2	17.1	**90.8**	12	14.5	290	8769	103.3%
Boron	1.81 gal	Foliar	213	29.3	17.2	**90.9**	12	14.6	293	8570	100.9%
		C.V. %	28	9.9	9.4	1.2	52	10.65	10.7	16	22.0
		LSD (0.05)	38	1.7	0.5	0.5	5	0.5	10	570	7.3%

Table 2: 2009 Starter Products

Product	Rate oz/acre	Timing	Stand	Tons	Sugar	APP Purity	PPM Nitrate	ES	EST	ESA	Revenue - % of Mean
Soygreen	1 lbs.	at planting in furrow	125	32.3	**15.0**	93.2	33	**13.0**	**260**	8381	103.9%
Broadcast P	45 lbs	at planting incorporated	124	30.8	**14.9**	92.8	42	12.9	257	7885	96.0%
Soygreen	2 lbs.	at planting in furrow	128	32.3	14.8	93.3	36	12.8	256	8249	102.0%
Pop-up (10-34-0)	3 gal	at planting in furrow	128	31.8	14.4	93.2	39	12.5	249	7925	94.5%
Untreated	N/A	N/A	129	32.2	14.8	93.5	35	12.9	258	8240	102.1%
Nutriplant (4-15-12)	4/100lb seed	at planting in furrow	122	30.6	14.7	93.7	34	12.8	256	7781	94.4%
Jump Start	seed treated	at planting	122	30.4	14.6	93.4	29	12.7	254	7666	94.2%
ManGro DF	2 lbs	In-Furrow	126	32.4	**15.0**	93.3	28	**13.0**	**261**	8417	105.9%
ManGro DF	3 lbs	In-Furrow	127	31.9	**15.1**	93.4	27	**13.1**	**262**	8356	105.8%
Boron	1.81 gal	Foliar	117	32.4	14.7	92.8	36	12.7	253	8197	101.1%
		C.V. %	25	33.4	5.0	1.3	68	5.7	6	31	16
		LSD (0.05)	19	3.2	0.4	1.2	14	0.5	9	834	13%

Results and Discussion

1. Table 2 and 3 describe the treatments tested in 2008 and 2009 for starter type products. These products are treatments that are applied in-furrow or to the seed that claim to enhance sugarbeet production. Significant data is presented in bold type.

2. In 2008 tons were influenced by Soygreen at the 1 lb/ac rate. Purity was influenced by broadcast P at the 45lb/ac rate, ManGro DF at the 3 lb/ac rate and boron at the 1.81 gal/ac rate.

3. In 2009 only sugar was influenced by the products. Soygreen 1 lb/ac, broadcast P 45lb/ac and ManGro 2 & 3 lb/acre had a positive influence.

4. Currently there is no clear explanation of why Soygreen influenced tons per acre and purity in 2008 or why ManGro and boron influenced sugar in 2009.

5. This research will be continued in 2011.

6. For both years planting issues with product settling were incurred making the results of the test inconclusive. Equipment upgrades have been made to deter this from happening in the future.

SMBSC In-Furrow Products Impact on Sugarbeet Growth

Sugarbeets were planted at two locations to test in-furrow products for sugarbeet production. The locations were located at Clara City and Lake Lillian, 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 shows the specifics of activities conducted at each site. Plots were 11 ft. (6 rows) wide and 50 ft long. Products used were popup fertilizer (10-34-0), Soygreen, Carbon Boost, Kreb-Start, Ambrosia, Jumpstart, NAF and combinations thereof. Sugarbeets were planted with a 6 row planter. Harvest data was collected from rows 3 and 4 of a 6 row plot. The research trial was harvested with a 1 row research harvester at Lake Lillian. 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. Research trials were harvested with a 2 row research harvester at Clara City and the whole plot length was harvested. One quality sub-sample was collected from each plot and analyzed for quality. Plots were not thinned as the sugarbeet stands did not warrant thinning.

TABLE 1. Treatment descriptions for 2009 Infurrow Products. 2 yrs Average

Product	Rate	As Applied	Stand	Tons per acre	Percent Sucrose	Purity	Brie Nitrate	ES	EST	ESA	Revenue - % of Mean
Soygreen	1 lb.	at planting in furrow	73	36.4	16.0	91.2	56	13.6	271	9720	94.9%
Soygreen+Popup	1 lb. + 3 gal.	at planting in furrow	84	**39.4**	16.2	**91.8**	**29**	13.8	277	**10796**	**107.7%**
Redline	2 gal.	at planting in furrow	72	38.1	16.0	91.5	51	13.7	273	**10285**	**101.3%**
Redline	3 gal	at planting in furrow	71	37.2	16.1	91.3	**26**	13.7	274	**10051**	99.1%
Untreated	N/A	N/A	80	34.0	16.0	91.4	**26**	13.6	272	9114	89.4%
Popup	3 gal	at planting in furrow	71	37.4	16.1	90.9	43	13.7	273	**10060**	98.9%
Jump Start	seed treated	at planting in furrow	67	35.3	16.2	91.7	31	13.9	277	9697	97.1%
Jump Start + Popup	seed treated + 3 gal.	at planting in furrow	72	36.1	15.9	91.4	**30**	13.5	270	9683	95.0%
Jump Start + Soygreen	seed treated + 1 lb.	at planting in furrow	77	39.1	16.2	**91.9**	34	13.9	278	**10727**	**107.1%**
Carbon Boost+Popup	8 oz + 3gal	at planting in furrow	67	34.9	16.1	91.5	30	13.7	274	9506	94.4%
Carbon Boost+Popup Kreb-Start F	8 oz + 3gal 64 oz	at planting in furrow 4-6 WAE	69	38.0	16.2	91.2	**28**	13.8	275	**10344**	**102.7%**
Carbon Boost+Popup Kreb-Start F Ambrosia F	8 oz + 3gal 64 oz 64 oz	at planting in furrow 4-6 WAE 14-21 DAC	79	39.0	16.1	**91.8**	**14**	13.7	275	**10613**	**105.3%**
Carbon Boost+Popup Ambrosia F	8 oz + 3gal 64 oz	at planting in furrow 14-21 DAC	78	**40.4**	16.2	91.1	65	13.7	275	**11003**	**109.2%**
Ambrosia F	64 oz	14-21 DAC	14	**42.4**	14.8	91.7	43	12.6	252	**10651**	98.5%
PCC	4 ton	Preplant application	72	37.3	16.1	91.1	32	13.7	274	**10160**	**100.8%**
Jump Start + PCC	seed treated + 4 ton.	at planting in furrow	75	37.4	15.9	91.6	28	13.6	272	**10060**	98.9%
NAF	750 lb.	at planting in furrow	77	36.4	16.1	91.6	**25**	13.7	274	9923	98.5%
Jump Start + NAF	seed treated + 750 lb	at planting in furrow	65	37.6	16.0	**91.9**	**24**	13.7	275	**10213**	**101.2%**
		C.V. %	25.21	8.29	3.87	1.00	85.84	4.67	4.67	9.23	11.79
		LSD (0.05)	36.27	2.75	0.55	0.81	25.00	0.56	11.23	825.20	5.7%

Figure 1:

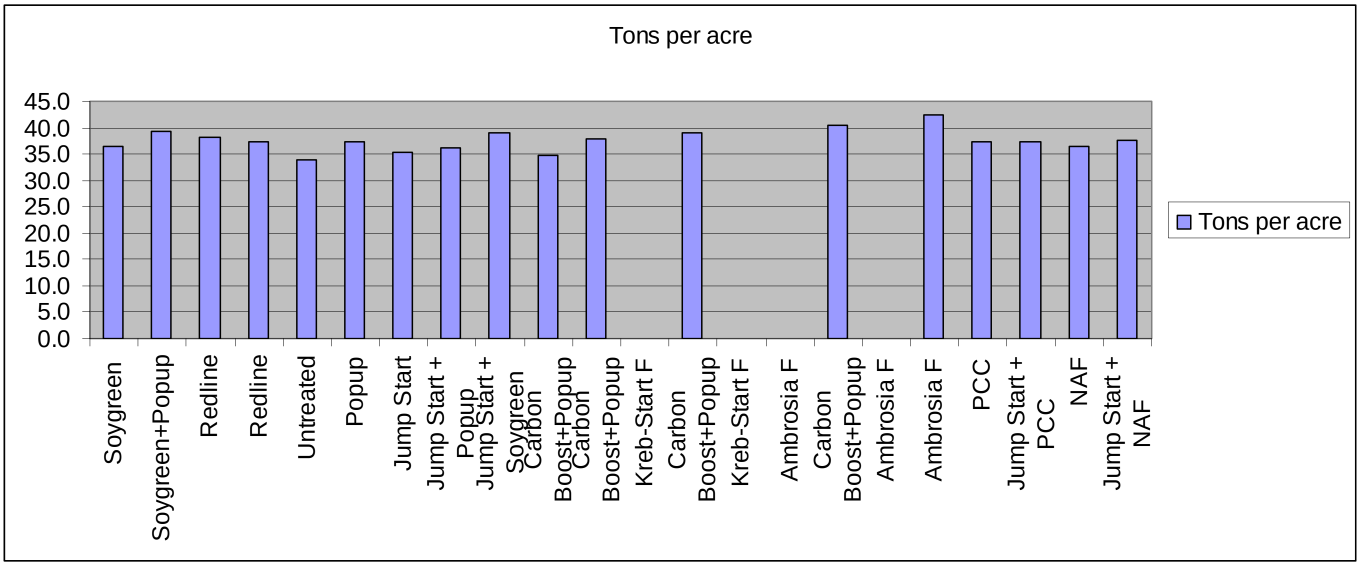


Figure 2:

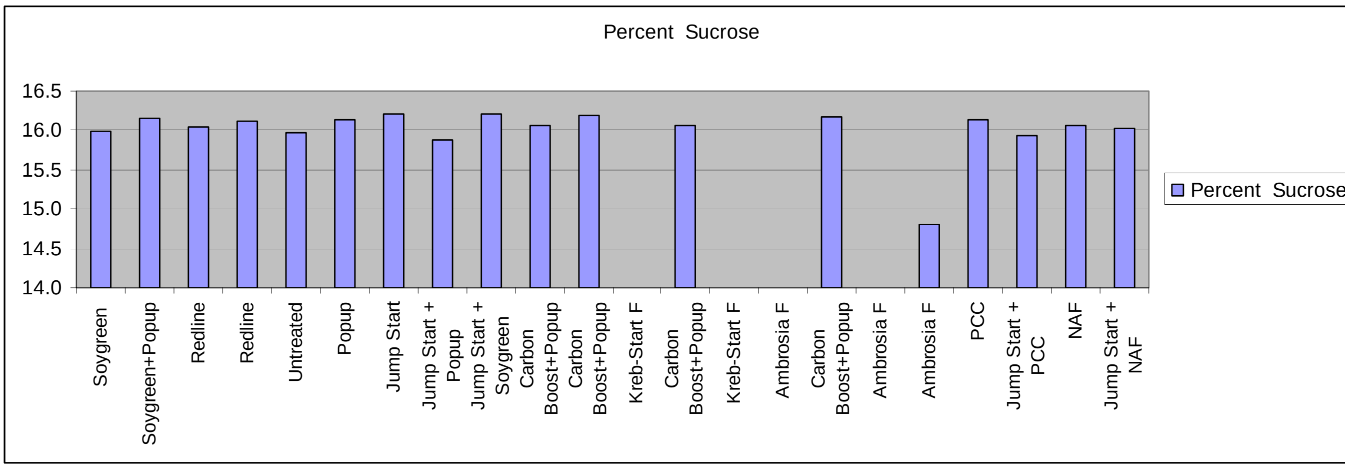
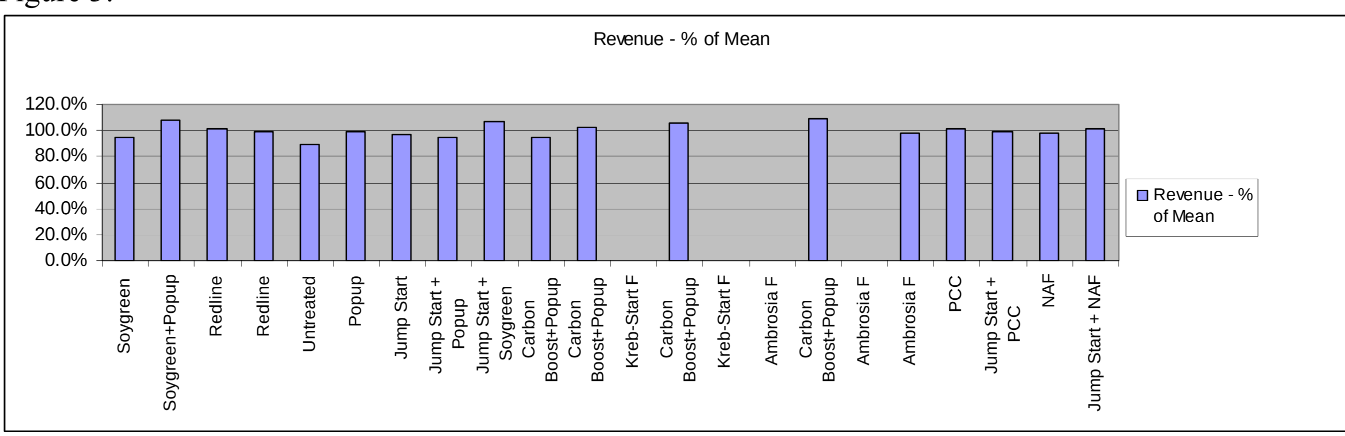


Figure 3:



Results and Discussion

1. Table 1 describes the treatments tested in 2009 for Infurrow products. These products are treatments that are applied in-furrow or to the seed that claim to enhance sugarbeet production. The products are presented in this report in reference to their influence on tons per acre (Figure 1), sugar percent (Figure 2) and sugarbeet revenue (Figure 3).

2. Tons, sugar content and revenue was not significantly influenced by treatments.

3. This was the first year of this research project. Conclusions should not be made based on one year of data.

SMBSC Evaluation of Glyphosate for Weed Control in Sugarbeet Considering Timing of Application-2009

Objectives

The objectives of the testing for weed control programs with Glyphosate (Roundup) in 2009 were conducted to determine the optimum timing of application.

Methods

Table 1, 4 and 7 show the specifics of activities conducted at the weed control program in 2009 at Milan, Clara City and Lake Lillian, Mn, respectively. Plots were 11 ft. (6 rows) wide and 35 ft long. Sugarbeet stands were 160-200 plants/100 ft and were not thinned. Sugarbeets were harvested with a 1 row harvester at Milan, Mn and a 2 row research harvester at Clara City. The Lake Lillian location was not harvested due to very wet condition at the site during the fall of 2009. Two rows of the six row plot were harvested analyzed for quality.

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 sites are designated by experiment number. Research site 0931 was near Milan, Mn, 0932 was near Clara City, Mn and 0933 was near Lake Lillian, Mn.

The treatments were initiated by weed stage or growing degree days (GDD) calculated using 34^{o} F as the base measuring the growing degree days from the planting date to the spray date and then spray date to spray date there after. Treatments were applied in 14 gpa mix at 40 psi.

Results and Discussion

The results will be discussed in general and not specific to one location. Research sites will not be combined in this report. The tables are arranged in that the weed control for each site is separate from the tables showing production data from each site. Revenue percent of mean is calculated by taking the experiment mean for revenue per acre divided by treatment revenue per acre multiplied by 100. Roundup PowerMax was used for the glyphosate herbicide. 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.

1. Weed control in general was very good with the glyphosate herbicide.
2. Starting applications late or stopping application to early gave lower percent weed control. A good example of the difficulties that can be present when delaying Roundup (glyphosate) applications is the poor weed control experienced at the 0932 location. At this location application of glyphosate was delayed due to

weather conditions. This delay was significant enough to hinder control of weeds tested at the location. Initiating application of glyphosate on larger weeds such 6 inch weeds does not give much room for delays or misapplications.

3. The reduced weed control due to delayed application on the 6 inch weed treatment was not overcome by increasing the glyphosate rate from 22 oz. to 32 oz. per acre.
4. An application at the canopy timing was important in maximizing weed control.
5. Full season weed control was more difficult to achieve with Lambsquarter and Amaranthus species than smartweed and velvetleaf.
6. Sugarbeet production tended to be directly related to weed control efficacy.
7. Treatment ranking by revenue percent of mean (Table 9) indicates that there are consistent trends pertaining to the revenue generated by particular treatment. However, some treatments indicate the variability of production among research sites.

Table 1. Site Specifics for weed control site 0931

DATE	PLANTED	VARIETY	SPACING	SOIL
5/4/2009	X	B95RR03	4.25"	Dry
	APPLIED	RATE	PRESSURE	WEATHER
8/22/2009	**Proline**	**5.7 oz.**	40psi	W 10, Sunny, 80'
8/5/2009	Supertin	5 oz.	40psi	NW 5, Sunny, 70'

TABLE 2a. Weed control of common lambsquarter and Amaranthus species with Roundup, site 0931.

TRT	Herbicide	Rate oz/acre	appl. Criteria	Lambsquarter 6/29	Lambsquarter 7/6	Lambsquarter 7/24	Amaranthus 6/29	Amaranthus 7/6	Amaranthus 7/24
				% weed control					
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	96	98	99	91	93	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds						
	Roundup PowerMax+AMS	22+2%	canopy						
2	Roundup PowerMax+AMS	22+2%	200 GDD	86	91	98	68	93	96
	Roundup PowerMax+AMS	22+2%	200 GDD						
	Roundup PowerMax+AMS	22+2%	canopy						
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	91	95	98	92	98	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds						
	Roundup PowerMax+AMS	22+2%	canopy						
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	98	98	94	90	87	90
	Roundup PowerMax+AMS	22+2%	200 GDD						
	Roundup PowerMax+AMS	22+2%	canopy						
5	Roundup PowerMax+AMS	22+2%+	2 inch weeds	93	97	99	89	96	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds						
	Roundup PowerMax+AMS	22+2%	canopy						
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	90	95	99	85	94	99
	Roundup PowerMax+AMS	22+2%	canopy						
7	Roundup PowerMax+AMS	22+2%	200 GDD	95	97	99	91	89	99
	Roundup PowerMax+AMS	22+2%	400 GDD						
	Roundup PowerMax+AMS	22+2%	canopy						
8	Roundup PowerMax+AMS	22+2%	400 GDD	99	99	99	99	94	99
	Roundup PowerMax+AMS	22+2%	400 GDD						
	Roundup PowerMax+AMS	22+2%	canopy						
9	Roundup PowerMax+AMS	22+2%	200 GDD	88	96	97	75	98	98
	Roundup PowerMax+AMS	22+2%	200 GDD						
	Roundup PowerMax+AMS	22+2%	canopy						
10	Roundup PowerMax+AMS	22+2%	200 GDD	76	90	99	73	93	95
	Roundup PowerMax+AMS	22+2%	canopy						
11	Roundup PowerMax+AMS	22+2%	200 GDD	92	94	78	85	95	31
	Roundup PowerMax+AMS	22+2%	400 GDD						
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	97	99	99	99	97	99
	Roundup PowerMax+AMS	22+2%	1 inch weeds						
	Roundup PowerMax+AMS	22+2%	1 inch weeds						
	Continue with 1 inch weeds								
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	97	98	93	96	92	86
	Roundup PowerMax+AMS	22+2%	2 inch weeds						
	Roundup PowerMax+AMS	22+2%	2 inch weeds						
	Continue with 2 inch weeds								
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	91	99	99	83	96	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds						
	Continue with 4 inch weeds								
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	95	93	94	96	97	99
	Roundup PowerMax+AMS	22+2%	6 inch weeds						
	Continue with 6 inch weeds								
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	99	99	99	99	94	99
	Roundup PowerMax+AMS	32+2%	1 inch weeds						
	Roundup PowerMax+AMS	32+2%	1 inch weeds						
	Continue with 1 inch weeds								
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	99	99	98	99	92	91
	Roundup PowerMax+AMS	32+2%	2 inch weeds						
	Roundup PowerMax+AMS	32+2%	2 inch weeds						
	Continue with 2 inch weeds								
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	81	94	99	78	94	98
	Roundup PowerMax+AMS	32+2%	4 inch weeds						
	Continue with 4 inch weeds								
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	98	82	83	99	95	95
	Roundup PowerMax+AMS	32+2%	6 inch weeds						
	Continue with 6 inch weeds								
			C.V	7.88	7.65	8.15	10.29	8.27	9.69
			LSD (0.5)	10	10	11	13	11	13

TABLE 2b. Weed control of Smart weed and Velevet leaf with Roundup, site 0931.

TRT	Herbicide	Rate oz/acre	appl. Criteria	Smartweed 6/29	Smartweed 7/24	Velvet Leaf 6/29	Velvet Leaf 7/6/	Velvet Leaf 7/24
				% weed control				
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	99	99	97	97	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds					
	Roundup PowerMax+AMS	22+2%	canopy					
2	Roundup PowerMax+AMS	22+2%	200 GDD	91	91	97	98	99
	Roundup PowerMax+AMS	22+2%	200 GDD					
	Roundup PowerMax+AMS	22+2%	canopy					
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	99	99	98	99	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds					
	Roundup PowerMax+AMS	22+2%	canopy					
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	96	96	97	96	99
	Roundup PowerMax+AMS	22+2%	200 GDD					
	Roundup PowerMax+AMS	22+2%	canopy					
5	Roundup PowerMax+AMS	22+2%+	2 inch weeds	96	96	99	99	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds					
	Roundup PowerMax+AMS	22+2%	canopy					
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	99	99	98	97	99
	Roundup PowerMax+AMS	22+2%	canopy					
7	Roundup PowerMax+AMS	22+2%	200 GDD	98	98	97	97	99
	Roundup PowerMax+AMS	22+2%	400 GDD					
	Roundup PowerMax+AMS	22+2%	canopy					
8	Roundup PowerMax+AMS	22+2%	400 GDD	99	99	99	91	99
	Roundup PowerMax+AMS	22+2%	400 GDD					
	Roundup PowerMax+AMS	22+2%	canopy					
9	Roundup PowerMax+AMS	22+2%	200 GDD	98	98	99	99	99
	Roundup PowerMax+AMS	22+2%	200 GDD					
	Roundup PowerMax+AMS	22+2%	canopy					
10	Roundup PowerMax+AMS	22+2%	200 GDD	90	90	96	99	99
	Roundup PowerMax+AMS	22+2%	canopy					
11	Roundup PowerMax+AMS	22+2%	200 GDD	99	99	98	99	83
	Roundup PowerMax+AMS	22+2%	400 GDD					
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	99	99	99	98	99
	Roundup PowerMax+AMS	22+2%	1 inch weeds					
	Roundup PowerMax+AMS	22+2%	1 inch weeds					
	Continue with 1 inch weeds							
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	99	99	99	99	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds					
	Roundup PowerMax+AMS	22+2%	2 inch weeds					
	Continue with 2 inch weeds							
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	99	99	97	99	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds					
	Continue with 4 inch weeds							
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	93	93	99	97	99
	Roundup PowerMax+AMS	22+2%	6 inch weeds					
	Continue with 6 inch weeds							
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	98	98	98	98	99
	Roundup PowerMax+AMS	32+2%	1 inch weeds					
	Roundup PowerMax+AMS	32+2%	1 inch weeds					
	Continue with 1 inch weeds							
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	99	99	99	97	99
	Roundup PowerMax+AMS	32+2%	2 inch weeds					
	Roundup PowerMax+AMS	32+2%	2 inch weeds					
	Continue with 2 inch weeds							
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	99	99	98	96	99
	Roundup PowerMax+AMS	32+2%	4 inch weeds					
	Continue with 4 inch weeds							
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	89	89	97	98	95
	Roundup PowerMax+AMS	32+2%	6 inch weeds					
	Continue with 6 inch weeds							
			C.V	6.22	6.22	2.75	4.32	5.46
			LSD (0.5)	9	9	4	6	8

TABLE 3a. Roundup application influence on sugarbeet yield, 0931

TRT	Herbicide	Rate oz/acre	appl. Criteria	Count	Tons Per Acre	Sugar	Purity	PPM Nitrate
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	139	27.60	13.27	86.81	196
	Roundup PowerMax+AMS	22+2%	2 inch weeds					
	Roundup PowerMax+AMS	22+2%	canopy					
2	Roundup PowerMax+AMS	22+2%	200 GDD	144	30.01	13.43	88.58	245
	Roundup PowerMax+AMS	22+2%	200 GDD					
	Roundup PowerMax+AMS	22+2%	canopy					
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds					
	Roundup PowerMax+AMS	22+2%	2 inch weeds	114	28.49	12.81	84.59	275
	Roundup PowerMax+AMS	22+2%	canopy					
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	139	31.63	12.89	85.89	238
	Roundup PowerMax+AMS	22+2%	200 GDD					
	Roundup PowerMax+AMS	22+2%	canopy					
	Roundup PowerMax+AMS	22+2%+	2 inch weeds					
5	Roundup PowerMax+AMS	22+2%	4 inch weeds	153	30.48	13.29	86.87	223
	Roundup PowerMax+AMS	22+2%	canopy					
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	135	27.54	13.28	86.50	259
	Roundup PowerMax+AMS	22+2%	canopy					
7	Roundup PowerMax+AMS	22+2%	200 GDD	143	27.45	13.15	85.93	237
	Roundup PowerMax+AMS	22+2%	400 GDD					
	Roundup PowerMax+AMS	22+2%	canopy					
8	Roundup PowerMax+AMS	22+2%	400 GDD	148	26.88	13.26	86.99	188
	Roundup PowerMax+AMS	22+2%	400 GDD					
	Roundup PowerMax+AMS	22+2%	canopy					
9	Roundup PowerMax+AMS	22+2%	200 GDD	120	26.85	12.40	79.80	256
	Roundup PowerMax+AMS	22+2%	200 GDD					
	Roundup PowerMax+AMS	22+2%	canopy					
10	Roundup PowerMax+AMS	22+2%	200 GDD	184	31.51	14.10	88.42	155
	Roundup PowerMax+AMS	22+2%	canopy					
11	Roundup PowerMax+AMS	22+2%	200 GDD	125	20.41	13.11	86.22	246
	Roundup PowerMax+AMS	22+2%	400 GDD					
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	148	26.21	13.19	86.04	230
	Roundup PowerMax+AMS	22+2%	1 inch weeds					
	Roundup PowerMax+AMS	22+2%	1 inch weeds					
	Continue with 1 inch weeds							
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	135	32.91	13.21	85.98	251
	Roundup PowerMax+AMS	22+2%	2 inch weeds					
	Roundup PowerMax+AMS	22+2%	2 inch weeds					
	Continue with 2 inch weeds							
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	149	29.81	13.65	86.70	187
	Roundup PowerMax+AMS	22+2%	4 inch weeds					
	Continue with 4 inch weeds							
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	129	26.43	13.02	85.63	250
	Roundup PowerMax+AMS	22+2%	6 inch weeds					
	Continue with 6 inch weeds							
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	183	35.18	13.05	86.43	222
	Roundup PowerMax+AMS	32+2%	1 inch weeds					
	Roundup PowerMax+AMS	32+2%	1 inch weeds					
	Continue with 1 inch weeds							
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	150	30.90	13.01	85.29	294
	Roundup PowerMax+AMS	32+2%	2 inch weeds					
	Roundup PowerMax+AMS	32+2%	2 inch weeds					
	Continue with 2 inch weeds							
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	148	24.24	13.50	86.45	199
	Roundup PowerMax+AMS	32+2%	4 inch weeds					
	Continue with 4 inch weeds							
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	115	27.64	13.10	86.86	228
	Roundup PowerMax+AMS	32+2%	6 inch weeds					
	Continue with 6 inch weeds							
			C.V. %	23.13	8.66	5.99	3.85	26.73
			LSD (0.05)	47	3.50	1.12	4.70	87

TABLE 3b. Roundup application influence on sugarbeet revenue, 0931

TRT	Herbicide	Rate oz/acre	appl. Criteria	Ext. Percent Sucrose	Ext Suc Per Ton	Ext Suc Per Acre	Revenue percent of mean
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	10.41	208	5742	100.71
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
2	Roundup PowerMax+AMS	22+2%	200 GDD	10.81	216	6472	115.54
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	9.64	193	5507	86.48
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	9.95	199	6309	106.77
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
	Roundup PowerMax+AMS	22+2%+	2 inch weeds	10.44	209	6391	113.34
5	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	10.37	207	5734	102.04
	Roundup PowerMax+AMS	22+2%	canopy				
7	Roundup PowerMax+AMS	22+2%	200 GDD	10.15	203	5559	93.17
	Roundup PowerMax+AMS	22+2%	400 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
8	Roundup PowerMax+AMS	22+2%	400 GDD	10.43	209	5635	101.43
	Roundup PowerMax+AMS	22+2%	400 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
9	Roundup PowerMax+AMS	22+2%	200 GDD	8.51	170	4521	51.49
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
10	Roundup PowerMax+AMS	22+2%	200 GDD	11.39	228	7183	141.44
	Roundup PowerMax+AMS	22+2%	canopy				
11	Roundup PowerMax+AMS	22+2%	200 GDD	10.18	204	4155	71.33
	Roundup PowerMax+AMS	22+2%	400 GDD				
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	10.21	204	5337	90.68
	Roundup PowerMax+AMS	22+2%	1 inch weeds				
	Roundup PowerMax+AMS	22+2%	1 inch weeds				
	Continue with 1 inch weeds						
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	10.23	205	6709	111.60
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Continue with 2 inch weeds						
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	10.70	214	6396	117.13
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Continue with 4 inch weeds						
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	9.99	200	5281	86.21
	Roundup PowerMax+AMS	22+2%	6 inch weeds				
	Continue with 6 inch weeds						
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	10.16	203	7163	123.34
	Roundup PowerMax+AMS	32+2%	1 inch weeds				
	Roundup PowerMax+AMS	32+2%	1 inch weeds				
	Continue with 1 inch weeds						
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	9.92	198	6116	99.31
	Roundup PowerMax+AMS	32+2%	2 inch weeds				
	Roundup PowerMax+AMS	32+2%	2 inch weeds				
	Continue with 2 inch weeds						
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	10.53	211	5107	91.24
	Roundup PowerMax+AMS	32+2%	4 inch weeds				
	Continue with 4 inch weeds						
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	10.27	205	5674	96.76
	Roundup PowerMax+AMS	32+2%	6 inch weeds				
	Continue with 6 inch weeds						
			C.V. %	11.24	11.23	14.65	35.50
			LSD (0.05)	1.63	33	1213	2.00

Table 4. Site Specifics for weed control site 0932

DATE	PLANTED	VARIETY	SPACING	SOIL
4/28/2009	**X**	BTS95RR03	3 15/16"	Adequat
** applied 10-340-0 @ 3 gpa				
	APPLIED	**RATE**	**PRESSURE**	**WEATHER**
5/28/2009	SelectMax 6oz.	15gpa	40psi	NW 5-10, Sunny, 75'
8/22/2009	Proline	5.7 oz.	40psi	W 10, Sunny, 80'
8/5/2009	Supertin 5oz.	14gpa	40psi	NW 5, Sunny, 75'

TABLE 5a. Weed control of common lambsquarter species with Roundup, 0932.

trt #	Herbicide	Rate oz/acre	appl. Criteria	Lambquater 6/23/09	Lambsquarter 7/24/09
				% WEED control	
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	**93**	**90**
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
2	Roundup PowerMax+AMS	22+2%	200 GDD	**96**	**96**
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	**98**	**95**
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	**96**	**99**
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
5	Roundup PowerMax+AMS	22+2%+	2 inch weeds	**92**	**95**
	Roundup PowerMax+AMS	22+2%	4 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	**81**	**94**
	Roundup PowerMax+AMS	22+2%	canopy		
7	Roundup PowerMax+AMS	22+2%	200 GDD	**97**	**98**
	Roundup PowerMax+AMS	22+2%	400 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
8	Roundup PowerMax+AMS	22+2%	400 GDD	**87**	**98**
	Roundup PowerMax+AMS	22+2%	400 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
9	Roundup PowerMax+AMS	22+2%	200 GDD	**98**	**94**
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
10	Roundup PowerMax+AMS	22+2%	200 GDD	**77**	**76**
	Roundup PowerMax+AMS	22+2%	canopy		
11	Roundup PowerMax+AMS	22+2%	200 GDD	**97**	**92**
	Roundup PowerMax+AMS	22+2%	400 GDD		
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	**96**	**99**
	Roundup PowerMax+AMS	22+2%	1 inch weeds		
	Roundup PowerMax+AMS	22+2%	1 inch weeds		
	Continue with 1 inch weeds				
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	**97**	**97**
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Continue with 2 inch weeds				
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	**96**	**98**
	Roundup PowerMax+AMS	22+2%	4 inch weeds		
	Continue with 4 inch weeds				
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	**46**	**97**
	Roundup PowerMax+AMS	22+2%	6 inch weeds		
	Continue with 6 inch weeds				
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	**99**	**99**
	Roundup PowerMax+AMS	32+2%	1 inch weeds		
	Roundup PowerMax+AMS	32+2%	1 inch weeds		
	Continue with 1 inch weeds				
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	**97**	**99**
	Roundup PowerMax+AMS	32+2%	2 inch weeds		
	Roundup PowerMax+AMS	32+2%	2 inch weeds		
	Continue with 2 inch weeds				
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	**98**	**98**
	Roundup PowerMax+AMS	32+2%	4 inch weeds		
	Continue with 4 inch weeds				
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	**11**	**45**
	Roundup PowerMax+AMS	32+2%	6 inch weeds		
	Continue with 6 inch weeds				
			C.V.	9.10	10.51
			LSD (0.5)	11	14

TABLE 5b. Weed Control of Common Lambsquarter and Amaranthus Species and Smartweed with Roundup, 0932.

trt #	Herbicide	Rate oz/acre	appl. Criteria	Smartweed	Amaranthus 6-23	Amaranthus 7-24
				% WEED control		
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	99	97	97
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
2	Roundup PowerMax+AMS	22+2%	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	99	99	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
5	Roundup PowerMax+AMS	22+2%+	2 inch weeds	99	94	94
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Roundup PowerMax+AMS	22+2%	canopy			
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	99	97	97
	Roundup PowerMax+AMS	22+2%	canopy			
7	Roundup PowerMax+AMS	22+2%	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
8	Roundup PowerMax+AMS	22+2%	400 GDD	99	97	97
	Roundup PowerMax+AMS	22+2%	400 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
9	Roundup PowerMax+AMS	22+2%	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	200 GDD			
	Roundup PowerMax+AMS	22+2%	canopy			
10	Roundup PowerMax+AMS	22+2%	200 GDD	57	84	84
	Roundup PowerMax+AMS	22+2%	canopy			
11	Roundup PowerMax+AMS	22+2%	200 GDD	99	99	99
	Roundup PowerMax+AMS	22+2%	400 GDD			
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	99	99	99
	Roundup PowerMax+AMS	22+2%	1 inch weeds			
	Roundup PowerMax+AMS	22+2%	1 inch weeds			
	Continue with 1 inch weeds					
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	99	95	95
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Roundup PowerMax+AMS	22+2%	2 inch weeds			
	Continue with 2 inch weeds					
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	99	99	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds			
	Continue with 4 inch weeds					
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	25	40	40
	Roundup PowerMax+AMS	22+2%	6 inch weeds			
	Continue with 6 inch weeds					
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	99	99	99
	Roundup PowerMax+AMS	32+2%	1 inch weeds			
	Roundup PowerMax+AMS	32+2%	1 inch weeds			
	Continue with 1 inch weeds					
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	97	99	99
	Roundup PowerMax+AMS	32+2%	2 inch weeds			
	Roundup PowerMax+AMS	32+2%	2 inch weeds			
	Continue with 2 inch weeds					
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	99	99	99
	Roundup PowerMax+AMS	32+2%	4 inch weeds			
	Continue with 4 inch weeds					
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	0	0	0
	Roundup PowerMax+AMS	32+2%	6 inch weeds			
	Continue with 6 inch weeds					
			C.V.	18.20	4.83	4.83
			LSD (0.5)	23	6	6

TABLE 6a. Roundup application influence on sugarbeet yield
Site 0932

trt #	Herbicide	Rate oz/acre	appl. Criteria	Tons per acre	Sugar	Purity	PPM Nitrate
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	22.88	15.98	89.94	41
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
2	Roundup PowerMax+AMS	22+2%	200 GDD	23.50	16.06	89.65	36
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	23.88	16.53	90.43	28
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	23.50	16.57	89.70	34
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
5	Roundup PowerMax+AMS	22+2%+	2 inch weeds	23.88	16.80	90.06	36
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	20.88	16.52	90.01	30
	Roundup PowerMax+AMS	22+2%	canopy				
7	Roundup PowerMax+AMS	22+2%	200 GDD	24.75	15.90	89.44	42
	Roundup PowerMax+AMS	22+2%	400 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
8	Roundup PowerMax+AMS	22+2%	400 GDD	23.88	16.90	90.26	28
	Roundup PowerMax+AMS	22+2%	400 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
9	Roundup PowerMax+AMS	22+2%	200 GDD	22.38	16.24	90.12	36
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
10	Roundup PowerMax+AMS	22+2%	200 GDD	23.88	16.53	90.29	37
	Roundup PowerMax+AMS	22+2%	canopy				
11	Roundup PowerMax+AMS	22+2%	200 GDD	22.25	16.37	90.50	24
	Roundup PowerMax+AMS	22+2%	400 GDD				
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	24.00	16.43	90.51	34
	Roundup PowerMax+AMS	22+2%	1 inch weeds				
	Roundup PowerMax+AMS	22+2%	1 inch weeds				
	Continue with 1 inch weeds						
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	23.75	16.01	90.14	39
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Continue with 2 inch weeds						
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	24.38	16.52	90.79	26
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Continue with 4 inch weeds						
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	25.00	16.62	90.80	40
	Roundup PowerMax+AMS	22+2%	6 inch weeds				
	Continue with 6 inch weeds						
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	25.00	16.27	89.21	41
	Roundup PowerMax+AMS	32+2%	1 inch weeds				
	Roundup PowerMax+AMS	32+2%	1 inch weeds				
	Continue with 1 inch weeds						
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	25.25	16.69	90.27	39
	Roundup PowerMax+AMS	32+2%	2 inch weeds				
	Roundup PowerMax+AMS	32+2%	2 inch weeds				
	Continue with 2 inch weeds						
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	24.75	16.28	90.30	31
	Roundup PowerMax+AMS	32+2%	4 inch weeds				
	Continue with 4 inch weeds						
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	20.38	16.30	90.10	40
	Roundup PowerMax+AMS	32+2%	6 inch weeds				
	Continue with 6 inch weeds						
			C.V. %	10.75	4.25	0.99	62.40
			LSD (0.05)	1.89	0.99	1.26	31

TABLE 6b. Treatment descriptions for 2009 SMSBC RR Program and Revenue Site 0932

trt #	Herbicide	Rate oz/acre	appl. Criteria	Ext. Percent Sucrose	Ext. Suc.per ton	Ext. Suc.per acre	Revenue percent of mean
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	13.32	266	8641	96.27
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
2	Roundup PowerMax+AMS	22+2%	200 GDD	13.34	267	9406	104.21
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	13.90	278	9465	108.84
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	13.80	276	8886	101.22
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
5	Roundup PowerMax+AMS	22+2%+	2 inch weeds	14.07	281	7984	92.47
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Roundup PowerMax+AMS	22+2%	canopy				
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	13.81	276	9414	108.10
	Roundup PowerMax+AMS	22+2%	canopy				
7	Roundup PowerMax+AMS	22+2%	200 GDD	13.15	263	8920	97.89
	Roundup PowerMax+AMS	22+2%	400 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
8	Roundup PowerMax+AMS	22+2%	400 GDD	14.20	284	9015	105.13
	Roundup PowerMax+AMS	22+2%	400 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
9	Roundup PowerMax+AMS	22+2%	200 GDD	13.58	272	8588	89.17
	Roundup PowerMax+AMS	22+2%	200 GDD				
	Roundup PowerMax+AMS	22+2%	canopy				
10	Roundup PowerMax+AMS	22+2%	200 GDD	13.88	278	8602	98.39
	Roundup PowerMax+AMS	22+2%	canopy				
11	Roundup PowerMax+AMS	22+2%	200 GDD	13.77	275	7311	106.55
	Roundup PowerMax+AMS	22+2%	400 GDD				
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	13.83	277	8197	93.19
	Roundup PowerMax+AMS	22+2%	1 inch weeds				
	Roundup PowerMax+AMS	22+2%	1 inch weeds				
	Continue with 1 inch weeds						
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	13.39	268	9062	101.27
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Roundup PowerMax+AMS	22+2%	2 inch weeds				
	Continue with 2 inch weeds						
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	13.96	279	8778	101.09
	Roundup PowerMax+AMS	22+2%	4 inch weeds				
	Continue with 4 inch weeds						
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	14.06	281	8980	104.01
	Roundup PowerMax+AMS	22+2%	6 inch weeds				
	Continue with 6 inch weeds						
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	13.43	269	8695	96.42
	Roundup PowerMax+AMS	32+2%	1 inch weeds				
	Roundup PowerMax+AMS	32+2%	1 inch weeds				
	Continue with 1 inch weeds						
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	14.01	280	8864	102.30
	Roundup PowerMax+AMS	32+2%	2 inch weeds				
	Roundup PowerMax+AMS	32+2%	2 inch weeds				
	Continue with 2 inch weeds						
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	13.65	273	8955	101.12
	Roundup PowerMax+AMS	32+2%	4 inch weeds				
	Continue with 4 inch weeds						
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	13.63	273	10080	90.47
	Roundup PowerMax+AMS	32+2%	6 inch weeds				
	Continue with 6 inch weeds						
			C.V. %	5.43	5.43	11.81	14.22
			LSD (0.05)	1.06	21	1472	20.16

Table 7. Site Specifics for weed control site 0931

DATE	PLANTED	VARIETY	SPACING	SOIL
5/4/2009		B95RR03	4.25"	Dry
	APPLIED	RATE	PRESSURE	WEATHER
8/22/2009	Proline	5.7 oz.	40psi	W 10, Sunny, 80'
8/5/2009	Supertin	32oz.	40psi	NW 5, Sunny, 70'

TABLE 8a. Weed control of lambsquarter with Roundup site 0933

TRT #	Herbicide	Rate oz/acre	appl. Criteria	Lambsquarter 6/22	Lambsquarter 7/30
				% weed control	
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	95	98
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
2	Roundup PowerMax+AMS	22+2%	200 GDD	96	88
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	99	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	98	99
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
5	Roundup PowerMax+AMS	22+2%+	2 inch weeds	81	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	95	99
	Roundup PowerMax+AMS	22+2%	canopy		
7	Roundup PowerMax+AMS	22+2%	200 GDD	99	99
	Roundup PowerMax+AMS	22+2%	400 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
8	Roundup PowerMax+AMS	22+2%	400 GDD	97	98
	Roundup PowerMax+AMS	22+2%	400 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
9	Roundup PowerMax+AMS	22+2%	200 GDD	91	99
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
10	Roundup PowerMax+AMS	22+2%	200 GDD	96	96
	Roundup PowerMax+AMS	22+2%	canopy		
11	Roundup PowerMax+AMS	22+2%	200 GDD	94	75
	Roundup PowerMax+AMS	22+2%	400 GDD		
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	99	99
	Roundup PowerMax+AMS	22+2%	1 inch weeds		
	Roundup PowerMax+AMS	22+2%	1 inch weeds		
	Continue with 1 inch weeds				
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	95	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Continue with 2 inch weeds				
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	97	94
	Roundup PowerMax+AMS	22+2%	4 inch weeds		
	Continue with 4 inch weeds				
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	73	93
	Roundup PowerMax+AMS	22+2%	6 inch weeds		
	Continue with 6 inch weeds				
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	98	99
	Roundup PowerMax+AMS	32+2%	1 inch weeds		
	Roundup PowerMax+AMS	32+2%	1 inch weeds		
	Continue with 1 inch weeds				
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	93	99
	Roundup PowerMax+AMS	32+2%	2 inch weeds		
	Roundup PowerMax+AMS	32+2%	2 inch weeds		
	Continue with 2 inch weeds				
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	96	99
	Roundup PowerMax+AMS	32+2%	4 inch weeds		
	Continue with 4 inch weeds				
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	88	99
	Roundup PowerMax+AMS	32+2%	6 inch weeds		
	Continue with 6 inch weeds				
			C.V	9.2	6.3
			LSD (0.5)	12.2	8.5

TABLE 8b. Weed control of Smart weed with Roundup. site 0933

TRT #	Herbicide	Rate oz/acre	appl. Criteria	Smartweed 6/22	Smartweed 7/30
				% weed control	
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	**98**	**99**
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
2	Roundup PowerMax+AMS	22+2%	200 GDD	**99**	**99**
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	**99**	**99**
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	**99**	**99**
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
5	Roundup PowerMax+AMS	22+2%+	2 inch weeds	**99**	**99**
	Roundup PowerMax+AMS	22+2%	4 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	**92**	**99**
	Roundup PowerMax+AMS	22+2%	canopy		
7	Roundup PowerMax+AMS	22+2%	200 GDD	**99**	**99**
	Roundup PowerMax+AMS	22+2%	400 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
8	Roundup PowerMax+AMS	22+2%	400 GDD	**99**	**99**
	Roundup PowerMax+AMS	22+2%	400 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
9	Roundup PowerMax+AMS	22+2%	200 GDD	**99**	**99**
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
10	Roundup PowerMax+AMS	22+2%	200 GDD	**98**	**99**
	Roundup PowerMax+AMS	22+2%	canopy		
11	Roundup PowerMax+AMS	22+2%	200 GDD	**98**	**99**
	Roundup PowerMax+AMS	22+2%	400 GDD		
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	**98**	**99**
	Roundup PowerMax+AMS	22+2%	1 inch weeds		
	Roundup PowerMax+AMS	22+2%	1 inch weeds		
	Continue with 1 inch weeds				
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	**97**	**99**
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Continue with 2 inch weeds				
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	**99**	**99**
	Roundup PowerMax+AMS	22+2%	4 inch weeds		
	Continue with 4 inch weeds				
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	**70**	**99**
	Roundup PowerMax+AMS	22+2%	6 inch weeds		
	Continue with 6 inch weeds				
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	**98**	**99**
	Roundup PowerMax+AMS	32+2%	1 inch weeds		
	Roundup PowerMax+AMS	32+2%	1 inch weeds		
	Continue with 1 inch weeds				
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	**99**	**99**
	Roundup PowerMax+AMS	32+2%	2 inch weeds		
	Roundup PowerMax+AMS	32+2%	2 inch weeds		
	Continue with 2 inch weeds				
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	**99**	**99**
	Roundup PowerMax+AMS	32+2%	4 inch weeds		
	Continue with 4 inch weeds				
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	**94**	**99**
	Roundup PowerMax+AMS	32+2%	6 inch weeds		
	Continue with 6 inch weeds				
			C.V	5.9	0.1
			LSD (0.5)	8.0	0.2

TABLE 8c. Weed control of Amaranthus species with Roundup, site 0933.

TRT #	Herbicide	Rate oz/acre	appl. Criteria	Amaranthus species 6/22	Amaranthus species 7/30
				% weed control	
1	Roundup PowerMax+AMS	22+2%	2 inch weeds	96	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
2	Roundup PowerMax+AMS	22+2%	200 GDD	97	84
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
3	Roundup PowerMax+AMS+Outlook	22+2%+18	2 inch weeds	99	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
4	Roundup PowerMax+AMS+Outlook	22+2%+18	200 GDD	94	99
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
5	Roundup PowerMax+AMS	22+2%+	2 inch weeds	94	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds		
	Roundup PowerMax+AMS	22+2%	canopy		
6	Roundup PowerMax+AMS	22+2%	4 inch weeds	96	99
	Roundup PowerMax+AMS	22+2%	canopy		
7	Roundup PowerMax+AMS	22+2%	200 GDD	98	99
	Roundup PowerMax+AMS	22+2%	400 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
8	Roundup PowerMax+AMS	22+2%	400 GDD	98	99
	Roundup PowerMax+AMS	22+2%	400 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
9	Roundup PowerMax+AMS	22+2%	200 GDD	98	99
	Roundup PowerMax+AMS	22+2%	200 GDD		
	Roundup PowerMax+AMS	22+2%	canopy		
10	Roundup PowerMax+AMS	22+2%	200 GDD	94	95
	Roundup PowerMax+AMS	22+2%	canopy		
11	Roundup PowerMax+AMS	22+2%	200 GDD	98	69
	Roundup PowerMax+AMS	22+2%	400 GDD		
12	Roundup PowerMax+AMS	22+2%	1 inch weeds	99	99
	Roundup PowerMax+AMS	22+2%	1 inch weeds		
	Roundup PowerMax+AMS	22+2%	1 inch weeds		
	Continue with 1 inch weeds				
13	Roundup PowerMax+AMS	22+2%	2 inch weeds	98	99
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Roundup PowerMax+AMS	22+2%	2 inch weeds		
	Continue with 2 inch weeds				
14	Roundup PowerMax+AMS	22+2%	4 inch weeds	99	99
	Roundup PowerMax+AMS	22+2%	4 inch weeds		
	Continue with 4 inch weeds				
15	Roundup PowerMax+AMS	22+2%	6 inch weeds	82	99
	Roundup PowerMax+AMS	22+2%	6 inch weeds		
	Continue with 6 inch weeds				
16	Roundup PowerMax+AMS	32+2%	1 inch weeds	99	99
	Roundup PowerMax+AMS	32+2%	1 inch weeds		
	Roundup PowerMax+AMS	32+2%	1 inch weeds		
	Continue with 1 inch weeds				
17	Roundup PowerMax+AMS	32+2%	2 inch weeds	99	99
	Roundup PowerMax+AMS	32+2%	2 inch weeds		
	Roundup PowerMax+AMS	32+2%	2 inch weeds		
	Continue with 2 inch weeds				
18	Roundup PowerMax+AMS	32+2%	4 inch weeds	98	99
	Roundup PowerMax+AMS	32+2%	4 inch weeds		
	Continue with 4 inch weeds				
19	Roundup PowerMax+AMS	32+2%	6 inch weeds	94	99
	Roundup PowerMax+AMS	32+2%	6 inch weeds		
	Continue with 6 inch weeds				
			C.V	4.8	10.6
			LSD (0.5)	6.6	14.5

TABLE 9. Sugarbeet Revenue percent of mean ranking

site 0931

TRT #	Revenue percent of mean
9	51.49
11	71.33
15	86.21
3	86.48
12	90.68
18	91.24
7	93.17
19	96.76
17	99.31
1	100.71
8	101.43
6	102.04
4	106.77
13	111.60
	113.34
2	115.54
14	117.13
16	123.34
10	141.44

site 0932

TRT #	Revenue percent of mean
9	89.17
19	90.47
5	92.47
12	93.19
1	96.27
16	96.42
7	97.89
10	98.39
14	101.09
18	101.12
4	101.22
13	101.27
17	102.30
15	104.01
2	104.21
8	105.13
11	106.55
6	108.10
3	108.84

EFFICACY OF MIXTURES OF GLYPHOSATE AND FUNGICIDES FOR CONTROLLING CERCOSPORA LEAF SPOT ON SUGARBEET

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[2]Research Technician, Plant Pathology Department, North Dakota State University

In 2008, glyphosate-tolerant sugarbeet seeds became commercially available for widespread use in all sugar producing states except California, in the United States. Growers have rapidly adopted this technology which was used on over 85% of the sugarbeet acreage in 2009. Growers wanted to know whether it is possible to mix glyphosate with fungicides and maintain effective pest control without causing phytotoxicity.

The objective of this research was to evaluate mixtures of glyphosate and fungicides for efficacy at controlling weeds and Cercospora leaf spot, and for phytotoxicity on sugarbeet.

MATERIALS AND METHODS

A field trial was conducted at Foxhome, MN in 2009. 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 19 May with Beta 86RR66 which is resistant to Rhizomania and has a Cercospora leaf spot KWS rating of 5.0. Seeds were treated with Tachigaren at 20g per 100,000 seeds and Poncho beta to provide protection against *Aphanomyces cochlioides* and insect pests, respectively. The site was seeded with barley as a cover crop at planting. Plots were thinned manually to 41,580 plants per acre. Weeds were controlled with a treatment application on 16 June and a maintenance application on 13 July using Roundup Powermax at 22 fl oz/A, Interlock at 4 fl oz/A, and Class Act NG at 1% v/v. Plots were inoculated with *C. beticola* inoculum provided by Margaret Rekoske (Betaseed, Shakopee, MN) on 14 July.

Treatments comprised of fungicides that are typically used for *C. beticola* control with glyphosate plus AMS, and glyphosate plus AMS with no fungicides. 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. Treatments were applied on 16 June and 3, 18 August. Treatments were applied at rates as indicated in Table 1.

Cercospora leaf spot severity was rated on the leaf spot assessment scale of 1 to 10. A rating of 1 indicated the presence of 1- 5 spots/leaf or 0.1% severity and a rating of 10 indicated 50% or higher disease severity. Cercospora leaf spot rating done 2 September is reported.

Plots were defoliated mechanically and harvested using a mechanical harvester on 14 October. 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 7.5 software package (Gylling Data Management Inc., Brookings, South Dakota, 1999). The least significant difference (LSD) test was used to compare treatments when the F-test for treatments was significant.

RESULTS AND DISCUSSIONS

Glyphosate provided excellent control of all weeds and the cover crop regardless of whether it was applied alone or with a fungicide. After inoculation, Cercospora leaf spot progressed very slowly in the control plots treated with glyphosate but no fungicide. After favorable weather conditions in mid-August, disease severity started to increase and reached economic levels by early September. All fungicide and glyphosate mixtures resulted in significantly better CLS control and significantly greater root yield and recoverable sucrose compared to glyphosate alone. No phytotoxicity was observed in any of the treatments. The data suggest that mixtures of glyphosate and certain fungicides can be safely used for effective weed and CLS control in glyphosate-tolerant sugarbeet.

Table 1. Effect of mixtures of glyphosate and fungicides on Cercospora leaf spot control, and sugarbeet yield and quality at Foxhome, MN in 2009

Treatment and rate/A*	CLS**	Root yield (t/A)	Sucrose concentration (%)	Recoverable sucrose (lb/A)
Weathermax 28 fl oz Amstik 2.5 lb ai/100 gal	7	24.3	14.1	6187
Eminent 125 SL 13 fl oz Weathermax 28 fl oz Amstik 2.5 lb ai/100 gal	2	30.6	14.9	8325
Headline 2.09 EC 9 fl oz Weathermax 28 fl oz Amstik 2.5 lb ai/100 gal	3	32.1	15.7	9324
Inspire XT 7 fl oz Weathermax 28 fl oz Amstik 2.5 lb ai/100 gal	2	30.9	15.1	8507
Super Tin 4L 8 fl oz Weathermax 28 fl oz Amstik 2.5 lb ai/100 gal	5	31.4	15.5	8994
Proline 5.7 fl oz + Premier 90 NIS 0.125%v/v Weathermax 28 fl oz Amstik 2.5 lb ai/100 gal	2	31.2	15.5	8909
LSD (P=0.05)	1.4	3.28	0.59	1041

*Treatments were applied on 16 June, 3 and 18 August.

**Cercospora leaf spot measured on 1-10 scale (1 = 1- 5 spots/leaf or 0.1% severity and 10∃50% severity) on 22 September.

North Dakota State University

Weed Control for Sugarbeets - Tank Mixtures

Trial ID: Expt 4 Protocol ID: Protocol 4-6
Location: Clara City Study Director:
Project ID: Investigator: Jeff Stachler
Sponsor Contact:

General Trial Information

Study Director: Jeff Stachler **Title:** Ext. Agron. - Sugarbeet Weed Sci.
Investigator: Jeff Stachler

Trial Status: F one-year/final

Trial Location

City: Clara City USA 49.376656 **-** 24.53833
State/Prov.: MN -124.715843 **-** -66.968887
Country: USA United States

Objectives:
Determine the response of RR soybean, RR canola, lambsquarters, and pigweed to various tank-mix and/or sequential partners with glyphosate.

Personnel

Study Director: Jeff Stachler **Title:** Ext. Agron. - Sugarbeet Weed Sci.
Affiliation: NDSU and U of MN
Address: NDSU Dept. 7670, P.O. Box 6050
Location: Fargo, ND
Postal Code: 58108-6050 **E-mail:** jeff.stachler@ndsu.edu
Phone No.: 701-231-8131 **Mobile No.:** 218-790-8131
Investigator: Jeff Stachler

Crop Description

Crop 1: BEAVA Beta vulgaris vulg. altissima Sugarbeet
Variety: Betaseed 95RR03
BBCH Scale: BSUG **Planting Date:** Apr-25-09
Planting Method: SEEDED seeded
Row Spacing, Unit: 22 IN
Harvest Date: Sep-17-09

Pest Description

Pest 1 Type: W **Code:** BRSRC Brassica rapa cv. 'Canola'
Common Name: Canola
Description: Roundup Ready
Artificial Population: X **Establishment Date:** Apr-24-09
Establishment Method/Description: seeded by drill in 4' perpendic. to plot

Pest 2 Type: W **Code:** AMASS Amaranthus sp.
Common Name: Amaranth
Description: likely redroot pigweed

Pest 3 Type: W **Code:** CHEAL Chenopodium album
Common Name: Common lambsquarters

Pest 4 Type: W **Code:** POLSS Polygonum sp.
Common Name: tearthumb (?) smartweed

Pest 5 Type: W **Code:** GLXMA Glycine max
Common Name: Soybean
Description: Roundup Ready Soybean
Artificial Population: X **Establishment Date:** Apr-24-09

Site and Design

Plot Width, Unit: 11 FT
Plot Length, Unit: 40 FT
Plot Area, Unit: 440 FT2 **Tillage Type:** CONTIL conventional-till
Replications: 4 **Study Design:** RACOBL Randomized Complete Block (RCB)

	Previous Crops	Year
1.	corn	2008

Maintenance

No.	Date	Maintenance Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit
1.	Apr-25-09	Tachigaren	70	%	DF	45	g/Unit

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Application Description

	A	B	C	D	E
Application Date:	May-22-09	May-29-09	Jun-5-09	Jun-18-09	May-1-09
Time of Day:	11:15 am	10:40 am	12:00 pm	10:15 am	12:00 pm
Application Method:	SPRAY	SPRAY	SPRAY	SPRAY	SPRAY
Application Timing:	POEMCR	POEMCR	POEMCR	POEMCR	PREMEA
Applied By:	Jeff	Jeff	Jeff	Lenny	Lenny
Air Temperature, Unit:	75 F	67 F	65 F	75 F	55 F
% Relative Humidity:	19	21	24	72	34
Wind Velocity, Unit:	7 MPH	2 MPH	8 MPH	4 MPH	18 MPH
Wind Direction:	S	SW	NNW	NE	N
Soil Temperature, Unit:	68 F	57 F	60 F	67 F	36 F
Soil Moisture:	GOOD	GOOD	DRY	GOOD	GOOD
% Cloud Cover:	20	30	10	15	10

Crop Stage At Each Application

	A	B	C	D	E
Crop 1 Code, BBCH Scale:	BEAVA BSUG	BEAVA BSUG	BEAVA BSUG	BEAVA BSUG	BEAVA BSUG
Stage Scale Used:	DESC		DESC	DESC	
Stage Majority, Percent:	V2		v8	12 lf	
Stage Minimum, Percent:			v3	10 lf	
Stage Maximum, Percent:			v9	14 lf	

North Dakota State University

Pest Stage At Each Application

	A	B	C	D	E
Pest 1 Code, Type, Scale:	BRSRC W	BRSRC W	BRSRC W	BRSRC W	BRSRC W
Stage Majority, Percent:	3 lf	3 lf	5 lf	bud	
Stage Minimum, Percent:	2lf	cotyl	3 lf	bud	
Stage Maximum, Percent:	3 lf	5 lf	bud	flower	
Height, Unit:	1 IN	1.5 IN	3.5 IN	2 IN	
Height Minimum, Maximum:	0.75 1.25	0.5 2.0	1.5 5	1 17	
Density, Unit:	17 M2	22 ROWFT	23 ROWFT	21 ROWFT	
Pest 2 Code, Type, Scale:	AMASS W	AMASS W	AMASS W	AMASS W	AMASS W
Stage Majority, Percent:	2 lf	1 lf		6 lf	
Stage Minimum, Percent:	1 lf	cotyl		6 lf	
Stage Maximum, Percent:	2 lf	1 lf		6 lf	
Height, Unit:	0.25 IN	0.25 IN		1 IN	
Height Minimum, Maximum:	0.125 0.25	0.25 0.25		1 1	
Density, Unit:	8 M2	4 M2	0 M2	4 M2	
Pest 3 Code, Type, Scale:	CHEAL W	CHEAL W	CHEAL W	CHEAL W	CHEAL W
Stage Majority, Percent:	4 lf	6 lf	6 lf	cotyl	
Stage Minimum, Percent:	1 lf	2 lf	1 lf	cotyl	
Stage Maximum, Percent:	5 lf	8 lf	1 lf	13 lf	
Height, Unit:	0.5 IN	0.75 IN	1.5 IN	0.75 IN	
Height Minimum, Maximum:	0.25 1	0.25 1	1.25 1.5	0.125 2	
Density, Unit:	12 M2	8 M2	2 M2	15 M2	
Pest 4 Code, Type, Scale:	POLSS W	POLSS W	POLSS W	POLSS W	POLSS W
Stage Majority, Percent:	3 lf	2 lf	5 lf		
Stage Minimum, Percent:	1 lf	2 lf	5 lf		
Stage Maximum, Percent:	4 lf	2 lf	5 lf		
Height, Unit:	0.5 IN	0.75 IN	1.5 IN		
Height Minimum, Maximum:	0.25 0.75	0.75 0.75	1.5 1.5		
Density, Unit:	20 M2	1 M2	1 M2	0 M2	
Pest 5 Code, Type, Scale:	GLXMA W	GLXMA W	GLXMA W	GLXMA W	GLXMA W
Stage Majority, Percent:	Unifol	Unifol	1 trif	1 trif	
Stage Minimum, Percent:	Unifol	cotyl	Unifol	unifol	
Stage Maximum, Percent:	Unifol	1 trif	2 trif	1 trif	
Height, Unit:	1 IN	2 IN	1.75 IN	1.75 IN	
Height Minimum, Maximum:	1 1	1 2	1.5 2.25	1 2.5	
Density, Unit:	2 ROWFT	8 ROWFT	3 ROWFT	6 ROWFT	

Application Equipment

		B	C	D	E
Equipment Type:	SPRBIC	SPRBIC	SPRBIC	SPRBIC	SPRBIC
Operating Pressure, Unit:	40 PSI	40 PSI	40 PSI	40 PSI	40 PSI
Nozzle Type:	flat fan	flat fan	flat fan	flat fan	flat fan
Nozzle Size:	8002	8002	8002	8002	8002
Ground Speed, Unit:	3 MPH	3 MPH	3 MPH	3 MPH	3 MPH
Spray Volume, Unit:	17 gal/ac	17 gal/ac	17 gal/ac	17 gal/ac	17 gal/ac
Mix Size, Unit:	2 liters	2 liters	2 liters	2 liters	2 liters

Trt No Treatment Application Comment

14 June 5 - Pest stage in pest stage at application
15 June 5-Colq Avg=12 lf, 7-14 lf; Avg=2.25", 1.25-3"; 8 plants/sq. meter
June 5-Amar Avg=7 lf, 4-8 lf; Avg=0.75", 0.25-1.25"; 12 plants/sq.meter
June 5-Smwe, Cano-no plants
June 5-Soyb Avg=1 trif, unifol-2 trif; Avg=2", 1-3"; 5 plants/ft of row
16 June 5-Colq Avg=10 lf, 6-17 lf; Avg=2.25", 0.75-3"; 18 plants/sq.meter
June 5-Amar Avg=5 lf, cot-9 lf; Avg=1", 0.25-2.5"; 9 plants/sq.meter
June 5-Smwe&Cano-none
June 5-Soyb Avg=1 trif, uni-1 trif; Avg=2", 1.25-2.75"; 2 plants/sq.meter
17 June 5-Colq Avg=12 lf, 8-13 lf; Avg=2.5", 1.5-3.25"; 3 plants/sq.m.
Amar Avg=5 lf, 3-9 lf; Avg=1", 0.25-1.5"; 5 plts/sq.m.
Smwe Avg=4 lf, 2-6 lf; Avg=2", 0.5-2.5", 3 plts/sq.m.
Cano-none
Soyb Avg=1 trif, 1-2 trif.; Avg=2", 2-2.5"; 2 plts/ft row
14 May 22-Colq Avg=4 lf, 3-6lf; Avg=0.75", 0.5-0.75"; 4 plants/sq.m.

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Amar Avg=2 lf, cotyl-4 lf; Avg=0.25", 0.125-0.5"; 21 plants/sq.m.
Smwe Avg=3 lf; Avg=0.75"; 1 plant/sq.m.
Cano Avg=3 lf, cotyl-3 lf; Avg=0.75", 0.25-1.25"; 21 plts/ft row
14 May 22-Soyb Avg=cotyl, cotyl-unifol; Avg=0.5", 0.25-1", 2 plants/ft row

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Weed Control for Sugarbeets - Tank Mixtures

Trial ID: Expt 4 Protocol ID: Protocol 4-6
Location: Clara City Study Director:
Project ID: Investigator: Jeff Stachler
Sponsor Contact:

Pest Type						W Weed	W Weed	W Weed
Pest Code						AMASS	CHEAL	POLSS
Pest Scientific Name						Amaranthus sp.	Chenopodium al>	Polygonum sp.
Pest Name						Amaranth	Common lambsqu>	Smartweed
Crop Code					BEAVA			
BBCH Scale					BSUG			
Crop Scientific Name					Beta vulgaris >			
Crop Name					Sugarbeet			
Description					Injury	Likely redroot>	Lambsquarters	Tearthumb Smar>
Rating Date					Jun-18-09	Jun-18-09	Jun-18-09	Jun-18-09
Rating Type					PHYGEN	CONTRO		
Rating Unit					%	%		
Number of Subsamples					1	1	1	1
Assessed By					Stachler	Stachler		
Days After First/Last Applic.					48	48	48	48
Trt-Eval Interval					27 DA-A	27 DA-A	27 DA-A	27 DA-A
Plant-Eval Interval					54 DP-1	54 DP-1	54 DP-1	54 DP-1
Trt No. Treatment Name	Rate	Rate Unit	Appl Code	Appl Description	1	2	3	4
1 AmStik	2.5	lb ai/a	A	2 leaf sgbt	0.0 a	98.3 a	90.3 abc	92.8 abc
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
AmStik	2.5	lb ai/a	C	2 lf + 14 Days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 Days				
2 Water = pH9.2			A	2 leaf sgbt	0.8 a	98.3 a	95.8 ab	96.8 abc
UpBeet	0.125	oz ai/a	A	2 leaf sgbt				
Destiny HC	1	% v/v	A	2 leaf sgbt				
ET4000 (mixture pH = 2.3)	1	% v/v	A	2 leaf sgbt				
RU PowerMax (mixture pH = 3.0)	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.125	oz ai/a	C	2 lf + 14 Days				
Destiny HC	1	% v/v	C	2 lf + 14 Days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 Days				
N-Tank (pH 2)	1	% v/v	C	2 lf + 14 Days				
3 Water = pH 7 - used AMADS			A	2 leaf sgbt	1.3 a	98.5 a	90.5 abc	95.8 abc
UpBeet	0.125	oz ai/a	A	2 leaf sgbt				
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
Destiny HC	1	% v/v	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.125	oz ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
Destiny HC	1	% v/v	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
4 UpBeet	0.25	oz ai/a	A	2 leaf sgbt	2.5 a	98.0 a	91.3 ab	96.8 abc
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
Destiny HC	1	% v/v	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.25	oz ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
Destiny HC	1	% v/v	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
5 UpBeet	0.5	oz ai/a	A	2 leaf sgbt	5.0 a	98.0 a	93.5 ab	94.5 abc
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
Destiny HC	1	% v/v	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.5	oz ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
Destiny HC	1	% v/v	C	2 lf + 14days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
6 Stinger	0.0469	lb ai/a	A	2 leaf sgbt	0.0 a	97.5 ab	91.5 ab	96.8 abc
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
Stinger	0.0469	lb ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				

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Pest Type		W Weed	W Weed	W Weed
Pest Code		AMASS	CHEAL	POLSS
Pest Scientific Name		Amaranthus sp.	Chenopodium al>	Polygonum sp.
Pest Name		Amaranth	Common lambsqu>	Smartweed
Crop Code	BEAVA			
BBCH Scale	BSUG			
Crop Scientific Name	Beta vulgaris >			
Crop Name	Sugarbeet			
Description	Injury	Likely redroot>	Lambsquarters	Tearthumb Smar>
Rating Date	Jun-18-09	Jun-18-09	Jun-18-09	Jun-18-09
Rating Type	PHYGEN	CONTRO		
Rating Unit	%	%		
Number of Subsamples	1	1	1	1
Assessed By	Stachler	Stachler		
Days After First/Last Applic.	48	48	48	48
Trt-Eval Interval	27 DA-A	27 DA-A	27 DA-A	27 DA-A
Plant-Eval Interval	54 DP-1	54 DP-1	54 DP-1	54 DP-1

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Appl Description	1	2	3	4
7	Stinger	0.0938	lb ai/a	A	2 leaf sgbt	0.0 a	98.5 a	91.0 abc	89.3 abc
	AmStik	2.5	lb ai/a	A	2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	Stinger	0.0938	lb ai/a	C	2 lf + 14 days				
	AmStik	2.5	lb ai/a	C	2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
8	UpBeet	0.25	oz ai/a	A	2 leaf sgbt	0.0 a	98.0 a	88.3 bcd	95.5 abc
	AmStik	2.5	lb ai/a	A	2 leaf sgbt				
	Stinger	0.0469	lb ai/a	A	2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	UpBeet	0.25	oz ai/a	C	2 lf + 14days				
	AmStik	2.5	lb ai/a	C	2 lf + 14 days				
	Stinger	0.0469	lb ai/a	C	2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
9	UpBeet	0.125	oz ai/a	A	2 leaf sgbt	1.3 a	98.8 a	98.5 a	98.8 a
	AmStik	2.5	lb ai/a	A	2 leaf sgbt				
	Betamix	0.167	lb ai/a	A	2 leaf sgbt				
	Nortron	0.0833	lb ai/a	A	2 leaf sgbt				
	Destiny HC	1	% v/v	A	2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	UpBeet	0.125	oz ai/a	C	2 lf + 14 days				
	AmStik	2.5	lb ai/a	C	2 lf + 14 days				
	Betamix	0.167	lb ai/a	C	2 lf + 14 days				
	Nortron	0.0833	lb ai/a	C	2 lf + 14 days				
	Destiny HC	1	% v/v	C	2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
10	UpBeet	0.25	oz ai/a	A	2 leaf sgbt	0.0 a	97.5 ab	93.8 ab	96.3 abc
	AmStik	2.5	lb ai/a	A	2 leaf sgbt				
	SelectMax	0.0312	lb ai/a	A	2 leaf sgbt				
	Destiny HC	1	% v/v	A	2 leaf sgbt				
	Stinger	0.0305	lb ai/a	A	2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	UpBeet	0.25	oz ai/a	C	2 lf + 14 days				
	AmStik	2.5	lb ai/a	C	2 lf + 14 days				
	Destiny HC	1	% v/v	C	2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14days				
11	AmStik	2.5	lb ai/a	A	2 leaf sgbt	1.3 a	98.3 a	94.0 ab	96.3 abc
	Nortron	0.375	lb ai/a	A	2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	Premier 90	0.25	% v/v	A	2 leaf sgbt				
	AmStik	2.5	lb ai/a	C	2 lf + 14 days				
	Nortron	0.375	lb ai/a	C	2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
	Premier 90	0.25	% v/v	C	2 lf + 14 days				
12	AmStik	2.5	lb ai/a	A	2 leaf sgbt	0.0 a	95.3 abc	81.0 cd	91.0 abc
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	UpBeet	0.0625	lb ai/a	B	2 lf + 7 days				
	Betamix	0.1067	lb ai/a	B	2 lf + 7 days				
	Nortron	0.0533	lb ai/a	B	2 lf + 7 days				
	MSO	1.5	% v/v	B	2 lf + 7 days				
	Stinger	1.3	fl oz/a	B	2 lf + 7 days				
	AmStik	2.5	lb ai/a	D	2 lf + 27 days				
	RU PowerMax	0.75	lb ae/a	D	2 lf + 27 days				

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Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Appl Description				
Pest Type							W Weed	W Weed	W Weed
Pest Code							AMASS	CHEAL	POLSS
Pest Scientific Name							Amaranthus sp.	Chenopodium al>	Polygonum sp.
Pest Name							Amaranth	Common lambsqu>	Smartweed
Crop Code						BEAVA			
BBCH Scale						BSUG			
Crop Scientific Name						Beta vulgaris >			
Crop Name						Sugarbeet			
Description						Injury	Likely redroot>	Lambsquarters	Tearthumb Smar>
Rating Date						Jun-18-09	Jun-18-09	Jun-18-09	Jun-18-09
Rating Type						PHYGEN	CONTRO		
Rating Unit						%	%		
Number of Subsamples						1	1	1	1
Assessed By						Stachler	Stachler		
Days After First/Last Applic.						48	48	48	48
Trt-Eval Interval						27 DA-A	27 DA-A	27 DA-A	27 DA-A
Plant-Eval Interval						54 DP-1	54 DP-1	54 DP-1	54 DP-1
						1	2	3	4
13	AmStik	2.5	lb ai/a	A	2 leaf sgbt	0.0 a	96.3 abc	98.3 ab	97.3 ab
	Outlook	10.5	fl oz/a	A	2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	AmStik	2.5	lb ai/a	C	8 leaf sgbt				
	Outlook	10.5	fl oz/a	C	8 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
14	AmStik	2.5	lb ai/a	A	2 leaf sgbt	0.0 a	98.5 a	97.8 ab	98.5 a
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	AmStik	2.5	lb ai/a	C	8 leaf sgbt				
	Outlook	21	fl oz/a	C	8 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
15	Nortron	3	lb ai/a	F	Preemergence	1.3 a	93.5 bc	78.8 d	80.3 c
	AmStik	2.5	lb ai/a	C	8 leaf sgbt				
	Outlook	21	fl oz/a	C	8 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
16	Nortron	3.75	lb ai/a	F	Preemergence	0.0 a	92.8 c	78.3 d	81.5 bc
	AmStik	2.5	lb ai/a	C	8 leaf sgbt				
	Outlook	21	fl oz/a	C	8 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
17	Nortron	3	lb ai/a	F	Preemergence	3.3 a	77.5 d	65.0 e	58.3 d
	UpBeet	0.25	oz ai/a	C	8 leaf sgbt				
	AmStik	2.5	lb ai/a	C	8 leaf sgbt				
	Outlook	21	fl oz/a	C	8 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
18	AmStik	2.5	lb ai/a	A	2 leaf sgbt	2.5 a	98.3 a	95.5 ab	92.0 abc
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	Harness	2.41	lb ai/a	C	8 leaf sgbt				
	AmStik	2.5	lb ai/a	C	8 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
LSD (P=.05)						3.01	4.19	10.02	16.53
Standard Deviation						2.13	2.96	7.09	11.69
CV						201.65	3.08	7.91	12.77
Bartlett's X2						5.582	76.291	41.7	89.834
P(Bartlett's X2)						0.694	0.001*	0.001*	0.001*
Replicate F						1.283	1.241	1.005	2.852
Replicate Prob(F)						0.2900	0.3045	0.3982	0.0463
Treatment F						1.808	11.298	6.004	2.833
Treatment Prob(F)						0.0530	0.0001	0.0001	0.0021

Means followed by same letter do not significantly differ (P=.05, LSD)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

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Pest Type	W Weed	W Weed	W Weed	W Weed
Pest Code	BRSRC	GLXMA	GLXMA	CHEAL
Pest Scientific Name	Brassica rapa >	Glycine max	Glycine max	Chenopodium al>
Pest Name	Canola	Soybean	Soybean	Common lambsqu>
Crop Code				
BBCH Scale				
Crop Scientific Name				
Crop Name				
Description	RR Canola	RR Soybean	RR Soybean	Lambsquarters
Rating Date	Jun-18-09	Jun-18-09	Jul-21-09	Jul-21-09
Rating Type				
Rating Unit				
Number of Subsamples	1	1	1	1
Assessed By				
Days After First/Last Applic.	48	48	81	81
Trt-Eval Interval	27 DA-A	27 DA-A	60 DA-A	60 DA-A
Plant-Eval Interval	54 DP-1	54 DP-1	87 DP-1	87 DP-1

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Appl Description	5	6	10	11
1	AmStik	2.5	lb ai/a	A	2 leaf sgbt	2.5 gh	6.3 hi	2.5 h	75.0 f
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	AmStik	2.5	lb ai/a	C	2 lf + 14 Days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14 Days				
2	Water = pH9.2			A	2 leaf sgbt	67.0 bc	50.0 e	42.5 fg	86.5 a-e
	UpBeet	0.125	oz ai/a	A	2 leaf sgbt				
	Destiny HC	1	% v/v	A	2 leaf sgbt				
	ET4000 (mixture pH = 2.3)	1	% v/v	A	2 leaf sgbt				
	RU PowerMax (mixture pH = 3.0)	0.75	lb ae/a	A	2 leaf sgbt				
	UpBeet	0.125	oz ai/a	C	2 lf + 14 Days				
	Destiny HC	1	% v/v	C	2 lf + 14 Days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14 Days				
	N-Tank (pH 2)	1	% v/v	C	2 lf + 14 Days				
3	Water = pH 7 - used AMADS			A	2 leaf sgbt	68.8 b	59.5 de	38.8 g	77.8 ef
	UpBeet	0.125	oz ai/a	A	2 leaf sgbt				
	AmStik	2.5	lb ai/a	A	2 leaf sgbt				
	Destiny HC	1	% v/v	A	2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	UpBeet	0.125	oz ai/a	C	2 lf + 14 days				
	AmStik	2.5	lb ai/a	C	2 lf + 14 days				
	Destiny HC	1	% v/v	C	2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
4	UpBeet	0.25	oz ai/a	A	2 leaf sgbt	77.5 a	63.8 cd	56.3 de	80.0 def
	AmStik	2.5	lb ai/a	A	2 leaf sgbt				
	Destiny HC	1	% v/v	A	2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	UpBeet	0.25	oz ai/a	C	2 lf + 14 days				
	AmStik	2.5	lb ai/a	C	2 lf + 14 days				
	Destiny HC	1	% v/v	C	2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
5	UpBeet	0.5	oz ai/a	A	2 leaf sgbt	82.5 a	71.3 bc	76.5 bc	84.5 b-f
	AmStik	2.5	lb ai/a	A	2 leaf sgbt				
	Destiny HC	1	% v/v	A	2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	UpBeet	0.5	oz ai/a	C	2 lf + 14 days				
	AmStik	2.5	lb ai/a	C	2 lf + 14 days				
	Destiny HC	1	% v/v	C	2 lf + 14days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
6	Stinger	0.0469	lb ai/a	A	2 leaf sgbt	5.0 gh	82.5 a	100.0 a	79.0 def
	AmStik	2.5	lb ai/a	A	2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
	Stinger	0.0469	lb ai/a	C	2 lf + 14 days				
	AmStik	2.5	lb ai/a	C	2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				

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Pest Type					W Weed	W Weed	W Weed	W Weed
Pest Code					BRSRC	GLXMA	GLXMA	CHEAL
Pest Scientific Name					Brassica rapa >	Glycine max	Glycine max	Chenopodium al>
Pest Name					Canola	Soybean	Soybean	Common lambsqu>
Crop Code								
BBCH Scale								
Crop Scientific Name								
Crop Name								
Description					RR Canola	RR Soybean	RR Soybean	Lambsquarters
Rating Date					Jun-18-09	Jun-18-09	Jul-21-09	Jul-21-09
Rating Type								
Rating Unit								
Number of Subsamples					1	1	1	1
Assessed By								
Days After First/Last Applic.					48	48	81	81
Trt-Eval Interval					27 DA-A	27 DA-A	60 DA-A	60 DA-A
Plant-Eval Interval					54 DP-1	54 DP-1	87 DP-1	87 DP-1
Trt No. Treatment Name	Rate	Rate Unit	Appl Code	Appl Description	5	6	10	11
7 Stinger	0.0938	lb ai/a	A	2 leaf sgbt	0.0 h	86.3 a	100.0 a	82.5 c-f
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
Stinger	0.0938	lb ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
8 UpBeet	0.25	oz ai/a	A	2 leaf sgbt	52.5 de	78.8 ab	100.0 a	87.3 a-e
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
Stinger	0.0469	lb ai/a	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.25	oz ai/a	C	2 lf + 14days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
Stinger	0.0469	lb ai/a	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
9 UpBeet	0.125	oz ai/a	A	2 leaf sgbt	75.0 ab	70.0 bc	72.5 c	85.8 b-f
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
Betamix	0.167	lb ai/a	A	2 leaf sgbt				
Nortron	0.0833	lb ai/a	A	2 leaf sgbt				
Destiny HC	1	% v/v	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.125	oz ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
Betamix	0.167	lb ai/a	C	2 lf + 14 days				
Nortron	0.0833	lb ai/a	C	2 lf + 14 days				
Destiny HC	1	% v/v	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
10 UpBeet	0.25	oz ai/a	A	2 leaf sgbt	60.0 cd	70.0 bc	68.3 cd	81.8 c-f
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
SelectMax	0.0312	lb ai/a	A	2 leaf sgbt				
Destiny HC	1	% v/v	A	2 leaf sgbt				
Stinger	0.0305	lb ai/a	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.25	oz ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
Destiny HC	1	% v/v	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14days				
11 AmStik	2.5	lb ai/a	A	2 leaf sgbt	40.0 f	60.0 d	41.3 fg	76.5 ef
Nortron	0.375	lb ai/a	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
Premier 90	0.25	% v/v	A	2 leaf sgbt				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
Nortron	0.375	lb ai/a	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
Premier 90	0.25	% v/v	C	2 lf + 14 days				
12 AmStik	2.5	lb ai/a	A	2 leaf sgbt	68.0 bc	82.0 a	88.3 ab	97.5 a
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.0625	lb ai/a	B	2 lf + 7 days				
Betamix	0.1067	lb ai/a	B	2 lf + 7 days				
Nortron	0.0533	lb ai/a	B	2 lf + 7 days				
MSO	1.5	% v/v	B	2 lf + 7 days				
Stinger	1.3	fl oz/a	B	2 lf + 7 days				
AmStik	2.5	lb ai/a	D	2 lf + 27 days				
RU PowerMax	0.75	lb ae/a	D	2 lf + 27 days				

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Pest Type					W Weed	W Weed	W Weed	W Weed
Pest Code					BRSRC	GLXMA	GLXMA	CHEAL
Pest Scientific Name					Brassica rapa >	Glycine max	Glycine max	Chenopodium al>
Pest Name					Canola	Soybean	Soybean	Common lambsqu>
Crop Code								
BBCH Scale								
Crop Scientific Name								
Crop Name								
Description					RR Canola	RR Soybean	RR Soybean	Lambsquarters
Rating Date					Jun-18-09	Jun-18-09	Jul-21-09	Jul-21-09
Rating Type								
Rating Unit								
Number of Subsamples					1	1	1	1
Assessed By								
Days After First/Last Applic.					48	48	81	81
Trt-Eval Interval					27 DA-A	27 DA-A	60 DA-A	60 DA-A
Plant-Eval Interval					54 DP-1	54 DP-1	87 DP-1	87 DP-1
Trt No. Treatment Name	Rate	Rate Unit	Appl Code	Appl Description	5	6	10	11
13 AmStik	2.5	lb ai/a	A	2 leaf sgbt	3.8 gh	13.8 gh	5.8 h	92.8 abc
Outlook	10.5	fl oz/a	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
Outlook	10.5	fl oz/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
14 AmStik	2.5	lb ai/a	A	2 leaf sgbt	2.5 gh	2.5 i	3.8 h	94.5 ab
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
Outlook	21	fl oz/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
15 Nortron	3	lb ai/a	F	Preemergence	8.8 g	21.3 fg	6.3 h	83.8 b-f
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
Outlook	21	fl oz/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
16 Nortron	3.75	lb ai/a	F	Preemergence	8.8 g	28.8 f	9.5 h	75.3 f
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
Outlook	21	fl oz/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
17 Nortron	3	lb ai/a	F	Preemergence	46.3 ef	58.8 de	52.0 ef	62.5 g
UpBeet	0.25	oz ai/a	C	8 leaf sgbt				
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
Outlook	21	fl oz/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
18 AmStik	2.5	lb ai/a	A	2 leaf sgbt	1.3 gh	11.3 hi	2.5 h	89.8 a-d
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
Harness	2.41	lb ai/a	C	8 leaf sgbt				
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
LSD (P=.05)					8.73	9.94	12.29	11.15
Standard Deviation					6.18	7.03	8.69	7.88
CV					16.59	13.81	18.05	9.51
Bartlett's X2					28.825	24.746	26.997	29.992
P(Bartlett's X2)					0.017*	0.053	0.019*	0.026*
Replicate F					1.839	1.667	0.936	1.815
Replicate Prob(F)					0.1518	0.1858	0.4302	0.1562
Treatment F					108.828	67.475	71.368	4.410
Treatment Prob(F)					0.0001	0.0001	0.0001	0.0001

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					12	13	14	15
Pest Type					W Weed			
Pest Code					AMASS			
Pest Scientific Name					Amaranthus sp.			
Pest Name					Amaranth			
Crop Code						BEAVA	BEAVA	BEAVA
BBCH Scale						BSUG	BSUG	BSUG
Crop Scientific Name						Beta vulgaris >	Beta vulgaris >	Beta vulgaris >
Crop Name						Sugarbeet	Sugarbeet	Sugarbeet
Description					Pigweed	Injury	Root Yield	Xsugpacr
Rating Date					Jul-21-09	Jul-21-09	Sep-17-09	Sep-17-09
Rating Type							Yield	Extract Suc
Rating Unit							Tons/A	lb/ac
Number of Subsamples					1	1	1	1
Assessed By								
Days After First/Last Applic.					81	81	139	139
Trt-Eval Interval					60 DA-A	60 DA-A		
Plant-Eval Interval					87 DP-1	87 DP-1	145 DP-1	145 DP-1
Trt No. Treatment Name	Rate	Rate Unit	Appl Code	Appl Description	12	13	14	15
1 AmStik	2.5	lb ai/a	A	2 leaf sgbt	80.0 fg	2.0 a	32.970 a	8704.489 a
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
AmStik	2.5	lb ai/a	C	2 lf + 14 Days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 Days				
2 Water = pH9.2			A	2 leaf sgbt	89.0 cde	1.5 a	35.373 a	9934.363 a
UpBeet	0.125	oz ai/a	A	2 leaf sgbt				
Destiny HC	1	% v/v	A	2 leaf sgbt				
ET4000 (mixture pH = 2.3)	1	% v/v	A	2 leaf sgbt				
RU PowerMax (mixture pH = 3.0)	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.125	oz ai/a	C	2 lf + 14 Days				
Destiny HC	1	% v/v	C	2 lf + 14 Days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 Days				
N-Tank (pH 2)	1	% v/v	C	2 lf + 14 Days				
3 Water = pH 7 - used AMADS			A	2 leaf sgbt	93.0 a-d	1.5 a	35.265 a	9836.587 a
UpBeet	0.125	oz ai/a	A	2 leaf sgbt				
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
Destiny HC	1	% v/v	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.125	oz ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
Destiny HC	1	% v/v	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
4 UpBeet	0.25	oz ai/a	A	2 leaf sgbt	95.3 abc	6.0 a	33.695 a	9734.044 a
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
Destiny HC	1	% v/v	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.25	oz ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
Destiny HC	1	% v/v	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
5 UpBeet	0.5	oz ai/a	A	2 leaf sgbt	94.8 a-d	5.8 a	33.008 a	8957.283 a
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
Destiny HC	1	% v/v	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
UpBeet	0.5	oz ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
Destiny HC	1	% v/v	C	2 lf + 14days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				
6 Stinger	0.0469	lb ai/a	A	2 leaf sgbt	78.3 g	0.8 a	38.553 a	10572.486 a
AmStik	2.5	lb ai/a	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
Stinger	0.0469	lb ai/a	C	2 lf + 14 days				
AmStik	2.5	lb ai/a	C	2 lf + 14 days				
RU PowerMax	0.75	lb ae/a	C	2 lf + 14 days				

North Dakota State University

Pest Type					W Weed			
Pest Code					AMASS			
Pest Scientific Name					Amaranthus sp.			
Pest Name					Amaranth			
Crop Code						BEAVA	BEAVA	BEAVA
BBCH Scale						BSUG	BSUG	BSUG
Crop Scientific Name						Beta vulgaris >	Beta vulgaris >	Beta vulgaris >
Crop Name						Sugarbeet	Sugarbeet	Sugarbeet
Description					Pigweed	Injury	Root Yield	Xsugpacr
Rating Date					Jul-21-09	Jul-21-09	Sep-17-09	Sep-17-09
Rating Type							Yield	Extract Suc
Rating Unit							Tons/A	lb/ac
Number of Subsamples					1	1	1	1
Assessed By								
Days After First/Last Applic.					81	81	139	139
Trt-Eval Interval					60 DA-A	60 DA-A		
Plant-Eval Interval					87 DP-1	87 DP-1	145 DP-1	145 DP-1
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code / Appl Description	12	13	14	15
7	Stinger	0.0938	lb ai/a	A 2 leaf sgbt	84.5 efg	2.8 a	36.900 a	10217.626 a
	AmStik	2.5	lb ai/a	A 2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A 2 leaf sgbt				
	Stinger	0.0938	lb ai/a	C 2 lf + 14 days				
	AmStik	2.5	lb ai/a	C 2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C 2 lf + 14 days				
8	UpBeet	0.25	oz ai/a	A 2 leaf sgbt	95.8 abc	2.8 a	36.263 a	10101.818 a
	AmStik	2.5	lb ai/a	A 2 leaf sgbt				
	Stinger	0.0469	lb ai/a	A 2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A 2 leaf sgbt				
	UpBeet	0.25	oz ai/a	C 2 lf + 14days				
	AmStik	2.5	lb ai/a	C 2 lf + 14 days				
	Stinger	0.0469	lb ai/a	C 2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C 2 lf + 14 days				
9	UpBeet	0.125	oz ai/a	A 2 leaf sgbt	91.0 a-e	4.5 a	35.888 a	9813.738 a
	AmStik	2.5	lb ai/a	A 2 leaf sgbt				
	Betamix	0.167	lb ai/a	A 2 leaf sgbt				
	Nortron	0.0833	lb ai/a	A 2 leaf sgbt				
	Destiny HC	1	% v/v	A 2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A 2 leaf sgbt				
	UpBeet	0.125	oz ai/a	C 2 lf + 14 days				
	AmStik	2.5	lb ai/a	C 2 lf + 14 days				
	Betamix	0.167	lb ai/a	C 2 lf + 14 days				
	Nortron	0.0833	lb ai/a	C 2 lf + 14 days				
	Destiny HC	1	% v/v	C 2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C 2 lf + 14 days				
10	UpBeet	0.25	oz ai/a	A 2 leaf sgbt	89.8 b-e	5.0 a	33.898 a	9594.731 a
	AmStik	2.5	lb ai/a	A 2 leaf sgbt				
	SelectMax	0.0312	lb ai/a	A 2 leaf sgbt				
	Destiny HC	1	% v/v	A 2 leaf sgbt				
	Stinger	0.0305	lb ai/a	A 2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A 2 leaf sgbt				
	UpBeet	0.25	oz ai/a	C 2 lf + 14 days				
	AmStik	2.5	lb ai/a	C 2 lf + 14 days				
	Destiny HC	1	% v/v	C 2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C 2 lf + 14days				
11	AmStik	2.5	lb ai/a	A 2 leaf sgbt	83.3 efg	2.0 a	33.130 a	8920.371 a
	Nortron	0.375	lb ai/a	A 2 leaf sgbt				
	RU PowerMax	0.75	lb ae/a	A 2 leaf sgbt				
	Premier 90	0.25	% v/v	A 2 leaf sgbt				
	AmStik	2.5	lb ai/a	C 2 lf + 14 days				
	Nortron	0.375	lb ai/a	C 2 lf + 14 days				
	RU PowerMax	0.75	lb ae/a	C 2 lf + 14 days				
	Premier 90	0.25	% v/v	C 2 lf + 14 days				
12	AmStik	2.5	lb ai/a	A 2 leaf sgbt	98.0 a	4.0 a	34.165 a	9207.313 a
	RU PowerMax	0.75	lb ae/a	A 2 leaf sgbt				
	UpBeet	0.0625	lb ai/a	B 2 lf + 7 days				
	Betamix	0.1067	lb ai/a	B 2 lf + 7 days				
	Nortron	0.0533	lb ai/a	B 2 lf + 7 days				
	MSO	1.5	% v/v	B 2 lf + 7 days				
	Stinger	1.3	fl oz/a	B 2 lf + 7 days				
	AmStik	2.5	lb ai/a	D 2 lf + 27 days				
	RU PowerMax	0.75	lb ae/a	D 2 lf + 27 days				

North Dakota State University

Pest Type					W Weed			
Pest Code					AMASS			
Pest Scientific Name					Amaranthus sp.			
Pest Name					Amaranth			
Crop Code						BEAVA	BEAVA	BEAVA
BBCH Scale						BSUG	BSUG	BSUG
Crop Scientific Name						Beta vulgaris >	Beta vulgaris >	Beta vulgaris >
Crop Name						Sugarbeet	Sugarbeet	Sugarbeet
Description					Pigweed	Injury	Root Yield	Xsugpacr
Rating Date					Jul-21-09	Jul-21-09	Sep-17-09	Sep-17-09
Rating Type							Yield	Extract Suc
Rating Unit							Tons/A	lb/ac
Number of Subsamples					1	1	1	1
Assessed By								
Days After First/Last Applic.					81	81	139	139
Trt-Eval Interval					60 DA-A	60 DA-A		
Plant-Eval Interval					87 DP-1	87 DP-1	145 DP-1	145 DP-1
Trt No. Treatment Name	Rate	Rate Unit	Appl Code	Appl Description	12	13	14	15
13 AmStik	2.5	lb ai/a	A	2 leaf sgbt	95.5 abc	3.3 a	34.038 a	9956.599 a
Outlook	10.5	fl oz/a	A	2 leaf sgbt				
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
Outlook	10.5	fl oz/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
14 AmStik	2.5	lb ai/a	A	2 leaf sgbt	95.0 abc	1.5 a	33.135 a	9222.708 a
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
Outlook	21	fl oz/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
15 Nortron	3	lb ai/a	F	Preemergence	91.0 a-e	4.5 a	31.565 a	9064.476 a
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
Outlook	21	fl oz/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
16 Nortron	3.75	lb ai/a	F	Preemergence	87.0 def	4.5 a	33.893 a	9428.972 a
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
Outlook	21	fl oz/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
17 Nortron	3	lb ai/a	F	Preemergence	77.0 g	3.5 a	35.965 a	9154.073 a
UpBeet	0.25	oz ai/a	C	8 leaf sgbt				
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
Outlook	21	fl oz/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
18 AmStik	2.5	lb ai/a	A	2 leaf sgbt	97.3 ab	3.8 a	33.495 a	8735.438 a
RU PowerMax	0.75	lb ae/a	A	2 leaf sgbt				
Harness	2.41	lb ai/a	C	8 leaf sgbt				
AmStik	2.5	lb ai/a	C	8 leaf sgbt				
RU PowerMax	0.75	lb ae/a	C	8 leaf sgbt				
LSD (P=.05)					7.91	4.29	5.6090	1558.4494
Standard Deviation					5.59	3.04	3.9662	1101.9901
CV					6.23	91.85	11.49	11.59
Bartlett's X2					21.659	21.777	17.653	31.472
P(Bartlett's X2)					0.155	0.193	0.411	0.017*
Replicate F					2.766	0.412	3.677	1.081
Replicate Prob(F)					0.0512	0.7452	0.0179	0.3656
Treatment F					5.704	1.058	0.753	0.973
Treatment Prob(F)					0.0001	0.4176	0.7345	0.5005

North Dakota State University

Weed Control for Sugarbeets - Tank Mixtures

Trial ID: Expt 4 Protocol ID: Protocol 4-6
Location: Clara City Study Director:
Project ID: Investigator: Jeff Stachler
Sponsor Contact:

Pest Type
W, Weed, G-BYRW7, G-WedStg = Weed or volunteer crop
Pest Code
AMASS, Amaranthus sp., = US
CHEAL, Chenopodium album, = US
POLSS, Polygonum sp., = US
BRSRC, Brassica rapa cv. 'Canola', = US
GLXMA, Glycine max, = US
Crop Code
BEAVA, BSUG, Beta vulgaris vulg. altissima, = US
Rating Type
PHYGEN = phytotoxicity - general / injury
CONTRO = control / burndown or knockdown
Yield = yield
Rating Unit
% = percent
lb/ac = pounds per acre
Plant-Eval Interval
54 DP-1 = 1 Apr-25-09
87 DP-1 = 1 Apr-25-09
145 DP-1 = 1 Apr-25-09

Trial Comments

No herbicide combinations significantly injured the Roundup Ready sugarbeet.

UpBeet applied twice at 0.5 and 1.0 oz/A in combination with Roundup PowerMAX and Destiny HC controlled greater than 76% of RR canola 13 days after the second application. Only UpBeet at 0.25 oz/A plus Betamix at 16.4 oz/A plus Nortron at 2.7 oz/A plus Roundup PowerMAX plus Destiny HC controlled RR canola similarly. Stinger applied twice at 2 and 4 oz/A in combination with Roundup PowerMAX controlled 100% of RR soybean on July 21st compared to only 88% applied once at 1.3 oz/A. UpBeet at 1.0 oz/A plus Roundup PowerMAX plus Destiny HC controlled 77% of RR soybean.

Harness and Oultook mixed with Roundup PowerMAX improved control of lambsquarters and pigweed compared to two applications of Roundup PowerMAX. Two applications of Outlook at 10.5 oz/A plus Roundup PowerMAX controlled lambsquarters and pigweed as well as Outlook at 21 oz/A plus Roundup PowerMAX applied in the second application. UpBeet in combination with glyphosate and Outlook reduced pigweed, lambsquarters, and tearthumb smartweed control on June 18th and July 21st compared to Outlook without UpBeet.

A mid-rate program of conventional herbicides applied 7 days after a Roundup PowerMAX application and followed with another Roundup PowerMAX application improved control of RR canola and soybean, lambsquarters, and pigweed compared to two applications of Roundup PowerMAX on June 18th and July 21st.

Mixing UpBeet in high pH water followed by lowering the spray mixture pH to 2.3 tended to improve control of lambsquarters and did not negatively impact control of other species.

UpBeet mixed with glyphosate improved pigweed control compared to glyphosate applied by alone.

Sugarbeet yield and extractable sucrose were not reduced by herbicide combinations reducing weed control and causing crop injury. However, two applications of Roundup PowerMAX caused the second lowest root yield and the lowest extractable sugar.

GIANT RAGWEED CONTROL IN ROUNDUP READY® SUGARBEET - NORTHWEST OF HUTCHINSON, MN - 2009

Jeff M. Stachler, Jason M. Fisher, and John L. Luecke
Extension Sugarbeet Specialist, Graduate Student, and Research Specialist
North Dakota State University and University of Minnesota

'Betaseed 95RR03' sugarbeet was seeded April 23, 2009 in 22 inch rows in a grower cooperator field having glyphosate-resistant giant ragweed NW of Hutchinson, MN. Sugarbeet seed was treated with Tachigaren at 45 grams dry product per 100,000 seeds. Herbicide treatment information is provided in the table below. All treatments were applied in 17 gpa water at 40 psi through 8002 nozzles with a bicycle sprayer to the center four rows of six row plots 40 feet in length. Glyphosate and/or clopyralid were applied according to the treatments in the data table below. Ammonium sulfate as AmStik from West Central was included in all treatments at 2.5 qt/A. Giant ragweed was evaluated 21 days after each application and at harvest. Only selected data is presented in the table below. Visual evaluations are an estimate of percent control in the treated plot area compared to the adjacent untreated strips and based upon a scale of 0 (no control) to 100% (complete control). Sugarbeet was harvested August 31 from one center row of each plot. Experiment designed as a randomized complete block having four replications.

Table. Application information.

Application Code	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Date of Application	May 18	June 12	July 1	June 2	June 23	July 13	June 12	July 1	July 22
Time of Day	4:30 pm	10:00 am	5:30 pm	2:30 pm	11:30 am	4:45 pm	10:00 am	5:30 pm	1:15 pm
Air Temperature (^{o}F)	86	66	74	69	88	76	66	74	78
Relative Humidity (%)	20	37	50	20	45	38	37	50	36
Soil Temp. (^{o}F at 6")	60	50	74	60	72	70	50	74	76
Wind Velocity (mph)	3	2	4	8	3	2	2	4	2
Cloud Cover (%)	20	90	90	5	90	70	90	90	90
Sugarbeet (stage - range)	Cot.-V2	V4-V8.5	V8.5-V17.9	V4-V7.2	V4-V14.5	V5-V24	V4-V8.5	V8.5-V17.9	V6-V16.5
Giant Ragweed (stage/height –range)	Cot.-3N/ 0.25-2"	-	-	1N-5N/ 1-7.5"	-	-	1N-6N/ 1-13.5"	-	-
Giant Ragweed (avg. density)	8.5/ft^2	-	-	10.8/ft^2	-	-	6/ft^2	-	-

Summary: No appreciable injury was observed with any treatments. Glyphosate applied once and multiple times inadequately controlled giant ragweed, although multiple glyphosate applications controlled more giant ragweed and increased sugarbeet yield compared to a single application. The inadequate control is a result of the presence of glyphosate-resistant biotypes in the population. Sugarbeet yield declined as giant ragweed height increased indicating the competitive ability of giant ragweed.

Increasing the rate of clopyralid improved giant ragweed control at nearly all evaluations and timings. Clopyralid (totaling 0.28 lb ae/A) plus glyphosate (0.75 lb ae/A at each application) controlled the most giant ragweed at harvest for each timing, except clopyralid (totaling 0.188 lb/A) plus glyphosate applied three times starting at 1 inch giant ragweed.

Clopyralid plus glyphosate applied once or multiple times to 6 inch giant ragweed could not improve sugarbeet yield and extractable sucrose. Clopyralid (0.94 lb/A) plus glyphosate (0.75 lb/A) maximized sugarbeet yield and extractable sucrose when applied two or three times to 1 or 3 inch giant ragweed, except three applications to 1 inch giant ragweed. Clopyralid plus glyphosate applied multiple times to 1 and 3 inch giant ragweed improved sugarbeet yield and usually extractable sucrose compared to a single application, except clopyralid (0.188 lb/A) plus glyphosate (0.75 lb/A) applied once to 3 inch giant ragweed.

Experiment continued on next page.

Table. Giant ragweed control in Roundup Ready® sugarbeet, NW Hutchinson, MN (Fisher, Stachler, and Luecke).

Treatment*	Rate	Timing	21 DAT 1,4,7	21 DAT 9	Harvest		
			Girw cntl			Root yield	Extr Sucr
	(lb ae/A)		%			Ton/A	lb/A
Untreated	-	-	0	0	0	0.0	0
Weed Free Check-1"	-	-	100	100	100	19.5	4910
Glyt-PM	0.75	1	42	7	7	3.7	1132
Clpy + Glyt-PM	0.047 + 0.75	1	43	10	5	0.3	74
Clpy + Glyt-PM	0.094 + 0.75	1	51	19	16	2.7	585
Clpy + Glyt-PM	0.188 + 0.75	1	63	26	23	8.3	1883
Clpy + Glyt-PM	0.047 + 0.75	1,2	45	70	60	19.5	3979
Clpy + Glyt-PM	0.094 + 0.75	1,2	50	94	92	20.9	4429
Clpy + Glyt-PM	0.094 + 0.75	1					
Clpy + Glyt-PM	0.188 + 0.75	2	48	100	99	16.8	4068
Clpy + Glyt-PM	0.047 + 0.75	1,2					
Clpy + Glyt-PM	0.094 + 0.75	3	45	98	99	19.0	4157
Clpy + Glyt-PM	0.094 + 0.75	1,2,3	53	100	100	17.3	4033
Weed-Free Check-3"	-	-	100	100	100	12.7	2787
Glyt-PM	0.75	4	43	20	23	5.7	1333
Clpy + Glyt-PM	0.047 + 0.75	4	52	36	31	0.9	257
Clpy + Glyt-PM	0.094 + 0.75	4	60	51	40	5.3	1142
Clpy + Glyt-PM	0.188 + 0.75	4	68	92	84	18.0	4078
Clpy + Glyt-PM	0.047 + 0.75	4,5	54	83	75	17.2	4004
Clpy + Glyt-PM	0.094 + 0.75	4,5	62	97	96	22.1	5227
Clpy + Glyt-PM	0.094 + 0.75	4					
Clpy + Glyt-PM	0.188 + 0.75	5	60	99	98	15.4	3308
Clpy + Glyt-PM	0.047 + 0.75	4,5					
Clpy + Glyt-PM	0.094 + 0.75	6	52	91	95	16.6	3429
Clpy + Glyt-PM	0.094 + 0.75	4,5,6	62	99	99	22.0	4612
Glyt-PM	0.75	4,5	45	57	55	14.5	2832
Glyt-PM	0.75	4,5,6	43	65	61	10.6	2894
Weed-Free Check-6"	-	-	100	100	100	11.4	2567
Glyt-PM	0.75	7	33	19	19	1.0	223
Clpy + Glyt-PM	0.047 + 0.75	7	45	49	40	5.8	1215
Clpy + Glyt-PM	0.094 + 0.75	7	55	63	53	11.3	1927
Clpy + Glyt-PM	0.188 + 0.75	7	65	61	54	12.8	2620
Clpy + Glyt-PM	0.047 + 0.75	7,8	44	78	75	5.5	1005
Clpy + Glyt-PM	0.094 + 0.75	7,8	54	85	81	5.7	1288
Clpy + Glyt-PM	0.094 + 0.75	7					
Clpy + Glyt-PM	0.188 + 0.75	8	53	92	94	5.3	943
Clpy + Glyt-PM	0.047 + 0.75	7,8					
Clpy + Glyt-PM	0.094 + 0.75	9	47	84	92	5.6	1113
Clpy + Glyt-PM	0.094 + 0.75	7,8,9	57	92	98	7.0	1186
CV (%)			8	7	7	45	46
LSD (0.05)			6	6	7	6.9	1549

*Glyt-PM = Roundup PowerMAX from Monsanto; Clpy = Stinger from Dow AgroSciences; Amstik = AMS and added to all treatments at 2.5 qt/A; lb ae/A = pound acid equivalent per acre; Girw = giant ragweed; cntl = control; Extr Sucr= Extractable sucrose.

GIANT RAGWEED CONTROL IN ROUNDUP READY® SUGARBEET
- SOUTHWEST OF HUTCHINSON, MN - 2009

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'Betaseed 95RR03' sugarbeet was seeded April 23, 2009 in 22 inch rows in a grower cooperator field having glyphosate-resistant giant ragweed SW of Hutchinson, MN. Sugarbeet seed was treated with Tachigaren at 45 grams dry product per 100,000 seeds. Herbicide treatment information is provided in the table below. All treatments were applied in 17 gpa water at 40 psi through 8002 nozzles with a bicycle sprayer to the center four rows of six row plots 40 feet in length. Glyphosate and/or clopyralid were applied according to the treatments in the data table below. Ammonium sulfate as AmStik from West Central was included in all treatments at 2.5 qt/A. Giant ragweed was evaluated 21 days after each application and at harvest. Only selected data is presented in the table below. Visual evaluations are an estimate of percent control in the treated plot area compared to the adjacent untreated strips and based upon a scale of 0 (no control) to 100% (complete control). Sugarbeet was harvested September 1 from one center row of each plot. Experiment designed as a randomized complete block having four replications.

Table. Application information.

Application Code	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Date of Application	May 18	June 11	July 1	June 1	June 22	July 13	June 11	July 1	July 22
Time of Day	1:30 pm	5:00 pm	2:00 pm	4:00 pm	3:00 pm	1:00 pm	5:00 pm	2:00 pm	10:30 am
Air Temperature (^oF)	76	70	78	75	89	76	70	78	77
Relative Humidity (%)	24	27	45	21	55	41	27	45	52
Soil Temp. (^oF at 6")	60	50	76	67	82	70	50	76	72
Wind Velocity (mph)	8	5	8	6	3	3	5	8	2
Cloud Cover (%)	20	20	20	40	5	40	20	20	5
Sugarbeet (stage – range)	Cot.-V2	V4-V9	V8-V17.9	V2.5-V6	V7.3-V13.3	V8-V20	V4-V9	V8-V17.9	V8-V22
Giant Ragweed (stage/height - range)	Cot.-2.5N/ 0.25-1.25"	-	-	Cot.-4N/ 0.25-5"	-	-	Cot.-5.5N/ 0.5-10"	-	-
Giant Ragweed (avg. density)	$12/ft^2$	-	-	$14/ft^2$	-	-	$23/ft^2$	-	-

Summary: No appreciable injury was observed with any treatment. Glyphosate applied once and multiple times inadequately controlled giant ragweed, although multiple glyphosate applications controlled more giant ragweed and increased sugarbeet yield compared to a single application. The inadequate control is a result of the presence of glyphosate-resistant biotypes in the population. Sugarbeet yield and extractable sucrose was similar for each weed-free check indicating removal of giant ragweed at the three timings had not impact upon yield and sucrose.

Increasing the rate of clopyralid improved giant ragweed control at nearly all evaluations and timings. Clopyralid plus glyphosate applied three times and twice totaling 0.28 lb ae/A plus 1.5 lb ae/A, respectively, controlled the most giant ragweed at harvest for each timing.

Clopyralid plus glyphosate applied once or multiple times to 6 inch giant ragweed could not improve sugarbeet yield and extractable sucrose. Clopyralid (totaling 0.28 lb/A) plus glyphosate (0.75 lb/A/application) applied two times to 1 inch giant ragweed and clopyralid (0.094 lb/A) plus glyphosate (0.75 lb/A) applied two and three times to 3 inch giant ragweed maximized sugarbeet yield and extractable sucrose.

Experiment continued on next page.

Table. Giant ragweed control in Roundup Ready® sugarbeet, SW Hutchinson, MN (Fisher, Stachler, and Luecke).

Treatment*	Rate	Timing	21 DAT 1,4,7	21 DAT 9	Harvest		
			Girw cntl			Root yield	Extr Sucr
	(lb ae/A)		%			Ton/A	lb/A
Untreated	-	-	0	0	0	0.0	0
Weed Free Check-1”	-	-	100	100	100	9.6	2132
Glyt-PM	0.75	1	34	8	5	0.0	0
Clpy + Glyt-PM	0.047 + 0.75	1	44	7	6	0.3	0
Clpy + Glyt-PM	0.094 + 0.75	1	48	25	19	0.1	0
Clpy + Glyt-PM	0.188 + 0.75	1	61	46	30	7.7	1884
Clpy + Glyt-PM	0.047 + 0.75	1,2	41	68	58	11.6	2614
Clpy + Glyt-PM	0.094 + 0.75	1,2	50	83	77	16.1	3425
Clpy + Glyt-PM Clpy + Glyt-PM	0.094 + 0.75 0.188 + 0.75	1 2	46	99	91	19.4	4389
Clpy + Glyt-PM Clpy + Glyt-PM	0.047 + 0.75 0.094 + 0.75	1,2 3	43	90	92	15.1	3234
Clpy + Glyt-PM	0.094 + 0.75	1,2,3	45	99	99	16.1	3531
Weed-Free Check-3”	-	-	100	100	100	11.4	2704
Glyt-PM	0.75	4	44	33	26	0.5	0
Clpy + Glyt-PM	0.047 + 0.75	4	49	47	35	0.6	0
Clpy + Glyt-PM	0.094 + 0.75	4	-	-	-	-	-
Clpy + Glyt-PM	0.188 + 0.75	4	66	76	66	10.5	2309
Clpy + Glyt-PM	0.047 + 0.75	4,5	49	80	76	10.3	2143
Clpy + Glyt-PM	0.094 + 0.75	4,5	58	87	80	18.0	3893
Clpy + Glyt-PM Clpy + Glyt-PM	0.094 + 0.75 0.188 + 0.75	4 5	57	94	90	13.7	2920
Clpy + Glyt-PM Clpy + Glyt-PM	0.047 + 0.75 0.094 + 0.75	4,5 6	57	98	99	13.3	2575
Clpy + Glyt-PM	0.094 + 0.75	4,5,6	68	100	100	17.0	3849
Glyt-PM	0.75	4,5	46	59	53	7.7	1615
Glyt-PM	0.75	4,5,6	49	71	67	7.9	1655
Weed-Free Check-6”	-	-	100	100	100	10.6	2567
Glyt-PM	0.75	7	34	23	20	0.0	0
Clpy + Glyt-PM	0.047 + 0.75	7	50	61	55	3.8	780
Clpy + Glyt-PM	0.094 + 0.75	7	55	74	66	2.4	1269
Clpy + Glyt-PM	0.188 + 0.75	7	65	82	78	4.3	1012
Clpy + Glyt-PM	0.047 + 0.75	7,8	48	80	80	2.5	777
Clpy + Glyt-PM	0.094 + 0.75	7,8	54	89	86	5.0	1288
Clpy + Glyt-PM Clpy + Glyt-PM	0.094 + 0.75 0.188 + 0.75	7 8	55	92	96	1.4	0
Clpy + Glyt-PM Clpy + Glyt-PM	0.047 + 0.75 0.094 + 0.75	7,8 9	44	85	96	3.1	2108
Clpy + Glyt-PM	0.094 + 0.75	7,8,9	55	89	96	4.2	972
CV (%)			9	7	7	45	46
LSD (0.05)			7	7	7	4.9	1196

*Glyt-PM = Roundup PowerMAX from Monsanto; Clpy = Stinger from Dow AgroSciences; Amstik = AMS and added to all treatments at 2.5 qt/A; lb ae/A = pound acid equivalent per acre; Girw = giant ragweed; cntrl = control; Extr Sucr= Extractable sucrose.