MICHIGAN SUGARBEET REACh

Research & Education Advisory Council

2009 Research Trial Results

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The council will provide direction for the Michigan/Ontario sugarbeet researchers and assemble and distribute research/agronomy information.

Cooperative educational efforts will be conducted with the goal of improving productivity and profitability for all stakeholders.

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Sugarbeet Advancement

STARTER FERTILIZER & BORON TRIAL

Houghtaling Farms

Location:	Sandusky, Sanilac Co.	**Tillage:**	Spring Field Cult. 1x
Variety:	HM-28RR	**Spacings:**	Rows - 28", Seed - 58,000 ppa
Planting Date:	5/3/2009	**Harvest Date:**	10/28/2009
Previous Crop:	Dry Beans	**Sample Date:**	10/16/2009
Soil Type:	Loam	**Herbicides:**	Glyphosate 3x
Fertilizer:	2x2: 15 Gal. 17-11-0 + 9S + B, 150# K20, 60# P 25 Gal. 28%	**Replicated:**	3x
		Fungicide:	Eminent (80 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP
2x2 Starter with Boron	**$1,142**	**7284**	**247**	**29.5**	**16.6**	**95.7**
2x2 Starter without Boron	**$1,088**	**6929**	**247**	**28.1**	**16.7**	**95.3**
No Starter	**$982**	**6033**	**243**	**24.8**	**16.4**	**95.4**
AVERAGE	**1070**	**6749**	**245**	**27.5**	**16.6**	**95.5**
LSD (5%)	**—**	**946**	**15 NS**	**3.3**	**0.6 NS**	**1.1 NS**
C.V. (%)	**—**	**6**	**3**	**5.4**	**1.6**	**0.5**

TRIAL RELIABILITY: Good

EMERGENCE:	Good	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Low	**NEMATODES:**	Not Detected
QUADRIS APP:	In-Furrow	**WEATHER:**	Good

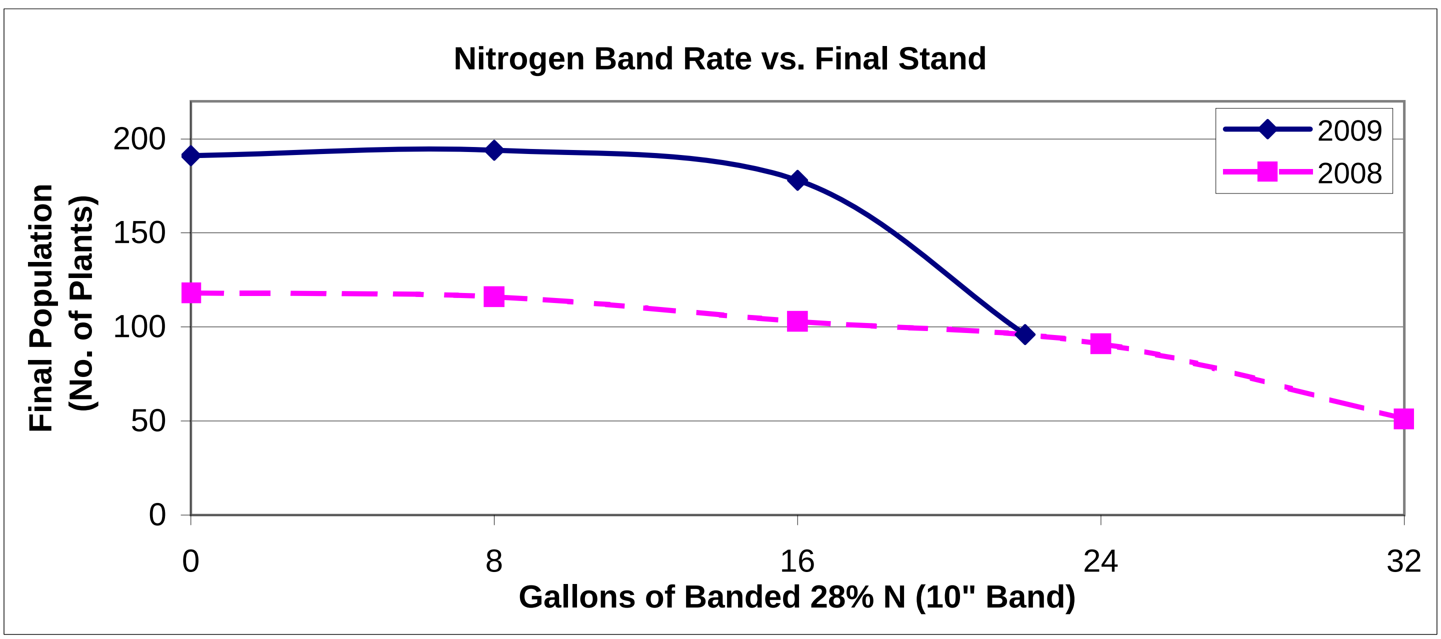
Comments: Trial was conducted to determine the yield effect of starter fertilizer with and without boron added to the starter mix. The starter mix: 5 gallons of Thiosul, 5 gallons of 10-34-0, and 5 gallons of 28%. The treatment "Starter with Boron" added boron at the rate of 1 qt/acre. Results indicate a significant difference between Starter with Boron and No Starter. No starter strips had 28 lbs less nitrogen than strips with starter and this may have led to the large yield difference. Soil test showed the field to have an average phosphorous level of 65 lbs (32 ppm). Revenue is based on a $40/ton payment, 10-34-0 cost of $840/ton, 28% cost of $325/ton, Thiosul cost of $300, and Borosol cost $14.25 gallon.

BANDED 28% NITROGEN AT PLANTING

EFFECT OF BAND RATE ON EMERGENCE

Cooperator:	2008 - Clay Crumbaugh 2009 - MSC, Roggenbuck Trial	**Variety:**	2008 - Crystal R-509 2009 - SX-1260RR
Planting Date:	2008 - 4/22/2008 2009 - 5/7/2009	**Replicated:**	2008 - 4x 2009 - 4x

TREATMENT Gallons of Banded 28% Nitrogen	***Lbs of Nitrogen***	**POPULATION 100 Ft. of Row**						**% Stand of 0 Gal Rate**	
		10 Day		**20 Day**		**30 Day**			
		2008	**2009**	**2008**	**2009**	**2008**	**2009**	**2008**	**2009**
0 Gal.	*0*	83	129	120	—	118	191	100%	100%
8 Gal.	*24*	76	130	113	—	116	194	98%	102%
16 Gal.	*48*	61	104	102	—	103	178	87%	93%
22 Gal	*66*	—	40	—	—	—	96	—	50%
24 Gal.	*72*	65	—	93	—	91	—	77%	—
32 Gal.	*96*	22	—	52	—	51	—	43%	—
LSD (5%)	—	28	17	27	—	24	22	—	—
C.V. (%)	—	29	11	19	—	16	8	—	—



Comments: Trial was conducted to look at effective and efficient ways to supply early season nitrogen to sugar beets. Past experience has indicated that 2x2 starter placement of nitrogen and other nutrients often stimulates early season growth and yield. Growers that are unable to apply by 2x2 may consider applying some of their nitrogen by spraying a 28% band over the row during planting. Research was done to evaluate the effect of 28% nitrogen applied in a 10" band on emergence. Different rates were applied 1 day after planting and emergence counts were taken. Within hours after the nitrogen application in both years, approximately ¼-inch of rainfall occurred. No significant effect on emergence occurred at 8 gallons per acre of 28% nitrogen in a ten inch band. Rates of 16, 24, and 32 gallons did affect emergence. Both trials were done on loams. Emergence evaluations have not been done on lighter textured soils.

*Nitrogen App. To Deficient Beets Mid Season****

Bay City, MI
2009

Trial Quality: Good

Treatment	Rate/ Acre	lbs N/A	$/ Acre**	RWSA	RWST	Tons/ Acre	% Suc	% CJP	Amino N	Color*
Coron (25-0-0)	10 qt	6.2	1129	8633	308	28.0	20.2	96.0	3.4	5.7
N Pact (26-0-0)	10 qt	6.5	1125	8598	309	27.9	20.3	96.0	3.0	5.3
+ Non-Ionic Sur	0.25%									
28% N	10 gal	30	1122	8575	305	28.1	20.3	95.4	3.9	5.8
28% N	20 gal	60	1109	8482	297	28.6	19.8	95.2	5.4	6.7
Untreated		0	1078	8243	309	26.7	20.3	96.0	3.7	4.8
Average			1097	8506	305.4	27.9	20.2	95.8	3.9	5.7
LSD (P=.05)			86	657	11.7	2.3	0.5	0.8	1.3	0.8
CV%			4.2	4.1	2.0	4.5	1.4	0.5	17.4	7.1

Treatments applied July 20, 2009, field was light green at time of application
N Pact and Coron were applied as a foliar spray.
28% nitrogen was applied sidedress using fluted coulters

* Color = visual canopy color in Sept (dark green = 10, 5 = yellow/green, 1 = yellow)
** Cost of products used; 28% N- $285/ton, Coron- $7.85/gal., N Pact- $5.62/gal.
*** Replicated strip trial - treatments applied by Michigan Sugar and plot harvested by Sugarbeet Advancement

Coron and N-Pact both contain readily available and slow release nitrogen sources.

Summary

Nitrogen was applied mid-season to a field of nitrogen deficient sugarbeets which were light green. Coron (10 qt/A), N Pact (10 qt/A) and 10 gal of 28% N increased the sugarbeet yield without lowering the sugar content. 20 gal of 28% N increased the root yield but lowered sugar content.

Enhancing sugar beet storage quality through N fertilization

Laura L. Van Eerd University of Guelph Ridgetown Campus

Dover, Ontario2007-08 and 2008-09

Trial quality: Good

Table 1. For 2007-08 and 2008-09 storage season, the impact of N rate and storage date on sugar beet quality*.

N Applied (lb N/ac)	Weight loss (%)	Purity (%)	Sugar (%)	R-NH_2	Amino-N	RWST	RWSA	Selling price ($ t^{-1})	Payout ($ ha^{-1})
0	4.1 a	95.9 a	20.5 a	103 c	5.9 c	307 a	27864 a	43.4 a	3213 a
50	3.9 a	95.9 a	20.5 a	109 c	6.3 c	305 a	28168 a	43.3 a	3255 a
100	3.7 a	95.6 ab	20.3 ab	120 bc	6.9 bc	301 ab	29219 ab	42.6 ab	3372 abc
150	4.2 a	95.0 b	19.7 bc	136 ab	8.1 ab	288 bc	28729 c	40.9 bc	3611 c
200	3.6 a	95.3 ab	19.7 bc	150 a	9.2 a	289 bc	30669 bc	41.0 bc	3524 bc
75+75	3.3 a	95.1 b	19.2 c	160 a	9.7 a	282 c	28582 a	40.0 c	3285 ab
50+50	3.3 a	95.9 a	20.1 ab	123 bc	7.3 bc	300 ab	29322 abc	42.5 ab	3381 abc
Harvest	-	95.8 z	20.7 z	122 z	7.1 z	308 z	30431 z	43.6 z	3506 z
December	3.3 z	95.6 z	19.6 x	121 z	7.2 z	289 y	28775 yx	41.0 y	3319 yx
January	3.3z	96.0 z	20.2 y	118 z	6.7 z	302 z	29986 zy	42.8 z	3450 zy
February	4.6 y	94.7 y	19.5 x	154 y	9.5 y	284 y	28105 x	40.3 y	3235 x
Statistics	-- P value --								
N	0.8449	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Retrieval date	0.0170	<.0001	<.0001	<.0001	<.0001	<.0001	0.0001	<.0001	<.0001
N x date	0.8467	0.4319	0.9326	0.9590	0.9746	0.8002	0.9919	0.8505	0.9918

*Within each column, different letters indicate a statistical difference. Data pooled over years.

Planted: 23April 2007, 19 April 2008 Harvested: 28 Oct. 2007, 1 Nov 2008
Plot size: 6 rows x 26 ft x 4 reps Row spacing:30 "

Summary: As expected, sugarbeet quality was highest at harvest and tended to decline over the storage season. With payment based on sugar and yield, the optimal rate of N was approximately 100 lb N/ac. Split applying N at 50+50 or 75+75 lb N/ac was not an advantage in terms of yield, quality or storage ability. **Nitrogen fertility (rate or timing) had no impact on outdoor large pile storage of sugarbeets.** The SPAD® chlorophyll meter looks promising for predicting sugarbeet yield and quality as well as N fertilizer requirement (data not shown).

Funding: Funding for this project was provided in part by Agriculture and Agri-Food Canada through the Agricultural Adaptation Council and the Alberta Agriculture and Food Program, Ontario Sugarbeet Growers Association, and Ontario Ministry of Agriculture, Food and Rural Affairs as well as in-kind analysis from Agri-Food Laboratories Ltd., A&L Laboratories Inc. and Michigan Sugar Company.

Roundup + Boron and Manganese Tank Mixes

Quanicassee, MI
2009

Trial Quality: Fair-Good

Treatment Name	Rate/A	App Timing	% Sugarbeet Injury* 7/18/2009
Roundup + AMS	22 oz	6 to 8 lf	0
Roundup + AMS +	22 oz	6 to 8 lf	0.8
Manganese Chelate	3 Qt	6 to 8 lf	
Tracite (Bo .02%/Mn .05%)	5 lb	6 to 8 lf	1.3
Manganese Chelate	3 Qt	6 to 8 lf	1.3
Roundup + AMS +	22 oz	6 to 8 lf	1.3
Tracite (N + Micro's)	5 lb	6 to 8 lf	
Roundup + AMS +	22 oz	6 to 8 lf	2.5
Manganese Sulfate	5 lb	6 to 8 lf	
Manganese Sulfate	5 lb	6 to 8 lf	3.8
Solubor	2.5 lb	6 to 8 lf	4.2
Roundup + AMS +	22 oz	6 to 8 lf	4.2
Solubor	2.5 lb	6 to 8 lf	
Average			2.2
LSD (P=.05)			1.8
CV%			78.9

Planted: May 4, 2009
Not Harvested
Reps: 6
AMS rate = 17 lbs/100 gal

*Sugarbeet injury: visual rating (0-100% scale) with 0 = no injury, 50 = sugarbeet size reduced by half or leaves 50% spotted, 100 = dead crop
Injury symptoms disappeared before harvest.

Summary

This was not a weedy field and weed ratings were not taken. The tank mix treatments of Roundup + fertilizers did not appear to increase sugarbeet injury (as has been the case in previous trials). The fertilizer treatments (alone) caused as much injury as the tank mixes. Injury symptoms disappeared well before harvest.

Evaluate Tank Mix Problems With Roundup and Herbicide/Insecticides

Sebewaing, MI

2009

Trial Quality: Good

Treatment* Name	Rate	Rate Unit	Appl Timing	% Phyto** 7/14	% Phyto** 9/4
Roundup WMax	22	fl oz/a	2 lf	0.00	0
Roundup WMax	22	fl oz/a	2 lf	0.63	0
Mustang Max EW	4	fl oz/a	2 lf		
Roundup WMax	22	fl oz/a	4 lf	0.63	0
Assure II	12	fl oz/a	4 lf		
Roundup WMax	22	fl oz/a	4 lf	0.63	0
Select	12	fl oz/a	4 lf		
Roundup WMax	22	fl oz/a	2 lf	1.25	0
UpBeet	0.5	oz/a	2 lf		
Roundup WMax	22	fl oz/a	2 lf	1.88	0
Lorsban	2	pt/a	2 lf		
Roundup WMax	22	fl oz/a	2 lf	2.50	0
Dual Magnum	1.67	pt/a	4 lf		
Roundup WMax	22	fl oz/a	4 lf	2.50	0
Stinger	2	oz/a	4 lf		
Roundup WMax	22	fl oz/a	4 lf	6.25	0
Stinger	4	oz/a	4 lf		
Roundup WMax	22	fl oz/a	2 lf	7.50	0
Outlook	21	fl oz/a	4 lf		
Average				2.38	0
LSD (P=.05)				3.00	0
CV%				87.1	0

Planted: May 13, 2009

Not Harvested

* AMS at 17 lbs/100 gal added to Roundup

** % Phyto: visual sugarbeet injury rating with 0 = no injury, 50 = sugarbeets 1/2 the size of normal or 50% spotted by burn, 100 = crop dead

Summary

Insecticides and Herbicides were tank mixed with Roundup to see if any crop injury occurred. The only treatments with noticeable sugarbeet injury were tank mixes of Outlook + Roundup and Stinger at 4 oz + Roundup. The injury from these treatments was short lived and was not apparent in early September.

Control of Clover With Roundup Tank Mixes

Pigeon, MI
2009

Trial Quality: Fair-Good

Treatment Name	Rate/A	App* Timing	% Clover Control 6/24	% Clover Control 7/27	**% Phyto 6/24	**% Phyto 7/27	$/ Acre	RWSA	RWST	Tons/A	% Suc
Roundup	22 oz	ACD	98.3	98.8	4.5	0.7	971	6602	256	25.9	18.1
AMS	17 lb	ACD									
Stinger	2 oz	AC									
Roundup	22 oz	BD	91.7	98.7	8.0	2.8	850	5856	266	22.0	18.6
AMS	17 lb	BD									
Stinger	4 oz	BD									
Roundup	22 oz	ACD	95.7	98.5	1.8	0	858	5771	260	22.3	18.2
AMS	17 lb	ACD									
Roundup	22 oz	ACD	96.5	98.5	4.7	0.3	807	5480	266	20.6	18.4
AMS	17 lb	ACD									
Stinger	2 oz	A									
Roundup	22 oz	BD	93.0	98.3	9.3	0.8	851	5771	265	21.7	18.6
AMS	17 lb	BD									
Stinger	4 oz	B									
Roundup	22 oz	BD	88.3	95.5	2.5	0	836	5587	270	20.7	18.5
AMS	17 lb	BD									
Untreated			0	0	0	0	294	1935	259	7.4	17.9
Average			73.5	70.4	3.9	0.6	781	5286	263.1	20.1	18.3
LSD (P=.05)			3.2	2.7	3.7	1.5	152	1205	11.6	4.5	0.6
CV%			3.9	3.1	81.8	214	19.7	19.1	3.7	18.9	2.8

Planted: April 24, 2009
Harvested: September 16, 2009
Reps: 6
Roundup PowerMax
AMS Rate: 17 lbs/100 Gal.

*Application Timing:
A = 2 lf, B = 4 lf
C = 6 lf, D = 10 lf

**% Phyto: visual rating (0-100% scale) with 0 = no injury, 50 = sugarbeet size reduced by 1/2 or leaves 50% spotted, 100 = dead beets

Summary

Increased clover control in Roundup Ready sugarbeets was achieved by adding 2 fl oz/A of Stinger to the Roundup at an early timing (2 leaf stage). Stinger included at the 2 and 6 leaf stage was slightly better than at the 2 leaf stage only. Sugarbeet injury increased when the Stinger rate was increased to 4 fl oz/A. Sugarbeet injury with Stinger at 2 fl oz was acceptable.

Evaluate Reclaim on Atrazine Carryover

Blumfield, MI
2009

Trial Quality: Poor-Fair

Treatment Name	Rate	Rate Unit	$/ Acre	RWSA	RWST	Tons/A	% Suc	% CJP	B/100ft 5/22	B/100ft 6/4
Reclaim No Atrazine	2	qt/a	1105	6906	271	25.5	18.4	94.8	194	215
Untreated No Atrazine			1068	6674	279	23.8	19.1	94.1	174	194
Reclaim No Atrazine	1	qt/a	1042	6514	278	23.2	18.9	94.5	208	220
Reclaim Atrazine	2 0.25	qt/a lb ai/a	557	3482	230	14.9	16.5	92.6	64	48
Reclaim Atrazine	1 0.25	qt/a lb ai/a	372	2328	225	9.9	16.3	92.2	31	27
Untreated Atrazine	 0.25	 lb ai/a	336	2103	216	9.4	15.8	92.1	35	27
Average			747	4668	250.0	17.8	17.5	93.4	117.6	121.8
LSD (P=.05)			270	1689	32.0	6.0	1.8	1.6	22.5	29.4
CV			18.1	18.1	6.4	17.0	5.1	0.8	9.6	12.1

Planted: May 4, 2009
Harvested: September 21, 2009
Reps: 6

Summary

Reclaim is a product which is supposed to inactivate herbicides in the soil such as carryover levels of Atrazine. In this trial Atrazine was applied at a rate of .25 lbs ai/A prior to planting sugarbeets. Reclaim was then applied at 1 and 2 quarts/A. Neither rate of Reclaim provided adequate protection from the Atrazine, however, the 2 qt rate was better than the 1 qt rate and both were better than no Reclaim. The .25 lb ai/A Atrazine rate was too high for a simulated carryover. This trial will be repeated with a lower simulated carryover of Atrazine.

Timing glyphosate applications by GDD in Roundup Ready sugarbeet

Christy Sprague and Gary Powell, Michigan State University

Location: East Lansing	**Tillage:** Conventional
Planting Date: May 5, 2009	**Herbicides:** see treatments
Soil Type: Loam; 2.5 OM; pH 7.8	**Variety:** Hilleshog 9042
Replicated: 4 times	**Population:** 4 3/8-inch spacing

Table 1. Effect of timing glyphosate by GDD[a] on sugarbeet yield and quality

ROUNDUP POWERMAX TIMING[b]	**YIELD**	**RWST[c]**	**RWSA[d]**
	tons/A	lb/ton	lb/A
2-inch fb. 4-inch weeds[e]	29.1	240	6970
400 fb. 400 fb. 400 GDD	31.6	230	7235
400 fb. 600 fb. 600 GDD	28.7	240	6935
600 fb. 600 GDD	29.1	235	6815
800 fb. 800 GDD	26.3	230	6045
1000 GDD	24.2	230	5580
Non-treated	4.5	225	1050
$LSD_{0.1}$[f]	4	12	1160

[a] Growing degree days (GDD) were calculated using a base temperature of 34 F.
[b] Roundup PowerMax (glyphosate) was applied at 22 fl oz/A + ammonium sulfate (AMS) at 17 lb/100 gal
[c] RWST = Recoverable white sugar per ton
[d] RWSA = Recoverable white sugar per acre
[e] Standard recommendation of glyphosate at 2-inch followed by 4-inch weeds
[f] Means within a column greater than least significant difference (LSD) value are different from each other.

Summary: This trial was conducted to determine if GDDs could be used as a tool to help time glyphosate applications in Roundup Ready sugarbeets. We examined several different GDD timing combinations (see Table 1) and compared them to the current standard recommendation of applying the first glyphosate application when weeds are 2-inches tall followed by a second glyphosate application when weeds are 4-inches in height. We were able to achieve differences in weed control and yield from the first year of this study. We have found that glyphosate applications after 600 GDD (800 GDD or longer) reduced sugarbeet yield and at 1000 GDD timing we observed a reduction in common lambsquarters and pigweed control. From the first year of this research, the first application of glyphosate should be made at 600 GDD or before.

Control of volunteer Roundup Ready soybean in Roundup Ready sugarbeet

Christy Sprague and Gary Powell, Michigan State University

Location: Saginaw Valley Research and Extension Center	**Tillage:** Conventional
Planting Date: April 16, 2009	**Herbicides:** see treatments
Soil Type: Silty clay loam; 2.4 OM; pH 7.9	**Variety:** Hilleshog 9042
Replicated: 4 times	**Population:** 4 1/8-inch spacing

Table 1. Control of volunteer Roundup Ready soybean in Roundup Ready sugarbeet (mid-August) and recoverable white sugar yields for the various treatments

	VOLUNTEER RR SOYBEAN CONTROL		**RECOVERABLE WHITE SUGAR PER ACRE**	
Herbicide treatments	V2 soybean	V4 soybean	V2 soybean	V4 soybean
	——— % control ———		——— lb/A ———	
Roundup PowerMax (22 fl oz) + AMS[a] alone	0		5695	
+ UpBeet (0.5 fl oz)	23	23	6450	5950
+ UpBeet (0.5 fl oz) + COC	38	45	6975	7450
+ UpBeet (0.5 fl oz) + MSO	48	68	6840	7695
+ UpBeet (1 fl oz)	28	48	6490	6030
+ Stinger (1 fl oz)	95	86	7860	6850
+ Stinger (2 fl oz)	99	99	7950	7090
+ Stinger (4 fl oz)	99	99	8335	8390
$LSD_{0.05}$[b]	12		1600	

[a] Abbreviations: AMS = ammonium sulfate; COC = crop oil concentrate; MSO = methylated seed oil
[b] Means within a column greater than least significant difference (LSD) value are different from each other

Summary: This trial was conducted to examine different control strategies for volunteer Roundup Ready soybean. While this may not be a wide-spread problem volunteer soybean has shown up on occasion in grower's fields. There were 15 different treatments that looked at two different application timings with UpBeet and Stinger combinations. The control treatment was two applications of Roundup PowerMax applied at 2-inch followed by 4-inch weeds. These application timings corresponded with V2 and V4 volunteer Roundup Ready soybean. Roundup PowerMax was applied alone and in combination with the treatments that are listed in Table 1 in either the first or second application timing. Results indicated that the greatest volunteer Roundup Ready soybean control that UpBeet provided was 68%. This treatment included methylated seed oil (MSO) at 1% v/v at the later application timing. All treatments that contained Stinger provided greater volunteer Roundup Ready soybean control than treatments with UpBeet. Volunteer Roundup Ready soybean can be controlled early with 1 to 4 oz of Stinger or late with 2 or 4 oz of Stinger. All Stinger treatments and treatments containing UpBeet with MSO or crop oil concentrate (COC) protected sugarbeet yield from volunteer soybean competition.

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Effect of herbicides on Rhizoctonia root and crown rot in Roundup Ready sugarbeets (2008 & 2009)

Kelly Barnett, Christy Sprague, Willie Kirk, Michigan State University, Linda Hanson, USDA-ARS Sugar Beet Research Unit

Location: Saginaw County	**Tillage:** Conventional
Planting Date: April 25, 2008 & April 16, 2009	**Herbicides:** see treatments
Soil Type: Clay ('08) **&** Clay loam ('09)	**Varieties:** see table
Replicated: 4 times each year	**Rhizoctonia incoluated:** 6-leaf sugarbeet

Table 1. Herbicide did not affect Rhizoctonia disease severity or the number of harvestable sugarbeets

	VARIETIES			
HERBICIDE TREATMENTS[a]	HILLESHOG 9027RR	HILLESHOG 9028RR	HILLESHOG 9029RR	CRYSTAL 827RR
	harvestable (%)[b]			
No herbicide	60	50	54	37
Standard-Split[c]	56	46	55	34
Roundup WMax[d]	59	51	58	37
$LSD_{0.05}$	NS	NS	NS	NS

Table 2. Averaged across all herbicide treatments, Rhizoctonia inoculated sugarbeet varieties differed in disease severity and the number of harvestable sugarbeets

VARIETIES	**HARVESTABLE (%)**[b,e]
Hilleshog 9027RR	58a
Hilleshog 9028RR	49ab
Hilleshog 9029RR	55a
Crystal 827RR	36b

[a] At the 6-8 leaf stage, sugarbeets were inoculated with *Rhizoctonia solani* AG-2-2-IIIB
[b] Harvestable (%) sugarbeets are the percent of total sugarbeets with a disease severity rating of 3 or less
[c] Betamix 2:3 pt + UpBeet 0.5 oz + Stinger 4 fl oz + Act. 90 0.25% v/v (two applications)
[d] Roundup WeatherMax 22 fl oz + 17 lb/100 gal (three applications)
[e] Means in each column followed by the same letter are not significantly different at $P \leq 0.05$

Summary: This trial was conducted to determine the effect of herbicide treatments on Rhizoctonia root and crown rot in four Roundup Ready sugarbeet varieties. This trial was conducted in 2008 and 2009. The combine results are presented above. Ten weeks after inoculation, sugarbeets were harvested and rated for disease severity using a scale of 0-7 (0 = healthy, 7 = completely rotted). Sugarbeets with a disease severity rating of 3 or less were considered harvestable. Roundup (glyphosate) did not increase or decrease Rhizoctonia root and crown rot in Roundup Ready sugarbeet for four commercial varieties (Table 1). However, varietal susceptibility to Rhizoctonia root and crown rot was different. The most susceptible variety to Rhizoctonia crown and root rot was Crystal 827RR (Table 2).

Effect of herbicide and fungicide treatments on Rhizoctonia-inoculated Roundup Ready sugarbeets (2008 & 2009)

Kelly Barnett, Christy Sprague, Willie Kirk, Michigan State University, Linda Hanson, USDA-ARS Sugar Beet Research Unit

Location: Saginaw County	**Tillage:** Conventional
Planting Date: April 25, 2008 & April 16, 2009	**Herbicides:** see treatments
Soil Type: Clay ('08) **&** Clay loam ('09)	**Varieties:** see table
Replicated: 4 times each year	**Rhizoctonia incoluated:** 6-leaf sugarbeet

Table 1. Averaged across all herbicide treatments, the time of fungicide application influenced Rhizoctonia root and crown rot disease severity and the number of harvestable sugarbeets (2008)[a]

	VARIETIES			
FUNGICIDE TREATMENTS	HILLESHOG 9027RR	HILLESHOG 9028RR	HILLESHOG 9029RR	CRYSTAL 827RR
	harvestable (%)[b,e]			
Foliar (Quadris)[c]	100a	92a	93a	92a
In-furrow (Quadris)[d]	70ab	54b	64b	41b
No fungicide	13c	5c	11c	0c

Table 2. Averaged across all herbicide treatments, the time of fungicide application influenced Rhizoctonia root and crown rot disease severity and the number of harvestable sugarbeets (2009)[a]

	VARIETIES			
FUNGICIDE TREATMENTS	HILLESHOG 9027RR	HILLESHOG 9028RR	HILLESHOG 9029RR	CRYSTAL 827RR
	harvestable (%)[b,e]			
Foliar (Quadris)[c]	88a	81ab	90a	55c
In-furrow (Quadris)[d]	71abc	53c	66bc	25d
No fungicide	16de	14de	12de	4e

[a] At the 6-8 leaf stage, sugarbeets were inoculated with *Rhizoctonia solani* AG-2-2-IIIB

[b] Harvestable (%) sugarbeets are the percent of total sugarbeets with a disease severity rating of 3 or less

[c] Quadris 45 fl oz foliar broadcast applied at the 6-8 leaf stage (equivalent to 11.4 fl oz applied in a 7" band)

[d] Quadris 0.6 fl oz/1000 ft. row applied in-furrow at planting

[e] Means in each column followed by the same letter are not significantly different at $P \leq 0.05$

Summary: This trial was conducted to determine the effect of herbicide and fungicide treatments on Rhizoctonia root and crown rot in four Roundup Ready sugarbeet varieties. Herbicide treatments included no herbicide, two standard-split applications, and three applications of Roundup WeatherMax. Ten weeks after inoculation, sugarbeets were harvested and rated for disease severity using a scale of 0-7 (0 = healthy, 7 = completely rotted). Sugarbeets with a disease severity rating of 3 or less were considered harvestable. Herbicide treatment did not have an effect on disease severity. Foliar Quadris applications provided the best protection against Rhizoctonia crown and root rot for three of the four varieties tested.

AVERAGES OF 3 RHIZOCTONIA TRIALS

Meylan, Wegener, & Bierlein

Location:	Linwood, Auburn, Vassar	**Tillage:**	
Variety:	Rhizoctonia Susceptible Varities	**Spacings:**	
Planting Date:		**Harvest Date:**	
Previous Crop:		**Sample Date:**	
Soil Type:		**Herbicides:**	
Fertilizer:		**Replicated:**	3 Locations, 11 Reps
		Fungicide:	

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	POPULATIONS 100 Ft. of Row		RHIZOCTONIA	
							15 DAY	30 DAY	1200 Ft. of Row	% Control vs. Check
In-Furrow + 6-8 Leaf - Low Rate	$1,147	8854	305	29.1	20.2	95.8	—	—	31	86%
In-Furrow	$1,154	8723	305	28.8	20.2	95.5	179	196	55	75%
6-8 Leaf Normal Rate	$1,105	8529	301	28.3	20.1	95.4	—	—	37	83%
2-4 & 6-8 Leaf Low Rate Twice	$1,038	8094	299	27.0	19.8	95.8	—	—	48	78%
2-4 Leaf Normal Rate	$1,032	7985	300	26.6	20.0	95.5	—	—	106	51%
Check	$949	7108	291	24.4	19.4	95.3	185	200	216	0%
AVERAGE	$1,071	8216	300	27.4	19.9	95.6	182	198	82	—
LSD (5%)	—	749	11	2.2	0.7	0.3	13 NS	20 NS	62	—
C.V. (%)	—	5	2	4.5	1.9	0.2	2	3	41	—

TRIAL RELIABILITY: **Excellent**

EMERGENCE:	Good	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Moderate	**NEMATODES:**	Detected in 2 of the trials
QUADRIS APP:	See Treatments	**WEATHER:**	Good

Comments: All trials used a Rhizoctonia susceptible variety (C-RR827, C-RR824, & B-17RR32). Rhizoctonia levels in all 3 trials were moderate. The in-furrow treatments were applied in T-bands with widths ranging from 2.75" to 5.5", and rates ranging from 4-7.5 oz/acre. Foliar application rates based on 30" rows were: Low Rate = 7 oz/ac, Normal Rate = 10.5 oz/ac. Quadris applications improved beet quality and yield. Rhizoctonia infections in 2009 seemed to be delayed, possibly due to a cold spring/early summer, causing improved control at the later 6-8 leaf timing. In-furrow treatments were effective even at lower application rates and band widths. In-furrow applications did not show any effect on emergence. Revenue calculations were based on a $40/ton payment, in-furrow application rate of 5.25 oz/ac, low rate of 7 oz/ac, normal rate of 10.5 oz/ac, Quadris cost of $2.40/oz, and an application cost of $7.50.

RHIZOCTONIA CONTROL TRIAL
Bierlein Farms Inc.

Location:	Vassar, Tuscola Co.	**Tillage:**	Fall Chisel, Spring Field Cult. 1x
Variety:	B-17RR32	**Spacings:**	Row - 28", Seed - 3 3/4"
Planting Date:	4/18/2009	**Harvest Date:**	10/27/2009
Previous Crop:	Corn	**Sample Date:**	10/16/2009
Soil Type:	Loam	**Herbicides:**	2x
Fertilizer:	PPI: 75# N by 28%, Sidedressed day after planting: 17.5 Gal. 28%, 2 Gal Thiosul, w/ Mn & B, Sidedressed in June: 15 Gal. of 28%	**Replicated:**	4x
		Fungicide:	Proline (50 DSV) Gem (95 DSV) Proline (140DSV

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	POPULATIONS 100 Ft. of Row		RHIZOCTONIA	
							17 DAY	30 DAY	1200 Ft. of Row	% Control vs. Check
In-Furrow & 6-8 Leaf - Low Rate	**$1,244**	**9073**	**286**	**31.7**	**19.0**	**95.8**	**—**	**—**	**62**	**70%**
In-Furrow	**$1,268**	**9070**	**282**	**32.1**	**18.8**	**95.7**	**212**	**237**	**58**	**72%**
6-8 Leaf Normal Rate	**$1,170**	**8549**	**285**	**30.0**	**19.0**	**95.5**	**—**	**—**	**49**	**76%**
2-4 & 6-8 Leaf Low Rate Twice	**$1,162**	**8445**	**285**	**29.6**	**18.9**	**95.9**	**—**	**—**	**70**	**66%**
2-4 Leaf Normal Rate	**$1,046**	**7669**	**284**	**27.0**	**18.9**	**95.7**	**—**	**—**	**205**	**1%**
Check	**$1,073**	**7609**	**280**	**27.2**	**18.7**	**95.5**	**216**	**241**	**207**	**0%**
AVERAGE	**—**	**8402**	**284**	**29.6**	**18.9**	**95.7**	**214**	**239**	**109**	**—**
LSD (5%)	**—**	**1166**	**11 NS**	**3.4**	**0.7 NS**	**0.8 NS**	**11 NS**	**15 NS**	**117**	**—**
C.V. (%)	**—**	**9**	**3**	**7.7**	**2.4**	**0.5**	**2**	**3**	**—**	**—**

TRIAL RELIABILITY: **Good**

EMERGENCE:	Excellent	**CERC. LEAF SPOT:**	Excellent
RHIZOCTONIA:	Moderate	**NEMATODES:**	Detected
QUADRIS APP:	See Treatments	**WEATHER:**	Good

Comments: Trial used **Rhizoctonia susceptible variety B-17RR32.** All treatments were Quadris with the following rates: Normal rate = 11.25 oz, Low Rate = 7.5 oz, In-Furrow = 4 oz. The in-furrow treatments were T-Band applied in a 4.4" band with 4.7 gallons/acre of water. The nozzles were 40015E at a 6" height from the soil surface. The foliar treatments were applied in a 7" band with 10.7 gallons/acre of water. In-furrow and 6-8 leaf treatments were not significantly different. Early foliar application (2-4 Leaf) under cold spring conditions performed very poorly. Revenue per acre is based on a $40 per ton projected payment, and Quadris cost deducted from the revenue at a rate of $2.40 per ounce plus a $7.50 foliar application cost.

RHIZOCTONIA CONTROL TRIAL # 1

Gene Meylan

Location:	Linwood, Bay Co.	**Tillage:**	Fall - Chisel, Spring Field Cult 1x
Variety:	C-827RR	**Spacings:**	Rows - 30", Seed - 4.5"
Planting Date:	4/18/2009	**Harvest Date:**	11/6/2009
Previous Crop:	Wheat	**Sample Date:**	10/15/2009
Soil Type:	Loam	**Herbicides:**	Glyphosate 2x
Fertilizer:	2x2: 20 Gal. 12-25-0 w/ 1qt of Mn & B. Total N = 110# / acre	**Replicated:**	4x
		Fungicide:	Eminent (65 DSV) Headline (94 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	POPULATIONS 100 Ft. of Row		RHIZOCTONIA	
							15 DAY	30 DAY	1200 Ft. of Row	% Control vs. Check
In-Furrow + 6-8 Leaf - Low Rate	$1,076	9029	327	27.7	21.4	96.1	—	—	16	92%
2-4 & 6-8 Leaf Low Rate Twice	$1,044	8838	324	27.3	21.3	95.9	—	—	25	88%
In-Furrow	$1,073	8824	331	26.7	21.6	96.1	134	165	54	73%
6-8 Leaf Normal Rate	$1,056	8821	321	27.4	21.2	95.8	—	—	27	87%
2-4 Leaf Normal Rate	$1,035	8626	319	27.1	21.0	95.8	—	—	60	70%
Susceptible Check	$966	7825	320	24.4	21.0	95.9	136	161	203	0%
AVERAGE	$1,042	8660	324	26.8	21.2	95.9	135	163	64	—
LSD (5%)	—	667	10	1.6	0.6 NS	0.6 NS	NS	NS	40	—
C.V. (%)	—	5	2	3.9	1.8	0.4	—	—	42	—

TRIAL RELIABILITY: **Excellent**

EMERGENCE:	Fair - Good	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Moderate	**NEMATODES:**	Not Detected
QUADRIS APP:	See Treatments	**WEATHER:**	Rain caused emergence issues

Comments: Trial was grown with **Rhizoctonia susceptible variety C-RR827** and had a moderate amount of Rhizoctonia. In-furrow and 6-8 leaf applications performed the best. The cool spring may have caused the Rhizoctonia infection to occur later in the spring. In-furrow applications were 7.5 oz of Quadris in 5 gal/ac of water in a 5.5" T-band (Nozzle was 8002E). Foliar treatment rates are as follows: Quadris Normal Rate = 10.5 oz/ac, Low Rate = 7 oz/ac.. Foliar treatments were applied in a 7" band with 10 gal/ac of water. Revenue per acre is based on a $40 per ton projected payment, Quadris cost at $2.40 per ounce, and a $7.50 foliar application cost.

RHIZOCTONIA CONTROL TRIAL # 2

Gene Meylan

Location: Linwood, Bay Co.
Variety: HM-27RR
Planting Date: 4/18/2009
Previous Crop: Wheat
Soil Type: Loam
Fertilizer: 2x2: 20 Gal. 12-25-0 w/ 1qt of Mn & B. Total N = 110# / acre

Tillage: Fall - Chisel, Spring Field Cult 1x
Spacings: Rows - 30", Seed - 4.5"
Harvest Date: 11/6/2009
Sample Date: 10/15/2009
Herbicides: Glyphosate 2x
Replicated: 4x
Fungicide: Eminent (65 DSV)
Headline (94 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	POPULATIONS 100 Ft. of Row		RHIZOCTONIA	
							15 DAY	30 DAY	1200 Ft. of Row	% Control vs. Check
6-8 Leaf Normal Rate	$980	7297	282	25.9	18.8	95.8	—	—	1	—
Resistant Check	$1,010	7297	295	24.7	19.5	96.0	63	109	19	—
AVERAGE	—	7297	289	25.3	19.1	95.9	—	—	10	—
LSD (5%)	—	1552 NS	40.5 NS	2.1 NS	2.6 NS	0.8 NS	—	—	12	—
C.V. (%)	—	9	6	3.7	6.1	0.4	—	—	54	—

TRIAL RELIABILITY: **Good**

EMERGENCE:	Fair - Good	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Moderate	**NEMATODES:**	Not Detected
QUADRIS APP:	See Treatments	**WEATHER:**	Rain caused emergence issues

Comments: These 2 treatments were part of "Meylan Rhizoctonia Control Trial # 1", but used **resistant variety HM-27RR**. The trials are not being combined due to uneven emergence between the susceptible and resistant variety. This trial shows that applying Quadris to a highly resistant variety provided excellent disease control. The susceptible variety grown as part of Meylan Trial #1 had a moderate amount of Rhizoctonia. Quadris was applied at 10.5 oz/acre in 10 gal./acre of water.

RHIZOCTONIA CONTROL TRIAL
Wegener Farms

Location:	Auburn, Bay County	**Tillage:**	Fall Moldboard, Spring S Tine 1x
Variety:	C-RR824	**Spacings:**	Rows - 30", Seed - 4 9/16"
Planting Date:	4/17/2009	**Harvest Date:**	11/5/2009
Previous Crop:	Wheat	**Sample Date:**	10/8/2009
Soil Type:	Loam	**Herbicides:**	Glyphosate 3x
Fertilizer:	Preplant 210# 33-0-0 2x2 - 15 Gal. 19-17-0 + Micros 10 Gal. of 28% Sidedress	**Replicated:**	3x
		Fungicide:	Proline (60 DSV) Headline (118 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	POPULATIONS 100 Ft. of Row		RHIZOCTONIA	
							17 DAY	32 DAY	1200 Ft. of Row	% Control vs. Check
In-Furrow + 6-8 Leaf - Low Rate	**$1,121**	**8464**	**302**	**28.0**	**20.2**	**95.4**	**—**	**—**	**16**	**93%**
In-Furrow	**$1,121**	**8272**	**301**	**27.5**	**20.3**	**94.8**	**191**	**185**	**53**	**78%**
6-8 Leaf Normal Rate	**$1,088**	**8217**	**297**	**27.6**	**20.0**	**94.9**	**—**	**—**	**35**	**85%**
6-8 Leaf Proline Normal Rate	**$1,033**	**7832**	**290**	**26.8**	**19.5**	**95.1**	**—**	**—**	**92**	**62%**
2-4 Leaf Normal Rate	**$1,016**	**7660**	**297**	**25.8**	**20.0**	**95.1**	**—**	**—**	**54**	**77%**
6-8 Leaf Quadris + Proline - 1/2 Rates	**$986**	**7462**	**289**	**25.7**	**19.4**	**95.3**	**—**	**—**	**56**	**77%**
2-4 Leaf Low Rate	**$986**	**7381**	**303**	**24.4**	**20.0**	**95.8**	**—**	**—**	**78**	**67%**
2-4 & 6-8 Leaf Low Rate Twice	**$908**	**6999**	**289**	**24.2**	**19.2**	**95.6**	**—**	**—**	**49**	**79%**
6-8 Leaf Low Rate	**$912**	**6868**	**284**	**24.1**	**19.1**	**95.2**	**—**	**—**	**103**	**57%**
Check	**$807**	**5890**	**272**	**21.7**	**18.5**	**94.6**	**203**	**197**	**239**	**0%**
AVERAGE	**$998**	**7505**	**293**	**25.6**	**19.6**	**95.2**	**197**	**191**	**78**	**—**
LSD (5%)	**—**	**1527**	**23**	**4.2**	**1.4**	**1.2 NS**	**14 NS**	**18 NS**	**101**	**—**
C.V. (%)	**—**	**12**	**5**	**9.7**	**4.2**	**0.7**	**3**			**—**

TRIAL RELIABILITY: **Fair**

EMERGENCE:	Excellent	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Moderate	**NEMATODES:**	Detected

Comments: Trial used **Rhizoctonia susceptible variety C-RR824.** All treatments were Quadris unless otherwise noted. In-Furrow applications were 5.25 oz of Quadris in 8.4 gal/ac of water in a 2.75" T-band (Nozzle was 2502E). Foliar treatment rates are as follows: Quadris Normal Rate = 10.5 oz/ac, Low Rate = 7 oz/ac, 1/2 Rate = 5.25 oz/ac, Proline Normal Rate = 5.7 oz/ac + NIS (0.25% v/v), 1/2 Rate = 2.85 oz/ac + NIS (0.25% v/v). Foliar treatments were applied in a 7" band with 10 gal/ac of water. Revenue is based on: $40 per ton payment, Quadris cost = $2.40 / oz, Proline + NIS cost = $21.29 for 5.7 oz, foliar application cost = $7.50.

RHIZOCTONIA CONTROL TRIAL
Schindler Farms LLC

Location: Bay County
Variety: B-1643N
Previous Crop: Corn
Soil Type: Loam
Spacings: Rows - 22", Seed - 4.6"
Fertilizer: 2x2: 18 Gal. of 16-18-0 + Micros, Fall: 200 Lbs of K_2O, 100 Lbs N by 1/3 Urea, AMS, & ESN 20 Gal. of 28% Sidedressed

Tillage: Fall - Chisel, Spring - S Tine
Planting Date: 4/16/2009
Harvest Date: 10/22/2009
Sample Date: 10/14/2009
Herbicides: 3 Pts of Nortron
Replicated: 4x
Fungicide: Inspire (50 DSV)
Headline (105 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	RHIZOCTONIA	
							Dead Beets / 1200' of Row	% Control vs. Check
Check	**$1,194**	**9198**	**313**	**29.4**	**20.5**	**96.2**	**66**	**0%**
2-4 & 6-8 Leaf Low Rate Twice	**$1,105**	**8966**	**310**	**29.0**	**20.4**	**95.9**	**18**	**73%**
6-8 Leaf Low Rate	**$1,088**	**8645**	**307**	**28.1**	**20.3**	**95.8**	**30**	**55%**
6-8 Leaf Normal Rate	**$1,065**	**8547**	**306**	**27.9**	**20.2**	**95.7**	**18**	**73%**
6-8 Leaf Quadris + Proline - 1/2 Rates	**$1,069**	**8540**	**306**	**27.8**	**20.0**	**96.2**	**36**	**45%**
2-4 Leaf Low Rate	**$1,072**	**8487**	**311**	**27.3**	**20.3**	**96.3**	**42**	**36%**
2-4 Leaf Normal Rate	**$1,042**	**8354**	**314**	**26.6**	**20.5**	**96.3**	**28**	**58%**
6-8 Leaf Proline Normal Rate	**$1,003**	**7950**	**300**	**26.5**	**20.0**	**95.3**	**111**	**-68%**
AVERAGE	**$1,080**	**8586**	**308**	**27.8**	**20.3**	**96.0**	**44**	**—**
LSD (5%)	**—**	**1016 NS**	**17 NS**	**2.6 NS**	**0.8 NS**	**0.9 NS**	**37**	**—**
C.V. (%)	**—**	**8**	**4**	**6.0**	**2.6**	**0.7**	**58**	**—**

TRIAL RELIABILITY: **Good CV's, but Confidence in yield is low.**

EMERGENCE:	Good	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Low & Patchy	**NEMATODES:**	Detected
QUADRIS APP:	See Treatments	**WEATHER:**	Good

Comments: Trial used **Rhizoctonia susceptible variety B-1643N** and had low levels of Rhizoctonia. Treatments were Quadris unless otherwise noted. Treatments were not significantly different in yield but **were for dead beet counts.** Treatment rates are as follows: Quadris Normal Rate = 14.3 oz/ac, Low Rate = 9.5 oz/ac, 1/2 Rate = 7.15 oz/ac, Proline Normal Rate = 5.7 oz/ac + NIS (0.25% v/v), 1/2 Rate = 2.85 oz/ac + NIS (0.25% v/v). Treatments were foliar applied in a 7" band with 13.4 gal/ac of water. Revenue per acre is based on a $40 per ton projected payment, Quadris cost at $2.40 per ounce, Proline + NIS cost at $21.29 for 5.7 oz, and a $7.50 foliar application cost.

Control of Rhizoctonia With Quadris & Proline

Blumfield, MI
2009

Trial Quality: Fair-Good

Treatment Name	Rate/A	App** Timing	Dead Beets*	Phyto ***	$/ Acre	RWSA	RWST	Tons/ Acre	% Suc	% CJP
Quadris	14.25 fl oz	B	3.3	0	890	6592	293	22.4	19.5	95.5
Roundup	22 fl oz	AB								
AMS	17 lb	AB								
Proline	7.7 fl oz	B	5.0	0	903	6748	304	22.3	20.1	95.7
Roundup	22 fl oz	AB								
AMS	17 lb	AB								
Proline	7.7 fl oz	A	6.0	0	903	6749	291	23.3	19.9	94.2
Roundup	22 fl oz	AB								
AMS	17 lb	AB								
Quadris	14.25 fl oz	A	7.5	0	800	5939	291	20.4	19.3	95.6
Roundup	22 fl oz	AB								
AMS	17 lb	AB								
Roundup	22 fl oz	AB	19.0	0	792	5784	281	20.4	19.0	94.8
AMS	17 lb	AB								
Average			8.2	0	857	6362	291.9	21.7	19.6	95.2
LSD (P=.05)			4.9	0	202	1801	41.7	5.3	2.2	1.6
CV%			39.4	0	18.7	18.4	9.3	15.9	7.2	1.1

Planted: May 4, 2009
Harvested: September 21, 2009
The treatments were band applied with Roundup
AMS Rate = 17 lbs/100 gal water
Variety: Crystal RR827

** Application Timing:
A = 2 to 4 lf
B = 6 to 8 lf

*Dead Beets: number per plot (approx 110 ft of row)

Reps: 6

*** % Phyto: visual sugarbeet injury rating with 0 = no injury, 50 = sugarbeets 1/2 the size of normal or 50% spotted by burn, 100 = crop dead

Summary

Quadris and Proline provided similar levels of Rhizoctonia control in this trial. The disease level was low to moderate. Later applications (6-8 leaf) were more effective than early applications (2-4 leaf). This may be due to the cool spring and Rhizoctonia may have been later in developing. Tank mixing with Roundup did not appear to be a problem.
Quadris has been more effective in most previous trials.

Sugarbeet Advancement

QUADRIS IN-FURROW TRIAL

Houghtaling Farms

Location: Munger, Bay Co.
Variety: B-1643N
Planting Date: 4/16/2009
Previous Crop: Wheat
Soil Type: Clay Loam
Fertilizer: 2x2 - 15 Gal. 17-11-0 + 9S + B
150# K_2O, 25 Gal. 28%

Tillage: Fall - Disk Ripped, Spring Cult. 1x
Spacings: Rows - 28", Seed - 58,000 ppa
Harvest Date: 11/5/2009
Sample Date: 10/16/2009
Herbicides: Microrates 4x
Replicated: 4x
Fungicide: Eminent (70 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	POPULATIONS 100 Ft. of Row		RHIZOCTONIA	
							19 DAY	32 DAY	1200 Ft. of Row	% Control vs. Check
4 oz. / Acre	—	7786	300	26.0	20.3	94.7	156	193	14	—
3 oz. / Acre	—	8602	308	27.7	20.4	95.5	125	158	14	—
2 oz. / Acre	—	7538	307	24.5	20.5	95.1	137	184	4	—
Check	—	7740	306	25.4	20.3	95.6	150	185	22	—
AVERAGE	—	7916	305	25.9	20.4	95.2	142	180	13	—
LSD (5%)	—	1190 NS	8 NS	3 NS	0.4 NS	0.5	59 NS	33 NS	16 NS	—
C.V. (%)	—	9	2	7.2	2.0	0.5	21	9	95	—

TRIAL RELIABILITY: **Fair CV's, but data is variable and confidence is low.**

EMERGENCE:	Fair	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Very Low	**NEMATODES:**	Detected
QUADRIS APP:	In Furrow 2" T-Band	**WEATHER:**	Heavy Rain Affected Emergence

Comments: Rhizoctonia levels were very low in all treatments and no significant differences were found. Trial data was variable and confidence in results is low. Trial was conducted to compare Quadris in-furrow rates at a T-band width that is lower than the recommended width of 7". The grower uses a 2" T-band width. The rates were established by reducing the low, normal, and high label rates by the same ratio the band width was reduced (2/7). The 3 oz/acre rate would represent the normal rate.

QUADRIS ON RESISTANT VARIETY

Trial # 1 by Sherwood Farms

Location:	Gratiot Co., Grafton Rd	**Tillage:**	Fall - Chisel & 1x Field Cult., Spring - Stale Seed Bed
Variety:	HM-27RR		
Planting Date:	4/11/2009	**Harvest Date:**	11/6/2009
Previous Crop:	Soybeans	**Sample Date:**	10/5/2009
Soil Type:	Loam	**Herbicides:**	Glyphosate 2x + Outlook 1x
Spacings:	Row - 30", Seed - 4"	**Replicated:**	6x
Fertilizer:	125# - 14-20-4, Pre: 32 Gallons 28% N	**Fungicide:**	Eminent (65 DSV) Headline (130 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	RHIZOCTONIA Dead Beets per 1200 Ft. of Row
Quadris	**$1,144**	**7703**	**265**	**29.1**	**17.9**	**94.9**	**8**
Check	**$1,033**	**6742**	**259**	**26.1**	**17.7**	**94.6**	**93**
AVERAGE	**—**	**7223**	**262**	**27.6**	**17.8**	**94.8**	**51**
LSD (5%)	**—**	**835**	**14 NS**	**2.6**	**0.9 NS**	**0.8 NS**	**68**
C.V. (%)	**—**	**8**	**4**	**6.0**	**3.3**	**0.6**	**—**

TRIAL RELIABILITY: **Good**

EMERGENCE:	Excellent	**CERC. LEAF SPOT:**	Excellent
RHIZOCTONIA:	Moderate - Heavy	**NEMATODES:**	Not Detected
QUADRIS APP:	4-6 Leaf, 10.5 oz/ac	**WEATHER:**	Good

Comments: This trial was conducted to evaluate the application of Quadris on a Rhizoctonia Resistant variety in the presence of moderate to heavy disease pressure. This trial had moderate to heavy disease pressure and the application of Quadris improved disease control, yield, and economic return. Revenue per acre is based on a $40 per ton projected payment, an "average RWST" equal to the trial average of 262, and Quadris cost deducted from the revenue at a rate of $25.20 per acre plus a $7.50 application cost. Quadris was applied at 10.5 oz/ac. in 10 gallons of water/acre in a 7" band.

QUADRIS ON RESISTANT VARIETY

Trial # 2 by Sherwood Farms

Location:	Gratiot Co., Lincoln Rd	**Tillage:**	Fall - Chisel & 1x Field Cult., Spring - Stale Seed Bed
Variety:	HM-27RR		
Planting Date:	4/11/2009	**Harvest Date:**	11/4/2009
Previous Crop:	Dry Beans	**Sample Date:**	10/5/2009
Soil Type:	Loam	**Herbicides:**	Glyphosate 2x + Outlook 1x
Spacings:	Row - 30", Seed - 4"	**Replicated:**	6x
Fertilizer:	125# 14-20-4, Pre: 28 Gallons 28% N	**Fungicide:**	Eminent (65 DSV) Headline (130 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	RHIZOCTONIA Dead Beets per 1200 Ft. of Row
Quadris	**$1,101**	**7289**	**259**	**28.2**	**17.7**	**94.4**	**1**
Check	**$1,098**	**7060**	**256**	**27.6**	**17.5**	**94.4**	**25**
AVERAGE	—	**7175**	**257**	**27.9**	**17.6**	**94.4**	**13**
LSD (5%)	—	**691 NS**	**18 NS**	**1.4 NS**	**1.0 NS**	**0.9 NS**	**15**
C.V. (%)	—	**6**	**5**	**3.3**	**4.0**	**0.6**	—

TRIAL RELIABILITY: **Excellent**

EMERGENCE:	Excellent	**CERC. LEAF SPOT:**	Excellent
RHIZOCTONIA:	Low	**NEMATODES:**	Not Detected
QUADRIS APP:	4-6 Leaf, 10.5 oz/ac	**WEATHER:**	Good

Comments: This trial was conducted to evaluate the application of Quadris on a Rhizoctonia Resistant variety in the presence of moderate to heavy disease pressure. This trial had a low level of disease pressure and no significant differences were measured in yield. Under low disease pressure a trend for improved yield and quality did occur. Revenue per acre is based on a $40 per ton projected payment, an "average RWST" equal to the trial average of 257, and Quadris cost deducted from the revenue at a rate of $25.20 per acre plus a $7.50 application cost. Quadris was applied at 10.5 oz/ac. in 10 gallons of water/acre in a 7" band.

QUADRIS ON RESISTANT VARIETY

Randy Sturm

Location:	Pigeon, Huron Co.	**Tillage:**	Fall - Disk Ripper, Spring - S Tine 1x
Variety:	HM-29RR		
Planting Date:	4/15/2009	**Harvest Date:**	9/23/2009
Previous Crop:	Soybeans	**Sample Date:**	9/23/2009
Soil Type:	Loam	**Herbicides:**	Glyphosate 2x
Spacings:	Rows - 28"	**Replicated:**	4x
Fertilizer:	Broad. 500# 3-13-17 + Mn & B, PPI 15 Gal. of 28%, Side dress 20 Gal. of 28%	**Fungicide:**	Proline (109 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	RHIZOCTONIA Dead Beets per 1200 Ft. of Row
Quadris	**$880**	**6781**	**301**	**22.5**	**19.9**	**95.9**	**8**
Check	**$818**	**6072**	**292**	**20.8**	**19.3**	**95.7**	**70**
AVERAGE	—	**6427**	**296**	**21.7**	**19.6**	**95.8**	**39**
LSD (5%)	—	**1397 NS**	**13 NS**	**3.9 NS**	**1.0 NS**	**1.0 NS**	**56**
C.V. (%)	—	**10**	**2**	**7.9**	**2.3**	**0.5**	—

TRIAL RELIABILITY: **Fair**

EMERGENCE:	Fair - Good, Water Damage	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Low, Spots of Moderate	**NEMATODES:**	Not Detected
QUADRIS APP:	6-8 Lf, 11.25 oz./acre	**WEATHER:**	Heavy Rain Early and July

Comments: This trial had early season water damage that affected yield and trial variability. Variety HM-29RR is moderately resistant to Rhizoctonia. No significant differences were found for yield but were found in dead beet counts. A trend did occur for improved yield and quality. Revenue per acre is based on a $40 per ton projected payment, an "average RWST" equal to the trial average of 296, and Quadris cost deducted from the revenue at a rate of $27.00 per acre plus a $7.50 application cost. Quadris was applied at 11.25 oz/ac. in 10.7 gallons of water/acre in a 7" band.

Row Spacing & Sugarbeet Population Trial

Sandusky, MI
2009

Trial Quality: Good

Summary

Data continue on next page

Recent research by Dr. Christy Sprague and Joe Armstrong has suggested that narrow row (22 inch) sugarbeet production increases sugarbeet yields compared to a conventional (28-30 inch) row spacing. Strip trials conducted by Sugarbeet Advancement supports these findings. A research trial was conducted by Michigan Sugar in 2009 comparing narrow row (22 inch) sugarbeet production to 30 inch row sugarbeets. Sugarbeet populations of 75, 100, 125, 150, 175, 200 and 250 plants per 100 foot of row were established for each row width. In general, yields were about 3 tons per acre higher in the narrow row plots (averaged over all sugarbeet populations). The grower payment increased by $127 with narrow rows. With respect to sugarbeet populations, the highest yields were achieved in plots with the highest number of beets (250 beets/100 ft) and the lowest yields came from plots with the lowest number of beets (75 beets/100 ft).
The yield increase was very consistent. At all of the populations the 22 inch rows yielded higher than the 30 inch row treatment.
There was not a quality difference between narrow rows and wide rows.
There was, however, a quality difference between populations with higher populations having higher quality. The LSD and CV were in a good range.

Planted: April 18, 2009
Harvested: September 17, 2009

Row Spacing
(Averaged Over All Populations)

Row Spacing	$/Acre	RWSA	RWST	Tons/A	% Suc	% CJP
22"	1351	8900	264	33.6	18.0	94.6
30"	1224	8069	263	30.7	18.1	94.2
Average	1288	8485	264	32.1	18.1	94.4
LSD (P=.05)	43.6	287.3	4.3	1.0	0.22	0.28

Row Spacing & Sugarbeet Population Trial

Sandusky, MI
2009

Trial Quality: Good

Population by Row Width

Row Spacing	Beets/ 100 ft	$/Acre	RWSA	RWST	Tons/A	% Suc	% CJP
22"	250	1510	9953	273	36.4	18.4	95.3
30"	250	1224	8063	263	30.7	17.9	94.6
22"	225	1352	8907	271	32.5	18.4	94.6
30"	225	1239	8163	264	30.9	18.1	94.3
22"	200	1379	9090	268	34.0	18.2	94.6
30"	200	1271	8373	272	30.8	18.5	94.7
22"	175	1387	9140	268	34.2	18.1	94.9
30"	175	1230	8103	264	30.7	18.1	94.4
22"	150	1312	8647	264	32.8	18.0	94.6
30"	150	1217	8021	263	30.5	18.0	94.3
22"	125	1379	9091	263	34.6	18.0	94.4
30"	125	1234	8132	266	30.6	18.3	94.2
22"	100	1261	8312	256	32.5	17.6	94.3
30"	100	1236	8144	268	30.3	18.4	94.4
22"	75	1224	8063	252	32.0	17.5	93.9
30"	75	1146	7555	245	30.8	17.4	92.7
Average		1288	8485	264	32.2	18.1	94.4
LSD (P=.05)		116.3	766.1	9.9	2.6	0.6	0.7
CV		6.3	6.3	2.6	5.6	2.2	0.5

Planted: April 18, 2009
Harvested: September 17, 2009

Average of 3 Poncho Beta Trials

Meylan, Wadsworth, & Richmond Brothers Farms

Location:	Bay, Sanilac, & Huron Counties	**Tillage:**	—
Variety:	HM-27RR, B-17RR32, & HM-28RR	**Harvest Date:**	—
Planting Date:	—	**Sample Date:**	—
Previous Crop:	—	**Herbicides:**	—
Soil Type:	—	**Replicated:**	4 Reps in each trial
Spacings:	—	**Fungicide:**	—
Fertilizer:	—		

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	POPULATIONS 100 Ft. of Row	
							DAY	DAY
Check	—	**8239**	**284**	**29.1**	**18.5**	**96.7**	—	—
Poncho Beta	—	**8230**	**283**	**29.2**	**18.5**	**96.6**	—	—
AVERAGE	—	**8235**	**284**	**29.2**	**18.5**	**96.6**	—	—
LSD (5%)	—	**178 NS**	**9 NS**	**1.5 NS**	**0.4 NS**	**0.6 NS**	—	—
C.V. (%)	—	**1**	**1**	**1.5**	**0.6**	**0.2**	—	—

TRIAL RELIABILITY: **Excellent**

EMERGENCE:	Excellent	**CERC. LEAF SPOT:**	Excellent control on all trials
RHIZOCTONIA:	Low	**NEMATODES:**	See individual trials
QUADRIS APP:	1x on each trial	**WEATHER:**	Variable

Comments: Average of 3 different locations. Poncho Beta is a systemic insecticide seed treatment. Each location had a different variety. None of the locations showed a significant yield difference. None of the locations had any visible insect damage.

PONCHO BETA SEED TREATMENT

Meylan Farms

Location:	Bay County	**Tillage:**	Fall Chisel, Spring 1x Triple K
Variety:	HM-27RR	**Harvest Date:**	10/19/2009
Planting Date:	3/26/2009	**Sample Date:**	10/15/2009
Previous Crop:	Dry Beans	**Herbicides:**	Glyphosate 2x
Soil Type:	Loam	**Replicated:**	4x
Spacings:	Row - 30", Seed - 4.5"	**Fungicide:**	Eminent, Headline
Fertilizer:	17 Gallons 19-17-0 2x2, 110 Lbs of Total N		

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	POPULATIONS 100 Ft. of Row	
							39 DAY	54 DAY
Check	—	**5696**	**290**	**19.7**	**18.8**	**96.9**	**140**	**140**
Poncho Beta	—	**5637**	**292**	**19.3**	**19.0**	**96.8**	**176**	**174**
AVERAGE	—	**5667**	**291**	**19.5**	**18.9**	**96.9**	**158**	**157**
LSD (5%)	—	**497 NS**	**10 NS**	**1.3 NS**	**0.4 NS**	**0.6 NS**	**22**	**22**
C.V. (%)	—	**4**	**2**	**2.9**	**1.0**	**0.3**	**8**	**8**

TRIAL RELIABILITY: **Excellent**

EMERGENCE:	Good, Slow due to Plant Date	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Low to Moderate	**NEMATODES:**	Unknown, But Suspected Probable
QUADRIS APP:	Yes	**WEATHER:**	Good

Comments: No differences were found in any yield category. It is unknown if the seed was from the same seed lot. The emergence difference maybe due to different seed lots or it maybe due to the treatments. No insect damage was observed with either treatment.

PONCHO BETA SEED TREATMENT

Wadsworth Farms Inc.

Location:	Sandusky, Sanilac Co.	**Tillage:**	Chisel, Spring Field Cult 1x
Variety:	B-17RR32	**Harvest Date:**	11/6/2009
Planting Date:	4/17/2009	**Sample Date:**	10/19/2009
Previous Crop:	Dry Beans	**Herbicides:**	Glyphosate 2x
Soil Type:	Loam	**Replicated:**	4x
Spacings:	Row - 28", Seed - 4 1/16"	**Fungicide:**	Eminent (71 DSV) Gem (140 DSV)
Fertilizer:	250 # 12-20-3 plus micros 2x2, 80 # N - anhydrous side dress, Variable rate 0-0-60		

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	POPULATIONS 100 Ft. of Row	
							16 DAY	30 DAY
Check	—	**10104**	**279**	**36.2**	**18.2**	**97.0**	**238**	**239**
Poncho Beta	—	**10063**	**279**	**36.0**	**18.1**	**97.1**	**247**	**245**
AVERAGE	—	**10083**	**279**	**36.1**	**18.1**	**97.1**	**242**	**242**
LSD (5%)	—	**189 NS**	**9 NS**	**0.5 NS**	**0.4 NS**	**0.8 NS**	**21 NS**	**15 NS**
C.V. (%)	—	**1**	**1**	**0.6**	**1.0**	**0.4**	**4**	**3**

TRIAL RELIABILITY: **Excellent**

EMERGENCE:	Excellent	**CERC. LEAF SPOT:**	Excellent
RHIZOCTONIA:	Low - Moderate	**NEMATODES:**	Detected
QUADRIS APP:	4-6 Leaf	**WEATHER:**	Good

Comments: No differences were found in any measurement category. It is unknown if the seed was from the same seed lot. No insect damage was observed with either treatment.

PONCHO BETA - MUSTANG TRIAL
Richmond Brothers Farms, LLC

Location:	Pigeon, Huron Co.	**Tillage:**	Dominator & 1x Field Cult in Fall, Stale Seed Bed in Spring
Variety:	HM-28RR		
Planting Date:	3/27/2009	**Harvest Date:**	11/8/2009
Previous Crop:	Wheat	**Sample Date:**	10/26/2009
Soil Type:	Loam	**Herbicides:**	Glyphosate 3x
Spacings:	Row - 30", Seed - 4.1"	**Replicated:**	4x
Fertilizer:	11 Gal. of 11-26-0 & 6 Gal. of 28% plus micros 2x2, 10,000 Gallons of Dairy Manure	**Fungicide:**	Proline (50 DSV), GEM (105 DSV), Proline

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	POPULATIONS 100 Ft. of Row		
							27 DAY	34 DAY	59 DAY
Mustang - Foliar Applied	—	9350	283	33.0	18.7	96.1	—	—	—
Poncho Beta	—	8991	278	32.3	18.5	95.8	45	203	231
Check	—	8918	283	31.6	18.6	96.2	30	188	233
Poncho Beta + Mustang	—	8874	275	32.3	18.2	96.1	—	—	—
AVERAGE	—	9033	280	32.3	18.5	96.1	38	196	232
LSD (5%)	—	684 NS	9 NS	1.9 NS	0.6 NS	0.4 NS	30 NS	22 NS	25 NS
C.V. (%)	—	5	2	3.7	2.1	0.2	36	5	5

TRIAL RELIABILITY: **Good**

EMERGENCE:	Excellent, Slow due to Plant Date	**CERC. LEAF SPOT:**	Excellent
RHIZOCTONIA:	Low	**NEMATODES:**	Not Detected
QUADRIS APP:	2-4 Leaf	**WEATHER:**	Good, High moisture in July

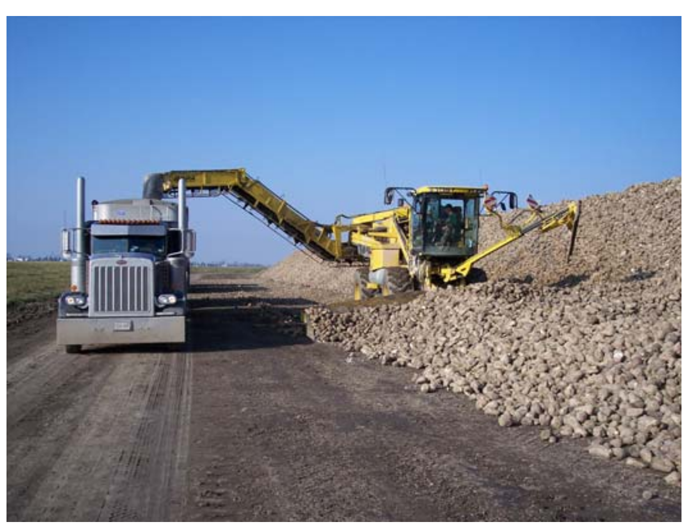
Comments: No significant differences were found in any measured category. It is unknown if the seed was from the same seed lot. No insect damage was observed with any treatment. Mustang Max EW was foliar applied at the 2-4 leaf stage in a 7.5 inch band at a rate of 1 oz./acre.


FERRIS WHEEL HARVESTER LOSS


COLLECTING HARVESTER LOSSES


POORLY TOPPED BEETS


PERFECTLY TOPPED BEETS


MAUS LOADING BEETS IN ONTARIO


VENTILATION OF BEETS


OAT COVER CROP IN BEETS


OAT COVER CROP IN BEETS


STRIP TILL IN SOYBEAN RESIDUE


CHISEL PLOW / STRIP TILL


STRIP TILL SHANK


LEVELER ON STRIP TILL EQUIPMENT


GROOVE GROUND ON TRACK TO
PLANT NARROW ROWS


NO STARTER OR NITROGEN FERTILIZER
2009 HAD LOW SOIL N


2009 BEAN & BEET FARM TOUR


MICHIGAN SUGAR RATING RHIZOCTONIA


SUGARBEET ADVANCEMENT
BAND SPRAYER


BAND SPRAYING FOR
RHIZOCTONIA CONTROL


RHIZOCTONIA ON SUGARBEETS
3-4-5 RATING


SUGARBEET CYST NEMATODE


SUGARBEET FIELD IN OREGON


COLOR VARIATION BETWEEN VARIETIES


APHANOMYCES ON BEETS


BEETS BROKEN OFF AT HARVEST
SHALLOW DIGGING

Quadris Trial
Palms Boys LLC

Location:	Palms, Huron Co.	**Tillage:**	Fall - Chisel, Spring - Field Cult.
Variety:	B-17RR62		
Planting Date:	4/25/2009	**Harvest Date:**	11/7/2009
Previous Crop:	Corn Silage	**Sample Date:**	10/12/2009
Soil Type:	Loam	**Herbicides:**	Glyphosate 3x
Spacings:	Rows - 28"	**Replicated:**	6x
Fertilizer:	5000 Gal. of Manure 12 Gal. 19-13-0 w/ Micros	**Fungicide:**	Eminent

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	RHIZOCTONIA Dead Beets per 1200 Ft of Row
Check	**$811**	**5196**	**255**	**20.2**	**17.9**	**93.4**	**26**
Quadris	**$763**	**5068**	**254**	**20.0**	**17.8**	**93.2**	**17**
AVERAGE	—	**5132**	**254**	**20.1**	**17.9**	**93.3**	**22**
LSD (5%)	—	**852 NS**	**15.0 NS**	**2.6 NS**	**0.9 NS**	**0.4 NS**	**25 NS**
C.V. (%)	—	**11**	**4**	**8.7**	**3.3**	**0.3**	**79**

TRIAL RELIABILITY: **Fair, but Confidence in results is low due to high Aphanomyces**

EMERGENCE:	Fair	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Low	**NEMATODES:**	Not Detected
QUADRIS APP:	4-6 Leaf, 11.25 oz/acre	**WEATHER:**	Heavy early season rain

Comments: Trial was conducted to evaluate a Quadris application on a Rhizoctonia susceptible variety in a field with a history of manure applications and low Rhizoctonia levels. Heavy rainfall occurred after planting causing a high level of Aphanomyces. The Aphanomyces had a large impact on trial reliability. Rhizoctonia levels were low and no significant differences were found. Revenue per acre is based on a $40 per ton projected payment, an "average RWST" equal to the trial average of 254, and Quadris cost deducted from the revenue at a rate of $27.00 per acre plus a $7.50 application cost.

UNIVERSITY of GUELPH RIDGETOWN CAMPUS

Screening sugar beet varieties for resistance to Rhizoctonia crown rot, 2009

Location: Ridgetown, Ontario, Canada
Planting Date: 5/5/09
Harvest Date: 11/2/09

Plot Size: 7m x 3m
Spacing: in-row 11cm, between row 75cm

Treatment	**Accumulated total dead plants**							**AUDPC**[1]
	Jun-19	**Jul-01**	**Jul-10**	**Jul-21**	**Aug-06**	**Aug-17**	**Aug-27**	
SX 1260RR	**0.0 ns**[2, 3]	**0.0 ns**	**0.5 ns**	**2.0 abc**[4]	**4.3 ns**	**5.8 bc**	**7.3 abc**	**151.3 abc**
HM 9050RR	**0.3**	**0.5**	**0.5**	**1.3 bc**	**2.8**	**3.0 bc**	**4.0 c**	**88.4 c**
HM 9042RR	**0.0**	**0.0**	**1.0**	**2.3 abc**	**3.5**	**4.8 bc**	**8.8 abc**	**145.5 bc**
HM 27RR	**0.0**	**0.0**	**0.0**	**0.3 c**	**0.8**	**1.3 c**	**2.8 c**	**35.9 c**
HM 28RR	**0.3**	**0.3**	**0.5**	**1.5 bc**	**2.3**	**4.5 bc**	**6.0 bc**	**112.2 bc**
HM 29RR	**0.0**	**0.3**	**0.8**	**2.0 abc**	**2.3**	**2.8 c**	**3.3 c**	**83.6 c**
Crystal RR824	**0.0**	**0.0**	**1.0**	4.5 ab	**8.8**	13.0 a	14.8 a	321 a
Crystal RR827	**0.0**	**0.3**	**1.3**	4.3 ab	**5.8**	**6.0 bc**	**6.5 bc**	**180.3 abc**
BTS 17RR32	**0.0**	**0.0**	**2.0**	5.8 a	**8.0**	9.8 ab	12.5 ab	283.4 ab
BTS 17RR62	**0.0**	**0.3**	**0.3**	**3.8 abc**	**3.8**	**5.5 abc**	**7.0 abc**	**152.6 abc**

[1] AUDPC = Area Under the Disease Progress Curve; represents the total amount of disease during the growing season (lower is better)

[2] numbers in **bold** are not significantly different than the best treatment in the same column

[3] ns = not significant at P ≤ 0.05, Duncan's new multiple range test

[4] Numbers in a column followed by the same letter are not significantly different at *P* ≤ 0.05, Duncan's new multiple range test

Comments:

Inoculum was prepared using 2 cultures - R9 from the U.S. and a strain from the University of Guelph. 18 g of wet inoculum was applied per row (row 1 and 2) in furrow. There was very low emergence in these rows. Rows 3 and 4 were inoculated on June 17 by sprinkling 10 g of inoculum over the foliage. It was raining while the inoculum was being applied. There were no differences among varieties for the in-furrow inoculation, so only the results from the foliar inoculated rows are presented here.

We would like to thank the Ontario Sugarbeet Growers Association for supporting this research.

Some data may have been transformed to meet the assumptions of statistical analysis; please contact us for more information.

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Evaluating new products for control of Rhizoctonia crown rot, 2009

Location: Ridgetown, Ontario, Canada
Planting Date: 5/5/09
Harvest Date: 11/2/09

Plot Size: 7m x 3m
Variety: Crystal RR827
Spacing: in-row 11cm, between row 75cm

Treatment	Accumulated total # dead plants							AUDPC[1]	Yield	
	Jun-19	Jul-01	Jul-07	Jul-21	Aug-06	Aug-17	Aug-27		# beets	Wt. (kg)
Nontreated control	**0.0 ns**[2, 3]	**2.5 ns**	**5.3 ns**	**8.3 ns**	**13.5 ns**	**14.5 ns**	**15.0 ns**	**575 ns**	**28.8 abc**[4]	**36.75 abc**
Quadris @ 1.1L Ha^{-1}	**0.5**	**0.8**	**1.5**	**3.3**	**6.0**	**7.8**	**8.0**	**266**	**35.0 a**	**48.70 a**
Headline @ 900mL Ha^{-1}	**0.3**	**2.5**	**5.0**	**8.0**	**10.5**	**12.3**	**12.5**	**496**	20.3 bc	31.95 bc
Proline @ 350mL Ha^{-1}	**0.0**	**0.0**	**1.5**	**3.3**	**4.0**	**4.8**	**5.3**	**184**	**33.3 a**	**47.15 ab**
Inspire @490mL Ha^{-1}	**0.8**	**1.3**	**4.5**	**6.5**	**8.5**	**9.0**	**9.0**	**384**	**24.0 abc**	31.45 bc
Caramba @ 980mL Ha^{-1}	**0.5**	**0.5**	**2.3**	**4.8**	**9.5**	**10.0**	**10.8**	**374**	**26.0 abc**	**40.40 abc**
Flint @ 210g Ha^{-1}	**0.0**	**1.0**	**4.0**	**9.5**	**13.0**	**15.0**	**15.5**	**573**	17.8 c	24.90 c
Tilt @ 500mL Ha^{-1}	**0.0**	**1.3**	**4.5**	**8.8**	**12.0**	**12.5**	**14.0**	**520**	**30.8 ab**	**43.45 ab**

[1] AUDPC = Area Under the Disease Progress Curve; represents the total amount of disease during the growing season (lower is better)

[2] numbers in **bold** are not significantly different than the best treatment in the same column

[3] ns = not significant at $P \leq 0.05$, Duncan's new multiple range test

[4] Numbers in a column followed by the same letter are not significantly different at $P \leq 0.05$, Duncan's new multiple range test

Comments:

Variability among plots was very high, therefore there were no statistically significant differences among treatments.
Inoculum was prepared using 2 cultures - R9 from the U.S. and a strain from the University of Guelph. 18 g of wet inoculum was applied per row (row 1 and 2) in furrow. There was very low emergence in these rows, so the trial was moved to the rows 3 and 4. They were inoculated on June 17. 10 g of inoculum was applied per 7 m row by sprinkling it over the foliage. It was raining while the inoculum was being applied.

We would like to thank the Ontario Sugarbeet Growers Association for supporting this research.

Some data may have been transformed to meet the assumptions of statistical analysis; please contact us for more information.

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Sugarbeet (*Beta vulgaris* L., 'ACH RR')
Rhizoctonia crown and root rot; *Rhizoctonia solani*

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Control of Rhizoctonia crown and root rot with fungicides, 2009.

Sugar beet cv. ACH RR was PAT-treated and planted at the Michigan State University Bean and Beet Farm, Richville, MI on 22 Apr. Seed was planted at 1" depth into four-row by 50-ft plots (ca. 4.375 in. between plants to give a target population of 275 plants/100ft. row) with 30" between rows replicated four times in a randomized complete block design. Fertilizer was drilled into plots immediately before planting, formulated according to results of soil tests (125 lb 46-0-0/A). No additional nitrogen was applied. All fungicides were applied with a hand held R&D spray boom delivering 10 gal/A (50 p.s.i.) and using one XR8003 nozzle per row in a 6" band at planting or at GS 2-4 and 4-6. Fungicides were applied broadcast with a hand-held R&D spray boom delivering 25 gal/A (80 p.s.i.) and using three XR11003VS nozzles per row for Proline treatments (except the in-furrow at planting treatment). Applications were made at planting (A); and banded applications on 6 and 14 May at GS 2-4 (B) and 4-6 (C), respectively and the broadcast application on 25 May equivalent to GS 6–8 (D). Cercospora leaf spot was controlled with an application of Eminent 125SL (13 fl oz) on 28 Jun. Weeds were controlled by cultivation and with Roundup Original Max 2.0 pt/A applied at GS2-4 and GS 6-8. Insects were controlled as necessary. Plant stand was rated 8, 15, 21 and 30 days after planting (DAP) and relative rate of emergence was calculated as the Relative Area Under the Emergence Progress Curve [RAUEPC from 0 – 30 DAP, maximum value = 100]. Plots were inoculated on 15 May [23 days after planting (DAP)] by spreading *R. solani* Anastemoses Group 2.2 (IIIB) infested barley across all plants in each plot. Plants with signs and symptoms of Rhizoctonia crown and root rot were counted 135 DAP on 4 Sep and expressed as the percentage of dead-beets. Samples of 50 beets per plot were harvested 135 DAP (10 ft from start of each plot from two center rows) and assessed for crown and root rot (*R. solani*) incidence (%) and severity. Severity of crown and root rot was measured as an index calculated by counting the number of roots (n = 20) falling in class 0 = 0%; 1 = 1 - 5%; 2 = 6 -10%; 3 = 11 – 15%; 4 =15 - 25%; 5 = 25 – 50%; 6 = 50 – 100% surface area of root affected by lesions; and 7 = dead and/or extensively decayed root. The number in each class is multiplied by the class number and summed. The sum is multiplied by a constant to express as a percentage. Increasing index values indicated the degree of severity. The trial was not harvested due to the high incidence and severity of crown and root rot. Meteorological variables were measured with a Campbell weather station located at the farm, latitude 43.3995 and longitude -83.6980 deg. Maximum, minimum and average daily air temperature (^{o}F) from planting on 22 Apr were 79.1, 28.5 and 53.1 (Apr), 84.3, 31.3 and 56.4 (May), 94.1, 36.5 and 64.8 and 1-d with maximum temperature >90^{o}F (Jun), 81.3, 45.7 and 65.2 and 0-d with maximum temperature >90^{o}F (Jul), 88.9, 41.5 and 67.1 and 0-d with maximum temperature >90^{o}F (Aug) and 82.0, 31.2 and 59.8 (to 6 Oct). Maximum, minimum and average daily soil temperatures (^{o}F) over the same period were 71.6, 44.4 and 57.2 (Apr), 66.0, 47.3 and 52.6 (May), 91.1, 51.0 and 67.6 (Jun), 87.2, 57.7 and 70.9 (Jul), 83.1, 54.2 and 70.6 (Aug) and 85.6, 43.6 and 65.7 (to 6 Oct). Maximum, minimum and average daily soil moisture (% of field capacity at 4" depth) was 65.9, 42.1 and 50.0 (Apr); 52.2, 22.4 and 32.1 (May); 62.6, 21.0 and 38.0 (Jun); 63.6, 26.7 and 45.9 (Jul), 66.2, 23.2 and 33.3 (Aug) and 49.2, 24.9 and 29.6 (Sep to 6 Oct). Precipitation was 3.04-in. (Apr), 1.23-in. (May), 4.81-in. (Jun), 2.73-in. (Jul), 3.48-in. (Aug) and 1.57-in. (Sep to 3 Oct).

Soil temperature and moisture conditions enhanced development of crown and root rot. There were no significant differences among treatments in terms of plant stand or RAUEPC. The mean percentage of dead and dying sugar beets 135 DAP in the non-treated plots was 32.9%. All treatments had significantly fewer dead or dying plants due to crown and root rot in comparison to the non-treated control. Treatments with greater than 9.5% incidence of dead and dying beets were significantly different from the current commercial standard Quadris applied at GS 4-6 (6.5%). Treatments with less than 82.5% incidence of crown and root rot on the beetroots were significantly different to the untreated control. Treatments with greater than 71.3% incidence of crown and root rot on the beetroots were significantly different from the current commercial standard Quadris (55%). All treatments had a lower severity index of crown and root rot on the beetroots and were significantly different to the untreated control (71.6%). Treatments with greater than 32.2% severity index of crown and root rot on the beetroots were significantly different from the current commercial standard Quadris (15%).

	Plant stand[z] DAP[y] (%)			RAUEPC[x]			Crown and root rot			
Treatment and rate/1000 ft. row	16	22	31	0 – 31 DAP	Dead beets (%)[w]		Incidence (%)[v]		Severity[u]	
LEM17 200EC 1.6 fl oz (A[t])….....	65.3	66.7	84.0	48.4	7.5	gh	71.3	d-g	27.7	c-g
LEM17 200EC 1.6 fl oz (C)……	58.3	65.5	81.6	45.6	9.5	e-h	73.8	def	28.6	c-g
YT669 2.08SC 1.3 fl oz (A)……	66.5	62.2	75.5	50.8	8.6	fgh	71.3	d-g	27.5	c-g
YT669 2.08SC 1.3 fl oz (C)……	70.1	70.1	85.0	50.3	12.1	d-g	55.0	g	16.6	g
Quadris 2.08FL 0.6 fl oz (A)……	63.8	64.5	81.5	48.3	20.5	b	93.8	ab	45.7	bc
Proline 480SC 0.33 fl oz + Induce 0.125% (B)………………	59.5	59.9	74.6	45.6	5.8	h	87.5	a-d	28.4	c-g
Proline 480SC 0.33 fl oz + Induce 0.125% (C)………………	59.6	66.1	80.7	47.0	7.7	gh	67.5	efg	16.8	g
Proline 480SC 0.33 fl oz + Induce 0.125% (D)……………....	63.1	67.2	83.9	48.8	14.5	cd	78.8	b-e	38.8	b-f
Proline 480SC 0.33 fl oz + Quadris 2.08FL 0.6 oz (A)……....	57.5	57.1	73.2	43.3	13.3	c-f	82.5	a-e	29.5	b-g
Proline 480SC 0.17 fl oz + Quadris 2.08FL 0.3 fl oz (A)……	59.8	65.4	80.5	46.8	13.8	cde	77.5	b-f	40.2	b-e
Moncut 70DF 0.98 oz (A)………	47.7	51.9	68.0	37.3	16.8	bc	87.5	a-d	43.4	bcd
Moncut 70DF 0.98 oz (B)………	66.6	69.6	85.2	51.7	13.0	c-f	88.8	a-d	32.1	b-g
Moncut 70DF 0.98 oz (C)………	57.3	59.9	74.9	44.7	8.1	gh	65.0	efg	33.2	b-g
Moncut 70DF 0.98 oz (D)………	63.3	65.1	79.5	47.4	15.3	cd	92.5	abc	47.5	b
Moncut 70DF 0.498 oz (A); Moncut 70DF 0.49 oz (B)………	62.6	59.8	75.3	46.5	5.3	h	75.0	c-f	21.3	fg
Moncut 70DF 0.498 oz (A); Moncut 70DF 0.49 oz (C)………	62.3	65.1	80.3	48.4	5.5	h	60.0	fg	21.1	fg
Moncut 70DF 0.498 oz (A); Moncut 70DF 0.49 oz (D)………	56.6	59.7	73.2	43.6	7.4	h	68.8	efg	26.8	d-g
Quadris 2.08FL 0.6 fl oz (C)……	64.7	68.7	86.0	50.2	6.5	h	55.0	g	15.0	g
Headline 2.09EC 0.69 fl oz (A)…	60.7	57.5	72.5	47.4	15.7	cd	95.0	ab	45.5	bc
Topsin-M 70WP 1.84 oz (D)……	59.5	62.5	73.0	47.7	7.8	gh	73.8	def	22.3	efg
Untreated………………………..	61.2	62.4	79.4	48.3	32.9	a	100.0	a	71.6	a
$LSD_{0.05}$	11.77	11.81	12.35	9.18	4.69		17.51		18.62	

[a] Plant stand expressed as a percentage of the target population of 275 plants/100ft. row from a sample of 2 x 50 ft rows per plot.
[y] DAP = days after planting on 22 Apr.
[x] Relative area under the emergence progress curve from planting to 31 days after planting.
[w] Dead and dying sugar beets (%) 135 DAP on 4 Sep.
[v] Percent crown and root incidence on sample of 20 beets on 4 Sep (percentage above category 0).
[u] Severity of crown and root rot was measured as an index calculated as described in the text.
[t] Application dates; A= 22 Apr; B= 15 May; C= 29 May; D= 11 Jun.
[s] Means followed by same letter are not significantly different at P = 0.05 (Fishers LSD).

Control of Rhizoctonia Root Rot With Actinovate AG

Saginaw, MI
2009

Trial Quailty: Fair

Treatment Name	Rate/ Acre	Appl Timing	Dead Beets per Plot*
Actinovate AG (soluble powder)	12 oz	IF	2.2
Actinovate AG (soluble powder)	6 oz	4-6 lf	
Actinovate AG (soluble powder)	6 oz	8-10 lf	
Quadris (2.08 lb/gal flowable)	7.1 fl oz	IF	4.4
Quadris (2.08 lb/gal flowable)	10.5 fl oz	4-6 lf	
Quadris (2.08 lb/gal flowable)	14.3 fl oz	4-6 lf	2.4
Actinovate AG (soluble powder)	12 oz	Pre	3.0
Actinovate AG (soluble powder)	6 oz	4-6 lf	
Actinovate AG (soluble powder)	6 oz	8-10 lf	
Quadris (2.08 lb/gal flowable)	7.1 fl oz	IF	3.0
Untreated			6.4
Average			3.6
LSD (P=.05)			2.8
CV%			59.4

Planted: June 30, 2009
Harvested: October 16, 2009
Reps: 5
Variety: Crystal RR827

* Dead Beets per Plot:
Number dead beets per 112 ft of row

Summary

Actinovate AG is a concentration of a beneficial bacterium (Streptomyces lydicus) which has demonstrated activity against fungus diseases such as Rhizoctonia solani, the organism which causes Rhizoctonia root and crown rot in sugarbeets. In this exploratory trial, Actinovate appeared to reduce the number of dead beets caused by Rhizoctonia and/or Aphanomyces. The results with Actinovate were similar to those of Quadris. The disease level in this field was low to moderate. More work needs to be done to see if Actinovate AG can be used as a tool to combat root rots in sugarbeets. The plot was planted very late because the biofungicide was late arriving. Actinovate (and Quadris) did not affect sugarbeet emergence.

Compare Cercospora Leafspot Fungicides

Quanicassee, MI

2009

<u>Trial Quality: Fair (low disease levels)</u>

Treatment*** Name	Rate/A	App* Time	CLS** 0-9	$/ Acre	RWSA	RWST	Tons/A	% Suc	% CJP
Inspire XT	7 fl oz	AC	0.50	1333	10340	304	34.0	19.9	96.1
Eminent	13 fl oz	AC	0.63	1312	10173	299	34.0	19.9	95.6
Proline	5.7 fl oz	AC	0.71	1286	10063	304	33.1	20.0	96.2
Super Tin	5 oz	AC	0.79	1318	10120	302	33.6	19.8	96.3
Headline	9 fl oz	AC	0.83	1274	10017	303	33.0	19.9	96.1
Dithane	2 lbs	AC	0.88	1337	10266	302	34.0	20.0	95.7
Enable	8 fl oz	AC	0.88	1280	10035	304	33.0	19.9	96.4
Dithane + COC	2 lbs	AC							
Gem SC	3.6 fl oz	AC	0.88	1252	9885	300	33.0	19.8	95.8
Enable + NIS	8 fl oz	AC	0.96	1264	9933	304	32.7	20.0	95.9
Caramba	9 fl oz	AC							
Enable	8 fl oz	AC	0.96	1251	9815	304	32.3	19.8	96.5
Caramba	9 fl oz	AC							
Topsin M + ST	8/5 oz	AC	1.46	1335	10371	304	34.1	19.8	96.5
Untreated			2.04	1244	9411	300	31.3	19.7	96.2
Average			1.0	1327	10036	302.6	33.2	19.9	96.1
LSD (P=.05)			0.4	76.0	574	8.1	1.8	0.4	0.8
CV%			35.8	5.0	5.0	2.3	4.8	1.6	0.7

Planted: May 4, 2009
Harvested: October 19, 2009
Variety: Crystal RR827

Rated: September 16, 2009
Reps: 6

* Applied: A= July 22, B= August 13, C= August 28

** CLS = Cercospora Leafspot; 0-9 Scale: 0 = No Disease, 3 = Heavily Spotted, 6 = 50% Desiccated, 9 = Completely Desiccated

*** Penncozeb applied at a (Timing B) for each treatment.

Summary

The disease level was low in this trial. Inspire provided the best Cercospora control followed by Eminent and Proline. Topsin + Super Tin gave the worst control. The reliability of this trial was only fair due to the low disease pressure which made ratings difficult. All of the treatments out yielded the untreated check.

Proline & Gem for Control of Cercospora Leafspot

Blumfield, MI

2009

Trial Quality: Fair - Moderate disease levels

Treatment	Rate	Rate Unit	Appl** Timing	CLS* 0-9	RWSA	RWST	Tons/A
Proline + Induce + 28% N	5	fl oz/a	A	1.21	7759	298	26.0
Gem SC + 28% N	3.5	fl oz/a	B				
Topsin + ST	8 + 3.75	oz/a	C				
Proline + Induce	5	fl oz/a	A	1.21	7912	300	26.5
Topsin + ST	8 + 3.75	oz/a	B				
Gem SC	3.5	fl oz/a	C				
Gem SC + 28% N	3.5	fl oz/a	A	1.32	7897	298	26.6
Proline + Induce + 28% N	1.5	qt/a	B				
Topsin + ST	8 + 3.75	oz/a	C				
Eminent 125 SL	13	fl oz/a	A	1.46	7840	298	26.3
Gem SC	3.5	fl oz/a	B				
Topsin + ST	8 + 3.75	oz/a	C				
Gem SC	3.5	fl oz/a	A	1.47	7814	298	26.3
Proline + Induce	5	fl oz/a	B				
Topsin + ST	8 + 3.75	oz/a	C				
Gem SC	3.5	fl oz/a	A	1.50	7733	297	26.1
Eminent 125 SL	13	fl oz/a	B				
Topsin + ST	8 + 3.75	oz/a	C				
Untreated				3.00	7451	290	25.7
Average				1.59	7772	296.9	26.2
LSD (P=.05)				0.45	435	11.7	1.6
CV%				24.0	4.7	3.3	5.3

Planted: May 4, 2009
Harvested: Sep 21, 2009
Reps: 6
Induce Rate: .125%
28% Nitrogen Rate: 1.5 qt/A
Variety: Crystal RR827

* CLS = Cercospora Leafspot
0-9 Scale: 0 = no disease, 3 = Heavily spotted
6 = 50% Desiccated, 9 = Completely Desiccated
CLS Rated: September 19, 2009

** Application Timing; A= August 4, B= August 12, C= August 31

Summary

Proline appeared to provide somewhat better Cercospora control than Gem SC in this trial. The addition of 28% N appeared to increase Cercospora control with Gem and Proline. Cercospora control with Proline was better than that of Eminent. The disease level was moderate in this trial.

Evaluate Inspire XT for Control of Cercospora Leafspot

Kawkawlin, MI
2009

Trial Quality: Fair (Low Cerc. Levels)

Treatment Name	Rate	Rate Unit	Appl** Timing	CLS* 0-9	RWSA	RWST	Tons/A	% Suc	% CJP
Inspire XT	7	fl oz/a	AC	0.00	7029	246	29.2	17.3	93.3
Headline	9	fl oz/a	BD						
Proline SC	5	fl oz/a	AC	0.00	6862	254	27.3	17.5	94.1
Induce	0.125	% v/v	AC						
Headline	9	fl oz/a	BD						
Eminent	13	fl oz/a	AC	0.20	7095	247	29.0	17.2	93.7
Headline	9	fl oz/a	BD						
Quadris	8.5	fl oz/a	AC	0.20	7308	251	28.4	17.4	93.9
Super Tin	5	oz/a	BD						
Untreated Check				1.80	6835	252	26.9	17.5	94.0
Average				0.44	7026	250.0	28.2	17.4	93.8
LSD (P=.05)				0.26	970	20.5	4.9	1.1	1.1
CV%				44.6	9.9	6.1	12.4	4.7	0.9

Planted: May 11, 2009
CLS Ratings: Sept 23, 2009
Harvested: Sept 29, 2009
Variety: Crystal RR827
** Application Codes; A= July 14, B= July 28
C= August 13, D= August 31

* CLS = Cercospora Leafspot
0-9 Scale: 0 = No Disease, 3 = Heavily Spotted,
6 = 50% Desiccated, 9 = Completely Desiccated

Summary

Inspire XT (difenoconazole) is a new fungicide from Syngenta which has shown very good activity against Cercospora beticola, the fungus which causes Cercospora leaf spot in sugarbeets. Inspire XT has translaminar activity which means that it moves small distances in the leaf (i.e. from the upper leaf surface to the lower leaf surface). In this trial Inspire XT provided good control of Cercospora leaf spot. Sugarbeet yields tended upward in the treated plots compared to the untreated check. The leaf spot infestation was low in this trial. None of the fungicides caused leaf injury to the sugarbeets.

Managing Varieties With Different Levels of Cercospora Tolerance With the BeetCast System

Quanicassee, MI
2009

Trial Quality: Fair to Good

Summary

Additional Data on the Next Page

Five varieties with different levels of Cercospora tolerance were sprayed with fungicides following 3 levels of BeetCast intensity. HM 42RR (98% of Cercospora check varieties), HM 29RR (108% of checks), HM 32RR (118% of checks), Crystal RR808 (127% of checks), and Crystal RR824 (134% of checks) were the varieties utilized in this trial. The BeetCast treatments were 45/45 DSV's, 55/55 DSV's and 70/70 DSV's. All of the treatments were sprayed 2 times. The level of disease in this trial was relatively low. The results were somewhat predictable with 45/45 giving better leafspot control than 55/55 which provided better control than 70/70. With respect to variety performance, they ranked (best to worst) HM 42RR > HM 29RR > HM 32RR > Crystal RR808 > Crystal RR824. Under these relatively light disease conditions, HM 42RR provided adequate control with the 70/70 scheme while the other varieties needed a 55/55 spray schedule to keep leafspot below an economic level (2.5 rating).

Disease Level by Variety

Variety	CLS** % Check	CLS* 0-9
HM 42RR	98	1.93
HM 29RR	108	2.39
HM 32RR	118	2.62
Crystal RR808	127	2.95
Crystal RR824	134	3.06
Average		2.59
LSD (P=.05)		0.11

* CLS = Cercospora Leafspot; 0-9 Scale: 0 = No Disease, 3 = Heavily Spotted, 6 = 50% Desiccated, 9 = Completely Desiccated

** % Check; Lower number shows more resistance.

Managing Varieties With Different Levels of Cercospora Tolerance With the BeetCast System

Quanicassee, MI

2009

Trial Quality: Fair-Good

By Variety

Treatment	Variety	CLS* 0-9	$/ Acre	RWSA	RWST	Tons/A	% Sugar	% CJP
55 55 DSV	**Cry RR808**	2.50	1375	10288	319	32.2	20.8	96.3
45 45 DSV	**Cry RR808**	2.50	1315	9836	320	30.7	20.7	96.8
70 70 DSV	**Cry RR808**	2.83	1346	10071	320	31.4	20.6	96.8
Untreated	**Cry RR808**	3.96	1240	9275	313	29.7	20.4	96.3
Average		2.9	1319	9868	318.0	31.0	20.6	96.6
45 45 DSV	**HM 32RR**	2.21	1304	9756	289	33.7	19.0	96.0
55 55 DSV	**HM 32RR**	2.50	1288	9633	282	34.2	18.8	95.6
70 70 DSV	**HM 32RR**	2.54	1284	9609	286	33.6	18.9	96.1
Untreated	**HM 32RR**	3.21	1231	9212	282	32.7	18.7	95.8
Average		2.6	1277	9552	284.8	33.5	18.8	95.9
45 45 DSV	**HM 42RR**	1.54	1167	8731	298	29.3	19.5	96.2
70 70 DSV	**HM 42RR**	1.79	1275	9535	305	31.3	19.8	96.7
55 55 DSV	**HM 42RR**	1.79	1241	9285	300	31.0	19.8	95.7
Untreated	**HM 42RR**	2.58	1174	8781	303	29.0	19.8	96.5
Average		1.9	1214	9083	301.5	30.1	19.7	96.3
55 55 DSV	**Cry RR824**	2.54	1403	10494	296	35.5	19.2	96.7
45 45 DSV	**Cry RR824**	2.58	1379	10316	299	34.5	19.5	96.5
70 70 DSV	**Cry RR824**	3.04	1358	10159	295	34.4	19.2	96.8
Untreated	**Cry RR824**	4.08	1360	10172	296	34.3	19.3	96.6
Average		3.1	1375	10285	296.5	34.7	19.3	96.6
45 45 DSV	**HM 29RR**	2.08	1306	9767	292	33.4	19.1	96.3
55 55 DSV	**HM 29RR**	2.08	1223	9148	296	30.9	19.4	96.3
70 70 DSV	**HM 29RR**	2.33	1272	9513	294	32.4	19.1	96.7
Untreated	**HM 29RR**	3.04	1352	10110	299	33.8	19.4	96.7
Average		2.4	1288	9635	295.4	32.6	19.3	96.5

Planted: May 4, 2009
Harvested: Oct. 20, 2009
Reps: 6

* CLS = Cercospora Leafspot
0-9 Scale: 0 = no disease, 3 = Heavily spotted
6 = 50% Desiccated, 9 = Completely Desiccated
Rated: September 14, 2009

Roundup + Cerc Fungicides Tank Mix Trial

Pigeon, MI (2009)

Trial Quality: Fair - Good

Treatment* Name	Rate/Acre	Appl*** Timing	CLS** 0-9 Sep-22	SB Phyto %**** Jul-18
Roundup Ultra Max + AMS	22 fl oz + 17 lb/100 gal	ABC	1.50	0
Inspire	7 fl oz	AC		
Roundup Ultra Max	22 fl oz + 17 lb/100 gal	ABC	1.71	0
Gem SC	3.6 fl oz	AC		
Roundup Ultra Max	22 fl oz + 17 lb/100 gal	ABC	1.79	0
Headline	9 fl oz	AC		
Roundup Ultra Max	22 fl oz + 17 lb/100 gal	ABC	2.00	0
Proline SC	5.7 fl oz	AC		
Roundup Ultra Max	22 fl oz + 17 lb/100 gal	ABC	2.08	0
Topsin + Super Tin	8 oz + 5 oz	AC		
Roundup Ultra Max	22 fl oz + 17 lb/100 gal	ABC	2.08	0
Super Tin	5 oz	ABC		
Roundup Ultra Max	22 fl oz + 17 lb/100 gal	ABC	2.08	0
Enable + Dithane + COC	8 fl oz + 2 lbs + 1 qt	AC		
Roundup Ultra Max	22 fl oz + 17 lb/100 gal	ABC	2.17	0
Penncozeb	2 lbs	AC		
Roundup Ultra Max	22 fl oz + 17 lb/100 gal	ABC	2.25	0
Kocide 3000	2 lbs	AC		
Roundup Ultra Max	22 fl oz + 17 lb/100 gal	ABC	3.42	0
Average			2.1	0
LSD (P=.05)			0.7	0
CV %			28.4	0

Planted: May 4, 2009
Not Harvested
Reps: 6

** CLS = Cercospora Leafspot; Rating Scale: 0-9
0 = No Disease, 3 = Heavily Spotted
6 = 50% Desiccation, 9 = Total Desiccation

* Super Tin included in each (B) timing application.
*** Application Timing; A= July 13, B= July 31, C= August 13
**** %SB Phyto: visual sugarbeet injury rating with 0 = no injury, 50 = sugarbeets 1/2 the size of normal or 50% spotted by burn, 100 = crop dead

Summary

None of the Roundup + fungicide tank mix applications caused sugarbeet injury in this trial. Roundup did not appear to influence the effectiveness of any of the fungicide treatments.

UNIVERSITY of GUELPH RIDGETOWN CAMPUS

Evaluation of Quadris sprayed at Rhizoctonia timing for control of Cercospora leaf spot later in the season

Location: Ridgetown, Ontario, Canada
Planting Date: 5/4/09
Harvest Date: 11/3/09

Plot Size: 7m x 2.25m
Variety: Crystal RR824
Spacing: in-row 11cm, between row 75cm

Treatment	**Cercospora rating**						**Yield**	
	Sep-03	**Sep-11**	**Sep-23**	**Oct-08**	**Oct-21**	**AUDPC**	**# beets**	**Wt. (kg)**
Nontreated control	1.8 a	1.1 a	2.2 a	2.7 a	3.0 a	103.9 a	**87.0 ns**	**51.5 ns**
Quadris @ 1.1L Ha^{-1} (4-leaf stage)	1.3 a	0.6 b	1.6 b	2.3 a	2.5 a	82.3 a	**95.8**	**58.7**
Headline @ 900mL Ha^{-1} (55/55/55 DSV)[6]	**0.5 b**	**0.3 c**	**0.4 c**	**0.6 b**	**0.5 b**	**22.7 b**	**98.0**	**60.7**
Quadris @ 1.1L Ha^{-1} (4-leaf stage) + Headline @ 900mL Ha^{-1} 55/55/55 DSV	**0.8 b**	**0.3 c**	**0.5 c**	**1.0 b**	**0.9 b**	**29.7 b**	**102.5**	**62.4**

[1] Based on a rating of 0 to 5, where 0 = no disease and 5 = original foliage completely destroyed

[2] AUDPC = Area Under the Disease Progress Curve; represents the total amount of disease during the growing season (lower is better)

[3] Numbers in **bold** are not significantly different than the best treatment in the same column

[4] Numbers in a column followed by the same letter are not significantly different at $P \leq 0.05$, Duncan's new multiple range test

[5] ns = not significant at P ≤ 0.05, Duncan's new multiple range test

[6] Actual Beetcast applications were made at 45 DSV, 53 DSV, and 49 DSV

Treatment	**CJP (%)**	**Suc (%)**	**Amino-N**	**RWST**	**Sugar Yield (t Ha^{-1})**
Nontreated control	**94.39 ns**[1, 2]	**18.39 ns**	**2.14 ns**	**270.6 ns**	**6.78 ns**
Quadris @ 1.1L Ha^{-1} (4-leaf stage)	**94.36**	**18.52**	**3.91**	**270.6**	**7.67**
Headline @ 900mL Ha^{-1} (55/55/55 DSV)[6]	**94.77**	**18.79**	**2.22**	**277.2**	**8.13**
Quadris @ 1.1L Ha^{-1} (4-leaf stage) + Headline @ 900mL Ha^{-1} 55/55/55 DSV	**95.33**	**18.88**	**4.47**	**281.9**	**8.49**

[1] Numbers in **bold** are not significantly different than the best treatment in the same column

[2] ns = not significant at P ≤ 0.05, Duncan's new multiple range test

Comments:

Some data may have been transformed to meet the assumptions of statistical analysis; please contact us for more information.

We would like to thank the Ontario Sugarbeet Growers Association for supporting this research.

For further information contact:

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Phyllis May 519-674-1642 / pmay@ridgetownc.uoguelph.ca

UNIVERSITY of GUELPH RIDGETOWN CAMPUS

Products for Cercospora leaf spot control in sugar beets, 2009

Location: Ridgetown, Ontario, Canada
Planting Date: 5/4/09
Harvest Date: 11/3/09
Spacing: in-row 11cm, between row 75cm

Plot Size: 7m x 2.25m
Variety: Crystal RR824
Application timing: 3 apps at Beetcast 45 DSV, 53 DSV, and 49 DSV

Treatment	Cercospora rating[1]								Yield	
	Aug-25	Sep-04	Sep-11	Sep-17	Sep-24	Oct-08	Oct-20	AUDPC[2]	# beets	Wt. (kg)
Nontreated control	1.0 a[3, 4]	1.1 a	1.1 ab	1.5 a	2.1 a	2.6 a	2.5 a	98.5 a	89.5 c	**67.35 ns[5]**
Quadris @ 1.1L Ha^{-1}	**0.1 b**	**0.2 b**	**0.4 cd**	**0.5 bc**	0.7 bcd	**0.7 cde**	0.7 cd	28.5 cd	**98.5 abc**	**69.65**
Headline @ 900mL Ha^{-1}	**0.1 b**	**0.1 b**	**0.1 d**	**0.2 c**	**0.3 e**	**0.5 e**	**0.5 d**	**15.7 e**	**96.0 abc**	**70.95**
Tilt @ 910mL Ha^{-1}	**0.2 b**	**0.3 b**	**0.5 cd**	**0.5 bc**	0.9 bcd	1.1 c	1.1 bc	39.5 bc	92.8 bc	**62.1**
Proline @ 350mL Ha^{-1}	**0.1 b**	**0.2 b**	**0.3 cd**	**0.3 bc**	**0.5 de**	**0.8 cde**	**0.7 cd**	**23.8 de**	**101.3 ab**	**76.9**
Inspire @490mL Ha^{-1}	**0.1 b**	**0.1 b**	**0.3 cd**	**0.3 bc**	**0.4 de**	**0.5 e**	**0.5 d**	**17.3 e**	**105.5 a**	**80.05**
Caramba @ 980mL Ha^{-1}	**0.3 b**	**0.3 b**	0.7 bc	0.7 b	1.0 b	1.5 b	1.3 b	49.2 b	**100.5 ab**	**68.95**
Flint @ 250g Ha^{-1}	**0.2 b**	**0.3 b**	**0.5 cd**	**0.5 bc**	1.0 b	1.0 cd	**0.9 bcd**	38.2 bc	**97.3 abc**	**69.1**
Senator @ 560g Ha^{-1}	1.1 a	1.2 a	1.3 ab	1.5 a	2.2 a	2.8 a	2.5 a	101.5 a	**101.8 ab**	**64.1**
Eminent @ 910L Ha^{-1}	**0.1 b**	**0.2 b**	**0.3 cd**	**0.2 bc**	**0.5 cde**	**0.6 de**	**0.6 cd**	**22.4 de**	**103.5 a**	**72.35**

[1] Based on a rating of 0 to 5, where 0 = no disease and 5 = original foliage completely destroyed

[2] AUDPC = Area Under the Disease Progress Curve; represents the total amount of disease during the growing season (lower is better)

[3] Numbers in **bold** are not significantly different than the best treatment in the same column

[4] Numbers in a column followed by the same letter are not significantly different at $P \leq 0.05$, Duncan's new multiple range test

[5] ns = not significant at $P \leq 0.05$, Duncan's new multiple range test

Treatment	CJP (%)	Suc (%)	Amino-N	RWST	Sugar Yield (t Ha^{-1})
Nontreated control	**94.96 ns**[1, 2]	**18.67 ns**	**1.56 ns**	**276.4 ns**	**8.83 ab**[3]
Quadris @ 1.1L Ha^{-1}	**94.69**	**19.16**	**2.87**	**282.7**	**9.32 ab**
Headline @ 900mL Ha^{-1}	**95.22**	**19.09**	**1.36**	**284.7**	**9.54 ab**
Tilt @ 910mL Ha^{-1}	**94.66**	**19.53**	**4.11**	**288.1**	8.48 b
Proline @ 350mL Ha^{-1}	**94.32**	**18.75**	**5.04**	**274.0**	**9.98 ab**
Inspire @490mL Ha^{-1}	**94.28**	**19.31**	**4.59**	**282.5**	**10.71 a**
Caramba @ 980mL Ha^{-1}	**94.85**	**19.32**	**3.67**	**286.1**	**9.34 ab**
Flint @ 250g Ha^{-1}	**95.58**	**18.88**	**2.08**	**283.5**	**9.3 ab**
Senator @ 560g Ha^{-1}	**94.87**	**18.58**	**4.66**	**274.6**	8.28 b
Eminent @ 910L Ha^{-1}	**94.83**	**19.01**	**5.11**	**281.2**	**9.61 ab**

[1] Numbers in **bold** are not significantly different than the best treatment in the same column

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Comments:

Some data may have been transformed to meet the assumptions of statistical analysis; please contact us for more information.

We would like to thank

For further information contact:

Cheryl Trueman, M.Sc 519-674-1646 / ctrueman@ridgetownc.uoguelph.ca

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Evaluation of water volume on the efficacy of products for control of Cercospora leaf spot alone and in combination with Roundup WeatherMax

Location: Ridgetown, Ontario, Canada

Planting Date: 5/4/09 Harvest Date: 11/3/09 Variety: Crystal RR824

Spacing: in-row 11cm, between row 75cm Plot Size: 7m x 2.25m

Applications: 3 apps at 45 DSV, 53 DSV, and 49 DSV

Treatment	Water Vol. (L Ha^{-1})	AUDPC[1]	Yield	
			# Beets	Wt. (kg)
Nontreated control	-	90.9 a[2, 3]	**89.5 ns**[4]	55.55 d
Tilt @ 910mL Ha^{-1}	100	58.7 abc	**96.5**	63.00 bcd
Headline @ 900mL Ha^{-1}	100	**20.8 ghi**	**110.0**	**71.85 abc**
Eminent @ 910L Ha^{-1}	100	**23.4 ghi**	**107.0**	**70.45 abc**
Proline @ 350mL Ha^{-1}	100	33.0 e-h	**101.3**	**70.75 abc**
Senator @ 560g Ha^{-1}	100	85.0 abc	**104.5**	61.20 cd
Flint @ 250g Ha^{-1}	100	52.6 b-e	**106.3**	**71.30 abc**
Tilt @ 910mL Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	65.1 abc	**110.0**	**67.20 abc**
Headline @ 900mL Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	**15.9 i**	**103.3**	**72.00 abc**
Eminent @ 910L Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	**23.7 ghi**	**104.3**	**69.10 abc**
Proline @ 350mL Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	34.9 d-g	**101.0**	**68.30 abc**
Senator @ 560g Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	76.4 ab	**106.5**	**68.30 abc**
Flint @ 250g Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	32.0 fgh	**103.0**	**74.55 ab**
Tilt @ 910mL Ha^{-1}	200	79.4 ab	**94.0**	**65.25 a-d**
Headline @ 900mL Ha^{-1}	200	**25.3 ghi**	**103.8**	**75.45 a**
Eminent @ 910L Ha^{-1}	200	**24.5 ghi**	**177.0**	**73.95 ab**
Proline @ 350mL Ha^{-1}	200	44.7 c-f	**101.8**	**71.90 abc**
Senator @ 560g Ha^{-1}	200	88.3 a	**101.3**	**66.95 abc**
Flint @ 250g Ha^{-1}	200	33.7 e-h	**98.8**	**75.90 a**
Tilt @ 910mL Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	53.4 a-d	**96.5**	**65.30 a-d**
Headline @ 900mL Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	**20.6 hi**	**100.5**	**70.30 abc**
Eminent @ 910L Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	**20.8 hi**	**101.5**	**70.70 abc**
Proline @ 350mL Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	31.2 fgh	**102.0**	**67.50 abc**
Senator @ 560g Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	77.9 ab	**101.5**	**67.75 abc**
Flint @ 250g Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	34.0 e-h	**103.0**	**75.60 a**

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[4] ns = not significant at $P \leq 0.05$, Duncan's new multiple range test

Treatment	Water Vol. (L Ha^{-1})	CJP (%)	Suc (%)	Amino-N	RWST	Sugar Yield (t Ha^{-1})
Nontreated control	100	94.39 bc[1, 2]	**18.80 ns**[3]	**3.14 ns**	**275.3 ns**	7.29 d
Tilt @ 910mL Ha^{-1}	100	94.39 bc	**19.58**	**2.62**	**287.4**	**8.63 a-d**
Headline @ 900mL Ha^{-1}	100	94.74 bc	**19.47**	**3.85**	**287.9**	**9.84 ab**
Eminent @ 910L Ha^{-1}	100	94.31 bc	**19.36**	**2.54**	**283.4**	**9.49 abc**
Proline @ 350mL Ha^{-1}	100	**95.28 ab**	**19.30**	**4.44**	**288.4**	**9.68 abc**
Senator @ 560g Ha^{-1}	100	94.24 bc	**18.75**	**1.12**	**273.6**	7.94 cd
Flint @ 250g Ha^{-1}	100	94.57 bc	**19.24**	**4.42**	**283.3**	**9.58 abc**
Tilt @ 910mL Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	94.77 bc	**18.76**	**4.16**	**277.0**	**8.79 a-d**
Headline @ 900mL Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	**95.79 a**	**19.67**	**0.74**	**292.4**	**9.97 ab**
Eminent @ 910L Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	94.65 bc	**19.90**	**1.36**	**294.2**	**9.65 abc**
Proline @ 350mL Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	94.64 bc	**19.56**	**3.66**	**288.8**	**9.36 abc**
Senator @ 560g Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	100	94.60 bc	**18.70**	**3.54**	**274.9**	**8.94 a-d**
Flint @ 250g Ha^{-1} + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	**95.09 ab**	**19.11**	**3.94**	**284.2**	**10.04 ab**
Tilt @ 910mL Ha^{-1}	200	94.35 bc	**18.54**	**1.25**	**270.8**	8.39 bcd
Headline @ 900mL Ha^{-1}	200	**95.06 ab**	**18.44**	**2.16**	**273.4**	**9.83 ab**
Eminent @ 910L Ha^{-1}	200	94.62 bc	**19.42**	**5.40**	**286.4**	**10.07 ab**
Proline @ 350mL Ha^{-1}	200	**95.11 ab**	**19.43**	**2.50**	**289.4**	**9.84 ab**
Senator @ 560g Ha^{-1}	200	94.76 bc	**18.71**	**5.26**	**276.1**	**8.80 a-d**
Flint @ 250g Ha^{-1}	200	94.67 bc	**19.58**	**5.12**	**289.1**	**10.40 abc**
Tilt @ 910mL Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	94.61 bc	**19.30**	**2.90**	**284.3**	**8.81 abc**
Headline @ 900mL Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	94.72 bc	**19.39**	**2.72**	**286.4**	**9.56 a-d**
Eminent @ 910L Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	94.50 bc	**19.32**	**2.81**	**284.0**	**9.53 abc**
Proline @ 350mL Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	**95.14 ab**	**18.74**	**5.61**	**278.8**	**8.90 abc**
Senator @ 560g Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	94.39 bc	**19.25**	**3.04**	**282.3**	**9.08 a-d**
Flint @ 250g Ha-1 + Roundup WeatherMAX @ 1.66L Ha^{-1}	200	93.82 c	**19.04**	**3.91**	**275.6**	**9.88 abc**

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Comments:

Some data may have been transformed to meet the assumptions of statistical analysis; please contact us for more information.

We would like to thank the Ontario Sugarbeet Growers Association for supporting this research.

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Impact of nitrogen fertility on *Cercospora beticola* disease.

Laura L. Van Eerd and Cheryl Trueman University of Guelph Ridgetown Campus
Ridgetown, Ontario 2009

Trial quality: Good - Phoma and Rhizoc were present in the trial.

Table 1. The effect of N fertility on cercospora disease and sugarbeet yield and quality*.

Treatment								
Variety	N rate	Fungicide	Yield (ton/ac)	Purity (%)	Sugar (%)	RWST	RWSA	Cercospora AUDPC**
Resistant	Full N rate	Full	35.5	94.6	19.9	294.3	10456	13.6
Resistant	Full N rate	None	31.5	94.2	19.7	286.9	9062	6.2
Susceptible	Full N rate	Full	31.1	94.3	19.5	286.2	8932	15.9
Susceptible	Full N rate	None	26.8	94.5	19.7	290.3	7957	36.9
Resistant	No N	Full	27.3	95.0	19.9	296.1	8210	8.9
Resistant	No N	None	22.4	94.9	19.5	290.4	6558	10.6
Susceptible	No N	Full	25.6	95.3	19.9	305.2	7904	10.5
Susceptible	No N	None	24.0	95.0	19.5	290.7	7092	23.9
P value								
		Nitrogen (N)	**0.0016**	**0.0051**	0.5708	0.1715	**0.0014**	0.4382
		Variety (V)	0.2713	0.7086	0.8481	0.7894	0.2047	0.3294
		Fungicide (F)	**0.0489**	0.5640	0.1436	0.1917	**0.0149**	0.3579
		N x V	0.2583	0.6500	0.3955	0.4279	0.5009	0.4563
		N x F	0.9833	0.8490	0.2536	0.3438	0.9596	0.9509
		V x F	0.6911	0.6539	0.9739	0.8775	0.1339	0.1093
		N x F x V	0.5392	0.4011	0.2574	0.2531	0.8211	0.4902

*Within each column, different letters indicate a statistical difference. Data pooled over years.
**AUDPC = Area under the disease progress curve; calculated from disease ratings on 6 occasions throughout the growing season – higher values indicate higher disease.

Planted: May 7
Harvested: November 4th 2009
Susceptible: Crystal 827RR
Resistant: HM9042RR
Plot size: 4 rows x 26 ft x 4 reps
Row spacing:30” with 4” in-row spacing
Other fertilization: 90 lb/ac P and 120 lb/ac K

Summary:
Yield and RWSA were higher with N fertilizer compared to no N, and yield and RWSA were higher with fungicides than without. Purity was higher with no N compared to full fertilizer rate and impurities (not shown) of NH_2 and amino-N were higher with the full N treatment. There were no differences between susceptible and resistant varieties. There were no differences among treatments for the total level of cercospora leaf spot observed. **The results suggest no interactions between N fertility and cercospora disease pressure.** However, cercospora disease pressure was relatively low this season and the trial should be repeated in order to confirm results.

Control of Cyst Nematodes with Vydate

Bay City, MI
2009

Trial Quality: Fair-Good

Treatment Name	Rate	Rate Unit	Appl* Description	$/ Acre	RWSA	RWST	Tons/ A	% Suc	% CJP	B/100ft 7-7	Nem #/100 cc
Untreated Beta 1643N				890	5061	237	21.4	16.4	94.1	218	45.0
Temik 15G	25	lbs/a	In-Furrow	711	4589	223	20.6	15.5	94.3	197	26.7
Untreated Beta 17RR32				791	4498	224	20.1	15.5	94.5	216	60.0
Vydate C-LV	2	qts/a	In-Furrow	709	4485	228	19.6	15.7	94.7	200	20.0
Vydate C-LV	1	qts/a	Band 14 Day								
Vydate C-LV	1	qts/a	Band 28 Day								
Vydate C-LV	1	qts/a	Band 14 Day	705	4464	228	19.6	15.8	94.4	204	60.0
Vydate C-LV	1	qts/a	Band 28 Day								
Vydate C-LV	1	qts/a	Band 42 Day								
Vydate C-LV	1	qts/a	Band 56 Day								
Vydate C-LV	2	qts/a	In-Furrow	677	4416	226	19.6	15.6	94.5	212	25.0
Vydate C-LV	1	qts/a	Band 14 Day								
Vydate C-LV	1	qts/a	Band 28 Day								
Vydate C-LV	1	qts/a	Band 42 Day								
Average				747	4586	227.5	20.2	15.7	94.4	207.7	39.4
LSD (P=.05)				75.4	463	7.2	1.9	0.4	0.7	13.9	44.2
CV%				9.9	9.9	3.1	9.2	2.3	0.7	6.6	74.0

Planted: May 13, 2009
Harvested: September 22, 2009
The variety used was Beta 17RR32.

* Banded trts: days after emergence

Summary

Vydate at 2 qt/A applied infurrow followed by two postemergence banded applications of Vydate at 1 qt/A lowered nematode counts compared to the untreated check. Temik at 25 lbs/A also appeared to lower nematode numbers. Vydate applied only post emergence was less effective. The nematode variety, B 1643N produced the highest yield. The nematode population was low to moderate. None of the Vydate treatments caused delayed or reduced stand establishment.

Rhizomania and Sugarbeet Cyst Nematode Survey of Ontario Sugarbeet Production Region - 2006-2009

Principal Researcher: Janice LeBoeuf, Vegetable Crop Specialist - Ontario Ministry of Agriculture, Food and Rural Affairs, Ridgetown, ON
Collaborators: Ron Pitblado, Ridgetown Campus - University of Guelph (former); Tom Welacky, Agriculture & Agri-Food Canada; Christian Krupke, Ridgetown Campus - University of Guelph (former); Cheryl Trueman, Ridgetown Campus - University of Guelph
Research Technicians: Phyllis May, George Stasko

Background

Rhizomania, caused by Beet Necrotic Yellow Vein Virus (BNYVV) and vectored by the fungus *Polymyxa betae* Keskin, was first identified in North America in 1983 in California. It has since spread to all of the U.S. sugarbeet growing regions, most recently the Great Lakes growing region, where it was positively identified in some Michigan counties in the fall of 2002. The disease was already widespread at that time.

Rhizomania is regarded as one of the most destructive of sugarbeet diseases. It can severely reduce tonnage and sucrose levels. The soil fungus that transmits the BNYVV is found in all sugarbeet growing regions of the world, and the virus has now spread to most areas as well. The disease is very infectious; a small amount of soil can start an infection which will eventually spread throughout a field. Once present, it cannot be eradicated, so it is important that management practices be used to slow its spread and reduce its impact. The disease can be present in a field for many years before symptoms are evident. In the meantime, it can be unwittingly spread by normal farming operations.

Sugarbeet cyst nematode (SBCN) is another destructive soil-borne pest of sugarbeets. SBCN has not been reported on sugarbeets in Ontario since the crop was reintroduced to the province in 1996 after about a 30 year absence. According to Michigan information, a population of 100-200 SBCN eggs per 100 cm^3 of soil can reduce the yield of susceptible sugarbeets. The use of resistant varieties and long crop rotations can reduce the impact of SBCN in infested fields. It is important to know if this nematode is present in the Ontario growing areas, so that growers can make appropriate management decisions.

We sampled sugarbeet fields across the Ontario growing area in 2006-2009 to determine if these pests were present, and if so, how widely distributed. If these pests are detected early, growers will be able to implement management practices to slow their spread and minimize impacts on yield and quality. If successful, this could reduce or delay the impacts of rhizomania and sugarbeet cyst nematode in the region.

Examples of mitigation practices for sugarbeet rhizomania

Reduce spread:
- minimum 4-yr crop rotation
- work infected fields last
- wash equipment
- manage tare dirt

Minimize impacts:
- use resistant varieties
- minimum 4-yr crop rotation
- early planting

Sugarbeets are produced on about 10,000 acres in Ontario. The value of the Ontario sugarbeet crop is approximately USD9.1 million (2006-2008). Using annual exchange rates (Bank of Canada), this is approximately $10 million in Canadian currency.

Project Objectives

- Determine if the rhizomania disease complex is present in Ontario by sampling a representative number of sugarbeet fields over 4 seasons.
- Determine if sugarbeet cyst nematode is present in the Ontario sugarbeet growing area by sampling a representative number of sugarbeet fields over 4 seasons.
- If rhizomania and/or sugarbeet cyst nematode are found, prepare educational materials and presentations for growers and crop consultants on preventing the spread of these pests and on managing the pests.

Method

In 2006, fields that were in sugarbeets for the third time (since 1996) were sampled, along with a random sampling of fields that were in sugarbeets for the first or second time, for a total of 95 fields. In 2007, 2008, and 2009, only fields that were in sugarbeets for at least the third time were sampled: 81 fields in 2007, 47 fields in 2008, and 59 fields in 2009.

The protocol to collect and test soil samples from sugarbeet fields for the BNYV virus was provided by W. Wintermantel, USDA-ARS (personal communication). Soil sampling took place from late June through September. Soil samples were used to grow rhizomania-susceptible sugarbeet seedlings in pots in the greenhouse facilities at Ridgetown Campus. Seedlings from each pot were washed and roots were tested using a Compound Direct ELISA test system for Beet Necrotic Yellow Vein Virus (Agdia Inc.). Testing was conducted by Ridgetown Campus technicians or Agdia Inc.

The remaining sugarbeet seedlings from the rhizomania screening were washed and examined for evidence of SBCN. Examinations were made between 30 and 60 days after planting in 2006 and at about 60 days after planting in 2007-2009.

Sugarbeet root samples were also taken from each field included in the survey. The roots were examined for nematode cysts.

The project also included provision to sample fields with symptoms that might indicate the presence of rhizomania or SBCN, but there were no reports of suspicious symptoms in any of the four years.

Results and Summary

A total of 282 fields were screened over four years. In 2009, four samples had insufficient seedling growth and were not tested for BNYVV. All of the tested samples were negative for Beet Necrotic Yellow Vein virus, the virus that causes Rhizomania.

No evidence of sugarbeet cyst nematode was found on sugarbeet root samples or on sugarbeet seedlings grown in soil from the sampled fields.

To date, sugarbeet rhizomania or sugarbeet cyst nematode have not been detected in the Ontario sugarbeet growing region.

Seedling Disease Survey in Michigan:

Linda Hanson, J. Mitch McGrath USDA-ARS and Rachel Naegele Michigan State University

Disease Survey: Samples have been collected of diseased seedling for two years. In 2008, samples were collected from six MI grower fields and 1 research field, 3-5 beets per field. In 2009, 17 MI beet fields were sampled, 3-5 beets per field. Results showed that many pathogens are present in MI grower fields and that growers should be aware of the specific seedling disease causing organisms potentially affecting their stands.

Table 1: Percent of fields sampled that contained indicated organisms in each of two years.

Pathogen	**2008**	**2009**
Rhizoctonia solani	100%*	30%*
Aphanomyces cochlioides	50%	73%*
Fusarium spp.	67%*	47%*
Pythium spp.	14%	40%
Phoma betae	28%	18%
Alternaria spp.	0%	18%

* Indicates that fungus was isolated from more than half of the beets in one or more fields that year and was the sole fungus isolate from the majority of beets in at least one field in the year.

Rhizoctonia solani isolates were further characterized to anastomosis group (AG). Of the *R. solani* collected, the majority of isolates (84%) were AG-2-2, traditionally associated with crown and root rot (CRR), and 15% were AG-4 (prior to 2000 reported as the primary seedling pathogen). One isolate belonged to another AG group.

In greenhouse and/or laboratory tests, MI seedling isolates of *R. solani* (both AG-4 and AG-2-2), *Fusarium oxysporum*, *Pythium*, *Aphanomyces*, and *Phoma* all caused damping-off of seedlings. All could kill some beet varieties, and reduced growth or weakened others.

One other pathogen has recently been identified as a potential seedling problem in MI. A sugar beet seed lot was found with very poor emergence. When seeds were tested, *Rhizopus stolonifer* was isolated. This pathogen can cause pre-emergence losses in other crops, such as cotton and peanut. Tests in the lab and greenhouse showed reduced seedling emergence of some sugar beet varieties when exposed to *R. stolonifer*. Preliminary field tests showed a reduction in seedling emergence of some varieties in the field when plots were inoculated with *R. stolonifer* at planting. *R. stolonifer* was isolated from ungerminated seeds and seeds which had died shortly after germination started.

TOPPING IMPACT ON QUALITY

Richmond Brothers Farms, LLC

Location:	Pigeon, Huron Co.	**Tillage:**	—
Variety:	HM-27RR	**Spacings:**	—
Planting Date:	—	**Harvest Date:**	—
Previous Crop:	—	**Sample Date:**	—
Soil Type:	—	**Herbicides:**	—
Fertilizer:	—	**Replicated:**	6x
		Fungicide:	—

TREATMENT	REV / TON	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP
Good Topping	**$40.29**	**—**	**286**	**—**	**19.0**	**95.9**
Bad Topping	**$39.71**	**—**	**282**	**—**	**18.8**	**95.7**
AVERAGE	**$40**	**—**	**284**	**—**	**18.9**	**95.8**
LSD (5%)	**—**	**—**	**7.5 NS**	**—**	**0.3 NS**	**0.8 NS**
C.V. (%)	**—**	**—**	**2**	**—**	**1.1**	**0.6**

TRIAL RELIABILITY: **Very Good**

EMERGENCE:	Excellent	**CERC. LEAF SPOT:**	Excellent
RHIZOCTONIA:	Low	**NEMATODES:**	Not Detected
QUADRIS APP:	2-4 Leaf	**WEATHER:**	Ideal Harvest Conditions

Comments: Trial was conducted to evaluate beet quality impact from poor topping. Richmond's were asked to do the best job topping they could and to do a fairly poor job (See centerfold pictures). Twelve sugar samples for each treatment were taken from the harvester. The trend was for reduced quality by 4 lbs/ton, 0.2% sugar, and 0.2% CJP. The difference in % sugar was significant at the 80% confidence level. Sugar samples were sawed down the center of the beet and the quality difference maybe larger if saw sections closer to the edge of the beet were included with the juice sample. The revenue per ton is based on a $40/ton payment and an "average RWST" equal to the trial average of 284. The $0.58 difference per ton is equal to $14.50/acre at 25 tons/acre or $1450 per 100 acres. **Poorly topped beets will have the additional issues of storability and increased pile repiration.**

Defoliation Effect on Sugarbeet Quality

St. Louis, MI
2009

Trial Quality: Good

Treatment	$/Acre Based on 25 Tons/A	RWST	% Sugar	% Purity	Amino N*
No Green Tops	1018	251.7	17.7	93.4	5.5
1/4 Beets with Green Tops	1001	247.6	17.4	93.3	6.7
1/2 Beets with Green Tops	979	242.0	17.2	92.8	6.8
All Beets with Green Tops	1002	247.6	17.3	93.5	5.4
Average	1000	247.2	17.4	93.3	6.1
LSD (P=.10)	23.2	4.73	0.27	0.65	1.10
CV	1.9	1.9	1.5	0.7	17.5

Averaging 3 Poor Defoliation Treatments

Treatment	$/Acre Based on 25 Tons/A	RWST	% Sugar	% Purity	Amino N*
No Green Tops	1010	251.7	17.7	93.4	5.5
Poor Defoliation	989	246.4	17.3	93.2	6.3
Average of 3 above					
Average	1000	249.1	17.5	93.3	5.9
LSD (P=.05)		5.7	0.3	0.8	1.4
CV		1.5	1.2	0.6	16.1

* A lower number is better.

Summary

Poorly defoliated sugarbeets were hand trimmed in the Good Defoliation treatment. In both ways of looking at the data there is a loss in RWST and $/acre from poor defoliation.

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Defoliation Effect on Sugarbeet Quality

From Piled Sugarbeets

2009

Treatment	$/Acre Based on 25 Ton/A	RWST	% Sugar	% CJP
Good Defoliation	1022	278.8	18.8	94.9
(No green tops)				
Poor Defoliation	1000	272.7	18.5	94.7
(Some green tops)				
Average	1011	275.8	18.7	94.8
LSD (P=.05)	11.9	3.2	0.1	0.3
CV	1.8	1.8	0.9	0.6

Summary

Sugarbeets were gathered from piles in Bay City. The roots were sawed as found for the Poor Defoliation treatment. For the Good Defoliation treatment the green was removed from the sawed root halves and sawed again. The poorly defoliated sugarbeets lost significant levels of sugar, purity and $22 per acre based on a 25 ton crop.

CLOVER COVER CROP
LAKKE Ewald

Location:	Unionville, Tuscola Co.	**Tillage:**	Fall Chisel, Spring Field Cult 1x
Variety:	B-17RR32	**Spacings:**	Rows - 22", Seed - 66,000 ppa
Planting Date:	4/9/2009	**Harvest Date:**	10/15/2009
Previous Crop:	Wheat / Clover Cover Crop	**Sample Date:**	10/12/2009
Soil Type:	Loam	**Herbicides:**	Glyphosate 2x
Fertilizer:	2x2: 40 Lbs N by 28% 36-57 Lbs N Variable Rate MAP & Potash Variable Rate	**Replicated:**	2x
		Fungicide:	Proline (52 DSV) Gem (123 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP
Wheat with Clover Cover Crop	**$1,079**	**8054**	**291**	**27.7**	**19.0**	**96.8**
Wheat without Clover	**$904**	**6578**	**291**	**22.6**	**19.0**	**96.5**
AVERAGE	**$991**	**7316**	**291**	**25.1**	**19**	**96.6**
LSD (5%)	—	**229**	**55 NS**	**5.7 NS**	**5.3 NS**	**5.6 NS**
C.V. (%)	—	**0**	**2**	**1.8**	**2.2**	**0.5**

TRIAL RELIABILITY: Excellent

EMERGENCE:	Good	**CERC. LEAF SPOT:**	Good
RHIZOCTONIA:	Low	**NEMATODES:**	Detected
QUADRIS APP:	4-6 Leaf	**WEATHER:**	Good

Comments: Trial was conducted to look at the impact of a clover cover crop when sugar beets follow wheat. Two strips in the field were not seeded with clover and were left as stubble after the wheat harvest in 2008. The clover was frost seeded in March and disk chisel plowed in November. The clover cover crop greatly enhanced yield and led to a larger greener canopy. The non clover strips had a smaller canopy and appeared to be nitrogen deficient, likely due to low N minerialization and nematode issues. Both strips had equal amounts of nitrogen fertilizer added. Good clover cover crops are estimated to supply 60 - 80 lbs of nitrogen and improve soil quality. If the non clover strips had not been nitrogen deficient, the yield difference probably would not have been so dramatic. Revenue is based on a payment of $40/ton, clover cost at $2.20/lb, seeding rate of 10 lbs/acre, and a $7.50 seeding cost.

Cover crops with reduced tillage in Roundup Ready sugarbeet

Christy Sprague and Gary Powell, Michigan State University

Location: East Lansing	**Tillage:** Spring strip till and no-till
Cover Crop Planting Date: October 10, 2008	**Strip-tillage Date:** March 27, 2009
Sugarbeet Planting Date: May 5, 2009	**Herbicides:** see treatments
Soil Type: Clay loam; 3.2 OM; pH 7.0	**Variety:** Hilleshog 9027
Replicated: 4 times	**Population:** 4 3/8-inch spacing

Table 1. Effect of glyphosate timing, cover crop and tillage on sugarbeet yield

	RECOVERABLE WHITE SUGAR PER ACRE			
	Wheat Cover Crop		No Cover Crop	
Roundup PowerMax timing[a,b]	Strip-till	No-till	Strip-till	No-till
	lb/A			
14 EPP	8720 ab[c]	7399 bc	9716 a	7203 bc
At Plant	7135 bc	5922 cd	8425 ab	5736 cd
EPOS	4336 d	3698 d	8551 ab	6110 cd

[a] Roundup PowerMax (glyphosate) was applied at 22 fl oz/A + ammonium sulfate (AMS) at 17 lb/100 gal

[b] Timing is the initial time of glyphosate application, EPOS applications were 2-weeks after planting. Two additional broadcast applications of Roundup PowerMax were made to control late-season weeds.

[c] Means in each column followed by the same letter are not significantly different at $P \leq 0.05$

Summary: Over the last two seasons we have conducted research to evaluate strategies utilizing cover crops (oat, winter wheat, oriental mustard, and oilseed radish) and reduced tillage systems (no-till and strip-tillage) in Roundup Ready sugarbeets. The objective of this experiment was to evaluate weed control, sugarbeet stand establishment, yield and quality in these different systems. Results from our preliminary 2008 study indicated cover crop type had a significant effect on weed control. We also observed cover crop, tillage and glyphosate application timing by cover crop effects on sugarbeet yield. Overall results in 2008 showed that treatments with no cover crop and no-tillage out yielded the strip-till and cover crop treatments. In 2008 strip-tillage treatments were established 2-weeks prior to sugarbeet planting, due to availability of the equipment. In 2009 with funding from Michigan Sugar Company we adjusted some of the treatments and lengthened the time between strip-tillage and sugarbeet planting. In 2009 strip-tillage with no cover regardless of initial glyphosate timing or controlling the wheat cover crop 2-weeks prior to planting with strip-tillage were our highest yielding treatments (Table 1). We have planted cover crops this fall at the new Saginaw Valley Research and Extension Center and will continue this research in 2010.

Zone Till vs. Chisel Plow Trial

Clay Crumbaugh

Location:	Gratiot County	**Tillage:**	Disk Chisel Plow vs. Zone Till Spring: Stale Seed Bed for Both
Variety:	HM-28RR		
Planting Date:	4/10/2009	**Harvest Date:**	11/6/2009
Previous Crop:	Soybeans	**Sample Date:**	10/26/2009
Soil Type:	Loam	**Herbicides:**	Glyposate 3x & Dual Magnum
Spacings:	Row - 30", Seed - 3 7/8"	**Replicated:**	4x
Fertilizer:	Starter: 263 Lbs 12-12-12 with 11 S - 2 Mn - 0.5 B, 19 Gal. 28% Pre-emerge	**Fungicide:**	Eminent (58 DSV) Headline (107 DSV)

TREATMENT	REV / ACRE	RWSA	RWST	TONS / ACRE	% SUGAR	% CJP	FINAL POP. 100 Ft. of Row 30 DAY
Fall: Zone Till Spring: Stale Seed Bed	$1,046	7721	289	26.7	19.1	96.1	211
Fall: Disk Chisel followed by Field Cultivator Spring: Stale Seed Bed	$1,032	7683	290	26.5	19.2	95.9	220
AVERAGE	----	7702	289	26.6	19.1	96.0	215
LSD (5%)	----	401 NS	6 NS	1.2 NS	0.3 NS	0.2 NS	28 NS
C.V. (%)	----	2	1	2.0	0.8	0.1	11

TRIAL RELIABILITY: Excellent

EMERGENCE:	Excellent	**CERC. LEAF SPOT:**	Excellent Control
RHIZOCTONIA:	Low / Moderate	**NEMATODES:**	None Detected
QUADRIS APP:	4 - 6 Leaf	**WEATHER:**	Heavy April Rains otherwise Good

Comments: Trial was setup with GPS guidance in 30 row blocks. Entire blocks were harvested using truck weights for each 6 row strip. Strips that had tracks from the sprayer were not used to increase the accuracy of the data. Brillion zone tillage tool had a shank depth of 16" (See centerfold pictures). All planting was done with no spring tillage into a stale seed bed. Cost estimates used in revenue calculation: Disk Chisel = $18.00, Field Cultivator = $12.00, Zone Tillage = $21.00. Revenue calculation used a $40 / ton payment and an "Average RWST" equal to the trial average of 289. No significant difference was found in any measurement category.

SPRAYER TRACK COMPACTION IMPACT ON YIELD

Clay Crumbaugh

Location:	Breckenridge, Gratiot Co.	**Tillage:**	Disk Chisel Plow vs. Zone Till Spring: Stale Seed Bed for Both
Variety:	HM-28RR		
Planting Date:	4/10/2009	**Spacings:**	Row - 30", Seed - 3 7/8"
Previous Crop:	Soybeans	**Harvest Date:**	11/6/2009
Soil Type:	Loam	**Herbicides:**	Glyposate 3x & Dual Magnum
Fertilizer:	Starter: 263 Lbs 12-12-12 with 11 S - 2 Mn - 0.5 B, 19 Gal. 28% Pre-emerge	**Replicated:**	7x
		Fungicide:	Eminent (58 DSV) Headline (107 DSV)

John Deere 4720, 800 Gallon Self Propelled Sprayer, 36 Rows

TREATMENT	TONS / ACRE
Sprayer Strips - 12 Row Strips	**24.8**
Non Sprayer Strips - 12 Row Strips	**26.4**
LSD (5%)	**0.9**
C.V. (%)	**2.7**

The yield loss due to the sprayer on a per acre basis for a 36 row sprayer was 2% or 0.52 ton/acre in 26 ton beets.

If the sprayer was 48 rows and caused the same damage, the loss would have been 1.5% or 0.39 ton/acre.

Comments: This data was taken from the Zone-Till trial that was done by Clay Crumbaugh. The trial harvested 45 consecutive strips using truck weights. This data is a comparison of strips that were used for spraying to adjacent strips that were not used for spraying. There were 7 trips made with the sprayer for fertilizer (1), herbicide (3), and fungicide (3) applications. All trips were made in the same track. Clay felt like none of the trips were done when soil conditions were very wet. He described the soil compaction caused as light to moderate as compared to what is seen with this sprayer. Both the sprayer and planter are equipped with RTK to avoid running on rows.

A Primer on Sugarbeet Breeding and Genetics

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Growers, agriculturalists and researchers are acutely aware of the performance of different sugar beet varieties in their areas. In Michigan, research on variety performance is conducted by Michigan Sugar Company as part of its variety approval system. Seed companies submit their most promising materials for variety testing, and of these, a few may be approved according to publicized selection criteria. This primer is intended as an introduction from a breeding standpoint. Considerations include the history of the crop, the genetics of breeding and agronomic characters, and the potential impact of new technologies. It is probably well understood that breeding new varieties is a time-consuming effort, often taking in excess of 10 years before germplasm with new characters is available to growers in new varieties.

History of the Crop

Sugar beet is one of the newer crops of significant economic importance and is a product of the Industrial Revolution. During the latter half of the 18th century, sucrose was discovered in roots of red and white beets used for animal fodder. Subsequently, beets with higher sugar levels were selectively bred, measures for the cultivation of beets for sugar were described, an extraction process was developed, and the first sugar factories were constructed.

Sugar beet is classified as *Beta vulgaris*, which includes fodder beet, red beet, Swiss chard and a wide variety of wild forms found around European and Mediterranean coastlines collectively known as subspecies *maritima* types. Most *Beta vulgaris* types are diploid with 18 chromosomes in each cell (however some sugar beet varieties are triploids). There are few or no barriers to cross fertilization among these types. The *maritima* types have contributed some of the most valuable disease resistances including resistance to *Cercospora* leaf spot and the rhizomania virus, and they have the potential to contribute a great deal more.

The majority of varieties grown today trace back to the early selections performed during the late 18th and early 19th centuries, probably originated from fodder beets grown in Poland from a type known as White Silesian beet. At that time, fodder beets and red beets were grown for animal feed and human consumption, a practice originating in the Middle Ages. Leafy beets (similar in use to Swiss chard types of today) were grown in gardens of Babylon and ancient Egypt, and these were the ancestors of all cultivated beets. During their early history, hybridization with wild beets undoubtedly occurred naturally. New types were probably selected from the progeny of these inadvertent out-crosses. While a great deal of genetic variation exists within *Beta vulgaris*, the germplasm base of sugar beet is a relatively narrow.

Breeding Sugar Beet

Sugar beet is biennial. Vegetative growth during the first year is geared towards bulking storage reserves, mainly sucrose in the roots, for the following year's reproductive growth. Sugar beets behave as a perennial if flowering is not induced. Induction of flowering occurs after a period of cool temperatures and long nights, a process known as vernalization that can occur at any time during the plant's growth and can be problematic for growers who plant their crop too early, leading to plants 'bolting' in the field accompanied by a loss of sucrose yield.

In practice, beets harvested from selection plots are placed in a 4 ^{o}C cooler for 12 – 16 weeks to effect vernalization. Flowering commences within five weeks after removing the plants from vernalization. In most commercial U.S. seed production, which takes place almost exclusively in the coastal valleys of Oregon, seeds are field planted in late summer and plants vernalize *in situ* during winter with little risk of freezing. Flowering, seed set and seed harvest is complete by August of the second year in the field. In the greenhouse, it is possible to obtain seed for testing the year following field selection of mother roots.

Beets have perfect flowers. Beets are wind pollinated. A complex self-incompatibility system serves to limit pollen germination and growth when it lands on its own flower, but there are a number of exceptions that allow self-fertilization. These exceptions, such as pseudo-self-fertility and genetic self-fertility, are often used for breeding purposes. In all cases, commercial seed is obtained in isolation plots separated by at least one mile from one another to prevent excessive pollen contamination from other varieties.

Beet seed is unusual from a botanical standpoint. The seed that is planted is actually the entire flower, which develops into a woody fruit, and is been polished and graded, and more recently primed and coated. Priming occurs when seeds are imbibed and then dried before the radicle emerges. Within the fruit or seedball (botanically a utricle) are one (monogerm seed) to five seeds (multigerm seed) that arise from the fusion of separate flowers borne in the leaf axils.

All commercial seed used in developed countries is monogerm. Monogermity is a single gene character expressed by the seed parent. Multigerm pollinators are used as pollinators for hybrids due to their higher vigor and ease of mass selection for disease resistance, in particular. The monogerm character is one of the few recessive genes common in breeding programs. Two other recessive genes are required that result in CMS (Cytoplasmic Male Sterility) in a sterile cytoplasm. Incorporating these three genes is one of the bottlenecks in developing better seed parents for hybrid varieties. Prior to the development of CMS and maintainer lines 50 years ago, commercial seed was open pollinated multigerm varieties.

Hybrids are made using a system of cytoplasmic male sterility (CMS). In this system, normal pollen development is disrupted by an unknown mechanism associated with a defect in the mitochondria (the energy producing machines of the cell). Mitochondria are inherited maternally and only the seed parent will contain, in this case, a sterile cytoplasm. For CMS to be expressed, two genes present in the cell's nucleus must be recessive. If either of these genes is dominant or the cytoplasm is normal, the plant will be pollen fertile. Generally, male sterile CMS lines are maintained by crossing with a similar genotype with a normal cytoplasm. These are known as maintainer or O-type lines. For each CMS, there needs to be a corresponding O-type line.

In hybrid seed production, monogerm CMS pollen-sterile seed parents are inter-planted with fertile monogerm or multigerm pollen donors. Seed is harvested exclusively from the CMS line. Because monogerm is expressed by the seed parent, all hybrid seed will be monogerm.

Seed parents must have at least these four characteristics to be useful; monogerm, CMS, lacking two nuclear restorer genes and have an O-type maintainer line. Together, a great deal of effort and expense is expended in identifying suitable seed parent lines. Coupled with the requirements for high sucrose and high tonnage yields, perhaps the most difficult phase of sugar beet breeding is producing good seed parent lines. If disease resistance needs to be homozygous (i.e. with two copies of the gene) in the hybrid, such traits also need to be incorporated in the seed parent.

Genetics of Agronomic Characters in Sugar Beet

Sugar beet breeding for agronomic characters has relied mainly on mass selection. This strategy works well for traits that are easily scored and relatively insensitive to environmental fluctuations. A variation on this theme, recurrent selection, has been practiced to some extent. With this method, selections are made and crossed with a common parent. The progeny are evaluated and the best performing families or lines are identified. Those seed parents whose progeny showed high performance are then inter-crossed and advanced to another round of selection. Frequently, progeny testing occurs with a promising pollinator crossed with a series of CMS testers.

Performance is measured in various ways. Agronomic characters such as sucrose percent and yield are measured at the end of the growing season. Disease nurseries are employed to evaluate performance under disease pressure. Visual evaluations for the number of crowns and sprangled roots, relative vigor, color, shape and smoothness of the roots are sometimes performed.

In general, breeding data typically collected in many breeding programs has been insufficient for examining the genetics of agronomic traits. Unfortunately, what information is available is often dated or inadequate and a re-examination of these questions with the more precise methodologies available today should be a high priority. A brief summary of the number of genes controlling a trait as well as their proposed mode of gene action is given below.

Sucrose: Percent sucrose in beets ranges from 4-6% in some wild species and up to 20% or more in elite sugar beet germplasm. Vegetable beets (red beet and Swiss chard) are generally intermediate in sucrose concentration, a range of 6-10% is commonly seen. Increasing the percent sucrose in sugar beet from intermediate to high levels occurred perhaps within the first 50 years of the sugar beet breeding. The inheritance of sucrose concentration has been show to be highly heritable and amenable to mass selection. Among crosses of sugar beets and other types, it was inferred that three or four genes control sucrose concentration.

Yield: Yield, either expressed as weight of the beet or per unit area, is an unpredictable trait. From progeny of high yielding beets, as well as from progeny of low yielding beets, both high and low yielders can be retrieved, indicating non-additive gene action. In practice, high yielding hybrids must be determined through trial and error by crossing seed parents with many prospective pollen parents to determining a parent's combining ability, and is a laborious and expensive task.

Disease resistance: Disease resistance in beets is generally dominant in its expression, due to the nature of the breeding system. Many resistances are controlled by dominant genes at more than one locus. For example, tolerance to the most prevalent type of *Cercospora* leaf spot is controlled by at least five independent genes. Similarly, tolerance to *Rhizoctonia* root rot is controlled by two or more genes. From these numbers it is clear that breeding for *Rhizoctonia* tolerance should be easier than breeding for *Cercospora*. In practice, this appears to be the case. For other major diseases, the pattern of inheritance is not as clear. Exceptions include that of rhizomania resistance where a single dominant gene is being widely used as well as a single gene for resistance to the beet cyst nematode. With the exception of *Rhizoctonia* tolerance, each of these resistances can be traced back to an origin from wild beets or other species. Resistance to other diseases, sometimes near immunity, has been identified among the wild species and it is not clear whether these resistances are the same or different from the ones currently in use.

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