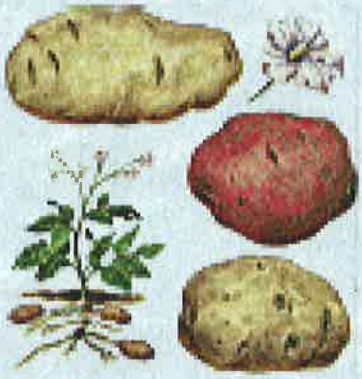
2008
RESEARCH REPORT

Potato Disease Control Project



Robert Davidson
&
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SLV Research Center

CONTENTS

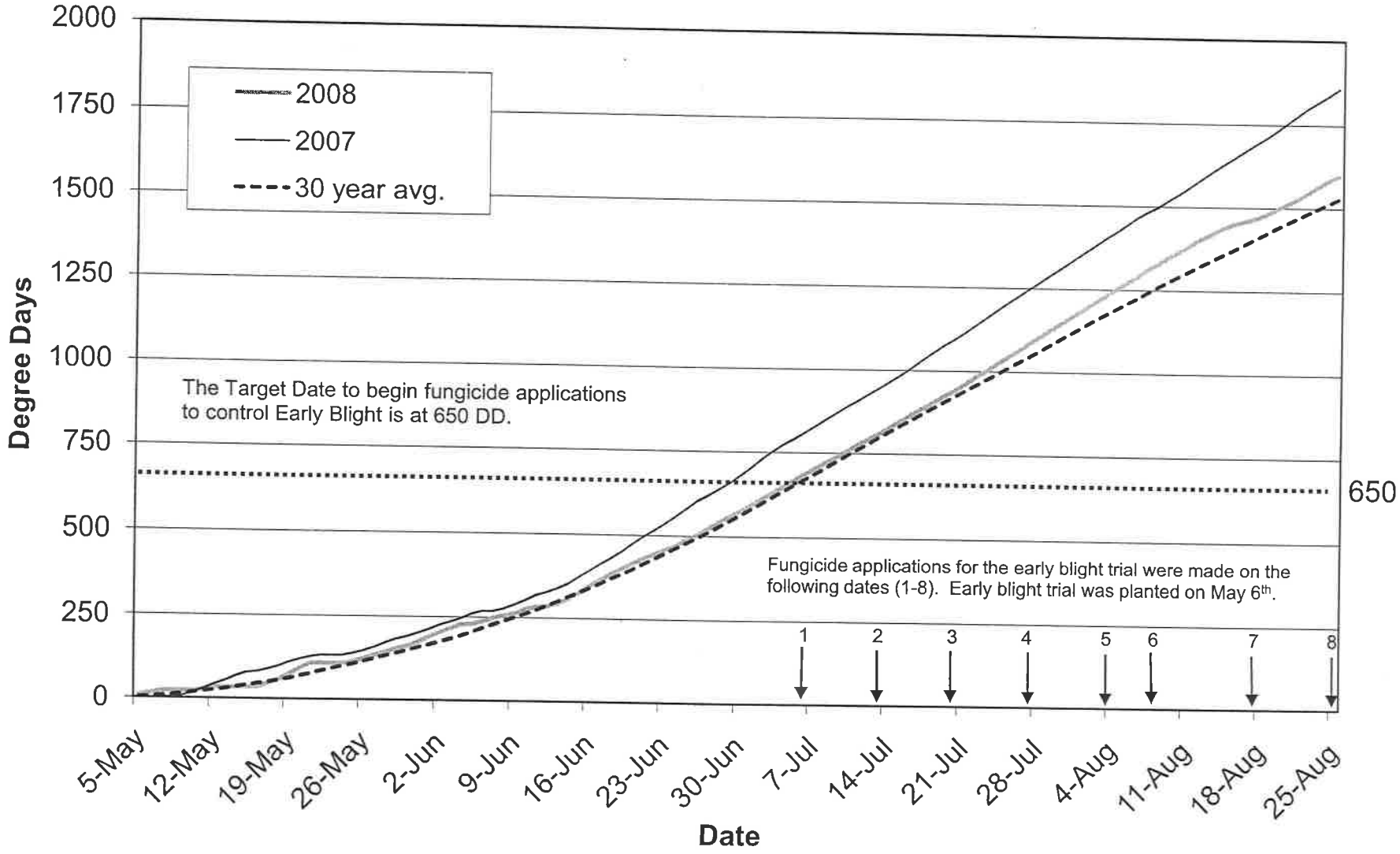
Early Blight Fungicide Trials

Research in previous years has shown that strobulirin products (i.e. Headline, Quadris, etc.) worked well in controlling early blight. Spraying schedules that include two or three fungicide applications during the season (with at least one of the fungicides being a strobulirin), starting once degree days for early blight have been reached and continuing fungicide applications every 14 to 21 days, have worked well in the San Luis Valley. Other products such as Endura, Bravo, Dithane, Polyram, Super Tin, and various numbered compounds have also had some success in controlling early blight, depending on application timing and which of the additional fungicides were used.

When yields (cwt/A) are analyzed for the early blight trial, a significant difference is typically not observed between the untreated control and the different treatments within a given year, even when disease levels are significantly lower in the treatments than in the control. However, when three years of early blight trial data were analyzed, the yields from the untreated controls was significantly less than several of the fungicide treatments. This indicates that when an effective fungicide program is used to control foliar early blight, yields tend to be improved.

In 2008, the overall AUDPC (Area Under the Disease Progress Curve) was less in the untreated control than in previous years and the difference between the untreated control and the fungicide programs was less than in previous years in the foliar early blight trial. This may be due to the increased threat of late blight in the SLV this year. As a result of this threat, late blight fungicides were applied more regularly by potato producers in 2008 than in previous years. Since many of these fungicides also control early blight, overall inoculum levels in the SLV were reduced. Lower overall inoculum levels may explain the lower AUDPC values observed in the foliar early blight trial this year.

Early Blight Degree Days for the San Luis Valley



2008 POTATO – FOLIAR EARLY BLIGHT FUNGICIDE TRIAL

Researchers:	Rob Davidson and Andrew Houser, Colorado State University, SLVRC
Location:	San Luis Valley Research Center, Center, CO
Cultivar:	Russet Norkotah Selection 8, cut seed, 2-4 oz.
Application:	All treatments applied using an R & D CO_2 charged tractor mounted plot sprayer with four XR 8002VS nozzles spaced seventeen inches apart at 60 psi pressure and applying 40 gallons/acre as a broadcast application.
Spray Dates:	July 7; July 14; July 21; July 28; August 4; August 8; August 18; August 28
Planted:	May 6, 2008
Plot Design:	Randomized complete block
Plot Size:	4 - 20 foot rows per treatment per replication, treatments applied to center two rows and data was taken on center two rows.
Plant Spacing:	12 inches
Row Spacing:	34 inches
Replications:	Four
Irrigation:	Solid set sprinkler, rate based on ET
Fertilizer:	80N-60P-40K-25S-2.5Z, preplant, 60N through sprinkler after tuber set
Herbicide:	Matrix, 1.5 oz./A + Eptam, 4.5 pt./A
Insecticide:	None
Vine Killer:	Rotobeat vines on September 2, 2008
Harvested:	September 25, 2008

DATA:

Disease: Early blight disease incidence based on percent leaves infected, readings taken weekly starting August 6, 2008. Due to high Early Blight incidence at the date of the last two disease readings (August 21st and August 28th), a vigor reading was also taken (1-5, 1 = low vigor & 5 = high vigor).

AUDPC: **Area Under the Disease Progress Curve (AUDPC) is a measure of the progression of Early Blight, starting on August 6th and ending with the last reading on August 28th. AUDPC gives a better idea of the total amount of Early Blight in a plot during this time period, rather than just looking at the weekly percent incidence. The total AUDPC for the control plot (1) indicates the total amount of Early Blight that was present if no fungicides were used to suppress disease. The other treatments should be compared with the control to determine the effectiveness at reducing the disease. AUDPC is based on total percent leaflets infected with Early Blight, with readings taken on a weekly basis.**

Yield: 2-20 foot rows per treatment per replication, total yield expressed as cwt/A.

Grade: By hand, percent tubers by weight in kilograms < 4 oz., 4-10 oz., > 10 oz., US # 2's, and culls.

Table 1. Fungicide programs evaluated for early blight control, San Luis Valley, Colorado 2008.

Program	Products	Rate	Application Schedule[a]
1	Untreated Control	-	-
2	AEC656948 + PYM	11floz./A	1,3,5,7
3	USF2015A	5.0 floz./A	1,3,5,7
4	Scala 60SC	7.0 oz./A	1,5
	Echo ZN	1.5 pt./A	1,5
	Echo ZN	2.125 pt./A	3,7
5	Echo ZN	2.125 pt./A	1
	Scala 60SC	7.0 floz./A	3
	Echo ZN	1.5 pt./A	3
	Reason	4.0 floz./A	5
	Bond	0.1% v/v	5
	Scala 60SC	7.0 oz./A	7
	Echo ZN	1.5 pt./A	7
6	Bravo WS	1.0 pt./A	1
	Quadris	5.0 floz./A	1
	Revus/Top (Inspire)	7.0 floz./A	3
	Bravo WS	1.5 pt./A	5
	Endura	2.5 oz./A	7
	SuperTin	2.5 oz./A	9
7	Quadris	6.1 floz./A	2
	Bravo WS	1.5 pt./A	4
	Endura	2.5 oz./A	6
8	Quadris	6.1 floz./A	1
	Bravo WS	1.5 pt./A	3
	Endura	2.5 oz./A	5
	Dithane Rainshield	2.0 lbs./A	7
9	Headline	6.1 floz./A	4,7
	Endura	2.5 oz./A	5,8
	Dithane Rainshield	2.0 lbs./A	6
10	Quadris	6.1 floz./A	4,7
	Bravo WS	1.5 pt./A	5,8
	Dithane Rainshield	2.0 lbs./A	6
11	Bravo WS	1.5 pt./A	1
	Quadris	6.1 floz./A	3
	Ranman	2.0 floz./A	5
	Endura	2.5 oz./A	7
12	Ranman	2.0 floz./A	1
	Headline	6.0 floz./A	3
	SuperTin	2.5 oz./A	5
	Bravo WS	1.5 pt./A	7

[a] Schedule for applying treatments on a weekly basis, schedule started on July 7 (i.e. 1 = week 1, 2 = week 2).

Table 2. Effect of fungicide programs on the incidence of early blight in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2008; No Late Blight occurred within the trial.

	Percent Leaves Infected (with one or more lesion)				Vigor[b]	
Treatment	August 6	August 21	August 28	AUDPC[a]	August 21	August 28
1	10.9 a	99.7	100	742.3 a	2.0 f	0.3 d
2	3.1 d	93.3	100	688.0 e	3.3 a	1.9 a
3	2.6 d	92.8	100	684.8 e	3.3 a	1.6 ab
4	5.9 bc	99.8	100	721.0 bc	2.6 cd	0.5 d
5	2.7 d	99.8	100	709.6 cd	2.8 bcd	0.6 d
6	3.2 d	98.3	100	705.8 d	3.1 ab	1.3 bc
7	3.4 d	98.6	100	708.5 cd	3.0 abc	1.4 ab
8	3.4 d	98.3	100	707.0 d	2.9 a-d	0.8 cd
9	6.4 b	99.4	100	723.3 b	2.6 cd	0.5 d
10	5.6 bc	99.7	100	720.4 bc	2.5 de	0.8 cd
11	4.2 cd	99.8	100	715.2 bcd	2.1 ef	0.6 d
12	3.8 d	99.7	100	714.0 bcd	2.6 cd	0.4 d
LSD(P=0.05)	1.82	NS	NS	12.63	0.38	0.51

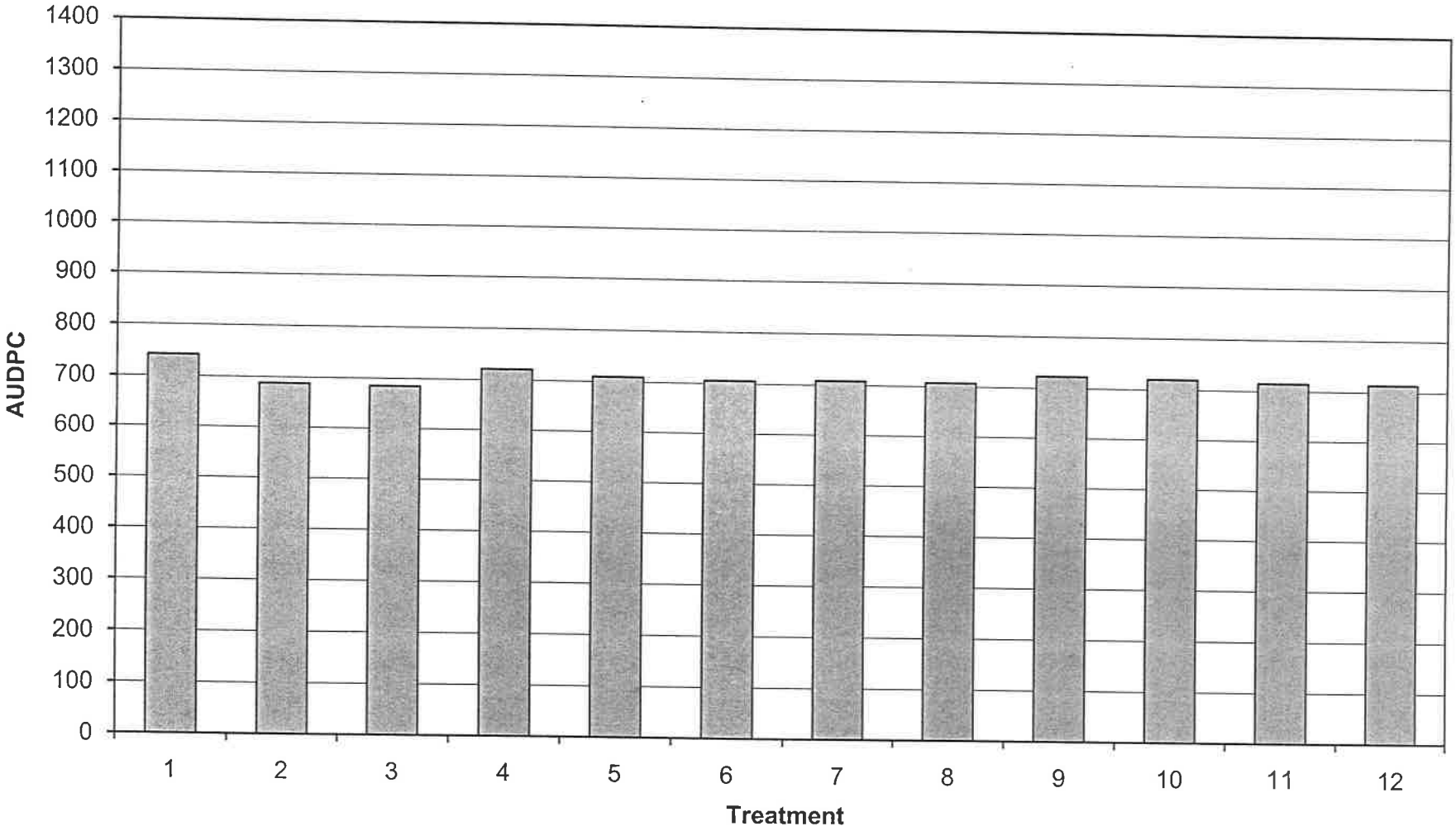
[a]AUDPC is the Area Under the Disease Progress Curve, accumulated from August 6 until August 28.
[b] Vigor readings were taken on August 21st and 28th with a rating of 1 to 5 (1 = poor and 5 = healthy).
Means followed by the same letters are not significantly different at P=0.05 for AUDPC.

Table 3. Effect of fungicide programs on tuber yield and quality in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2008.

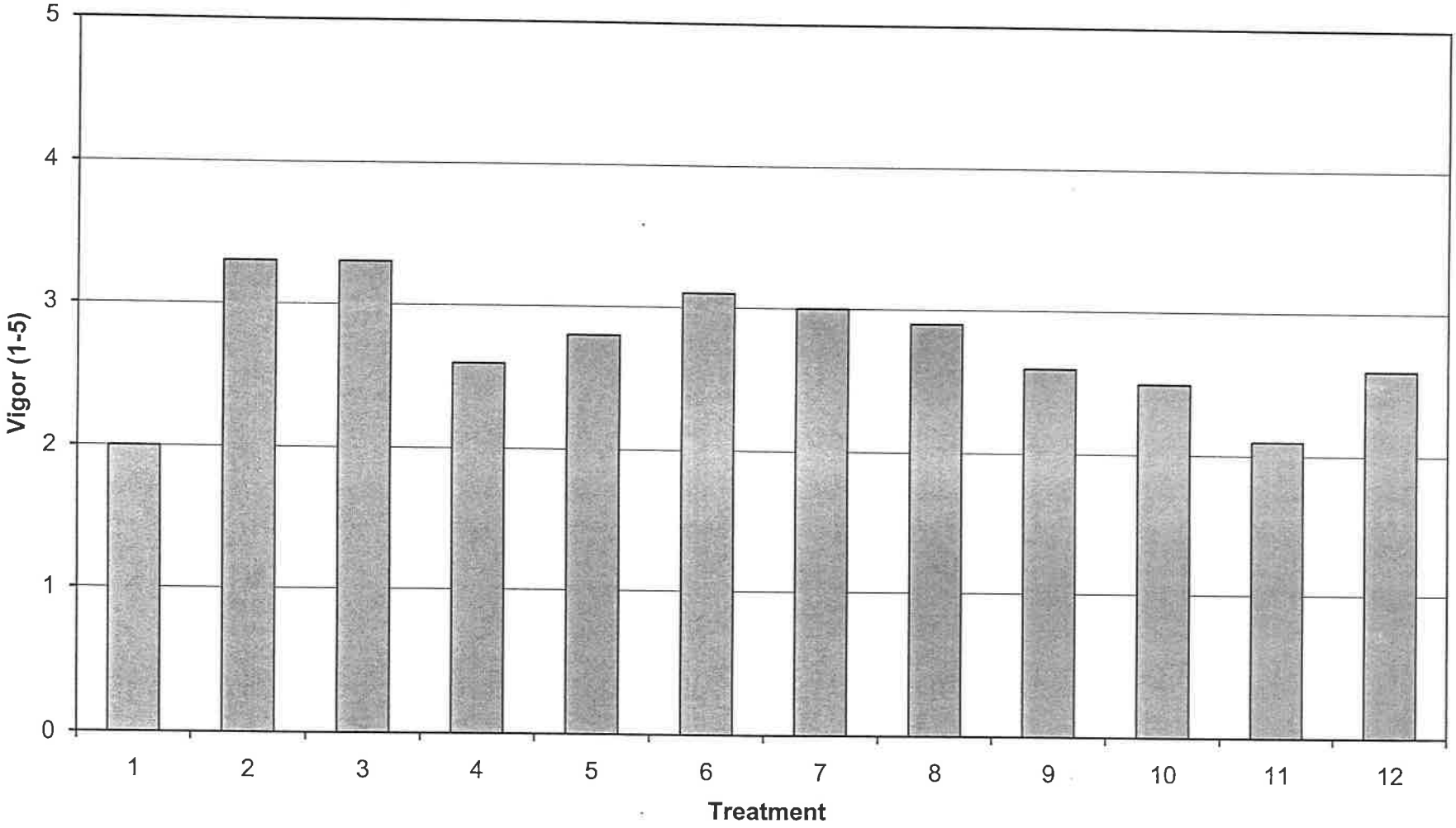
	Percent[a]					
Treatment	< 4 oz.	4-10 oz.	> 10 oz.	US No 2's	Culls	Cwt/A[b]
1	30.0	57.8	7.1	5.1	0.0	360.61
2	26.9	56.1	13.3	3.3	0.5	421.31
3	24.7	55.4	11.3	4.7	3.9	381.33
4	30.1	63.0	5.1	1.5	0.3	356.80
5	27.3	62.0	7.6	2.5	0.6	363.99
6	25.0	60.7	9.3	4.3	0.7	401.00
7	23.8	59.0	12.4	4.1	0.7	390.43
8	26.5	61.1	8.5	3.1	0.9	373.72
9	28.4	57.8	8.9	4.2	0.7	376.04
10	27.9	55.6	9.9	5.4	1.2	381.12
11	24.6	64.2	6.4	3.0	1.8	386.83
12	28.4	59.9	6.5	4.1	1.1	374.57
LSD(P=0.05)	NS	NS	NS	NS	NS	NS

[a] Based on tuber weight in kilograms, mean of four replications.
[b] Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of four replications.

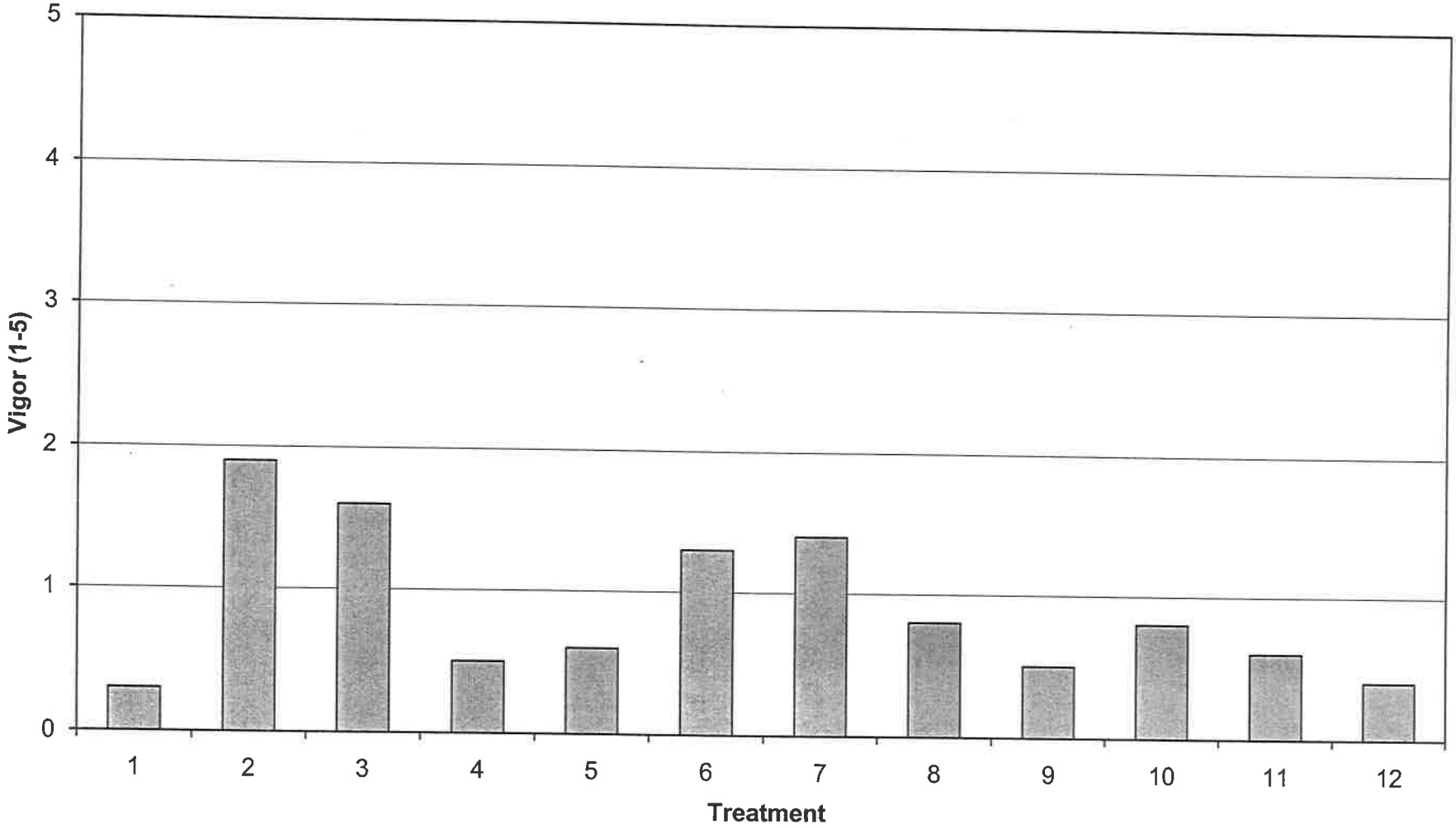
Area Under the Disease Progress Curve for Early Blight
2008 Foliar Fungicide Trial, Colorado State University
San Luis Valley Research Center, Center, CO
Total Amount of Accumulated Early Blight - Final Readings Taken on August 28, 2008



Plant Vigor Reading (0 = dead plant, 5 = excellent vigor)
2008 Early Blight Foliar Fungicide Trial
Colorado State University, San Luis Valley Research Center, Center, CO
Vigor Readings Taken on August 21, 2008



Plant Vigor Reading (0 = dead plant, 5 = excellent vigor)
2008 Early Blight Foliar Fungicide Trial
Colorado State University, San Luis Valley Research Center, Center, CO
Vigor Readings Taken on August 28, 2008



2008 POTATO – FOLIAR EARLY BLIGHT SYNGENTA DEMONSTRATION FUNGICIDE TRIAL

Researchers: Rob Davidson and Andrew Houser, Colorado State University, SLVRC

Location: San Luis Valley Research Center, Center, CO

Cultivar: Russet Norkotah Selection 8, cut seed, 2-4 oz.

Application: All treatments applied using an R & D CO_2 charged tractor mounted plot sprayer with four XR 8002VS nozzles spaced seventeen inches apart at 60 psi pressure and applying 40 gallons/acre as a broadcast application.

Spray Dates: July 7; July 21; August 4; August 18

Planted: May 6, 2008

Plot Design: Randomized complete block

Plot Size: 4 - 20 foot rows per treatment per replication, treatments applied to center two rows and data was taken on center two rows.

Plant Spacing: 12 inches

Row Spacing: 34 inches

Replications: Four

Irrigation: Solid set sprinkler, rate based on ET

Fertilizer: 80N-60P-40K-25S-2.5Z, preplant, 60N through sprinkler after tuber set

Herbicide: Matrix, 1.5 oz./A + Eptam, 4.5 pt./A

Insecticide: None

Vine Killer: Rotobeat vines on September 2, 2008

Harvested: September 25, 2008

DATA:

Disease: Early blight disease incidence based on percent leaves infected, readings taken weekly starting August 1, 2008. Due to high Early Blight incidence at the date of the last two disease readings (August 21st and August 28th), a vigor reading was also taken (1-5, 1 = low vigor & 5 = high vigor).

AUDPC: **Area Under the Disease Progress Curve (AUDPC) is a measure of the progression of Early Blight, starting on August 1st and ending with the last reading on August 28th. AUDPC gives a better idea of the total amount of Early Blight in a plot during this time period, rather than just looking at the weekly percent incidence. The total AUDPC for the control plot (1) indicates the total amount of Early Blight that was present if no fungicides were used to suppress disease. The other treatments should be compared with the control to determine the effectiveness at reducing the disease. AUDPC is based on total percent leaflets infected with Early Blight, with readings taken on a weekly basis.**

Yield: 2-20 foot rows per treatment per replication, total yield expressed as cwt/A.

Grade: By hand, percent tubers by weight in kilograms < 4 oz., 4-10 oz., > 10 oz., US # 2's, and culls.

Table 1. Fungicide programs evaluated for early blight control, San Luis Valley, Colorado 2008.

Program	Products	Rate	Application Schedule[a]
1	Untreated Control	-	-
2	Bravo WS	1.5 pt./A	1,3,5,7
3	Bravo WS	1.0 pt./A	1
	Quadris	5.0 floz./A	1
	Revus/Top (Inspire)	7.0 floz./A	3
	Bravo WS	1.5 pt./A	5
	Endura	2.5 oz./A	7
4	Revus/Top (Inspire)	7.0 floz./A	1
	Quadris Opti	1.6 pt./A	3
	Bravo WS	1.5 pt./A	5
	Endura	2.5 oz./A	7
5	Bravo WS	1.5 pt./A	1
	Revus/Top (Inspire)	7.0 floz./A	3
	Bravo WS	1.5 pt./A	5
	Endura	2.5 oz./A	7

[a] Schedule for applying treatments on a weekly basis, schedule started on July 7 (i.e. 1 = week 1, 2 = week 2).

Table 2. Effect of fungicide programs on the incidence of early blight in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2008; No Late Blight occurred within the trial.

	Percent Leaves Infected (with one or more lesion)					Vigor[b]	
Treatment	August 1	August 6	August 21	August 28	AUDPC[a]	August 21	August 28
1	3.5	7.4 a	100.0	100.0	732.1 a	1.13 b	0.00 b
2	1.3	2.5 b	99.4	100.0	709.0 b	2.38 a	0.75 a
3	1.2	2.4 b	99.4	100.0	708.5 b	2.63 a	0.50 a
4	1.5	2.3 b	99.6	100.0	709.3 b	2.50 a	0.75 a
5	1.5	2.5 b	99.8	100.0	710.8 b	2.50 a	0.50 a
LSD(P=0.05)	NS	0.82	NS	NS	5.88	0.45	0.37

[a]AUDPC is the Area Under the Disease Progress Curve, accumulated from August 1 until August 28.
[b] Vigor readings were taken on August 21st and 28th with a rating of 0 to 5 (0 = dead and 5 = healthy).
Means followed by the same letters are not significantly different at P=0.05 for AUDPC.

Table 3. Effect of fungicide programs on tuber yield and quality in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2008.

	Percent[a]					
Treatment	< 4 oz.	4-10 oz.	> 10 oz.	US No 2's	Culls	Cwt/A[b]
1	32.0	59.7	5.4	2.7	0.3	318.1
2	31.3	58.6	5.7	2.3	2.1	331.8
3	29.4	57.6	10.8	2.1	0.1	374.2
4	32.5	55.6	7.2	4.0	0.7	350.0
5	27.8	58.0	9.4	2.0	2.8	349.0
LSD(P=0.05)	NS	NS	NS	NS	NS	NS

[a] Based on tuber weight in kilograms, mean of four replications.
[b] Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of four replications.

Table 1. Evaluation of Foliar Fungicide Programs for Early Blight Control in the years 2005, 2006 and 2007.

	Yield (Cwt/A)[a]				AUDPC[b]				
Treatment	**2005**	**2006**	**2007**	**Mean**	**2005**	**2006**	**2007**	**Mean**	**Cost/A[c]**
1. Untreated Control	389.6	353.4	328.2 bc	357.1 b	782.5 a	998.1 a	1281.1 a	1020.6 a	-
2. Strobulirin (4)[d] + Bravo (5) + Endura (6)	446.4	367.0	349.4 ab	387.6 a	261.6 d	736.5 d	994.5 b	644.2 d	$46.54
3. Dithane (4,6) + Bravo (5)	403.3	334.1	369.7 a	369.0 ab	389.9 c	877.0 b	1028.9 b	765.3 b	$35.03[e]
4. Dithane (1,4) + Quadris (3)	414.8	361.5	318.0 c	364.8 b	484.2 b	821.6 bc	1030.7 b	778.8 b	$40.20[e]
5. Dithane (4,6) + Quadris (5)	403.3	376.3	330.8 bc	370.1 ab	328.7 cd	783.1 cd	1015.6 b	709.2 c	$40.20[e]
LSD (P = 0.05)	NS	NS	25.09	20.81	69.00	60.01	36.32	30.70	-

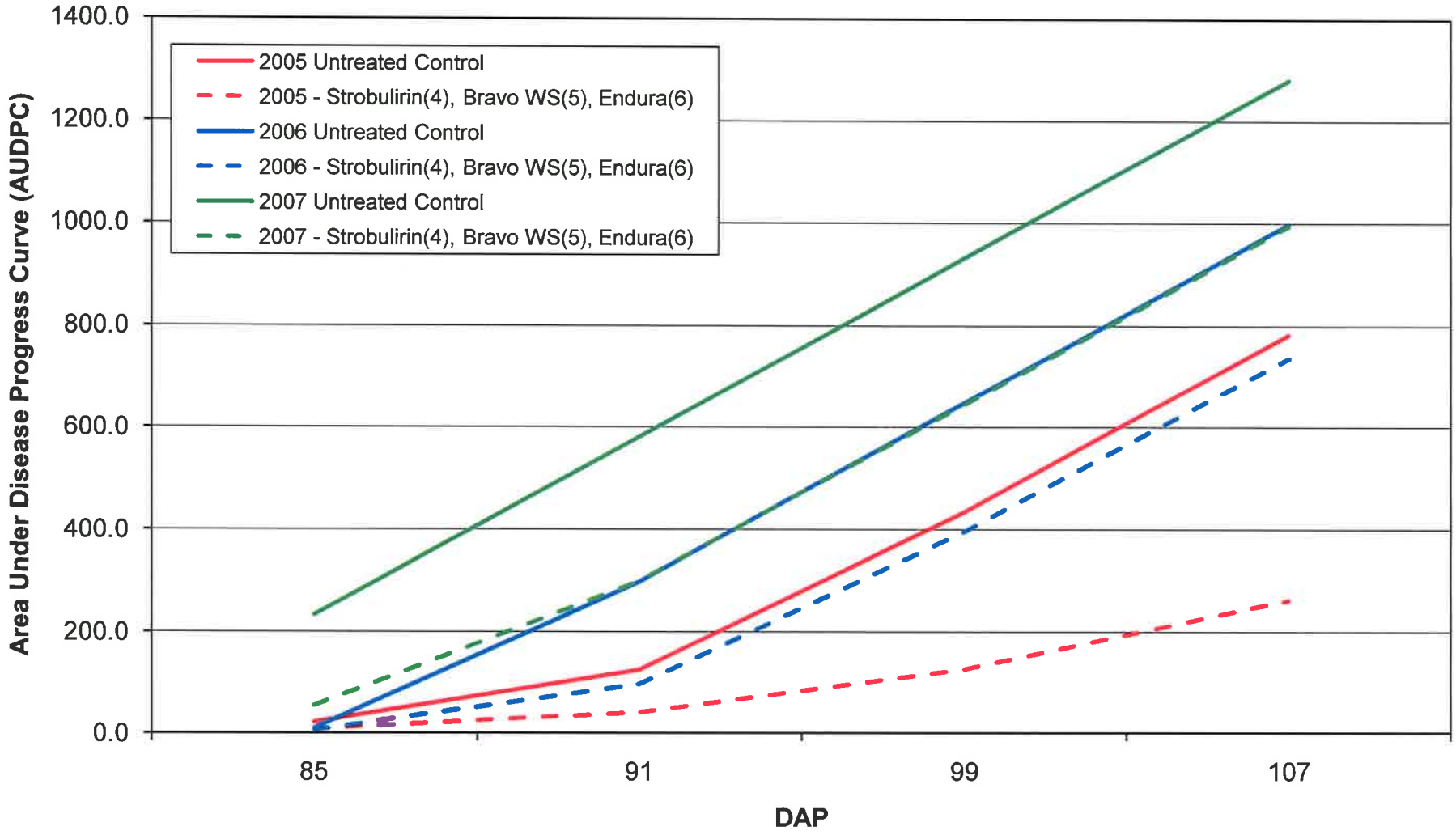
[a] Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of four replications.
[b] AUDPC is the Area Under the Disease Progress Curve, accumulated throughout the month of August.
[c] These prices do not include application costs. Total cost/acre was based on 2009 prices and were obtained from Schall Chemical Supply LLC.
[d] Fungicide applications began once the Early blight degree day model reached a value of 650DD, which typically occurs around the first week of July. The number in parentheses represents the week number after the threshold of 650DD was reached. For example: (1) = fungicide was applied the first week after 650DD was reached, (2) = the second week, etc.
[e] Due to the limited availability of Dithane Rainshield in 2009, the price of Penncozeb 75DF was used to calculate the overall cost/acre.
Means followed by the same letters are not significantly different at P=0.05 for AUDPC.

Table 2. Evaluation of Foliar Fungicide Programs for Early Blight in the years 2006, 2007 and 2008.

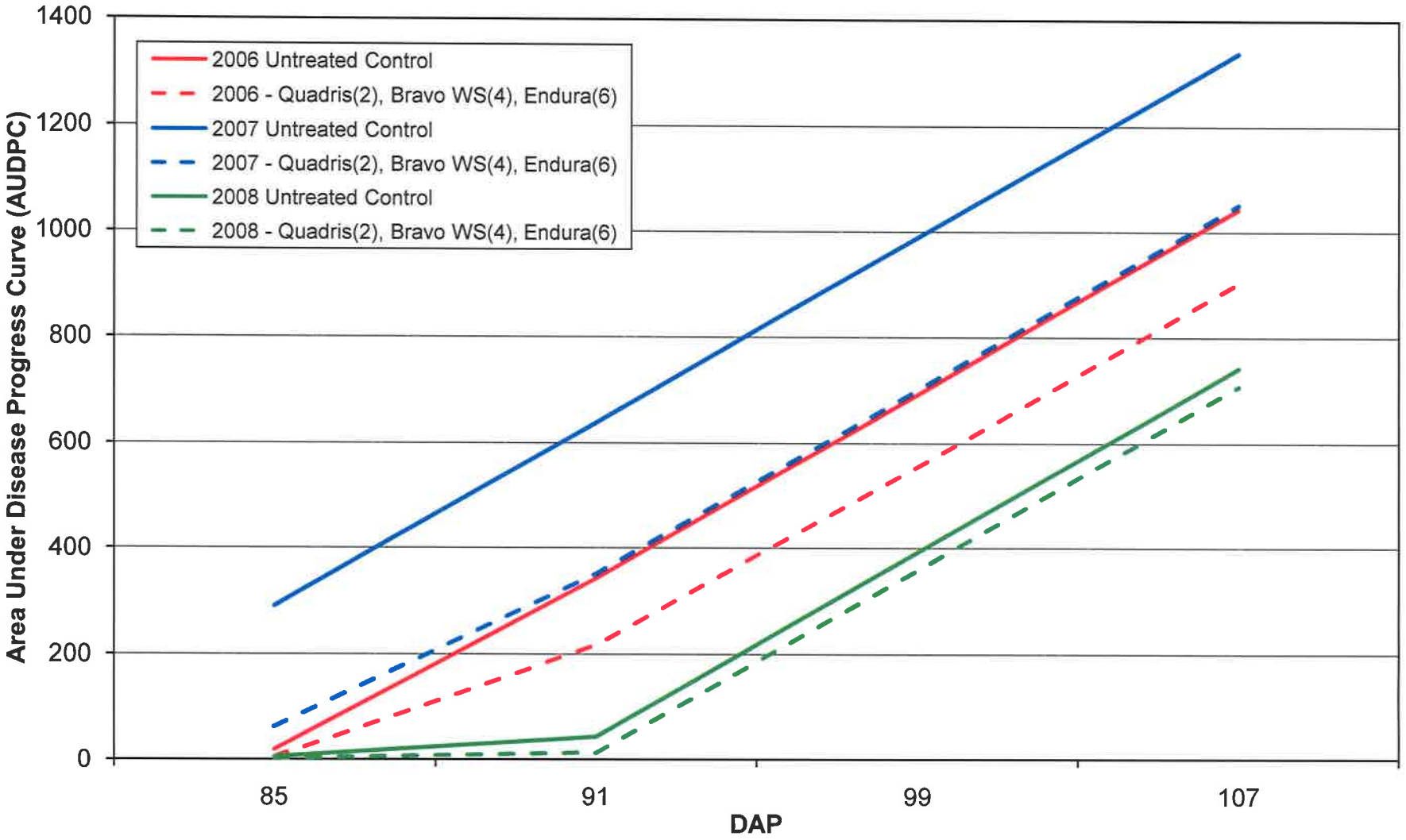
	Yield (Cwt/A)[a]				AUDPC[b]				
Treatment	**2006**	**2007**	**2008**	**Mean**	**2006**	**2007**	**2008**	**Mean**	**Cost/A[c]**
1. Untreated Control	319.3 b	355.3	360.6	345.1 b	1041.8 a	1338.6 a	742.3 a	1040.9 a	-
2. Quadris (2)[d] + Bravo (4) + Endura (6)	375.6 a	377.6	390.4	381.2 a	901.5 b	1051.2 b	708.5 cd	887.1 b	$46.54
3. Quadris (1) + Bravo (3) + Endura (5) + Dithane (7)	345.8 ab	406.6	373.7	375.4 a	764.2 c	992.2 c	707.0 d	821.1 c	$57.54[e]
4. Headline (4,7) + Endura (5,8) + Dithane (6)	362.5 a	392.2	376.1	376.9 a	589.5 d	1009.5 bc	723.3 b	774.1 d	$78.64[e]
5. Quadris (4,7) + Bravo (5,8) + Dithane (6)	345.4 ab	369.1	381.1	365.2 ab	834.8 bc	1041.2 b	720.4 bc	865.4 b	$77.40[e]
LSD (P = 0.05)	33.36	NS	NS	24.67	83.22	46.47	13.17	32.58	-

[a] Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of four replications.
[b] AUDPC is the Area Under the Disease Progress Curve, accumulated throughout the month of August.
[c] These prices do not include application costs. Total cost/acre was based on 2009 prices and were obtained from Schall Chemical Supply LLC.
[d] Fungicide applications began once the Early blight degree day model reached a value of 650DD, which typically occurs around the first week of July. The number in parentheses represents the week number after the threshold of 650DD was reached. For example: (1) = fungicide was applied the first week after 650DD was reached, (2) = the second week, etc.
[e] Due to the limited availability of Dithane Rainshield in 2009, the price of Penncozeb 75DF was used to calculate the overall cost/acre.
Means followed by the same letters are not significantly different at P=0.05 for AUDPC.

Area Under the Disease Progress Curve for Early Blight
Early Blight Fungicide Trial (2005, 2006, 2007),
Colorado State University, San Luis Valley Research Center, Center, CO
Total Amount of Accumulated Early Blight Through Season

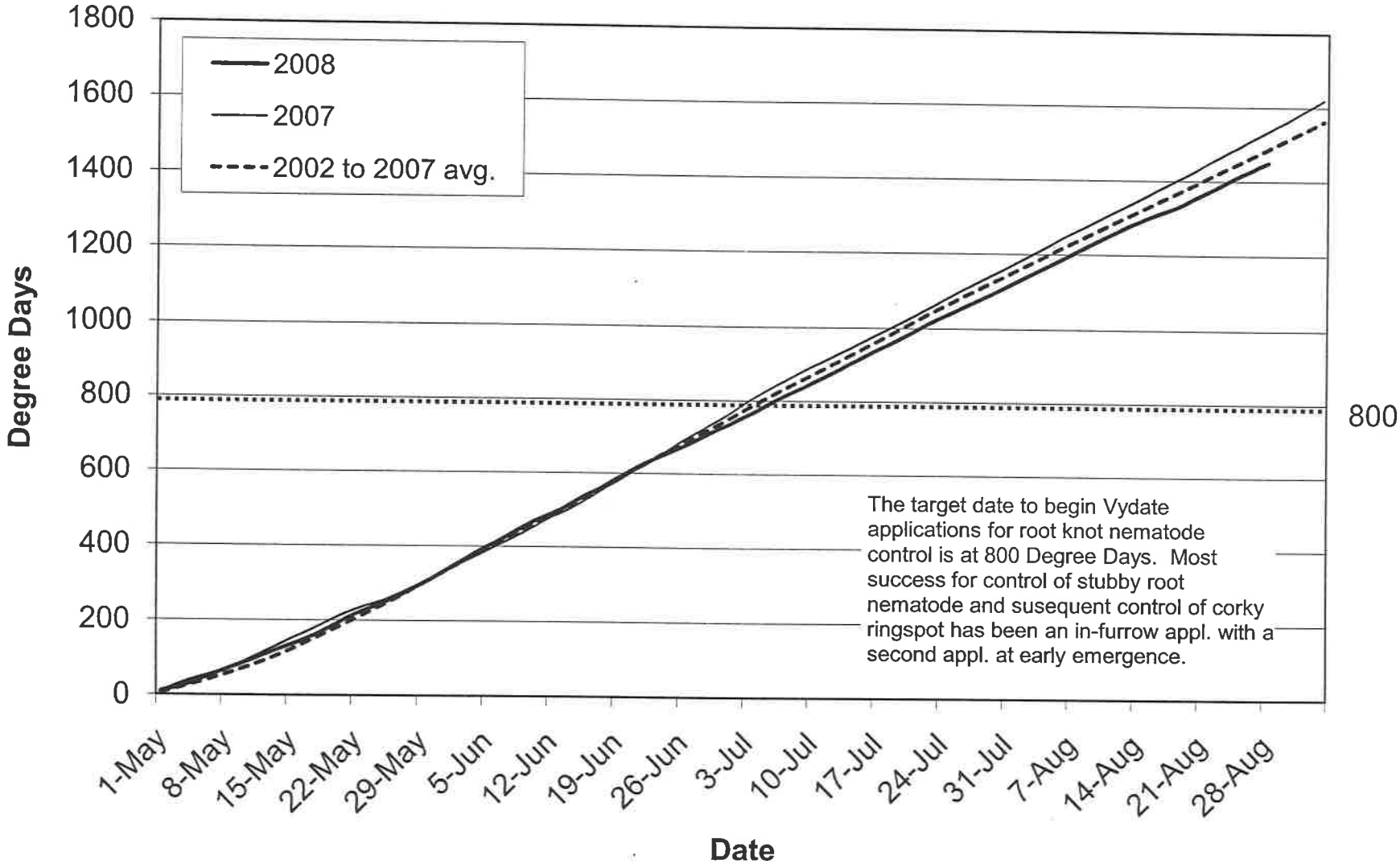


Area Under the Disease Progress Curve for Early Blight
Early Blight Fungicide Trial (2006, 2007, 2008),
Colorado State University, San Luis Valley Research Center, Center, CO
Total Amount of Accumulated Early Blight Through Season



Root Knot Nematode Degree Days

Root Knot Nematode Degree Days for the San Luis Valley



SLV Late Blight Forecasting

Over the last several years weather stations have been positioned at three locations around the San Luis Valley (Blanca, Hooper, & Sargent) in order to determine late blight severity units. This was continued in 2008 in order to determine the potential risk we have for late blight here in the valley.

A uMetos weather station was used at the Blanca and Hooper sites to determine late blight severity. This unit uses the Fry model to calculate severity units (fry units). Humidity, air temperature, and leaf wetness are used to calculate severity units. Fry units accumulate differently depending of the level of susceptibility of a particular cultivar. Due to these differences, the severity units for a moderately susceptible cultivar has been recorded and graphed. Once the total number of fry units reaches 35 for a moderately susceptible cultivar, late blight can occur.

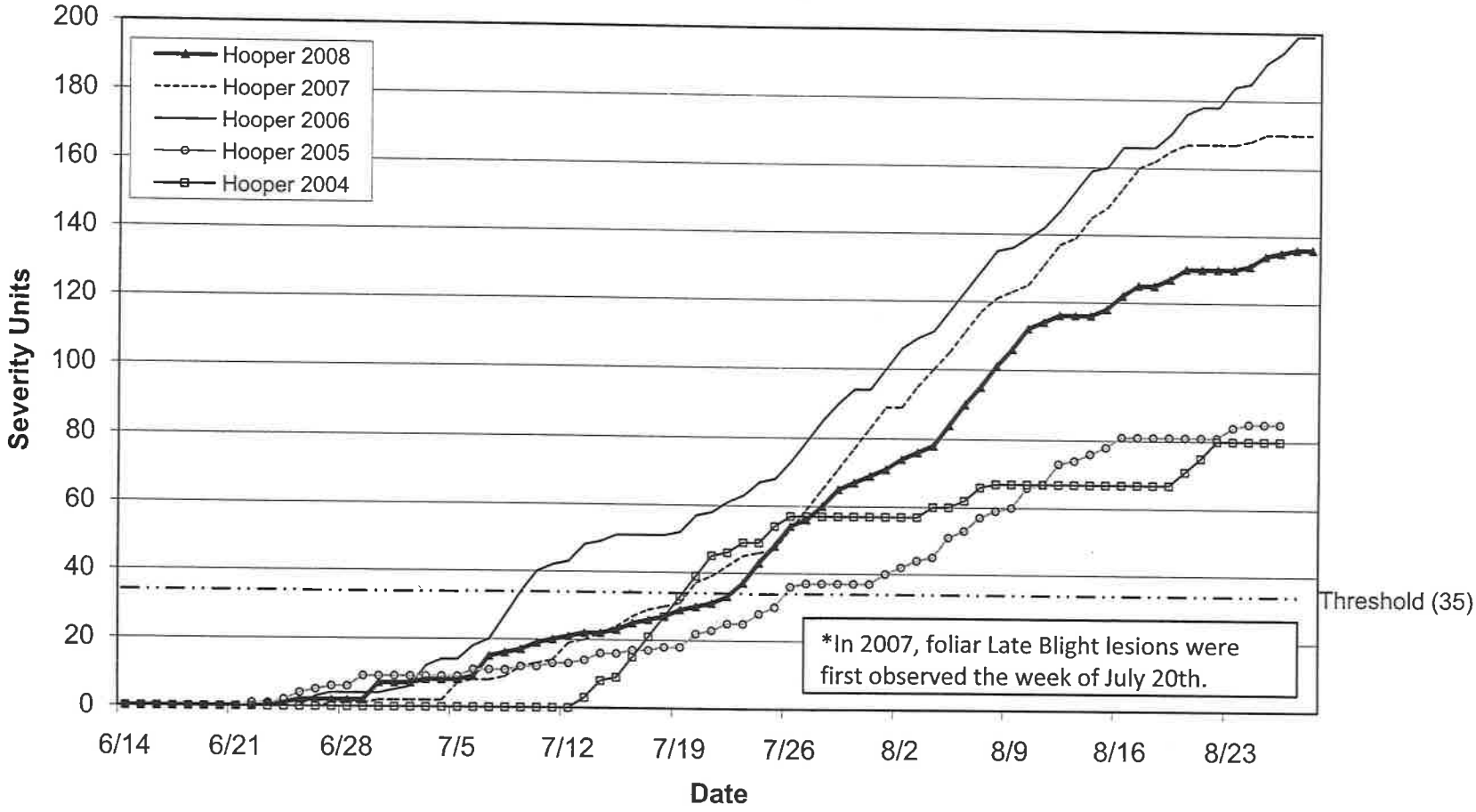
The uMetos weather station also calculated the Smith Period. When a Smith Period is reached on a given day, conditions favorable for late blight lesion development have been reached under mild inoculum pressure. In 2007, the Smith Period was reached on seven different days. The first two days (July 20 and 28) coincided with when late blight lesions were first observed in the San Luis Valley for 2007. In 2008, the Smith Period was reached on four different days, but late blight lesions were not detected.

At the Sargent site, a Watch Dog weather station was used to determine late blight severity. This unit uses the Wallin model for calculating late blight severity units. Humidity, air temperature, and rainfall are used to calculate severity units. Once the total number of severity units reaches 18, late blight can occur. This information may become critical in the future if late blight ever becomes established in the San Luis Valley.

In 2007, late blight was discovered near the Blanca site in the southern end of the San Luis Valley. Foliar symptoms were discovered on July 27-29, 2007. This coincided within four days of the Fry unit predictive threshold and within eight days of the Wallin model threshold. This indicates that these models are performing as expected with the Fry model being more accurate than the Wallin model.

Potato Late Blight Fry Units, San Luis Valley (Hooper site), Colorado, 2004 - 2008

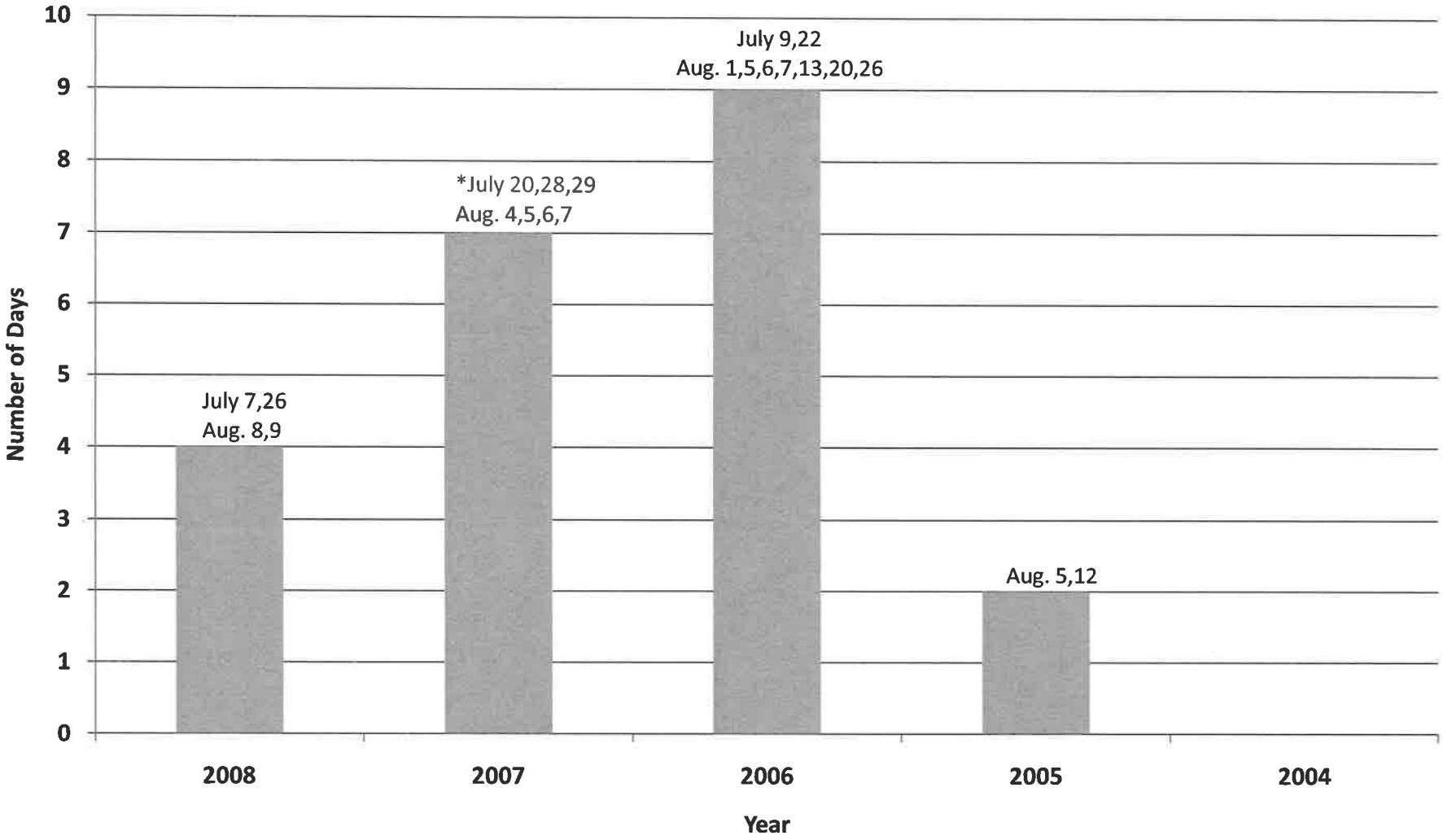
Moderate Susceptible Varieties



Footnote:

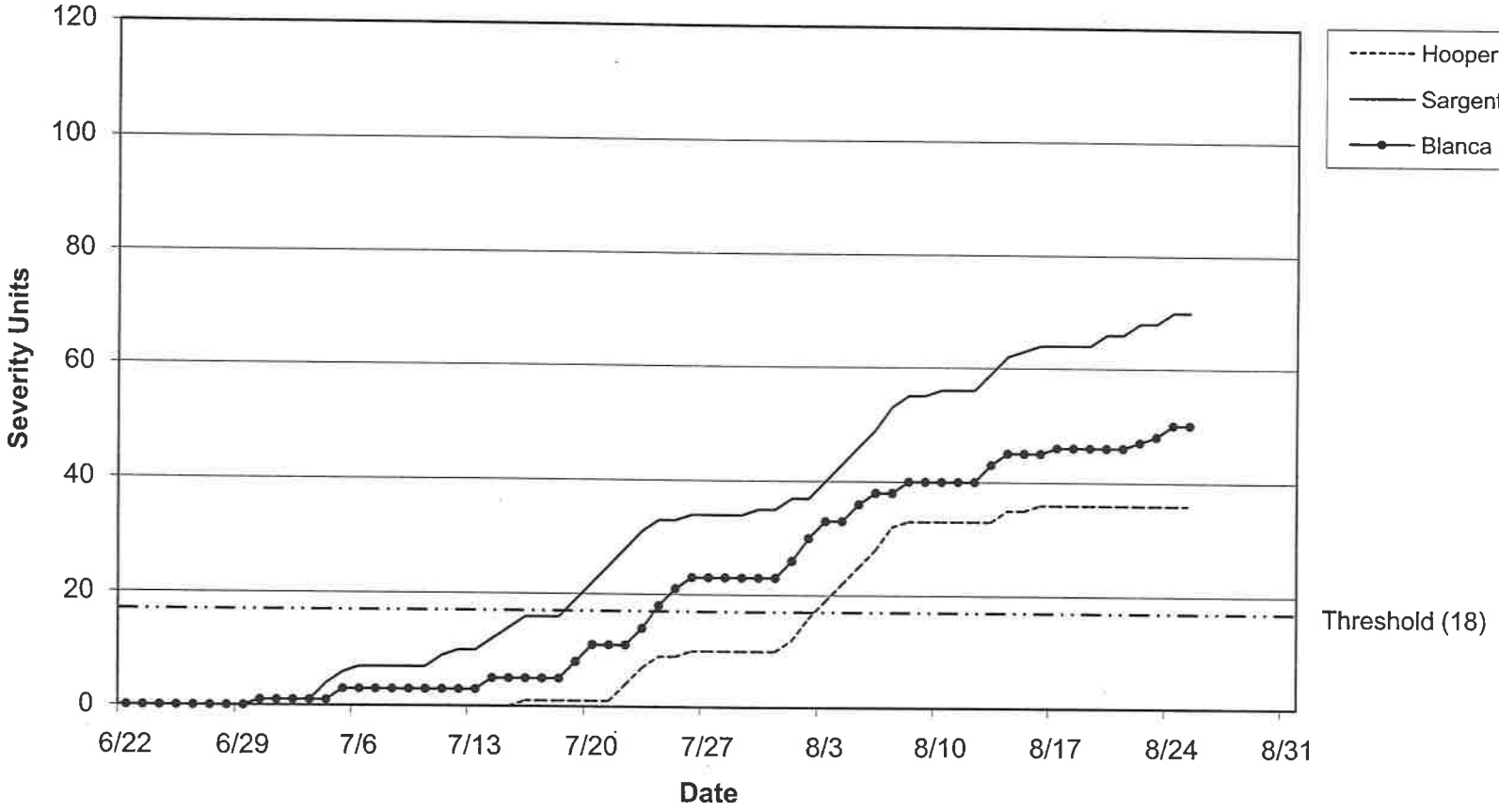
- The Fry Late Blight model was used to calculate the severity units.
- The 2008 Hooper weather station was set up on June 10, 2008.
- The 2007 Hooper weather station was set up on June 18, 2007.
- The 2006 Hooper weather station was set up on June 14, 2006.
- The 2005 Hooper weather station was set up on June 8, 2005.
- The 2004 Hooper weather station was set up on June 14, 2004.

Number of days when conditions were favorable for Late Blight Lesion formation.
Based on Smith Model for Hooper Area, 2004 - 2008.



* Dates in red indicate when foliar late blight lesions were initially observed in 2007.

Potato Late Blight Severity Values - Wallin Model, San Luis Valley, Colorado, 2008



Footnote:
- The Sargent weather station was set up on June 25, 2008.
- The Hooper weather station was set up on July 10, 2008.
- The Blanca weather station was set up on June 25, 2008.

Pink Rot Trials

The fungicide Ridomil Gold has worked well at controlling pink rot in the San Luis Valley. However, in recent years the pink rot pathogen has become resistant in many potato growing regions across the United States. Due to the low level of disease pressure here at the station, resistance to Ridomil Gold has not yet been discovered. We have evaluated various fungicide treatments during the last several years and have found a few to be somewhat effective at controlling pink rot, but Ridomil Gold has had the most success. Even though we have had success with this product, the jury is still out on whether or not this product should be used in the San Luis Valley. Concern has focused on how quickly the pathogen obtains resistance and on the fact that resistant strains are more aggressive. Reducing any excess irrigation water in the latter part of the growing season can decrease the amount of disease in the potato field.

EVALUATION OF FUNGICIDES FOR CONTROL OF PINK ROT ON POTATO, 2008

Researchers: Rob Davidson and Andrew Houser, Colorado State University, SLVRC
Location: Off-station, San Luis Valley, Center, CO
Cultivar: Russet Norkotah selection 8, cut seed, 2-4 oz.
Objective: To evaluate the efficacy of various fungicides in controlling pink rot in potato.
Application: In-furrow treatments were applied using an R & D CO_2 charged backpack sprayer mounted to a potato planter at 35 PSI, with one XR 8002VS nozzle directed to spray the soil as it covered the seed piece (50% mix) and one XR 8002VS nozzle directed over seed piece (50% mix), at 10 gal./A for the 2 nozzle applications. Single nozzle in-furrow treatments were applied using an R & D CO_2 charged backpack sprayer at 35 PSI, with one XR 8002VS nozzle, at 10 gallons/acre as a directed in-furrow application. Foliar treatments were applied using an R & D CO_2 charged backpack sprayer at 35 PSI, with two XR 8002VS nozzles, at 20 gallons/acre (Treatments applied At Hilling were made with one nozzle at 10 gallons per acre).

Treatments:

1. Control, no treatment
2. Ridomil Gold @ 0.42 floz./1000 row ft. (IF)
3. Ridomil Gold @ 0.42 floz./1000 row ft. (IF) + Phostrol @ 8.0 pt./A (IF)
4. Ranman @ 0.42 floz./1000 row ft. (IF) + Silwet L77 @ 0.315 floz./1000 row ft. (IF)
5. Ranman @ 0.42 floz./1000 row ft. (IF) + Silwet L77 @ 0.315 floz./1000 row ft. (IF) - 2 nozzles
6. Ranman @ 0.42 floz./1000 row ft. (IF) + Silwet L77 @ 0.315 floz./1000 row ft. (IF) & Ranman @ 2.75 floz./A (AH) + Silwet L77 @ 2.0 floz./A (AH)
7. Ranman @ 0.42 floz./1000 row ft. (IF) + Silwet L77 @ 0.315 floz./1000 row ft. (IF) & Phostrol @ 10.0 pt./A (TI)
8. Ranman @ 0.42 floz./1000 row ft. (IF) + Silwet L77 @ 0.315 floz./1000 row ft. (IF) & Reason @ 4.0 floz./A (Foliar - 2,5)
9. Reason @ 4.0 floz./A (Foliar - 2,5)
10. Revus @ 0.503 floz/1000 row ft. (IF)
11. Revus @ 0.503 floz/1000 row ft. (IF) - 2 nozzles
12. Omega @ 1.5pt./A (IF) - 2 nozzles
13. Omega @ 1.5pt./A (IF) + Revus @ 0.503 floz/1000 row ft. (IF) - 2 nozzles
14. Revus @ 0.5 floz/1000 row ft. (IF) & Revus @ 7.0 floz/A - prior to hilling
15. Untreated Control

Planted: May 6, 2008
Plot Design: Randomized complete block
Plot Size: 2 - 20 foot rows per treatment per replication
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: four
Irrigation: Center pivot irrigation system, rate based on ET
Fertilizer: Unavailable
Herbicide: Unavailable
Insecticide: Unavailable
Vine Killer: Vines killed on August 23, 2008
Harvested: September 17 and 18, 2008

DATA

Disease: Mean percent of tubers with pink rot at harvest multiplied by disease severity rating of 1-5 (1 = less than 5% rotten, 5 = 100% rotten) per treatment per replication.
Yield: 2-20 foot row per treatment per replication, total yield expressed as cwt/A.
Grade: By hand, percent tubers by weight in pounds < 4 oz., 4-10 oz., > 10 oz., US # 2's and culls.

Table 1. Effect of applied products, for control of pink rot, on tuber yield and quality in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2008.

Program	Treatment	Percent[b]								
	Product/Rate & Application Schedule[a]	< 4 oz.	4-10 oz.	> 10 oz.	US #2's	Culls	cwt/A[c]	No. rot	% rot[d]	% rot x severity[e]
1	Untreated Control	23.6 ab	43.3	28.5	0.8	3.8	474.5	1.00	0.96	4.74
2 (Standard)	Ridomil Gold @ 0.42 floz./1000 row ft. (IF)	22.0 abc	39.9	31.9	0.7	5.5	474.7	1.00	0.69	3.40
3 (Standard)	Ridomil Gold @ 0.42 floz./1000 row ft. (IF) Phostrol @ 8.0 pt./A (IF)	16.4 cd	47.0	31.3	0.3	5.1	507.2	0.00	0.00	0.00
4	Ranman @ 0.42 floz./1000 row ft. (IF) Silwet L77 @ 0.315 floz./1000 row ft. (IF)	14.1 d	41.1	35.2	0.6	8.9	416.5	0.00	0.00	0.00
5	Ranman @ 0.42 floz./1000 row ft. (IF) - 2 nozzles Silwet L77 @ 0.315 floz./1000 row ft. (IF) - 2 nozzles	17.5 bcd	40.4	33.1	1.1	7.9	455.6	0.75	0.33	1.56
6	Ranman @ 0.42 floz./1000 row ft. (IF) Silwet L77 @ 0.315 floz./1000 row ft. (IF) Ranman @ 2.75 floz./A (AH) Silwet L77 @ 2.0 floz./A (AH)	24.3 a	42.3	24.9	0.9	7.8	460.1	0.00	0.00	0.00
7	Ranman @ 0.42 floz./1000 row ft. (IF) Silwet L77 @ 0.315 floz./1000 row ft. (IF) Phostrol @ 10.0 pt./A (TI)	16.2 cd	39.3	34.0	2.3	8.0	408.8	0.00	0.00	0.00
8	Ranman @ 0.42 floz./1000 row ft. (IF) Silwet L77 @ 0.315 floz./1000 row ft. (IF) Reason @ 4.0 floz./A (Foliar - 2,5)	23.7 ab	43.8	24.9	1.3	6.3	490.8	0.13	0.10	0.52
9	Reason @ 4.0 floz./A (Foliar - 2,5)	17.4 bcd	39.5	39.2	1.4	2.5	498.6	0.50	0.25	1.23
10	Revus @ 0.503 floz./1000 row ft. (IF)	18.4 a-d	40.1	31.6	1.9	8.1	451.6	0.38	0.21	1.05
11	Revus @ 0.503 floz./1000 row ft. (IF) - 2 nozzles	25.1 a	38.2	28.3	1.3	7.1	428.3	0.63	0.36	1.64
12	Omega @ 1.5pt./A (IF) - 2 nozzles	20.2 a-d	42.8	30.4	0.8	5.8	500.9	0.75	0.72	3.22
13	Omega @ 1.5pt./A (IF) - 2 nozzles Revus @ 0.503 floz./1000 row ft. (IF) - 2 nozzles	21.3 abc	40.7	33.8	0.3	3.9	488.4	0.13	0.14	0.68
14	Revus @ 0.5 floz./1000 row ft. (IF) Revus @ 7.0 floz./A - prior to hilling	24.9 a	43.2	25.3	0.7	5.8	391.1	0.25	0.44	1.52
15	Untreated Control	20.0 a-d	40.8	31.3	1.0	7.0	463.0	1.63	1.09	5.11
CV		23.3	14.6	23.0	143.0	73.9	22.4	153.0	189.3	193.0
F value		0.02	0.89	.25	0.84	0.81	0.93	0.07	0.34	0.34
LSD(P=0.05)		6.76	NS	NS	NS	NS	NS	NS	NS	NS

[a] Application Schedule Abbreviations (IF = In-Furrow on May 6, 2008; AH = At Hilling on June 19, 2008; TI = Tuber Initiation on July 18, 2008).
[b] Based on tuber weight in kilograms, mean of four replications.
[c] Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of four replications.
[d] Mean percent of tubers with pink rot at harvest per treatment per replication (i.e. 0.86 = 0.86%).
[e] Mean percent of tubers with pink rot at harvest multiplied by disease severity from 1 to 5(1 = less than 5% rotten, 5 = 100 % rotten).
Means followed by the same letters are not significantly different at P=0.05 for AUDPC.
Several infected tubers were lost in the field (primarily in the untreated control) due to pink rot severity and rot and were not measured at harvest. This affects "% rot" and "% rot x severity" which may explain the non-significant results in these categories. Also, the "% rot" was taken from the weight of rotten tubers remaining at harvest. Due to the severity of rot, the actual rot weight was greater than the recorded rot weight. If this lost weight could have been recorded, a significant difference among treatments most likely would have been found. Fungicide programs that suppressed the spread of pink rot in the tuber did result in a higher rot weight because more of the infected tuber remained intact. The completely rotten tubers were not fully intact resulting in a lower measured weight.

Powdery Scab Trials

This research effort is directed at gaining a better understanding of the factors that lead to root galling and powdery scab symptom development on tubers. These factors include (under SLV conditions): understanding the role of irrigation, timing of water application, role of soil temperature, conditions within the potato hill which foster infection and symptom development, current inoculum level and how the inoculum moves in the Valley (both soil and seed borne), screening various chemistries that might impact infection and symptom development, and the cultivar by rotation situation leading to increased disease levels. Additionally, Andrew Houser has finished his M.S. project to understand the various factors present in disease development in the greenhouse. His efforts try to mimic field results in terms of disease development leading to a method for early greenhouse screening of all initial germplasm from the Cultivar Development program.

Results from this project indicate that as the environment in many other potato regions is moving away from critical soil temperatures for powdery scab infection and symptom development, the soil temperatures in the SLV are becoming more conducive for infection. Rotating susceptible cultivars with cultivars less susceptible, especially where root galling is concerned, can help alleviate the disease pressure and help growers harvest a cleaner crop, regardless of cultivar susceptibility.

Soil temperature and soil moisture readings taken at three soil depths (6, 8, & 10 in.), give a better understanding of field soil dynamics and help to determine how powdery scab development in the SLV is affected by these two soil parameters. Early season excess moisture can increase powdery scab infection and development. Also, when dissecting individual hills at harvest, tubers which sit in the region of the hill with the highest soil moisture during the season have the highest numbers and severity of powdery scab lesions. Finally, work with Omega (Fluazinam) is finishing. A 24LSC label was obtained in 2007 for commercial use of the product on potatoes to control powdery scab. Studies on the in-furrow placement of the chemical in the hill (over the seed piece and into the covering soil as a split application) have been successful. Ultimately, a successful management program will incorporate several factors including: soil surveys to predict spore loads, cultivars selection, water management at the appropriate times during the season, and use of Omega when warranted.

Russets with skin mutations (i.e. lacking a russet skin) were evaluated for powdery scab lesion severity. It was determined that development of a russet skin provides resistance to lesion development; presumably due to either impeding infection or the actual russet development.

The biofungicide ZONIX was evaluated in the greenhouse this year. Under medium to high levels of inoculum, ZONIX was found to be ineffective in managing powdery scab development on roots and tubers. There is some evidence, that under extremely low inoculum levels, ZONIX can reduce disease development. However, there was no significant difference from the untreated control.

2008 EVALUATION OF FUNGICIDES APPLIED AT PLANTING FOR CONTROL OF POWDERY SCAB ON POTATO

Researchers: Robert Davidson and Andrew Houser, Colorado State University
Location: Off-station trial, San Luis Valley, CO
Cultivar: Cherry Red, cut seed, 2-4 oz.
Objective: To evaluate the efficacy of various fungicide treatments in controlling powdery scab on potato.
Application: In-furrow treatments were applied using an R & D CO_2 charged backpack sprayer mounted to a potato planter at 35 PSI, with one XR 8002VS nozzle directed to spray the soil as it covered the seed piece (50% mix) and one XR 8002VS nozzle directed over seed piece (50% mix), at 10 gal./A. On-seed treatments were applied directly to whole seed and planted within 24 hours.

Treatments:

1. Control, no treatment
2. Omega @ 1.5 pt./A (one nozzle directed over seed), At Planting
3. Omega @ 3.0 pt./A (one nozzle directed over seed), At Planting
4. Omega @ 1.5 pt./A (two nozzles), At Planting
5. Omega @ 3.0 pt./A (two nozzles), At Planting
6. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting
   Omega @ 1.5 pt./A (Applied just prior to hilling on June 18, 2008)
7. Omega @ 1.5 pt./A (two nozzles), At Planting
   Omega @ 1.5 pt./A (Applied just prior to hilling on June 18, 2008)
8. Omega @ 2.0 pt./A (two nozzles), At Planting
9. Omega @ 1.5 pt./A (two nozzles with extra soil mixing), At Planting
10. Omega @ 3.0 pt./A (two nozzles with extra soil mixing), At Planting

Planted: May 9, 2008
Plot Design: Randomized
Plot Size: 2 - 20 foot rows per treatment per replication
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Four
Irrigation: Center pivot sprinkler, rate based on ET
Fertilizer: Unavailable
Herbicide: Unavailable
Insecticide: Unavailable
Fungicide: Unavailable
Vine Killer: Unavailable
Harvested: September 19, 22, & 23, 2008

DATA

Disease: Mean percent of the total number of tubers showing one or more powdery scab lesions at harvest multiplied by the severity of the lesions, where 1 = not severe and 5 = very severe. Mean percent of the total number of unmarketable tubers due to powdery scab lesion severity, multiplied by the severity rating, where 1 = not severe and 5 = very severe.

Yield: Total yield expressed as hundred weight per acre. A second cwt/A has also been calculated in which all unmarketable tubers (due to high powdery scab severity), have been removed from the total yield, 2-20 foot rows per treatment per replication, mean of four replications.

Grade: By hand, percent tubers by weight in kilograms < 4 oz., 4-10 oz., > 10 oz., and culls.

Table 1. Evaluation of fungicides on the incidence of powdery scab on tubers in the cultivar Cherry Red, San Luis Valley, Colorado, 2008

Treatment	Tuber symptoms				
	Percent Incidence[a]	Percent Healthy[b]	Severity Index[c]	Percent Unmarketable[d]	Severity Index (Unmarketable)[e]
1. Untreated Control	93.0 a	6.9 d	285.9 a	68.6 a	257.9 a
2. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting	70.2 cd	29.8 ab	140.2 cd	35.0 d	105.0 cd
3. Omega @ 3.0 pt./A (one nozzle dir. over seed), At Planting	69.4 d	30.6 a	134.9 d	32.7 d	98.2 d
[f]4. Omega @ 1.5 pt./A (two nozzles), At Planting	75.1 bcd	24.9 abc	181.2 bcd	47.6 bc	153.7 bc
[f]5. Omega @ 3.0 pt./A (two nozzles), At Planting	77.4 bcd	22.6 abc	189.0 bc	49.2 bc	160.9 b
6. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting Omega @ 1.5 pt./A (Applied just prior to hilling)	82.6 ab	17.4 cd	201.7 b	52.4 bc	171.5 b
[f]7. Omega @ 1.5 pt./A (two nozzles), At Planting Omega @ 1.5 pt./A (Applied just prior to hilling)	72.4 bcd	27.6 abc	168.2 bcd	41.7 cd	137.5 bcd
[f]8. Omega @ 2.0 pt./A (two nozzles), At Planting	80.7 bc	19.3 bc	203.1 b	57.1 ab	179.6 b
[g]9. Omega @ 1.5 pt./A (two nozzles w/ extra soil mixing), At Planting	70.6 cd	29.5 ab	163.1 bcd	40.4 cd	132.9 bcd
[g]10. Omega @ 3.0 pt./A (two nozzles w/ extra soil mixing), At Planting	75.6 bcd	24.4 abc	163.0 bcd	43.7 cd	131.2 bcd
LSD(P=0.05)	10.54	10.54	49.36	12.36	51.11

[a] Percent incidence = mean percent of the total number of tubers with one or more powdery scab lesion at harvest. Mean of four replications.

[b] Percent healthy = mean percent of the total number of tubers with zero powdery scab lesions at harvest. Mean of four replications.

[c] Severity Index = mean percent of the number of infected tubers/treatment/replication multiplied by the avg. severity of the lesions, where 1 = very little or no disease and 5 = heavily infested.

[d] Percent Unmarketable = mean percent of the total number of tubers with a lesion severity rating of three or higher at harvest. Mean of four replications.

[e] Severity Index (Unmarketable) = mean percent of the number of unmarketable tubers due to powdery scab lesion severity/treatment/replication multiplied by the average severity of the lesions, where 1 = very little or no disease and 5 = heavily infested.

[f] Where two nozzles were used, one nozzle was directed over the seed piece (50% of mix) and one nozzle was directed at the soil as it covered the seed piece (50% of mix).

[g] Where two nozzles were used, one nozzle was directed over the seed piece (50% of mix) and one nozzle was directed at the soil as it covered the seed piece (50% of mix). The covering soil was also mixed with a fork as the fungicide was being applied.

Means followed by the same letter are not significantly different at P=0.05.

Robert D. Davidson (Professor) and Andrew J. Houser (Research Associate), Colorado State University

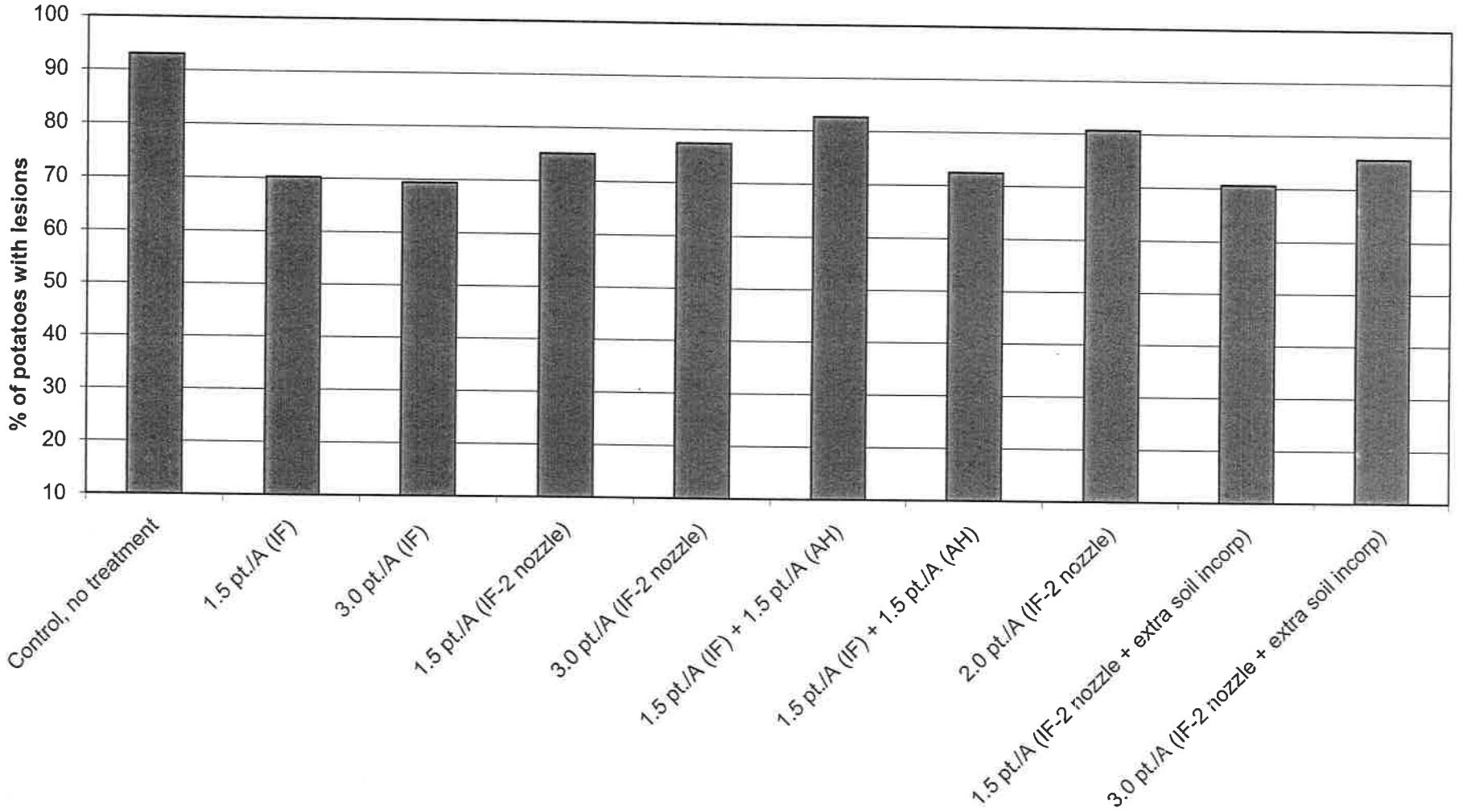
Table 2. Evaluation of fungicide programs on tuber yield and quality in the cultivar Cherry Red, San Luis Valley, Colorado, 2008

Treatment	Percent[a]				Cwt/A[b]	Marketable Cwt/A[c]	Est. total cost/A[d]
	< 4 oz.	4-10 oz.	> 10 oz.	culls			
1. Untreated Control	29.3 a	48.5	14.7 c	7.4	370.8	91.2 d	-
2. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting	19.0 c	40.1	34.1 a	6.7	479.0	314.8 a	$89.06
3. Omega @ 3.0 pt./A (one nozzle dir. over seed), At Planting	19.2 c	48.4	24.2 b	8.2	448.5	265.5 ab	$178.13
[e]4. Omega @ 1.5 pt./A (two nozzles), At Planting	28.0 ab	47.2	16.6 bc	8.2	362.3	149.7 cd	$89.06
[e]5. Omega @ 3.0 pt./A (two nozzles), At Planting	28.8 a	51.9	12.6 c	6.7	401.3	177.1 c	$178.13
6. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting Omega @ 1.5 pt./A (Applied just prior to hilling)	28.1 ab	49.4	11.6 c	10.9	376.7	136.9 cd	$178.13
[e]7. Omega @ 1.5 pt./A (two nozzles), At Planting Omega @ 1.5 pt./A (Applied just prior to hilling)	25.5 abc	46.0	18.5 bc	10.0	396.9	200.6 bc	$178.13
[e]8. Omega @ 2.0 pt./A (two nozzles), At Planting	27.4 ab	43.3	17.0 bc	12.2	381.3	130.0 cd	$118.75
[f]9. Omega @ 1.5 pt./A (two nozzles w/ extra soil mixing), At Planting	27.9 ab	45.3	18.5 bc	8.4	394.5	197.4 bc	$89.06
[f]10. Omega @ 3.0 pt./A (two nozzles w/ extra soil mixing), At Planting	21.2 bc	46.9	20.3 bc	11.5	365.5	166.3 c	$178.13
LSD(P=0.05)	6.94	NS	8.99	NS	NS	70.86	-

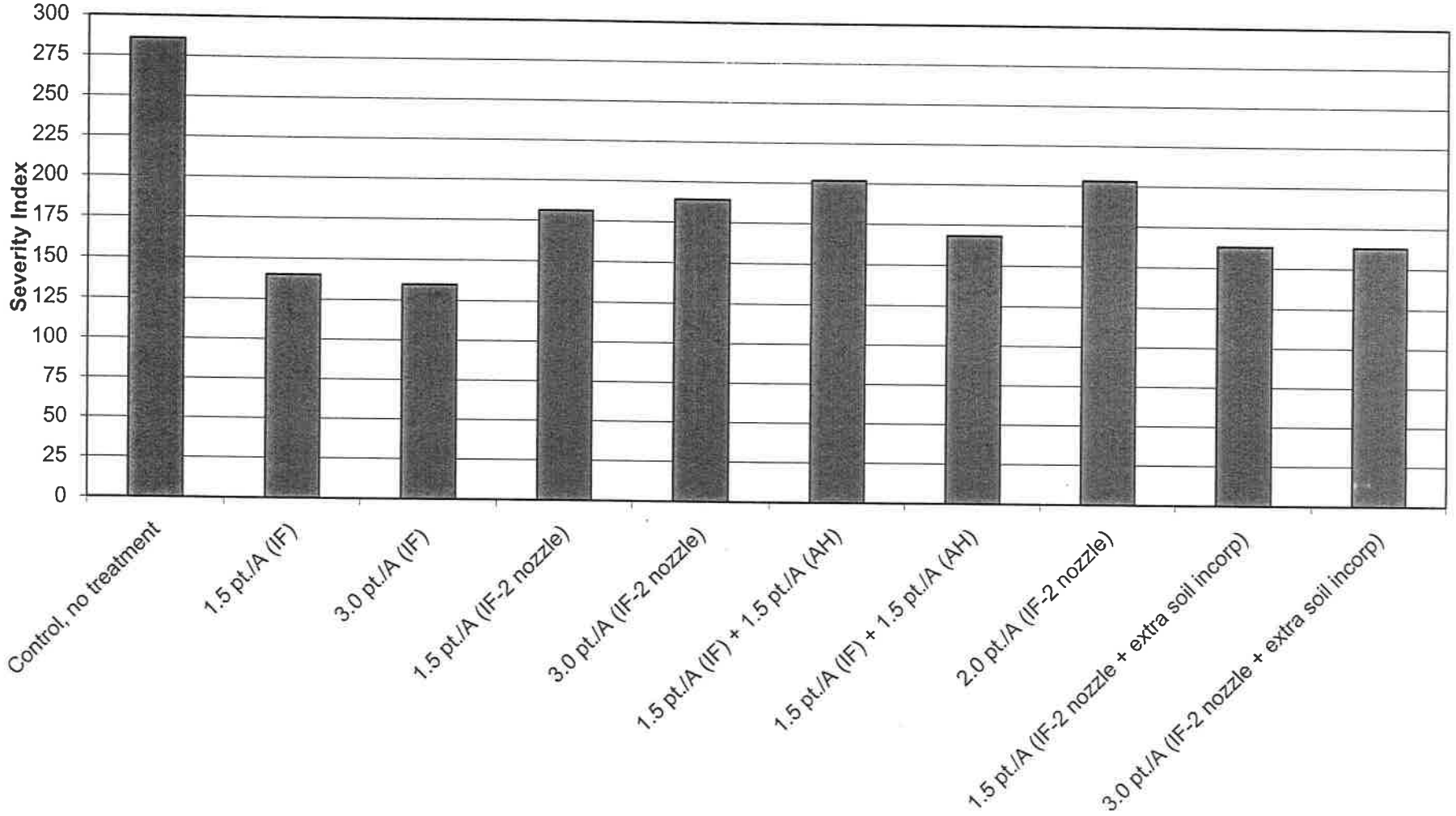
[a] Based on tuber weight in kilograms, mean of four replications.
[b] Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of four replications.
[c] Total yield expressed as hundred weight per acre (All unmarketable tubers due to high powdery scab severity have been removed from the total yield), 2-20 foot rows per treatment per replication, mean of four replications.
[d] These prices do not include application costs. Total cost/acre was based on 2009 prices and were obtained from Schall Chemical Supply LLC.
[e] Where two nozzles are used, one nozzle is directed over the seed piece (50% of mix) and one nozzle is directed at the soil as it covers the seed piece (50% of mix).
[f] Where two nozzles were used, one nozzle was directed over the seed piece (50% of mix) and one nozzle was directed at the soil as it covered the seed piece (50% of mix). The covering soil was also mixed with a fork as the fungicide was being applied.

Means followed by the same letter are not significantly different at P=0.05.

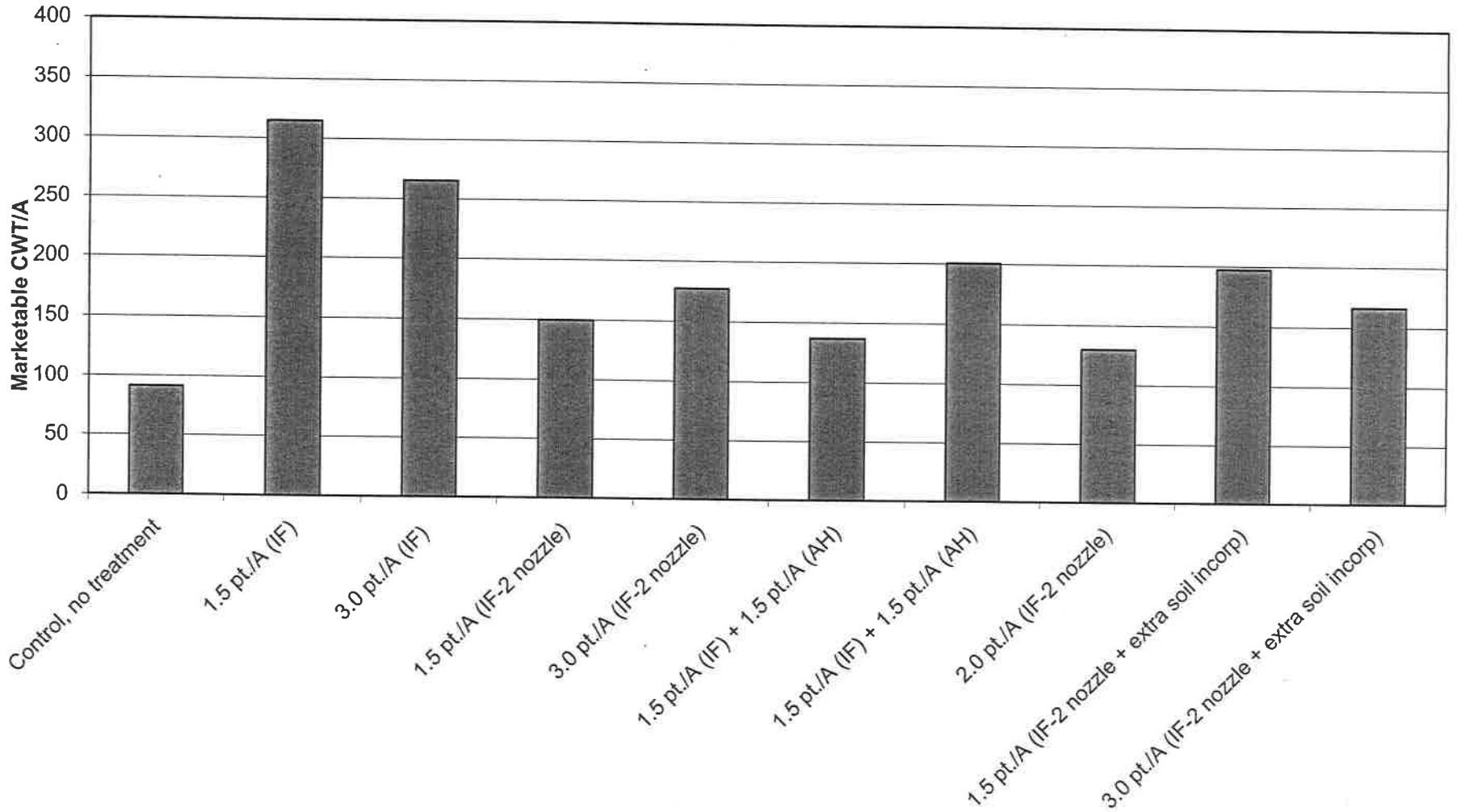
Percent of Potatoes at Harvest with Powdery Scab Lesions
Evaluation of the Fungicide Omega for Control of Powdery Scab
San Luis Valley, Colorado, 2008



Severity Index for Potatoes with Powdery Scab Lesions
Evaluation of the Fungicide Omega for Control of Powdery Scab
San Luis Valley, Colorado, 2008



Marketable Yield (Potatoes with a Severity Rating Greater than Three have been Removed)
Evaluation of the Fungicide Omega for Control of Powdery Scab
San Luis Valley, Colorado, 2008



2008 EVALUATION OF THE BIOFUNGICIDE ZONIX FOR CONTROL OF POWDERY SCAB ON POTATO

Researchers: Robert Davidson and Andrew Houser, Colorado State University, SLVRC

Location: Greenhouse trial, San Luis Valley Research Center, CO

Objective: To evaluate the biofungicide ZONIX for the control of powdery scab.

Application: For ZONIX treatments, product was applied either 4 or 6 times at approximately 5 day intervals starting at tuber set. Low rate = 1.5 floz./10 gal of water or 0.41 ml per pot per application. High rate = 2.0 floz./10 gal of water or 0.55 ml per pot per application.
For Omega treatments, product was applied and mixed in soil prior to planting (PP) at a rate of 0.023 ml Omega/pot or 1.5 pt/acre.

Application Timing: Treatments with only four ZONIX applications were made on the following days: 46DAP, 50DAP, 55DAP, and 60DAP. Treatments with six applications were made on the following days: 46DAP, 50DAP, 55DAP, 60DAP, 64DAP, 70DAP.

Treatments:

1. Control (Not Inoculated)
2. Control (Not Inoculated) + ZONIX (High rate - 6 app.)
3. Control (Inoculated)
4. ZONIX (Low rate - 4 app.)
5. ZONIX (High Rate - 4 app.)
6. ZONIX (High rate - 6 app.)
7. Omega (PP - Preplant)
8. Omega (PP) + ZONIX (Low rate - 4 app.)
9. Omega (PP) + ZONIX (High rate - 4 app.)
10. Omega (PP) + ZONIX (High rate - 6 app.)

Planted: January 17 & 18, 2008
Plot Design: Randomized Complete Block
Plot Size: Four 6" pots per treatment per replication
Cultivar: DT6063-1R (Cherry Red)
Seed: Potato eyes were removed from seed tubers using a melon scoop and allowed to suberize for several days. One eyeball was planted per pot, two inches deep in the soil.
Inoculum: One sporeball per gram of soil
Replications: Three
Irrigation: Drip irrigation, rate predetermined based on the optimal irrigation regime for powdery scab symptom development.
Fertilizer: 20N-20P-20K, applied three times (total of 1.25gN per pot or 40N/acre)
Insecticide: Conserve SC @ 3ml/gal applied on February 29, 2008
Vine Killer: Vines were removed at harvest time on May 16, 2008
Harvested: May 16, 2008

DATA

Disease: Galls on roots rated 0 to 4, 0 = none, 4 = heavily infected.
Mean percent of per pot showing one or more powdery scab lesions at harvest multiplied by the severity of the lesions, where 1 = very little or no disease and 5 = heavily infested.
Root and tuber readings were taken on May 28, 2008.

Table 1. Evaluation of the biofungicide ZONIX for the management of powdery scab in a greenhouse environment, San Luis Valley Research Center, Colorado, 2008.

Treatment	Tuber symptoms		Root Gall Rating[c]
	Percent Incidence[a]	Severity Index[b]	
1. Control (Not Inoculated)	19.4 c	15.3 b	0.0 b
2. Control (Not Inoculated) + ZONIX[d] (High rate - 6 app.)	2.8 c	2.8 b	0.0 b
3. Control (Inoculated)	53.8 b	158.3 a	1.5 a
4. ZONIX @ (Low rate - 4 app.)	95.8 a	254.2 a	1.5 a
5. ZONIX (High Rate - 4 app.)	68.8 ab	247.9 a	1.5 a
6. ZONIX (High rate - 6 app.)	70.7 ab	164.2 a	2.0 a
7. Omega (PP)[e]	6.3 c	6.3 b	0.0 b
8. Omega (PP) + ZONIX (Low rate - 4 app.)	0.0 c	0.0 b	0.0 b
9. Omega (PP) + ZONIX (High rate - 4 app.)	2.1 c	2.1 b	0.0 b
10. Omega (PP) + ZONIX (High rate - 6 app.)	0.0 c	0.0 b	0.0 b
LSD(P=0.05)	29.35	107.55	0.56

2008 Clonal Evaluation for Storage Rots

Treatments: *Erwinia* - 50ul of 1.6 x 10^4 cfu/ml into 3 inoculation sites, stem end.
Fusarium - 50ul of 160-200 spores/tuber into 3 inoculation sites, stem end.
Alternaria - 40 spores/tuber in a 50-50 oil-water spray, after bruising.

Tubers kept at 55-60^{0}F after inoculation for 4 weeks. Readings: 12/11/08

Inoculation/Reading: *Erwinia* (11/12/08) *Fusarium* (11/12/08)
Alternaria (Not performed in 2008)

Cultivars:

1. AC99375-1RU
2. AC00170-2W
3. CO00188-4W
4. CO00277-2R
5. CO00291-5R
6. CO00415-1R
7. CO99045-1W/Y
8. CO99053-3RU
9. CO99053-4RU
10. CO99076-6R
11. CO99100-1RU
12. CO99256-2R
13. AC97306-1RU
14. CO99338-3RU/Y
15. CO00405-1R
16. CO00412-5W/Y
17. CO00197-3W
18. CO00379-2R/Y
19. ATC00293-1W/Y
20. CO00270-7W
21. Centennial Russet
22. Russet Norkotah Sel. 3
23. Russet Nugget
24. Sangre Sel. 10
25. Rio Grand Russet

Evaluation: Ranked by Score. Scores based upon 3 reps x 10 tubers/rep.
Tuber evaluations follow: Control will always equal 1 or 0.

Fusarium	*Erwinia*	*Alternaria*
1 = No symptoms	1 = No symptoms	0 = No symptoms
2 = Localized damage	2 = Localized damage	1 = 1/8" dia./1peel
3 = < 50% tuber damage	3 = < 50% tuber damage	2 = 1/4" dia./2 peels
4 = > 50% tuber damage	4 = > 50% tuber damage	3 = 1/2" dia./3 peels
5 = 100% tuber damage	5 = 100% tuber damage	4 = > 10% tuber damage
		5 = 100% tuber damage

Grade loss occurs at 3 for *Fusarium* and *Erwinia* and at 4 for *Alternaria*

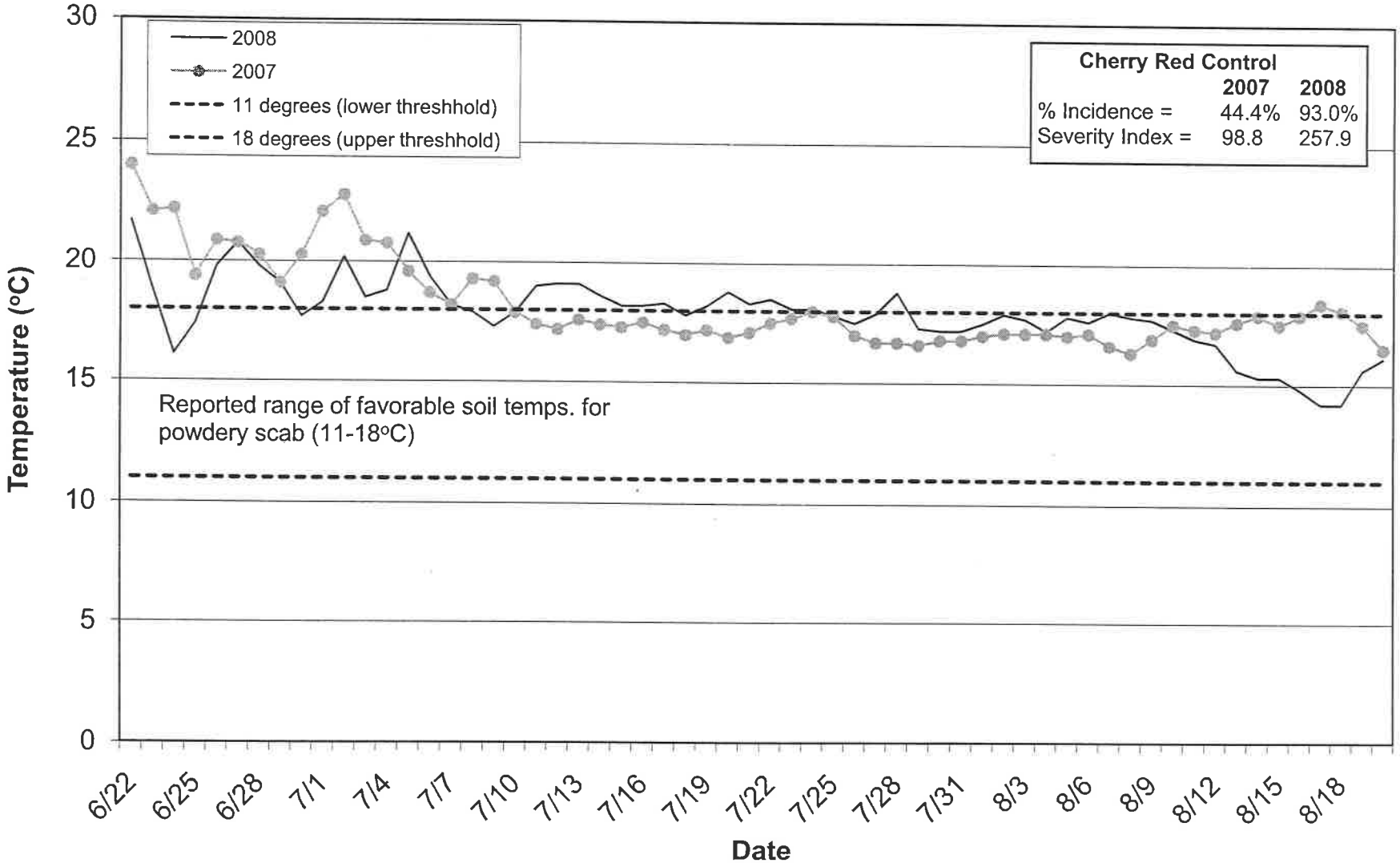
Table 3. Clonal Evaluation for Storage Rot			
Fusarium			
Inoculation	**11/14/2007**	**11/12/2008**	
Reading	**12/12/2007**	**12/11/2008**	
Clone	**Avg Score**	**Avg Score**	**2 Yr. Avg**
AC99375-1RU	3.20	3.70	3.45
AC00170-2W		2.50	
CO00188-4W		3.00	
CO00277-2R		3.50	
CO00291-5R		3.40	
CO00415-1R		3.90	
CO99045-1W/Y	3.20	3.90	3.55
CO99053-3RU	3.00	3.90	3.45
CO99053-4RU	3.00	4.10	3.55
CO99076-6R	2.10	2.60	2.35
CO99100-1RU	3.00	3.00	3.00
CO99256-2R	3.00	3.00	3.00
AC97306-1RU		3.00	
CO99338-3RU/Y	3.00	3.00	3.00
CO00405-1R		3.70	
CO00412-5W/Y		3.10	
CO00197-3W		3.20	
CO00379-2R/Y		3.50	
ATC00293-1W/Y		2.90	
CO00270-7W		3.00	
AC99329-7PW/Y	3.00	2.90	2.95
AC99330-1P/Y	3.80	3.00	3.40
Centennial RU		2.40	
Rio Grande RU	2.90	3.40	3.15
RU Norkotah 3	3.00	3.20	3.10
RU Nugget	3.40	3.80	3.60
Sangre 10	2.40	2.70	2.55

1 = No symptoms, 2 = Localized damage
3 = <50% tuber damage, 4 = >50% tuber damage,
5 = 100% tuber damage. Grade loss occurs at 3.00.

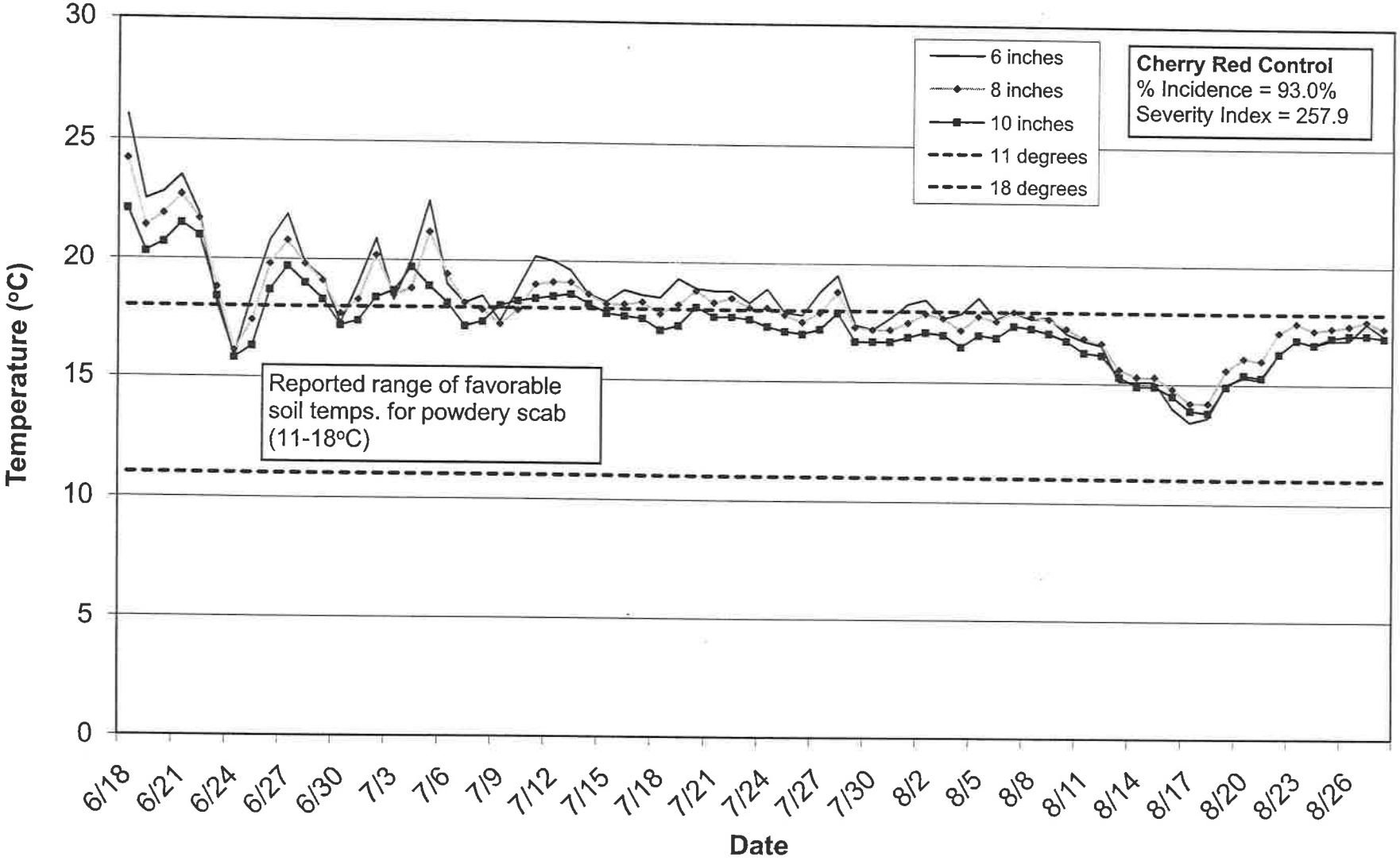
Table 4. Clonal Evaluation for Storage Rot			
Erwinia			
Inoculation	**11/14/2007**	**11/12/2008**	
Reading	**12/12/2007**	**12/11/2008**	
Clone	**Avg Score**	**Avg Score**	**2 Yr. Avg**
AC99375-1RU	3.50	1.20	
AC00170-2W		1.80	
CO00188-4W		1.50	
CO00277-2R		1.20	
CO00291-5R		1.80	
CO00415-1R		1.00	
CO99045-1W/Y	2.60	1.70	2.15
CO99053-3RU	2.50	1.40	1.95
CO99053-4RU	2.40	1.40	1.90
CO99076-6R	2.10	2.00	2.05
CO99100-1RU	2.60	1.90	2.25
CO99256-2R	2.70	1.90	2.30
AC97306-1RU		2.10	
CO99338-3RU/Y	2.20	1.40	1.80
CO00405-1R		1.80	
CO00412-5W/Y		2.30	
CO00197-3W		2.00	
CO00379-2R/Y		2.00	
ATC00293-1W/Y		1.40	
CO00270-7W		2.00	
AC99329-7PW/Y	2.50	1.50	2.00
AC99330-1P/Y	3.60	2.10	2.85
Centennial RU		1.10	
Rio Grande RU	3.10	2.00	3.55
RU Norkotah 3	2.30	2.00	2.15
RU Nugget	3.20	2.10	2.65
Sangre 10	2.30	1.90	

1 = No symptoms, 2 = Localized damage
3 = <50% tuber damage, 4 = >50% tuber damage,
5 = 100% tuber damage. Grade loss occurs at 3.00.

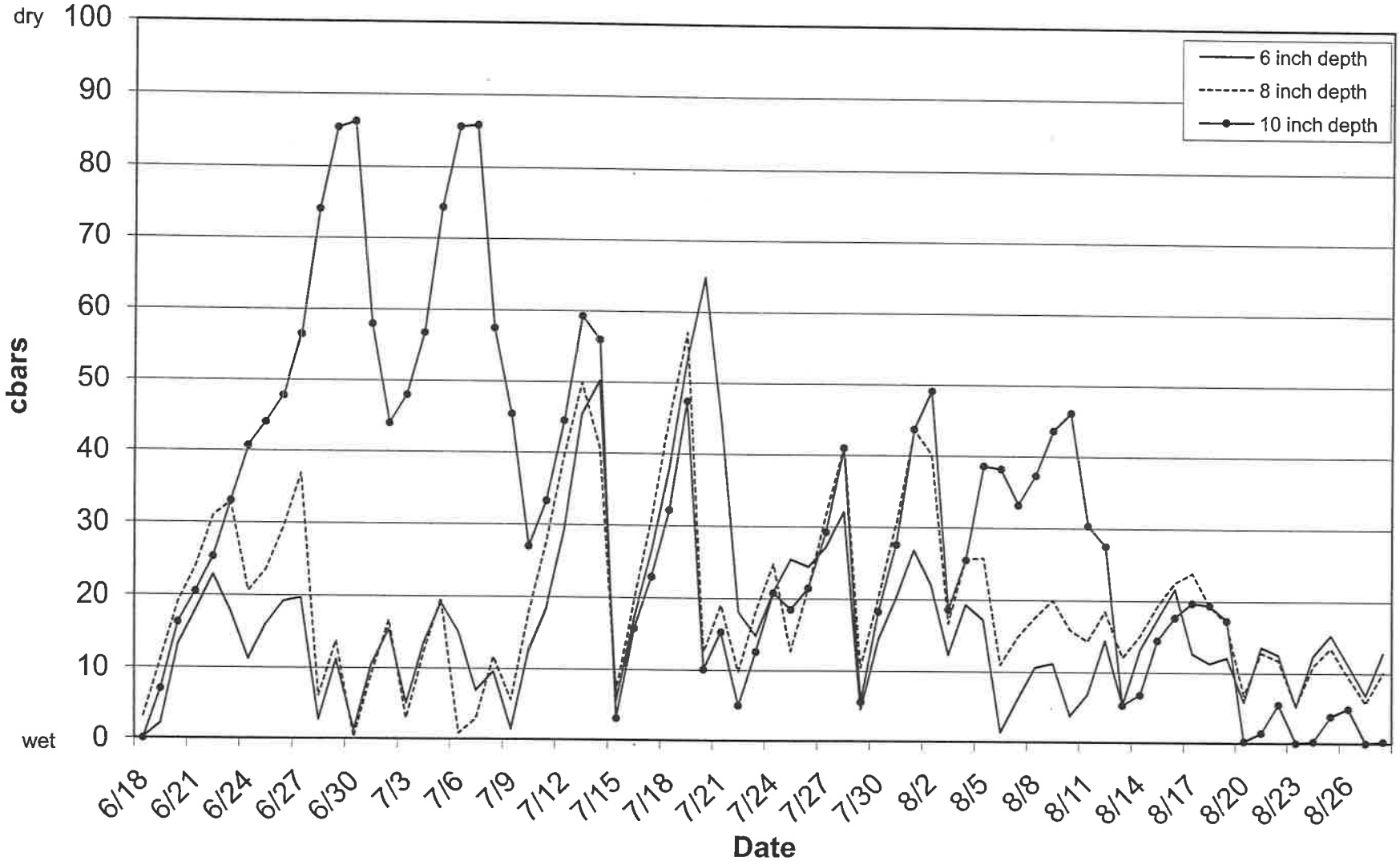
Average Soil Temperature Readings 8" Under Potato Plant Canopy, Powdery Scab Trial, San Luis Valley, Coloardo, 2007 & 2008



Average Soil Temperature Readings at 6, 8, and 10" Under Potato Plant Canopy, Powdery Scab Trial, San Luis Valley, Coloardo, 2008



Soil Moisture Readings (Daily Average) 6, 8 & 10 Inches Below Soil Surface, Powdery Scab Trial, San Luis Valley, Coloardo, 2008



Soil Amendment Trial

EVALUATION OF PLANT AMENDMENTS FOR INCREASED POTATO HEALTH AND YIELD ON THE CULTIVARS RUSSET NORKOTAH SELECTION 8 AND SANGRE, 2008

Researchers: Rob Davidson and Andrew Houser, Colorado State University, SLVRC

Location: San Luis Valley Research Center, Center, CO

Cultivar: Russet Norkotah selection 8 and Sangre, cut seed, 2-4 oz.

Objective: To evaluate the efficacy of using Beyond, NuEarth and compost as plant amendments in increasing plant health and yield in potato.

Application: In-Furrow treatments were applied using an R & D CO_2 charged backpack sprayer at 35 PSI, with one XR 8002VS nozzle, at 10 gallons/acre as a directed in-furrow application. For treatments 4 and 8, compost was applied in-furrow prior to planting. Foliar treatments were applied using an R & D CO_2 charged backpack sprayer at 35 PSI, with two XR 8002VS nozzles, at 20 gallons/acre.

Treatments:

1. Russet Norkotah selection 8, untreated control
2. Russet Norkotah selection 8, Beyond @ 16 floz./A (applied In-furrow and at tuber initiation)
3. Russet Norkotah selection 8, NuEarth @ 8.0 gal./A (applied In-furrow and at tuber initiation)
4. Russet Norkotah selection 8, Compost @ 4.0 tons/A (applied In-furrow prior to planting)
5. Sangre, untreated control
6. Sangre, Beyond @ 16 floz./A (applied In-furrow and at tuber initiation)
7. Sangre, NuEarth @ 8.0 gal./A (applied In-furrow and at tuber initiation)
8. Sangre, Compost @ 4.0 tons/A (applied In-furrow prior to planting)

Planted: May 13, 2008

Plot Design: Randomized complete block

Plot Size: 2 - 10 foot rows per treatment per replication

Plant Spacing: 12 inches

Row Spacing: 34 inches

Replications: four

Irrigation: Solid set sprinkler, rate based on ET

Fertilizer: 80N-60P-40K-25S-2.5Z, preplant, 60N through sprinkler after tuber set

Herbicide: Matrix, 1.5 oz./A + Eptam, 4.5 pt./A

Insecticide: None

Fungicide: Bravo WS @ 1.5 pt./A + Quadris @ 6.1 floz./A

Vine Killer: Rotobeat vines on September 2, 2008

Harvested: September 8, 2008

DATA

Yield: 2-10 foot rows per treatment per replication, total yield expressed as cwt/A.

Grade: By hand, percent tubers by weight in kilograms < 4 oz., 4-10 oz., > 10 oz., US #2's and culls.

Disease: At harvest, pink rot and powdery scab were found and evaluated in the trial. Mean percent of tubers with pink rot at harvest was multiplied by a disease severity rating of 1-5 (1=less than 5% rotten, 5=100% rotten) per treatment per replication. Mean percent of the total number of tubers with powdery scab, showing one or more lesions at harvest multiplied by the severity of the lesions, where 1 = not severe and 5 = very severe.

Table 1. Effects of Biological treatments, applied at planting and in season for increasing tuber yield and quality in the potato cultivar Russet Norkotah selection 8, San Luis Valley, Colorado, 2008.

Program			Percent[a]						
	Treatment/Rate	Application Schedule	< 4 oz.	4-10 oz.	> 10 oz.	Culls	Cwt/A[b]	kg rot[c]	% rot[d]
1.	Control, no treatment	-	21.6 a	51.3	22.8	4.3	356.0	0.2	0.7
2.	Beyond @ 16 floz./A Beyond @ 16 floz./A	May 13, 20008 (In-furrow) July 18, 2008 (At tuber set)	18.7 ab	58.1	18.6	4.6	318.7	0.3	1.5
3.	NuEarth @ 8.0 gal./A NuEarth @ 8.0 gal./A	May 13, 20008 (In-furrow) July 18, 2008 (At tuber set)	22.4 a	47.0	26.1	4.5	321.7	0.2	1.1
4.	Compost @ 4 tons/A	May 13, 20008 (Added to furrow at planting)	14.8 b	50.3	28.7	6.2	336.9	0.3	1.4
LSD(P=0.05)			4.15	NS	NS	NS	NS	NS	NS

[a] Based on tuber weight in kilograms, mean of four replications.
[b] Total yield expressed as hundred weight per acre, 2-10 foot rows per treatment per replication, mean of four replications.
[c] Average weight in kilograms of rotten tubers found at harvest.
[d] Percent of rotten tubers at harvest based on total tuber weight.

Table 2. Effects of Biological treatments, applied at planting and in season for increasing tuber yield and quality in the potato cultivar Sangre, San Luis Valley, Colorado, 2008.

Program			Percent[a]							Powdery scab	
	Treatment/Rate	Application Schedule	< 4 oz.	4-10 oz.	> 10 oz.	Culls	Cwt/A[b]	kg rot[c]	% rot[d]	% incidenc[e]	Severity Index[f]
1.	Control, no treatment	-	34.2	50.3	13.0	2.5	372.0	1.7	6.94	82.5	232.5
2.	Beyond @ 16 floz./A Beyond @ 16 floz./A	May 13, 20008 (In-furrow) July 18, 2008 (At tuber set)	40.7	46.5	12.0	0.7	360.2	1.1	5.20	72.5	187.5
3.	NuEarth @ 8.0 gal./A NuEarth @ 8.0 gal./A	May 13, 20008 (In-furrow) July 18, 2008 (At tuber set)	39.2	44.4	7.7	8.8	312.8	1.6	7.35	72.5	202.5
4.	Compost @ 4 tons/A	May 13, 20008 (Added to furrow at planting)	40.3	47.1	8.5	4.1	314.1	2.0	9.47	62.5	157.5
LSD(P=0.05)			NS	NS	NS	NS	NS	NS	NS	NS	NS

[a] Based on tuber weight in kilograms, mean of four replications.
[b] Total yield expressed as hundred weight per acre, 2-10 foot rows per treatment per replication, mean of four replications.
[c] Average weight in kilograms of rotten tubers found at harvest.
[d] Percent of rotten tubers at harvest based on total tuber weight.
[e] Percent of tubers expressing powdery scab lesions at harvest, mean of four replications.
[f] Percent powdery scab incidence multiplied by a severity rating (rating scale of 1 to 5, 1 = 1 to 2% of tuber covered by powdery scab lesions, 5 = >25% coverage), mean of four replications.