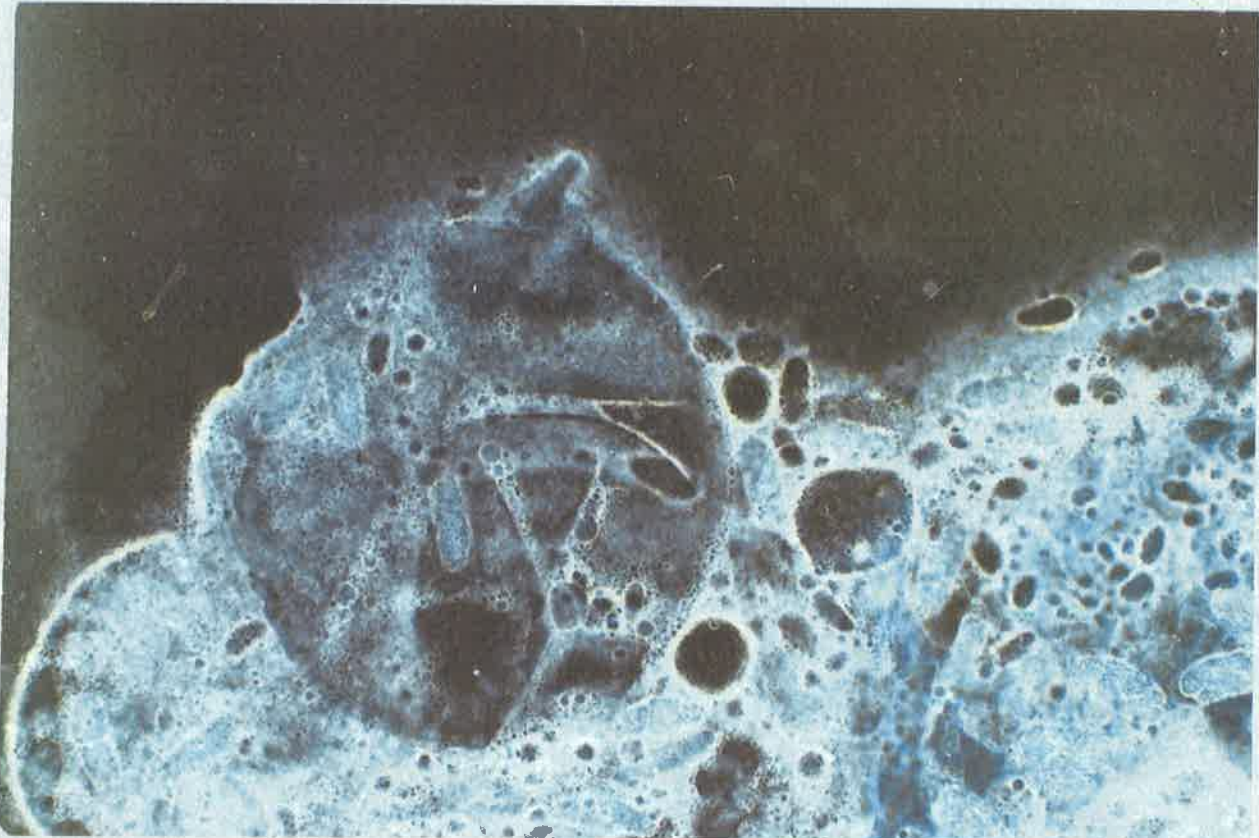


**2010**

**Potato Research Report  
Potato Disease Control Project**



**Robert Davidson, Andrew Houser and Richard Haslar  
Colorado State University SLV Research Center**

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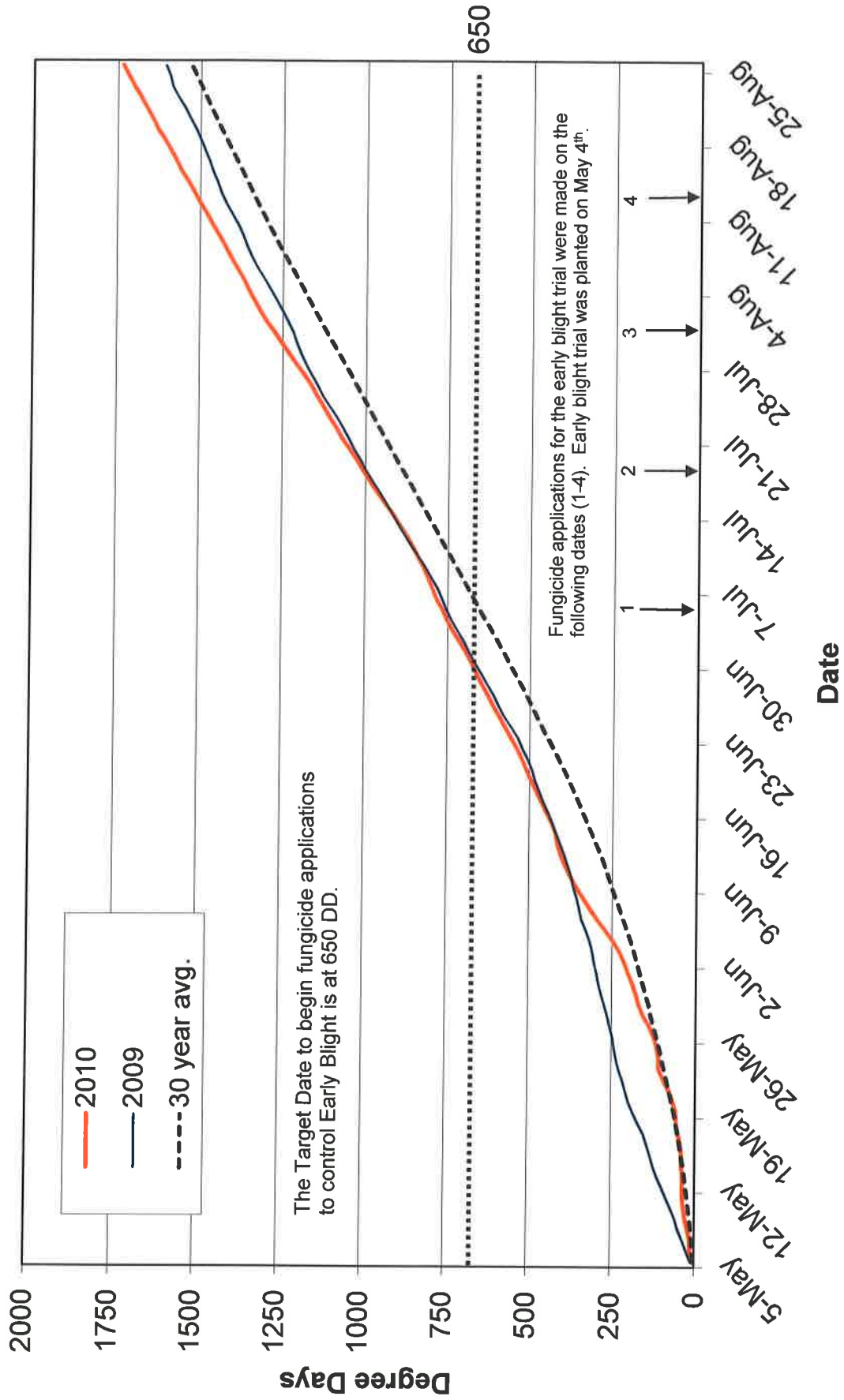
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# Early Blight Fungicide Trials

Research has shown that strobilurin products (i.e. Headline, Quadris, etc.) worked well in controlling early blight and were significantly better than all other combination treatments when these products were used first in the rotation. Spraying schedules that include two or three fungicide applications during the season (with at least one of the fungicides being a strobilurin), 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 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 or more years of early blight trial data are analyzed, the yields from the untreated controls are significantly less than several of the fungicide combination treatments. This indicates that when an effective fungicide program is used to control foliar early blight, yields are improved.

# Early Blight Degree Days for the San Luis Valley



— 2010  
— 2009  
- - - 30 year avg.

The Target Date to begin fungicide applications to control Early Blight is at 650 DD.

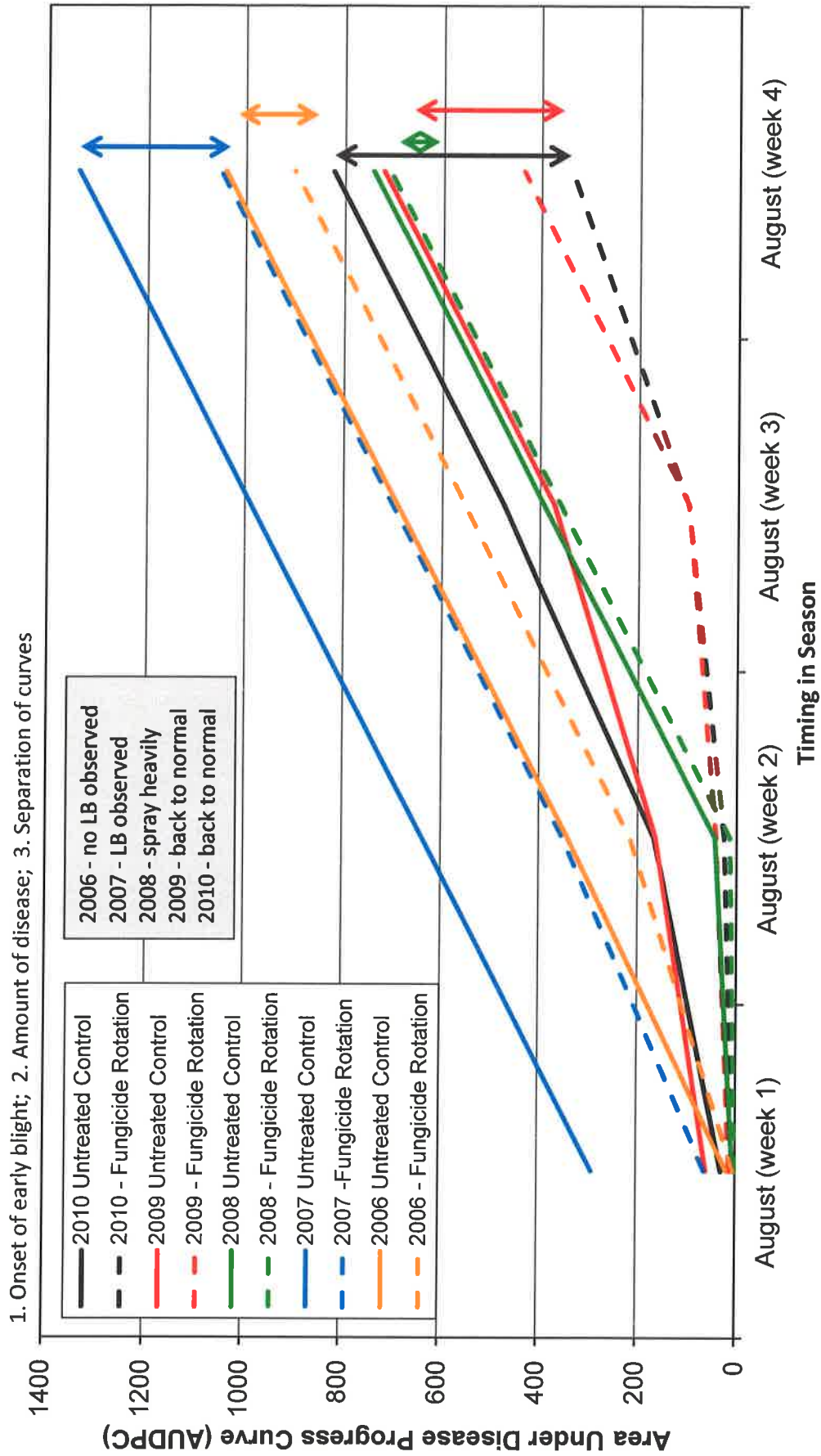
Fungicide applications for the early blight trial were made on the following dates (1-4). Early blight trial was planted on May 4<sup>th</sup>.

1 → 7-Jul    2 → 21-Jul    3 → 4-Aug    4 → 18-Aug

# Area Under the Disease Progress Curve for Early Blight

## Early Blight Fungicide Trial (2006 - 2010), Colorado State University, San Luis Valley Research Center, Center, CO

### Total Amount of Accumulated Early Blight Through Season



\* Fungicide rotations for each year consisted of Quadris, followed by Bravo WS, followed by Endura applied on two week intervals. For 2010, a second application of Quadris was applied between the Bravo WS and Endura applications.

## 2010 POTATO – FOLIAR EARLY BLIGHT FUNGICIDE TRIAL #1

- 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<sub>2</sub> 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 6; July 19; August 2; August 13
- Planted:** May 4, 2010
- 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, 50N 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, 2010
- Harvested:** September 20, 2010
- DATA:**
- Disease:** Early blight disease incidence based on percent leaves infected, readings taken weekly starting August 6, 2010.
- AUDPC:** **Area Under the Disease Progress Curve (AUDPC) is a measure of the progression of Early Blight, starting on August 6<sup>th</sup> and ending with the last reading on August 30<sup>th</sup>. 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 2010.

<u>Program</u>	<u>Products</u>	<u>Rate</u>	<u>Application Schedule<sup>a</sup></u>
1	Untreated Control	-	-
2	Bravo WS	1.5 pt./A	1,3,5,7
3	Quadris	6.2 floz./A	1
	Revus Top	7.0 floz./A	3
	Bravo WS	1.5 pt./A	5
	Endura	2.5 oz./A	7
4	Revus Top	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	Quadris Top	8.0 floz./A	1
	Bravo WS	1.5 pt./A	3
	Quadris Opti	1.5 pt./A	5
	Revus Top	7.0 floz./A	7
6	Quadris Top	8.0 floz./A	1
	Bravo WS	1.5 pt./A	3
	Quadris Opti	1.6 pt./A	5
	Endura	2.5 oz./A	7

<sup>a</sup> Schedule for applying treatments on a weekly basis, schedule started on July 6 (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, 2010; No Late Blight occurred within the trial.

Treatment	Percent Leaves Infected <sup>a</sup> (with one or more lesion)				AUDPC <sup>c</sup>
	August 6 <sup>b</sup>	August 13	August 25	September 1	
1	8.2 a	39.5 a	87.9 a	99.5 a	822.9 a
2	3.8 bc	9.2 b	37.9 c	88.3 ab	487.1 c
3	4.6 b	13.2 b	64.6 b	87.3 ab	593.8 b
4	2.5 cd	9.1 b	35.0 c	76.3 bc	430.0 cd
5	2.5 cd	5.3 b	23.8 d	77.5 bc	381.5 de
6	1.5 d	5.6 b	21.2 d	68.0 c	337.0 e
LSD(P=0.05)	1.7	11.6	9.6	12.5	85.7

<sup>a</sup> Percent of leaflets with Early Blight lesions per plant (3 plants evaluated per treatment/rep, mean of four replications).

<sup>b</sup> Readings were taken from only two replications due to the low levels of Early Blight present.

<sup>c</sup> AUDPC is the Area Under the Disease Progress Curve, accumulated weekly from August 6 through September 1.

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



**Table 3.** Effect of fungicide programs on tuber yield and quality in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2010.

Treatment	Percent <sup>a</sup>					
	< 4 oz.	4-10 oz.	> 10 oz.	US No 2's	Culls	Cwt/A <sup>b</sup>
1	13.1	52.3	29.4	1.7	3.5	428.9 b
2	9.1	43.6	40.2	0.9	6.3	497.9 a
3	7.9	46.4	39.2	0.5	6.0	475.2 ab
4	12.5	46.6	36.6	1.1	3.4	505.7 a
5	10.3	46.5	37.6	0.6	5.1	488.8 a
6	10.8	45.8	38.3	1.0	4.2	512.3 a
LSD(P=0.05)	NS	NS	NS	NS	NS	49.3

<sup>a</sup> Based on tuber weight in kilograms, mean of four replications.

<sup>b</sup> Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of four replications.

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

## 2010 POTATO – FOLIAR EARLY BLIGHT FUNGICIDE TRIAL #2

- 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<sub>2</sub> 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 6; July 19; August 2; August 13
- Planted:** May 4, 2010
- 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, 50N 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, 2010
- Harvested:** September 21, 2010
- DATA:**
- Disease:** Early blight disease incidence based on percent leaves infected, readings taken weekly starting August 6, 2010.
- AUDPC:** **Area Under the Disease Progress Curve (AUDPC) is a measure of the progression of Early Blight, starting on August 6<sup>th</sup> and ending with the last reading on August 30<sup>th</sup>. 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 2010.

<u>Program</u>	<u>Products</u>	<u>Rate</u>	<u>Application Schedule<sup>a</sup></u>
1	Untreated Control	-	-
2	Echo ZN	2.0 pt./A	1
	Luna Tranquility	11.0 oz./A	3,7
	Reason	4.0 oz./A	5
3	Echo ZN	2.0 pt./A	1
	Luna Tranquility	11.0 oz./A	3,7
	Scala 60SC	7.0 oz./A	5
4	Echo ZN	2.0 pt./A	1
	Scala 60SC	7.0 oz./A	3,7
	Dithane Rainshield	2.0 lbs./A	5
5	Dithane Rainshield	2.0 lbs./A	1,5
	Scala 60SC	7.0 oz./A	3,7
	Echo ZN	1.5 pt./A	3,7

<sup>a</sup> Schedule for applying treatments on a weekly basis, schedule started on July 6 (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, 2010; No Late Blight occurred within the trial.

Treatment	Percent Leaves Infected <sup>a</sup> (with one or more lesion)				AUDPC <sup>b</sup>
	August 6	August 13	August 23	August 30	
1	8.7 a	36.3 a	88.5 a	98.8 a	812.6 a
2	2.0 c	4.2 c	22.9 d	70.4 c	348.3 d
3	1.5 c	5.2 c	19.6 d	60.0 c	301.9 d
4	6.1 b	17.5 b	72.5 b	99.0 a	682.8 b
5	2.5 c	7.6 bc	40.0 c	83.7 b	468.4 c
LSD(P=0.05)	2.0	11.3	15.7	11.7	118.5

<sup>a</sup> Percent of leaflets with Early Blight lesions per plant (3 plants evaluated per treatment/rep, mean of four replications).

<sup>b</sup> AUDPC is the Area Under the Disease Progress Curve, accumulated weekly from August 6 through August 30.

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, 2010.

Treatment	Percent <sup>a</sup>					
	< 4 oz.	4-10 oz.	> 10 oz.	US No 2's	Culls	Cwt/A <sup>b</sup>
1	8.3	50.3	37.2	1.8	2.5 b	473.3
<sup>c</sup> 2	9.4	42.2	40.2	1.1	7.1 a	454.3
3	9.6	48.5	37.2	1.7	3.0 b	485.8
4	9.9	51.8	35.0	1.0	2.3 b	463.6
5	10.5	46.1	39.1	0.9	3.4 b	472.9
LSD(P=0.05)	NS	NS	NS	NS	2.1	NS

<sup>a</sup> Based on tuber weight in kilograms, mean of four replications.

<sup>b</sup> Total yield expressed as hundred weight per acre (culls are removed from the cwt/A), 2-20 foot rows per treatment per replication, mean of four replications.

<sup>c</sup> Due to psyllid damage in the east end of the field, yield data from treatment 2, rep 4 was not included in the analysis. Yield data from reps 1, 2, & 3 was used.

## 2010 POTATO – FOLIAR EARLY BLIGHT FUNGICIDE TRIAL #3

**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<sub>2</sub> 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 6; July 19; August 2; August 13

**Treatments:**

1. Control, no treatment
2. Luna Sensation @ 5.0 oz./A (Applied on July 6 & 19, August 2 & 13)
3. Luna Tranquility @ 11.0 oz./A (Applied on July 6 & 19, August 2 & 13)

**Planted:** May 11, 2010  
**Plot Design:** Randomized complete block  
**Plot Size:** Two - 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, 50N through sprinkler after tuber set  
**Herbicide:** Matrix, 1.5 oz./A + Eptam, 4.5 pt./A  
**Insecticide:** None  
**Vine Killer:** Rotobeat vines on September 9, 2010  
**Harvested:** September 21, 2010

### DATA:

**Disease:** Early blight disease incidence based on percent leaves infected, readings taken weekly starting August 6, 2010.

**AUDPC:** **Area Under the Disease Progress Curve (AUDPC) is a measure of the progression of Early Blight, starting on August 6<sup>th</sup> and ending with the last reading on August 30<sup>th</sup>. 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:** 2-10 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.

**Table 1.** Effect of fungicide programs on the incidence of early blight in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2010; No Late Blight occurred within the trial.

Treatment	Percent Leaves Infected <sup>a</sup> (with one or more lesion)				AUDPC <sup>b</sup>
	August 6	August 13	August 23	August 30	
1	9.6 a	30.4 a	87.9 a	99.2 a	794.8 a
2	1.3 b	3.5 b	17.9 b	30.8 b	187.5 b
3	1.5 b	3.3 b	20.8 b	31.3 b	199.2 b
LSD(P=0.05)	2.7	10.4	12.0	7.5	82.3

<sup>a</sup> Percent of leaflets with Early Blight lesions per plant (3 plants evaluated per treatment/rep, mean of four replications).

<sup>b</sup> AUDPC is the Area Under the Disease Progress Curve, accumulated weekly from August 6 through August 30.

Means followed by the same letters are not significantly different at P=0.05 for AUDPC.

**Table 2.** Effect of fungicide programs on tuber yield and quality in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2010.

Treatment	Percent <sup>a</sup>			US No 2's	Culls	Cwt/A <sup>b</sup>
	< 4 oz.	4-10 oz.	> 10 oz.			
1	10.3	50.3	32.6	1.2 a	5.7	420.3
2	4.5	47.2	39.3	0.3 b	8.7	420.7
3	10.4	43.2	37.5	0.2 b	8.7	460.9
LSD(P=0.05)	NS	NS	NS	0.7	NS	NS

<sup>a</sup> Based on tuber weight in kilograms, mean of four replications.

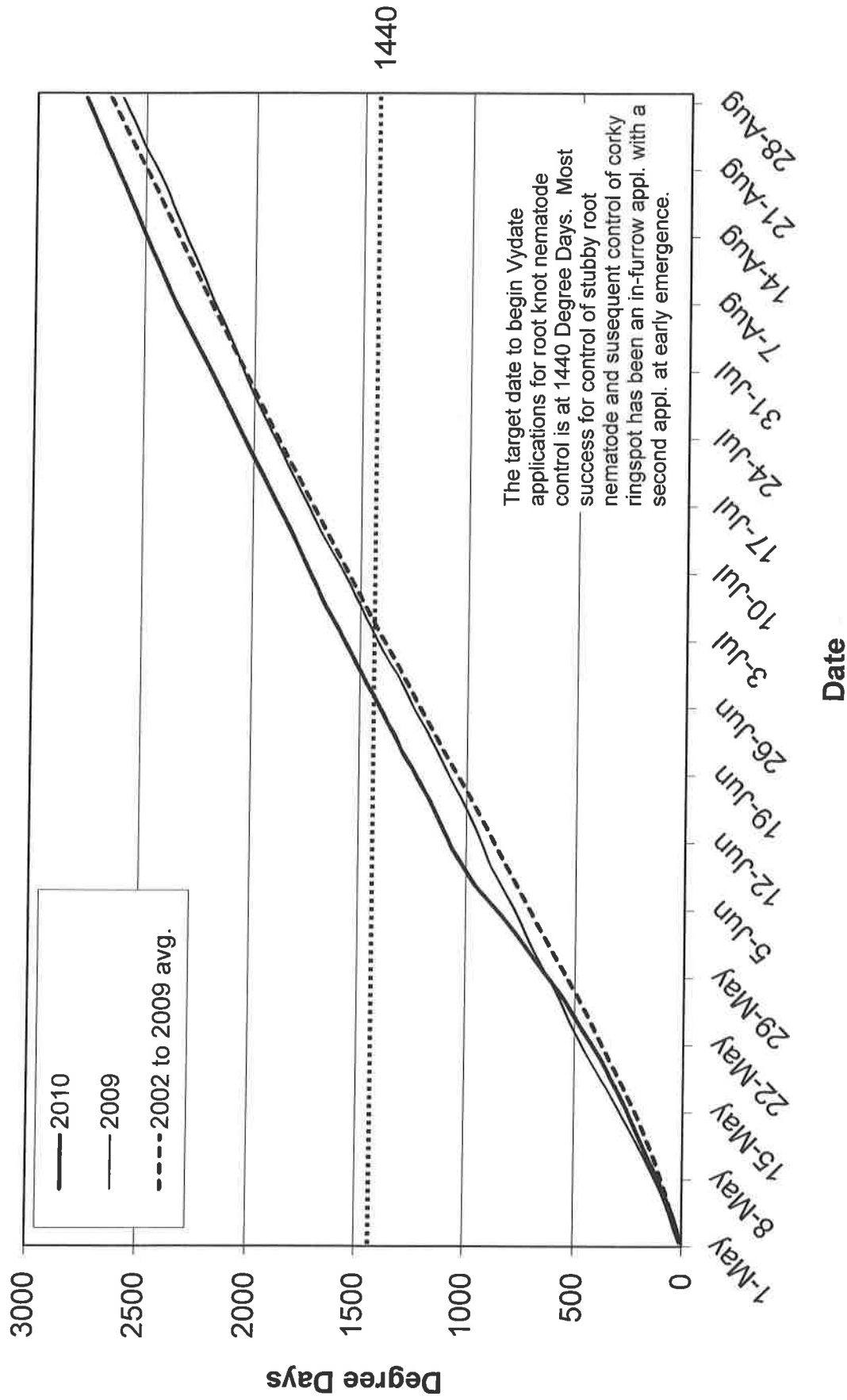
<sup>b</sup> Total yield expressed as hundred weight per acre (culls are removed from the cwt/A), 2-10 foot rows per treatment per replication, mean of four replications.

Means followed by the same letters are not significantly different at P=0.05 for AUDPC.



# Root Knot Nematode Degree Days

# Root Knot Nematode Degree Days for the San Luis Valley



1440

# SLV Late Blight Forecasting

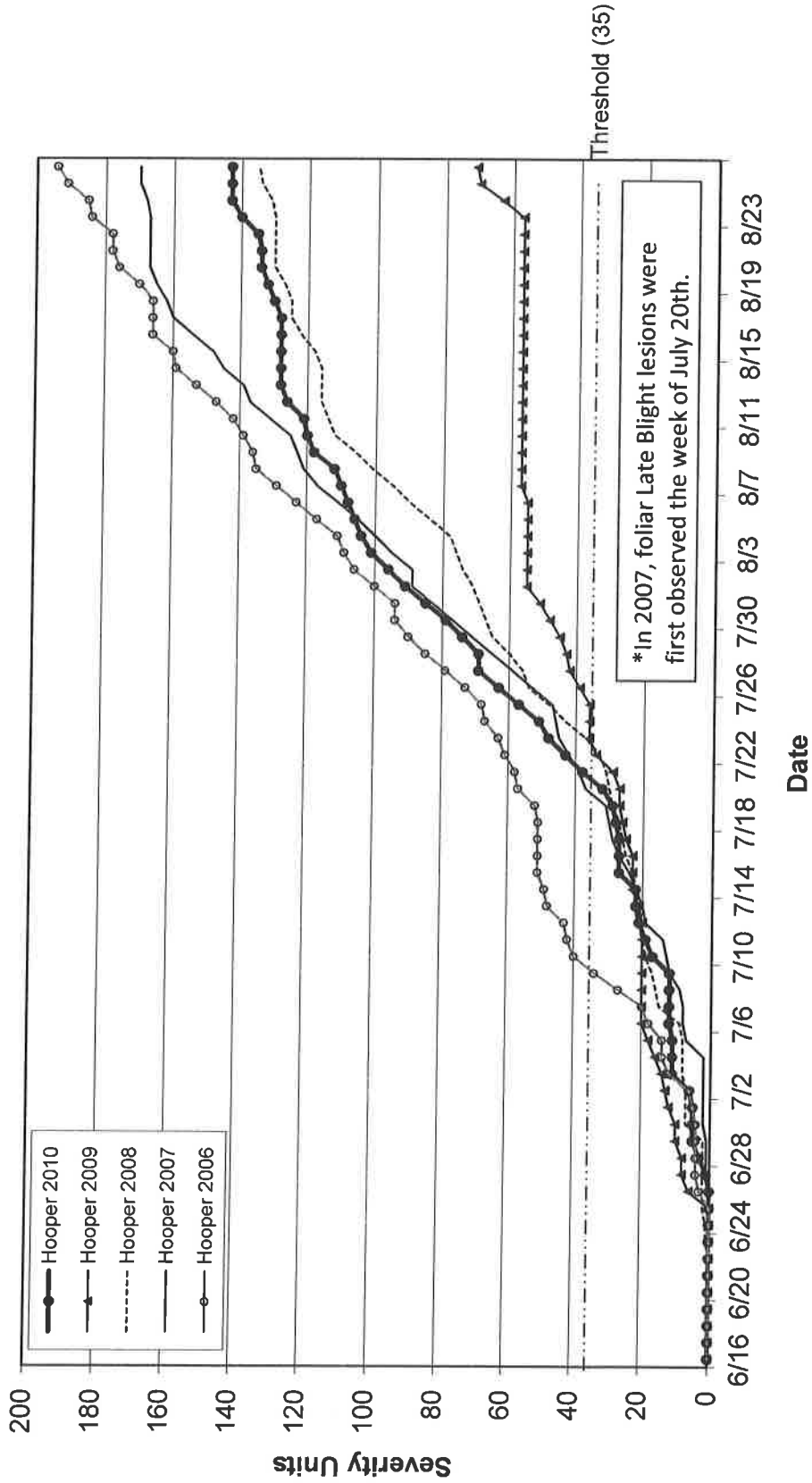
Over the last several years weather stations have been positioned at three locations around the San Luis Valley (Blanca, Hooper, & Sargent) in order to determine late blight severity units. This was continued in 2010 in order to determine the potential risk we have for late blight here in the valley.

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 2009, the overall number of smith periods were low compared with other years. In 2010, smith periods were high (higher than in 2007 when late blight was detected). Although a high number of smith periods indicates that the potential for late blight infections is high, the date of the initial smith period occurrence is also important. In 2009 this date occurred on June 26<sup>th</sup>, which was approximately three weeks ahead of average. In years with an early occurrence of smith periods, it would be advised that fungicide applications be made earlier than in a typical year for late blight management.

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.

**Potato Late Blight Fry Units, San Luis Valley (Hooper site), Colorado, 2006 - 2010**  
Moderately Susceptible Varieties

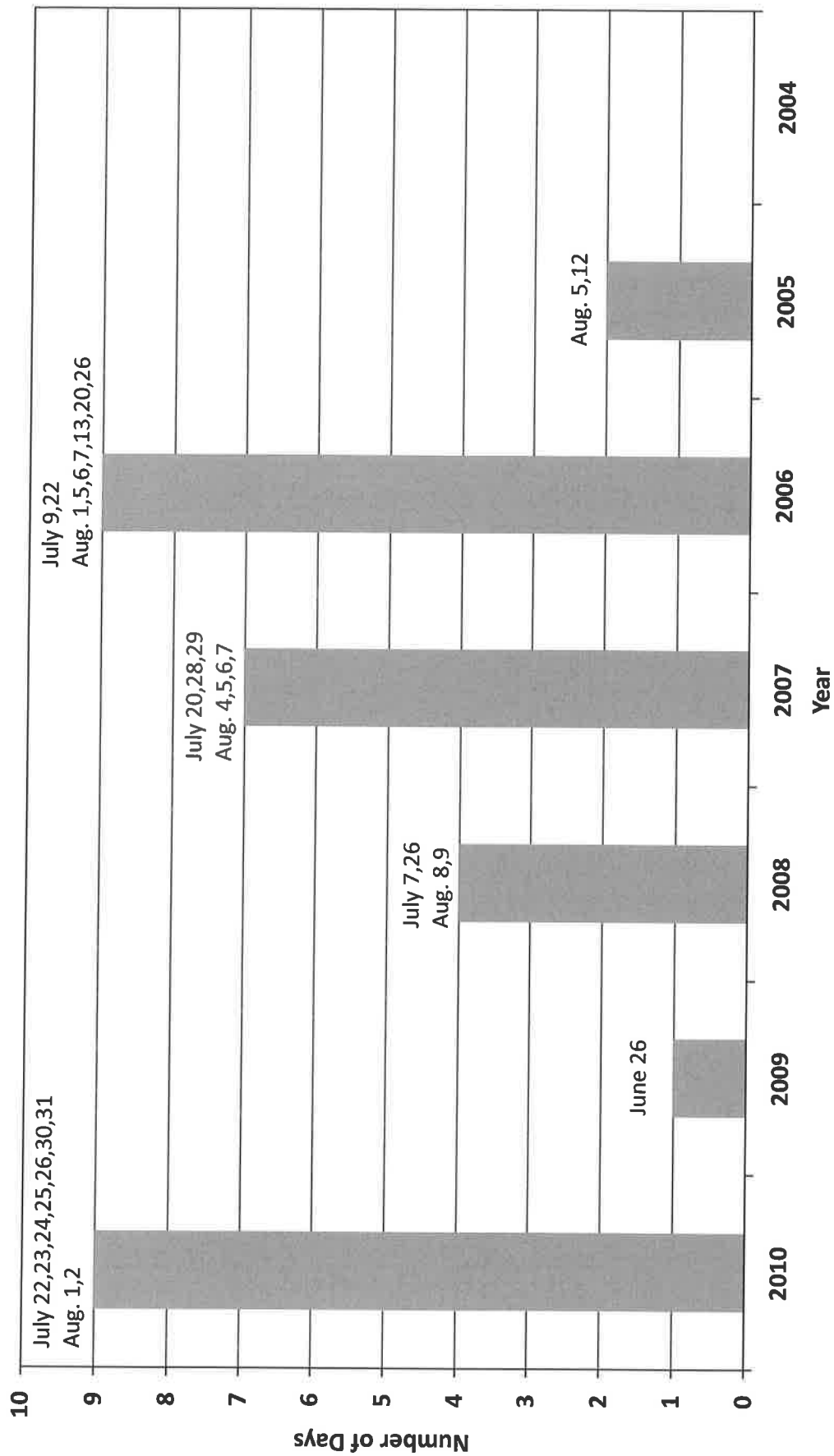


**Footnote:**

- The Fry Late Blight model was used to calculate the severity units.
- The 2010 Hooper weather station was set up on June 16, 2010.
- The 2009 Hooper weather station was set up on June 11, 2009.

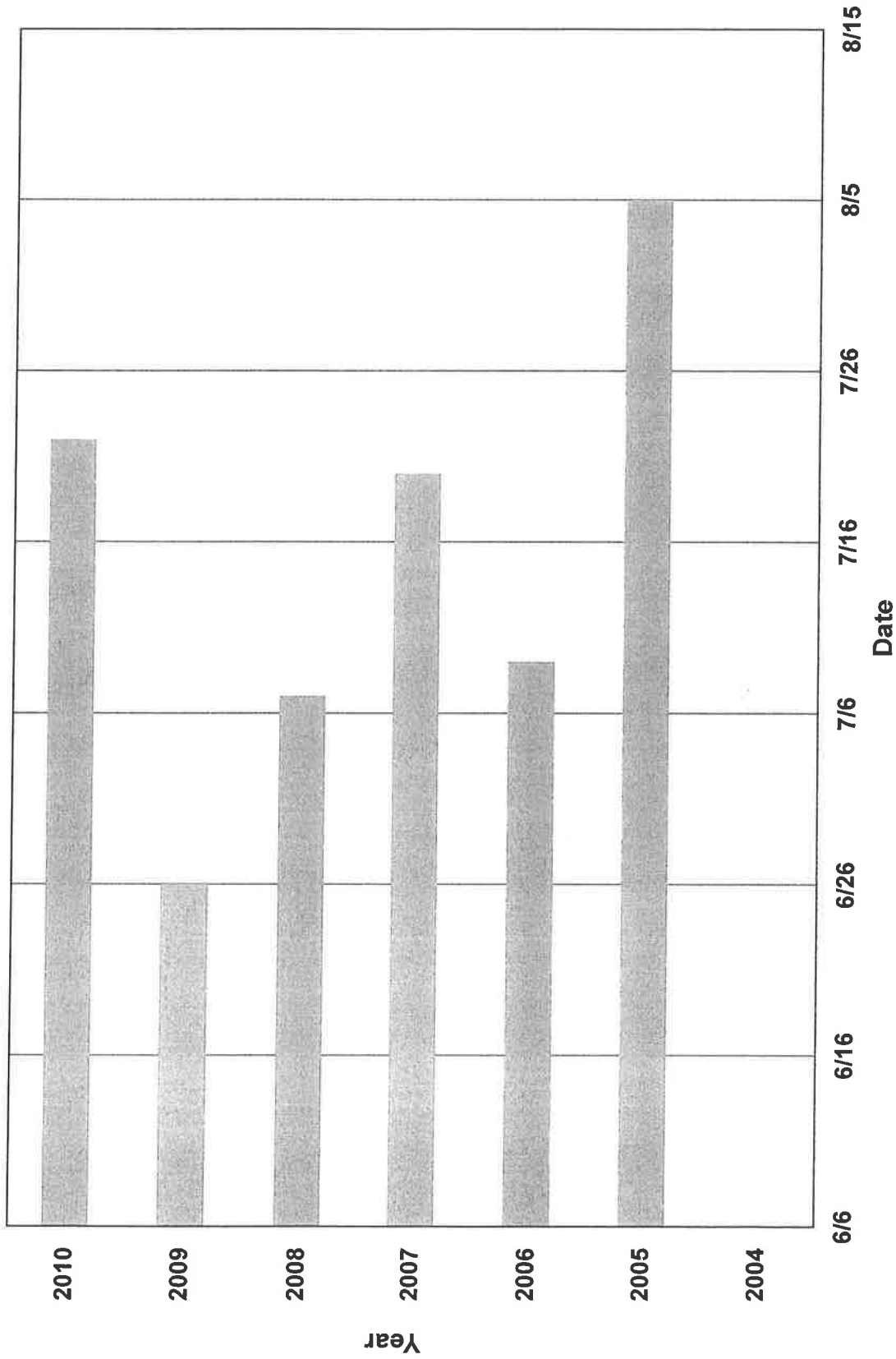
- The 2008 Hooper weather station was set up on June 10, 2008.
- The 2007 Hooper weather station was set up on June 18, 2007.
- The 2006 Hooper weather station was set up on June 14, 2006.

**Number of days when conditions were favorable for Late Blight Lesion formation.  
Based on Smith Model for Hooper Area, 2004 - 2010.**



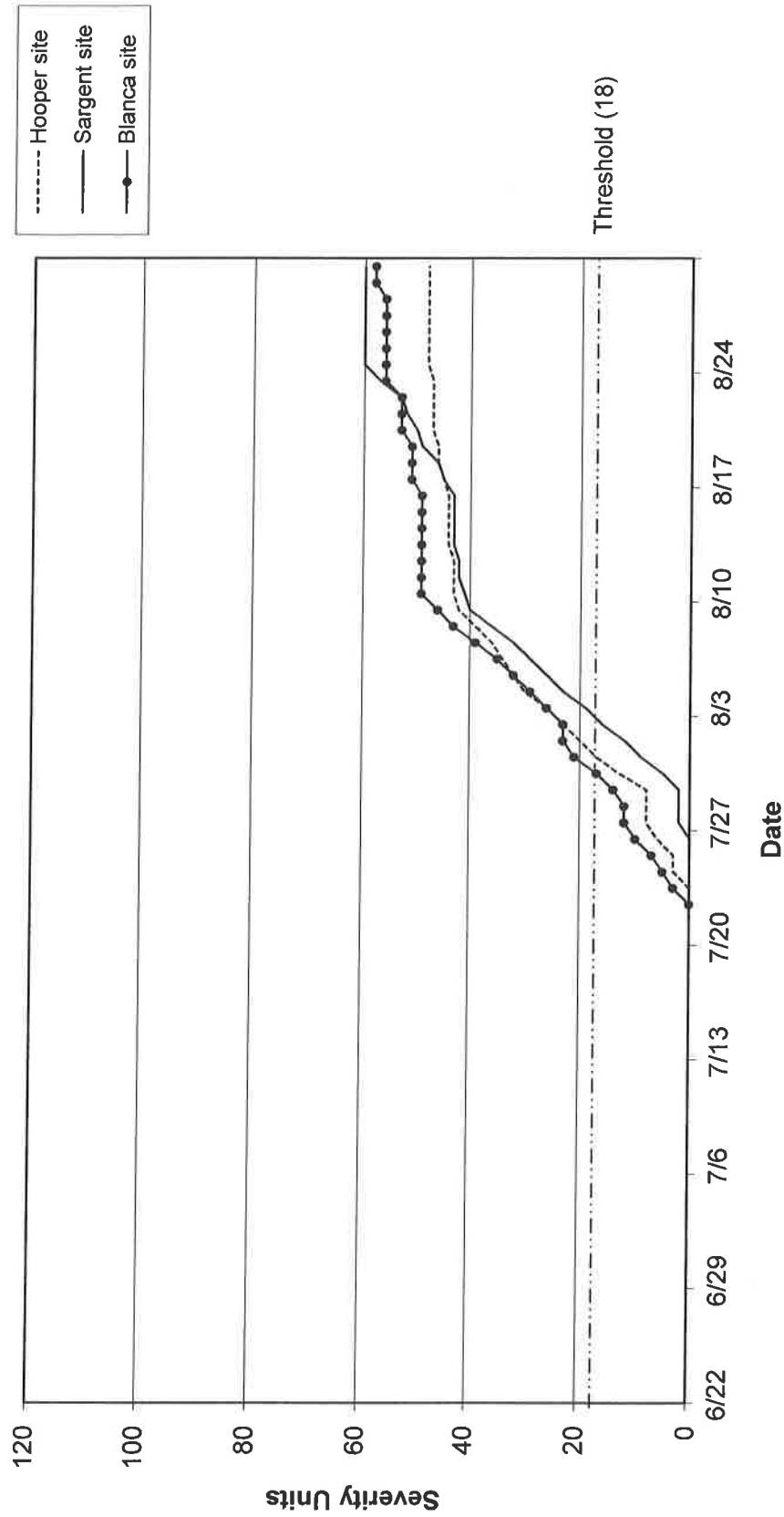
\* Dates in red indicate when foliar late blight lesions were initially observed in 2007.

The Date when Smith Periods initially began to accumulate (conditions were favorable for Late Blight Lesion formation).  
Based on Smith Model for Hooper Area, 2004 - 2010.



\*In 2007, foliar late blight lesions were initially observed the week of July 20th.

**Potato Late Blight Severity Values - Wallin Model,  
San Luis Valley, Colorado, 2010**



**Footnote:**

- The Sargent weather station began collecting data on July 26, 2010.
- The Hooper weather station began collecting data on July 23, 2010.
- The Blanca weather station began collecting data on July 22, 2010.

# 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.

In 2010, several chemistries showed good to excellent results. It is of note that in the 2010 pink rot trial, the combination of Ridomil Gold + Phostrol applied In-furrow had the worst performance of any other fungicide treatment and the untreated control.



## EVALUATION OF FUNGICIDES FOR CONTROL OF PINK ROT ON POTATO, 2010

- Researchers:** Rob Davidson and Andrew Houser, Colorado State University, SLVRC
- Location:** Off-station, San Luis Valley, CO
- Cultivar:** Russet Norkotah sel. 3, cut seed, 2-4 oz.
- Objective:** To evaluate the efficacy of various fungicides in controlling pink rot in potato.
- Application:** In-furrow (IF), after hilling (AH) and tuber initiation (TI) treatments were applied using an R & D CO<sub>2</sub> charged backpack sprayer at 35 PSI, with one XR 8002VS nozzle, at 10 gallons/acre as a directed application. Applications were made on June 24 for AH & TI treatments.
- Treatments:**
1. Control, no treatment
  2. Ranman @ 0.42 floz/1000 row ft + Silwet @ 0.32 floz/1000 row ft (IF - 2 nozzle) & Ranman @ 2.75 floz/A (AH)
  3. Ridomil Gold @ 0.42 floz/1000 row ft (IF)
  4. Presidio @ .125 lbai/A (IF) + Ridomil Gold @ 0.42 floz/1000 row ft (IF)
  5. Ridomil Gold @ 0.42 floz/1000 row ft (IF) + Phostrol @ 8.0 pt./A (IF)
  6. Phostrol @ 8.0 pt./A (TI)
  7. Omega @ 1.5 pt./A (IF - 2 nozzle)
  8. Ranman @ 0.42 floz/1000 row ft + Silwet @ 0.32 floz/1000 row ft (IF - 2 nozzle)
  9. Ranman @ 0.42 floz/1000 row ft + Silwet @ 0.32 floz/1000 row ft (IF - 2 nozzle) & Phostrol @ 8.0 pt./A (TI)
  10. Control, no treatment
- Planted:** May 5, 2010
- 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, rate based on ET
- Fertilizer:** 75N-100P, preplant, 75N through sprinkler in season
- Herbicide:** NA
- Fungicide:** Tanos @ 6.0 oz/A, Phostrol @ 1.25 gal/A (2 apps), Endura @ 2.5 oz/A, Serenade @ 0.5 gal/A. Penncozeb @ 0.75 lb/A (2 apps), & SuperTin @ 3.8 oz/A
- Insecticide:** NA
- Vine Killer:** Vines were chopped and Reglone was applied on September 7, 2010
- Harvested:** September 15 and 16, 2010

### 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 kilograms < 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 sel. 3, San Luis Valley, Colorado, 2010.

Program	Treatment	Percent <sup>b</sup>					US #2's & culls	cwt/A <sup>d</sup>	cwt/A - culls <sup>e</sup>	No. rot	% rot <sup>f</sup>	% rot x severity <sup>g</sup>
		% Stand <sup>c</sup>	< 4 oz.	4-10 oz.	> 10 oz.							
h <sub>1</sub> .	Untreated Control	81.7	26.0 abc	45.2	25.9 bcd	2.9	398.3	387.1	7.8 ab	2.2 ab	9.7 ab	
	Ranman @ 0.42 floz/1000 row ft (IF) - 2 nozzle	78.7	21.9 cd	46.0	29.8 abc	2.4	398.7	389.9	3.0 cde	1.1 bc	4.4 bc	
	Silwet @ 0.32 floz/1000 row ft (IF) - 2 nozzle											
	Ranman @ 2.75 floz/A (AH)											
h <sub>3</sub>	Ridomil Gold @ 0.42 floz/1000 row ft (IF)	76.5	20.0 d	41.6	35.4 a	3.0	437.1	424.1	5.8 bcd	1.0 bc	4.9 bc	
	Presidio @ .125 lbai/A (IF)	74.9	26.0 abc	46.9	24.7 bcd	2.4	426.1	415.9	1.3 de	0.4 c	1.5 c	
h <sub>5</sub> .	Ridomil Gold @ 0.42 floz/1000 row ft (IF)											
	Ridomil Gold @ 0.42 floz/1000 row ft (IF)	80.9	24.6 bcd	46.1	28.0 a-d	1.4	419.3	413.4	10.5 a	3.4 a	14.8 a	
6.	Phostrol @ 8.0 pt./A (IF)											
	Phostrol @ 8.0 pt./A (TI)	84.3	30.7 a	44.0	23.1 cd	2.2	386.7	378.4	2.8 cde	1.2 bc	5.8 bc	
7.	Omega @ 1.5 pt./A (IF - 2 nozzle)	78.9	27.7 ab	46.4	24.5 cd	1.4	414.8	408.7	4.0 b-e	0.9 bc	3.9 bc	
	Ranman @ 0.42 floz/1000 row ft (IF) - 2 nozzle											
8.	Silwet @ 0.32 floz/1000 row ft (IF) - 2 nozzle	80.2	25.0 bcd	40.3	32.5 ab	2.2	416.3	407.6	0.8 e	0.2 c	0.8 c	
	Ranman @ 0.42 floz/1000 row ft (IF) - 2 nozzle											
9	Silwet @ 0.32 floz/1000 row ft (IF) - 2 nozzle	74.5	27.1 ab	47.0	23.6 cd	2.4	442.2	432.2	1.5 de	1.0 bc	4.0 bc	
	Phostrol @ 8.0 pt./A (TI)											
10.	Untreated Control	88.9	29.3 ab	46.7	20.6 d	3.4	383.7	372.3	7.3 abc	2.2 ab	10.5 ab	
	Untreated Control	NS	5.10	NS	7.93	NS	NS	NS	4.63	1.61	6.80	

<sup>a</sup> Application Schedule Abbreviations (IF = In-Furrow on May 5, 2010; AH = Applied after hilling on June 24, 2010).

<sup>b</sup> Based on tuber weight in kilograms, mean of four replications.

<sup>c</sup> Plant stand counts were taken on June 24, 2010, 2-20 foot rows per treatment per replication, mean of four replications.

<sup>d</sup> Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of four replications.

<sup>e</sup> Hundred weight per acre - US #2s and culls, 2-20 foot rows per treatment per replication, mean of four replications.

<sup>f</sup> Mean percent of tubers with pink rot at harvest per treatment per replication (i.e. 0.86 = 0.86%).

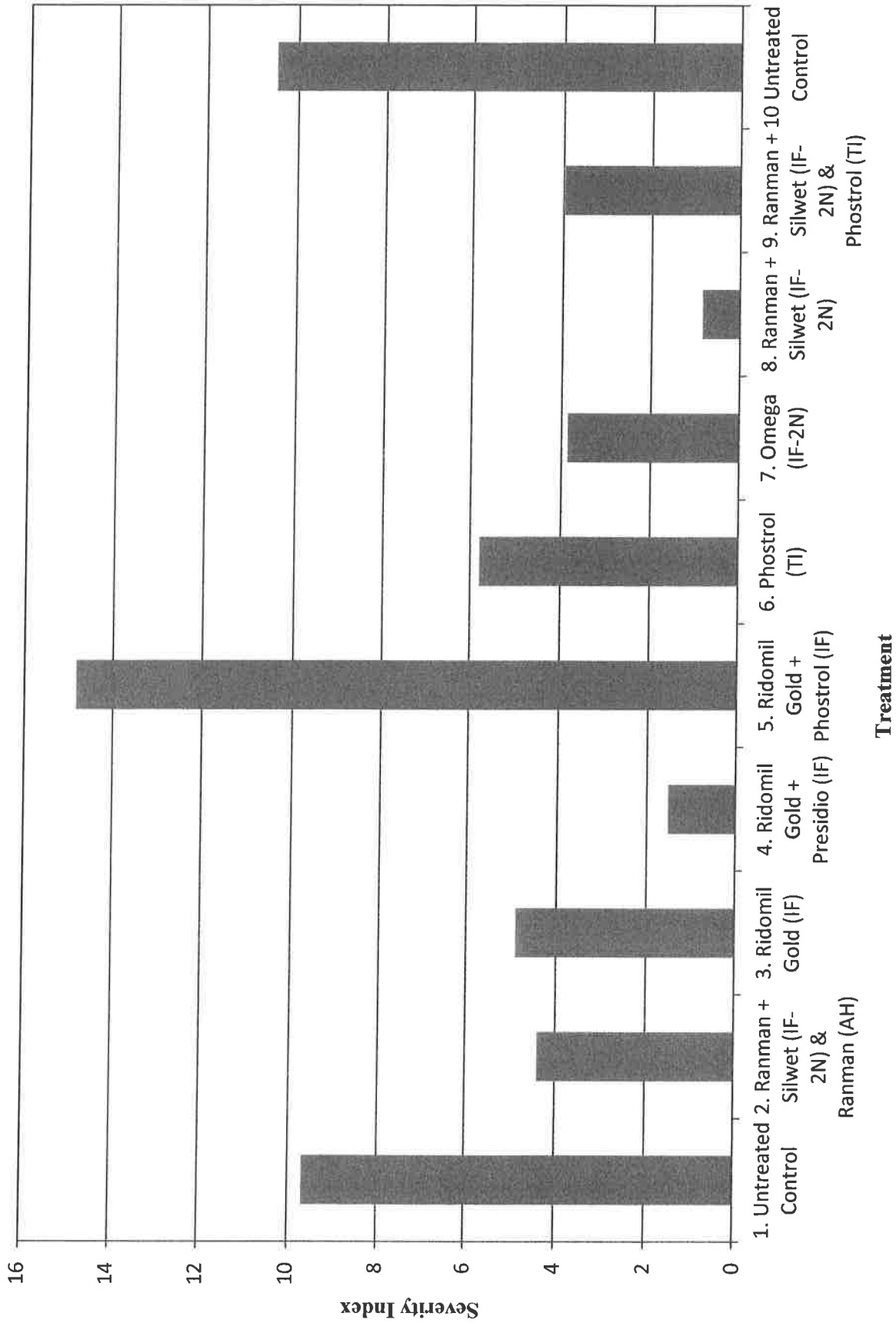
<sup>g</sup> Mean percent of tubers with pink rot at harvest multiplied by disease severity from 1 to 5 (1 = less than 5% rotten, 5 = 100% rotten).

<sup>h</sup> Belay insecticide was applied in-furrow to treatments 1, 2, 3, 4 & 5.

Means followed by the same letters are not significantly different at P=0.05 for AUDPC.

## 2010 Pink Rot Fungicide Trial - % of tubers at harvest with pink rot

Severity Index = % rot x severity of rot (rating of 1 to 5 with 1=healthy, 5 = 100% of tuber has pink rot)



# 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.

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 two or 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 finished. 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 (standard practice for the last three years at the SLVRC), cultivar selection, water management at the appropriate times during the season, and use of Omega when warranted.

## EVALUATION OF ADVANCED CLONES FOR SUSCEPTIBILITY TO POWDERY SCAB, 2010

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

**Location:** Greenhouse trial, San Luis Valley, CO

**Objective:** To evaluate the susceptibility of advanced potato clones to powdery scab.

**Clones:**

1. AC99329-7PW/Y	15. CO00412-5W/Y
2. AC99330-1P/Y	16. CO01399-10P/Y
3. AC99375-1RU	17. CO99045-1W/Y
4. ATC00293-1W/Y	18. CO99053-3RU
5. Centennial Russet	19. CO99053-4RU
6. Centennial Russet L-1	20. CO99076-6R
7. Centennial Russet L-1M	21. CO99100-1RU
8. Centennial Russet L-2	22. CO99256-2R
9. Centennial Russet L-2M	23. Colorado Rose
10. CO00188-4W	24. DT6063-1R
11. CO00197-3W	25. Mesa Russet
12. CO00270-7W	26. Russet Nugget
13. CO00277-2R	27. Russet Nugget L-2
14. CO00291-5R	28. Russet Nugget L-2M

**Planted:** May 28, 2010

**Plot Design:** Randomized Complete Block Design

**Plot Size:** One 6" pots per treatment per replication

**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.

**Replications:** Four

**Irrigation:** Drip irrigation, rate predetermined based on the optimal irrigation regime for powdery scab symptom development.

**Fertilizer:** 10N-30P-20K, applied three times

**Insecticide:** Conserve SC

**Vine Killer:** Vines were removed at harvest time on September 20, 2010

**Harvested:** September 20, 27 & 28, 2010

### DATA

**Disease:** Galls on roots rated 0 to 4, 0 = none, 4 = heavily infected, readings taken on September 30, October 1, November 22 & 23, 2010.

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.

Percent of tubers per pot which are unmarketable due to powdery scab severity. Tuber readings were taken on September 30, October 1, November 22 & 23, 2010.

**Table 1.** Evaluation of advanced clones for tuber susceptibility to powdery scab in a greenhouse environment, San Luis Valley, Colorado, 2010.

Cultivar	Tuber symptoms						Fresh Root Wt. (g) <sup>d</sup>
	% Stand <sup>a</sup>	Percent Incidence	Percent Healthy	Severity Index <sup>b</sup>	% Unmarketable	Root Gall Rating <sup>c</sup>	
AC99329-7PW/Y	100	43.4 c-h	56.7 b-g	33.3 cd	8.3 cde	1.3 abc	2.3
AC99330-1P/Y	100	62.5 a-e	37.5 e-i	141.7 abc	41.7 ab	2.0 a	2.7
AC99375-1RU	100	0.0 i	100.0 a	0.0 d	0.0 e	0.0 d	7.3
ATC00293-1W/Y	100	35.4 d-i	64.6 a-f	50.0 cd	12.5 b-e	1.5 ab	3.4
Centennial Russet	75	0.0 i	100.0 a	0.0 d	0.0 e	0.0 d	3.3
Centennial Russet L-1	75	0.0 i	100.0 a	0.0 d	0.0 e	0.2 cd	2.3
Centennial Russet L-1M	100	18.8 f-i	81.3 a-d	0.0 d	0.0 e	0.0 d	1.0
Centennial Russet L-2	100	0.0 i	100.0 a	0.0 d	0.0 e	0.3 cd	2.7
Centennial Russet L-2M	100	12.5 hi	87.5 ab	0.0 d	0.0 e	0.0 d	1.8
CO00188-4W	75	16.7 ghi	83.3 abc	0.0 d	0.0 e	0.3 cd	0.9
CO00197-3W	75	19.4 f-i	80.6 a-d	33.3 cd	11.1 b-e	0.3 cd	0.9
CO00270-7W	100	62.5 a-e	37.5 e-i	125.0 abc	37.5 abc	1.8 ab	4.7
CO00277-2R	50	100.0 a	0.0 i	200.0 a	50.0 a	0.0 d	0.6
CO00291-5R	75	50.0 b-h	50.0 b-h	0.0 d	0.0 e	0.7 bcd	6.1
CO00412-5W/Y	75	55.6 b-f	44.4 d-h	133.3 abc	33.3 a-d	0.7 bcd	1.4
CO01399-10P/Y	75	41.7 c-h	58.3 b-g	0.0 d	0.0 e	0.7 bcd	1.3
CO99045-1W/Y	100	25.3 e-i	74.7 a-e	10.7 d	3.6 de	1.0 a-d	1.6
CO99053-3RU	100	0.0 i	100.0 a	0.0 d	0.0 e	0.0 d	6.1
CO99053-4RU	100	0.0 i	100.0 a	0.0 d	0.0 e	0.0 d	0.8
CO99076-6R	100	66.7 a-d	33.3 f-i	62.5 bcd	20.8 a-e	0.0 d	0.5
CO99100-1RU	100	0.0 i	100.0 a	0.0 d	0.0 e	0.0 d	2.4
CO99256-2R	100	54.2 b-g	45.8 c-h	66.7 bcd	16.7 b-e	1.0 a-d	3.0
Colorado Rose	75	83.3 ab	16.7 hi	127.8 abc	27.8 a-e	0.7 bcd	1.4
DT6063-1R	75	77.8 abc	22.2 ghi	166.7 ab	50.0 a	1.0 a-d	1.1
Mesa Russet	100	0.0 i	100.0 a	0.0 d	0.0 e	0.3 cd	2.1
Russet Nugget	100	0.0 i	100.0 a	0.0 d	0.0 e	0.3 cd	9.9
Russet Nugget L-2	100	0.0 i	100.0 a	0.0 d	0.0 e	0.0 d	12.5
Russet Nugget L-2M	100	25.0 e-i	75.0 a-e	0.0 d	0.0 e	0.0 d	12.4
LSD(P=0.05)		8.1	38.1	106.4	31.7	1.1	

<sup>a</sup> Percent Stand is based on the number of pots (four reps with one pot per rep) with growing plants that produced one or more tubers and/or a measurable amount of root mass for disease evaluation – if stand is less than 50%, the results are considered questionable.

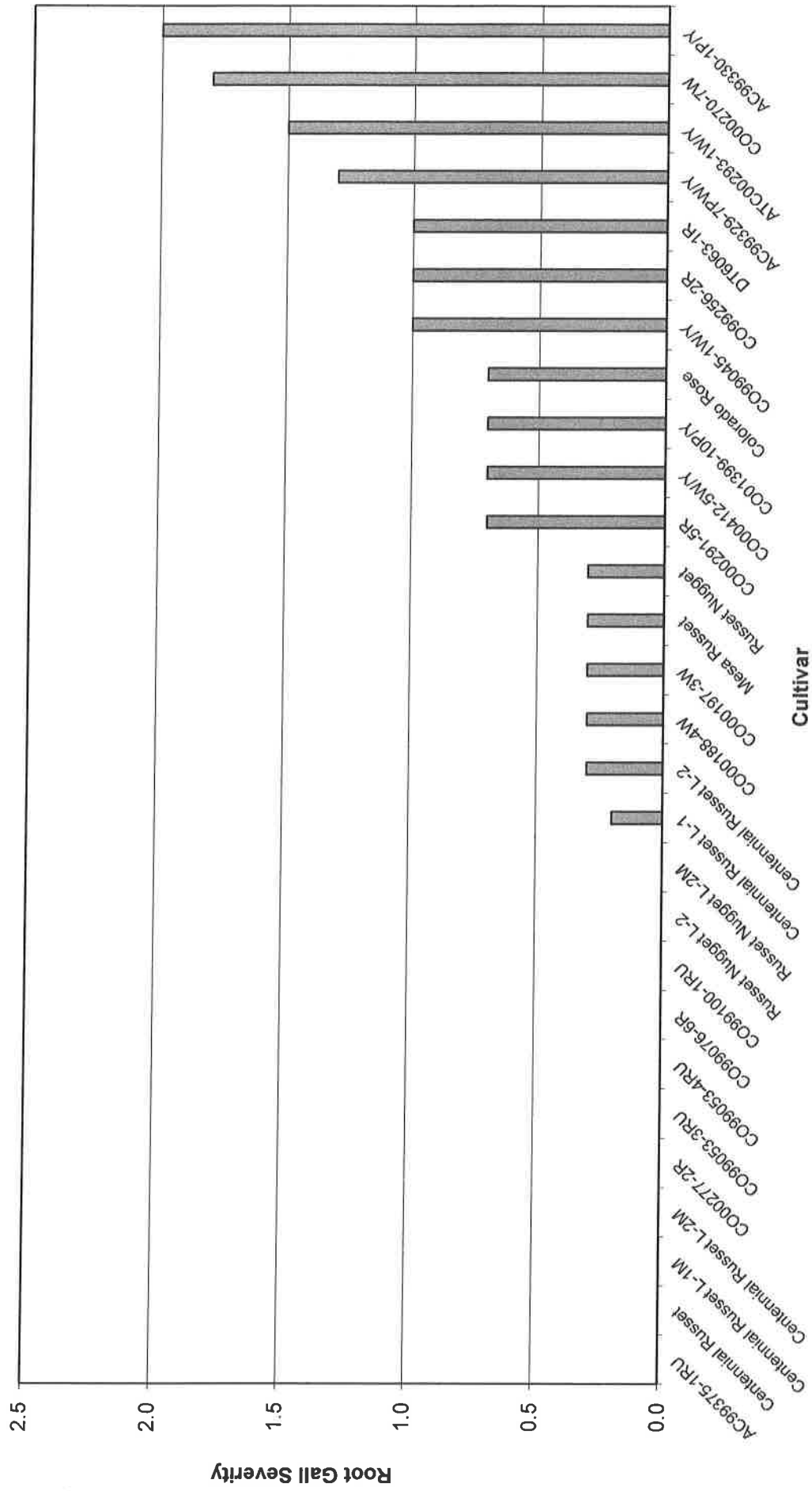
<sup>b</sup> Severity Index = mean percent of the number of affected tubers multiplied by the severity of the lesions, where 1 = very little or no disease and 5 = heavily infested.

<sup>c</sup> Root Gall Rating = visual analysis of roots for the presence of powdery scab root galls, where 0 = no root galls and 4 = extensive root galls. All plants were rated.

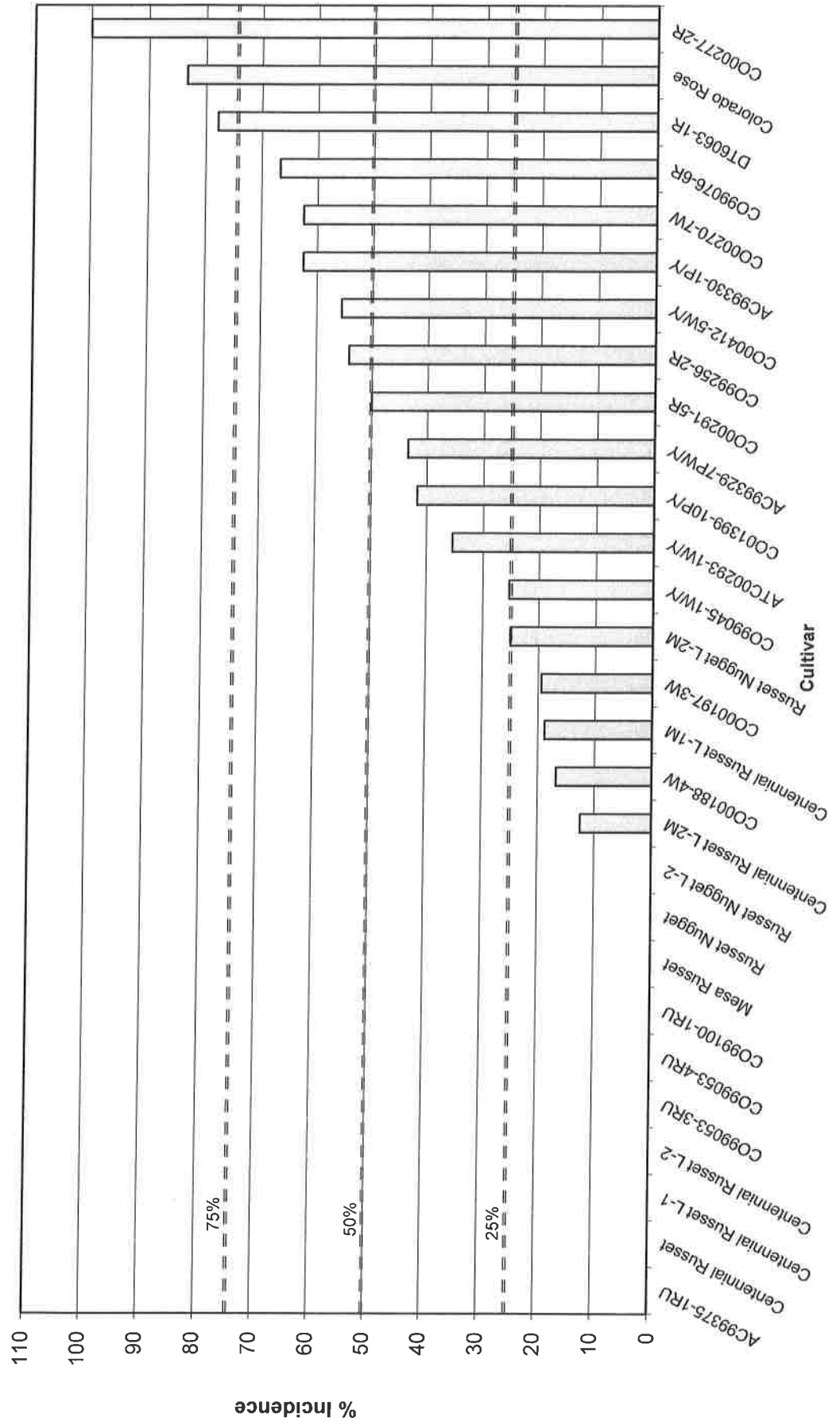
<sup>d</sup> Mean fresh root weight data was collected when disease readings were taken. Root weight varied in some cases due to disease severity, which had an impact on the root gall reading. Where root weights are low, root gall readings are questionable.

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

**Root Gall Severity Readings (0-4, where 0=no galls & 4 = roots are heavily infested with root galls)  
 Evaluation of Advanced Clones for Susceptibility to Powdery Scab Root Galls - Inoculated Controls  
 San Luis Valley, Colorado, 2010**

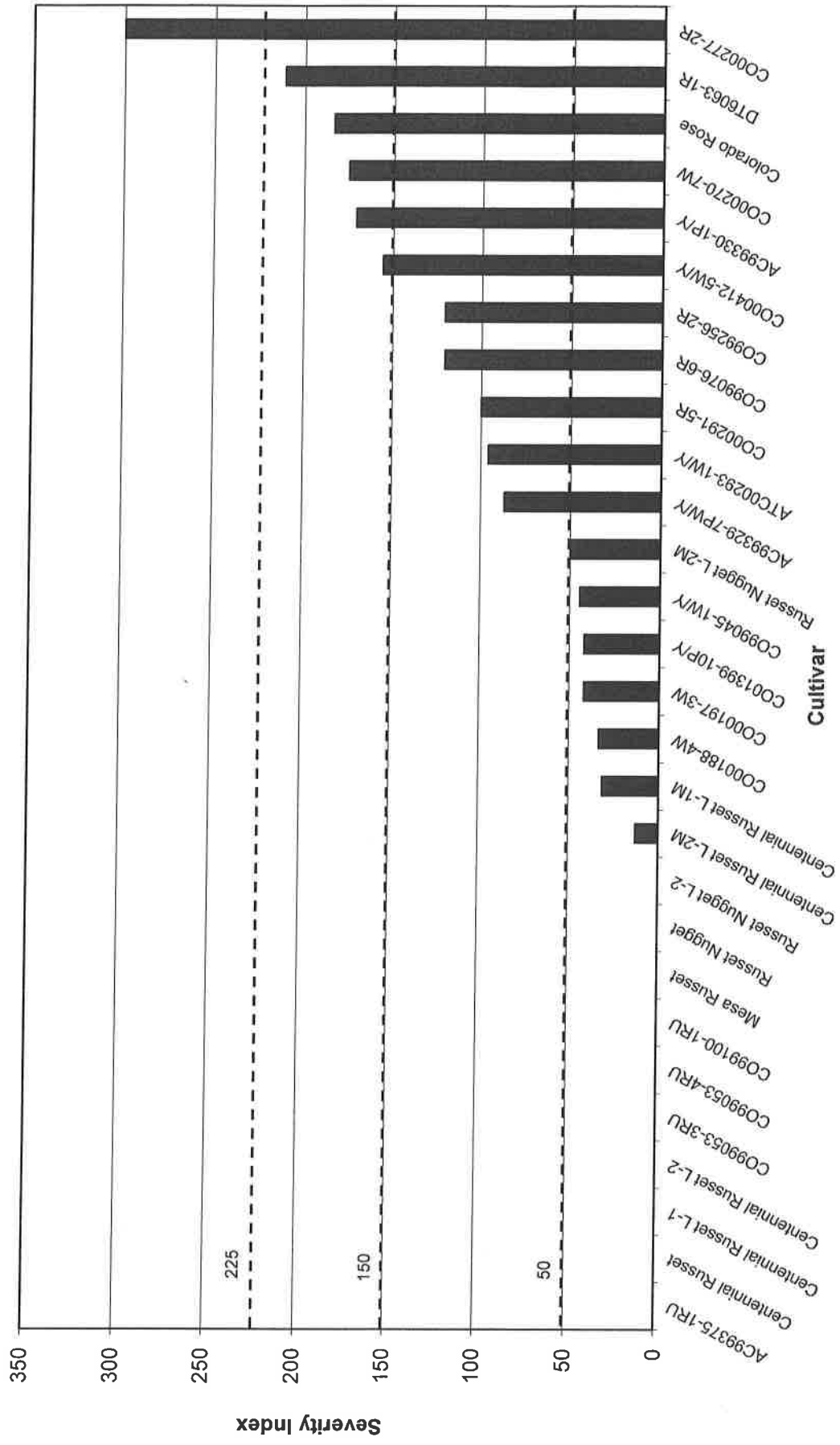


**% Incidence of Tubers with Powdery Scab**  
**Evaluation of Advanced Clones for Tuber Susceptibility to Powdery Scab**  
**San Luis Valley, Colorado, 2010**

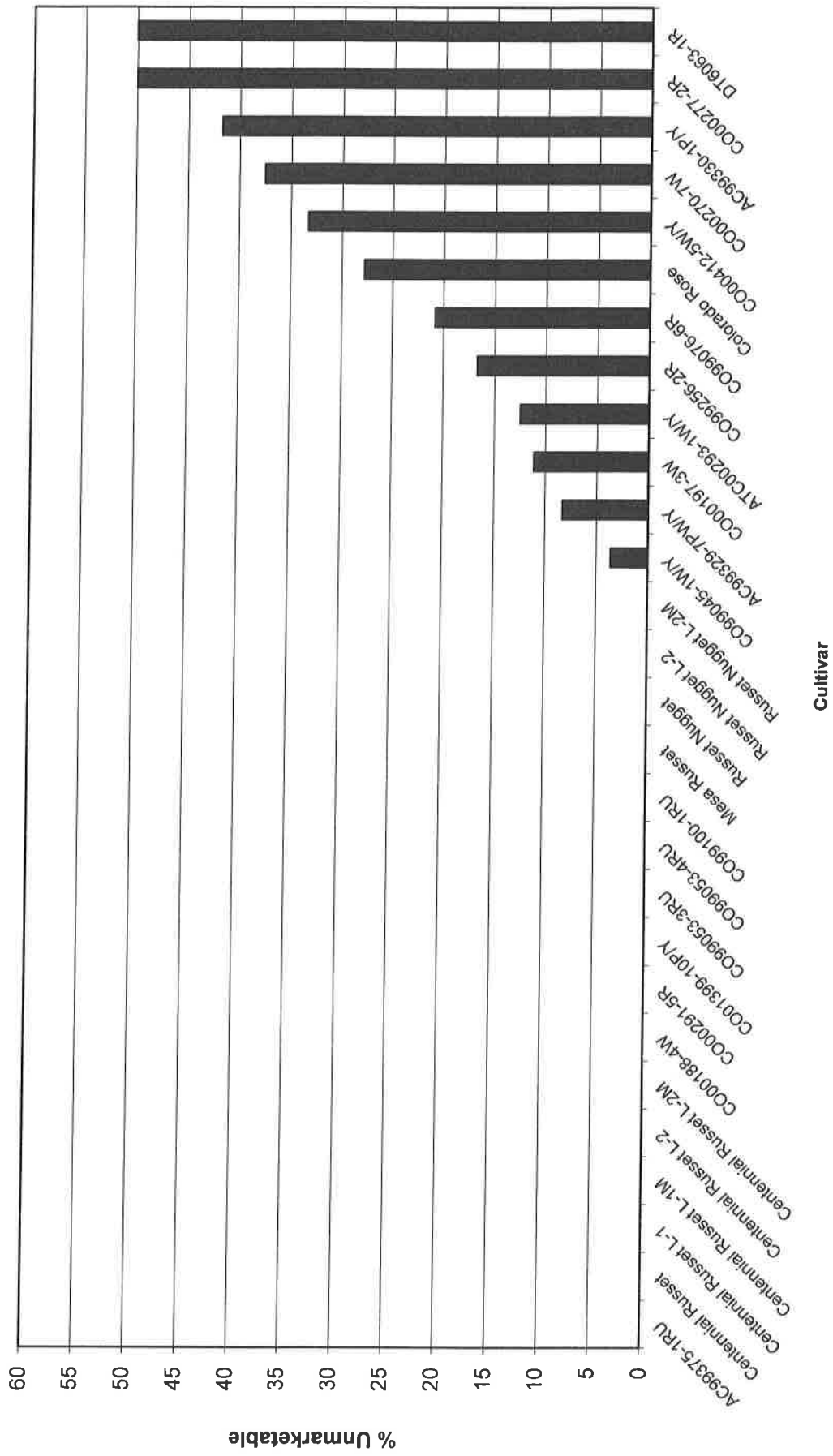




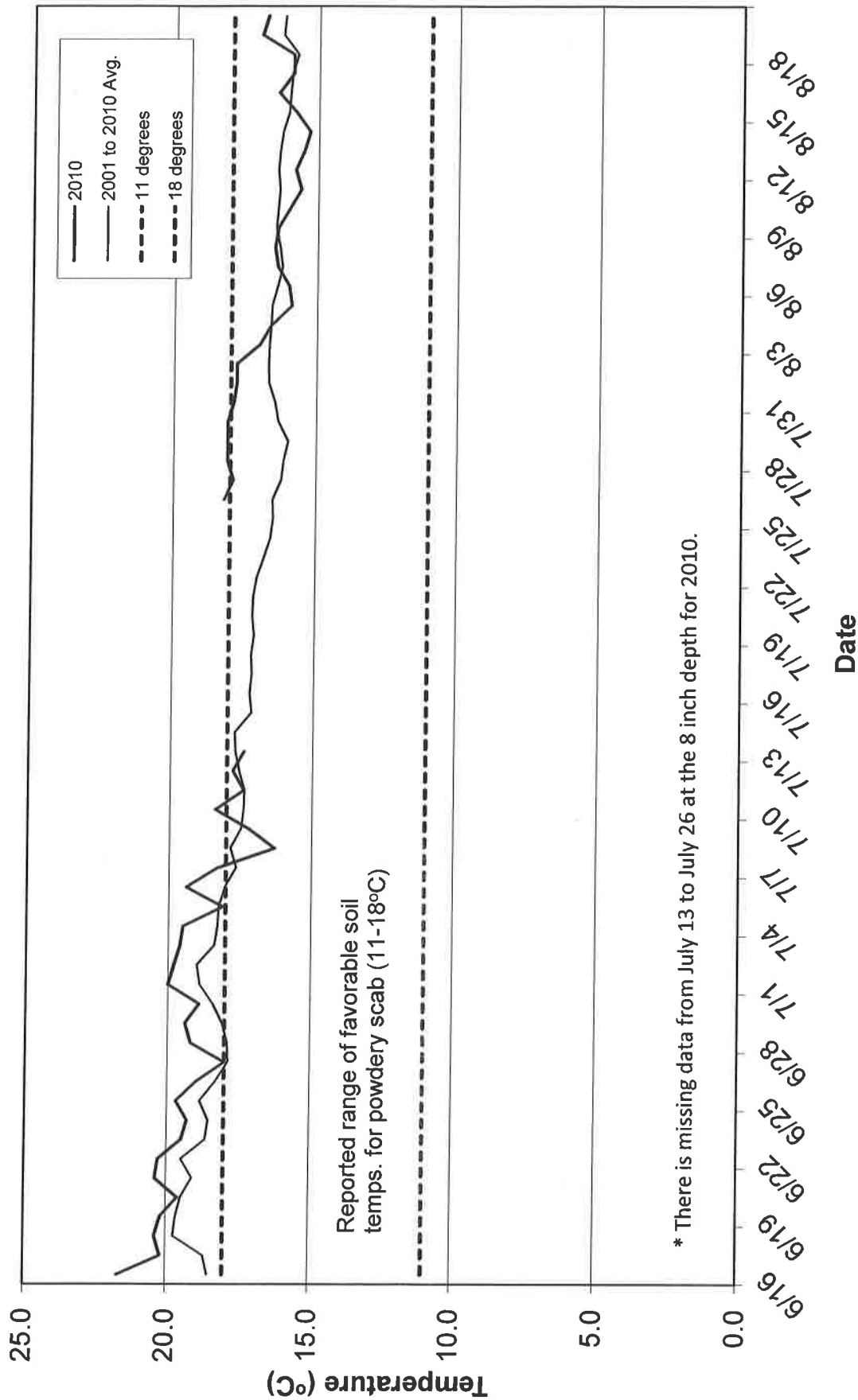
**Powdery Scab Severity Index (% potatoes with powdery scab multiplied by severity - 1 to 5)  
 Evaluation of Advanced Clones for Tuber Susceptibility to Powdery Scab  
 San Luis Valley, Colorado, 2010**



**Percent of Potatoes at Harvest that are Unmarketable due to Powdery Scab Severity  
 Evaluation of Advanced Clones for Tuber Susceptibility to Powdery Scab  
 San Luis Valley, Colorado, 2010**

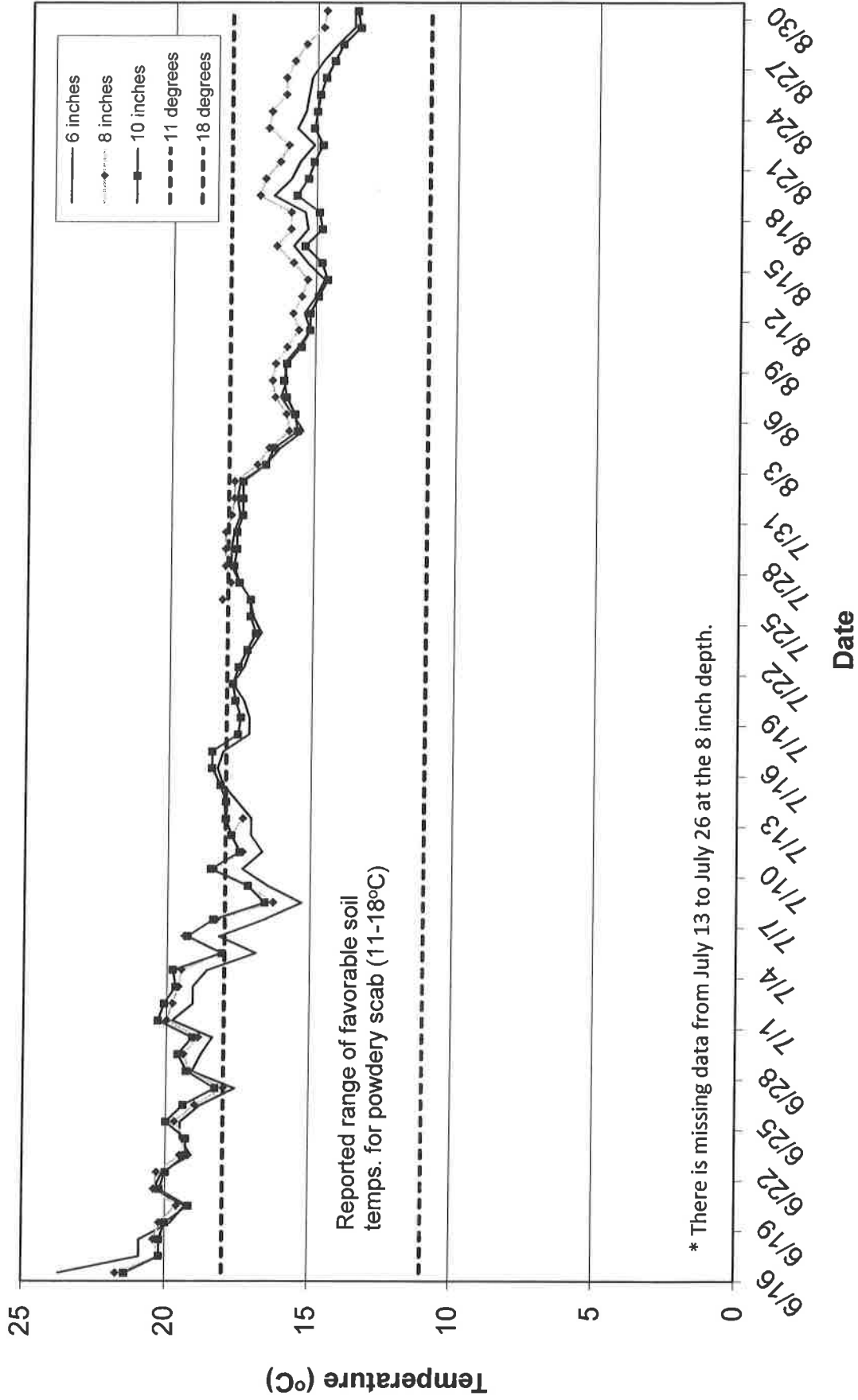


### Average Soil Temperature Readings from 2001 to 2010 Under Potato Plant Canopy (8" depth), San Luis Valley, Colorado

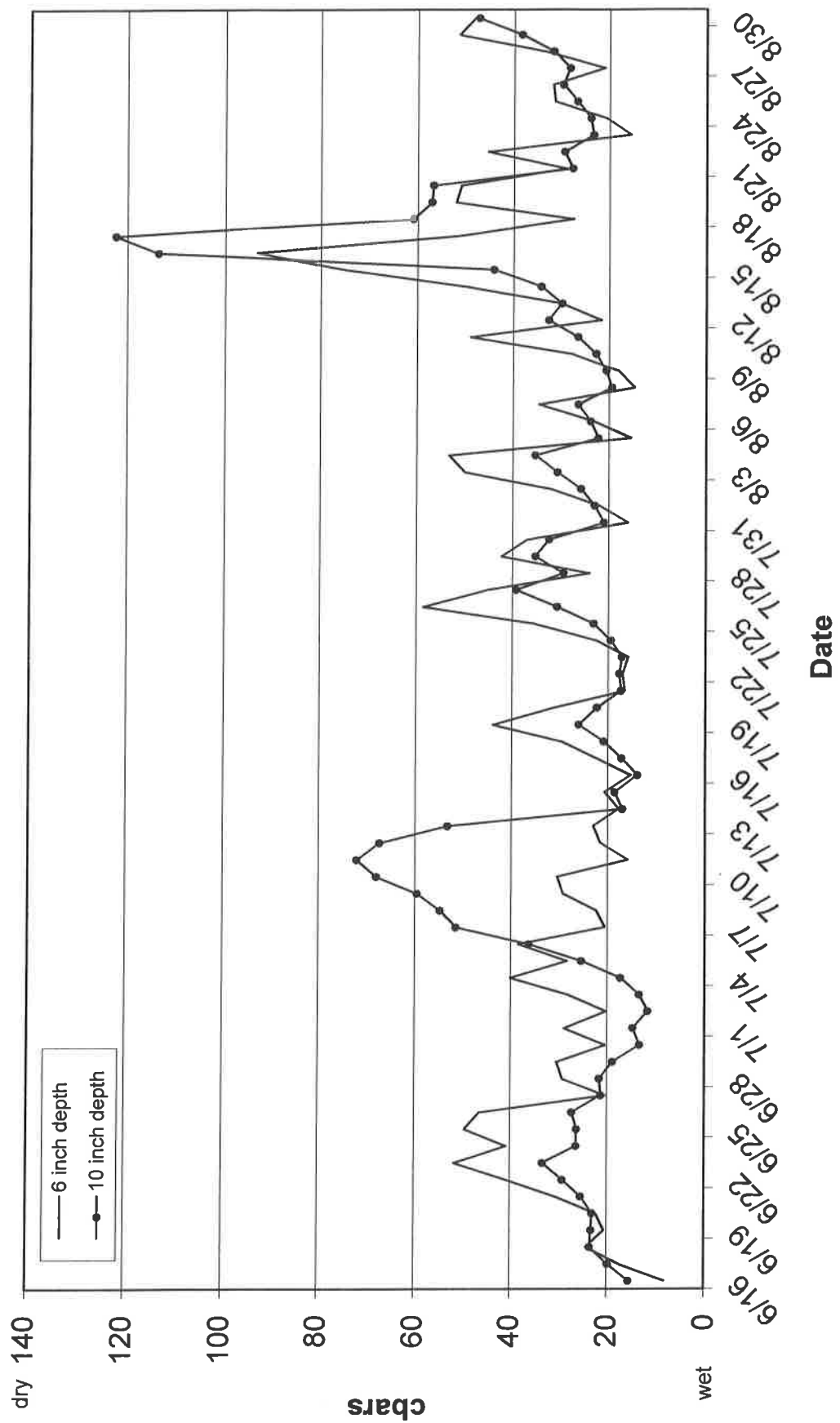


\* There is missing data from July 13 to July 26 at the 8 inch depth for 2010.

**Average Soil Temperature Readings at 6, 8 & 10" Under Potato Plant Canopy,  
San Luis Valley, Sargent location, Colorado, 2010**



**Soil Moisture Readings (Daily Average) 6 & 10 Inches Below Soil Surface,  
San Luis Valley, Sargent location, Colorado, 2010**



# ZEBA Soil Amendment Trial

Zeba is a soil amendment that allows for better water retention in the soil. We have begun evaluations on this product looking at three potato cultivars (Rio Grande Russet, AC99375-1RU, & Russet Burbank) with different water requirements. Two irrigation regimes have been utilized (one irrigation regime was based on ET recommendations and the other was based on soil moisture readings taken from soil that was treated with Zeba).

Based on irrigation scheduling recommendations from the two regimes, irrigation levels were approximately three inches less over the course of the growing season (eliminating approximately one irrigation event every two weeks). Soil moisture was recorded and different recommendations were made starting mid-July, to correspond with tuber set.

Preliminary results indicate that the addition of Zeba increased the water retention of the soil, thereby increasing yields in potato cultivars that have low water scavenging potential (i.e. Russet Burbank) when plants were irrigated using ET recommendations. Additional evaluations need to be conducted on the effectiveness of ZEBA before recommendations can be made to the industry.

**EVALUATION OF ZEBBA PLANT AMENDMENT FOR INCREASED POTATO HEALTH AND YIELD ON THE CULTIVARS RUSSET BURBANK, AC99375-1RU, AND RIO GRANDE RUSSET, 2010**

- Researchers:** Rob Davidson and Andrew Houser, Colorado State University, SLVRC
- Location:** San Luis Valley Research Center, Center, CO
- Cultivars:** Russet Burbank, AC99375-1RU and Rio Grande Russet, cut seed, 2-4 oz.
- Objective:** To evaluate the efficacy of using Zeba as a plant amendment for increasing the retention of soil moisture, plant health and yield in potato.
- Application:** All Zeba treatments were applied by hand over the seed piece in-furrow.
- Treatments:**
1. Russet Burbank, untreated control (Irrigation based on SLV ET Report)
  2. AC99375-1RU, untreated control (Irrigation based on SLV ET Report)
  3. Rio Grande Russet, untreated control (Irrigation based on SLV ET Report)
  4. Russet Burbank, Zeba @ 10 lb./A (Irrigation based on SLV ET Report)
  5. AC99375-1RU, Zeba @ 10 lb./A (Irrigation based on SLV ET Report)
  6. Rio Grande Russet, Zeba @ 10 lb./A (Irrigation based on SLV ET Report)
  7. Russet Burbank, untreated control (Irrigation based on SM readings from Zeba Plots)
  8. AC99375-1RU, untreated control (Irrigation based on SM readings from Zeba Plots)
  9. Rio Grande Russet, untreated control (Irrigation based on SM readings from Zeba Plots)
  10. Russet Burbank, Zeba @ 10 lb./A (Irrigation based on SM readings from Zeba Plots)
  11. AC99375-1RU, Zeba @ 10 lb./A (Irrigation based on SM readings from Zeba Plots)
  12. Rio Grande Russet, Zeba @ 10 lb./A (Irrigation based on SM readings from Zeba Plots)
- Planted:** May 11, 2010
- Plot Design:** Randomized complete block
- Plot Size:** 1 - 20 foot rows per treatment per replication
- Plant Spacing:** 12 inches
- Row Spacing:** 34 inches
- Replications:** four
- Irrigation:** Solid set sprinkler, rate based on ET and on SM readings from Zeba Plots. Total irrigation prior to July 19<sup>th</sup> was 11.75 inches. After July 19<sup>th</sup>, the total irrigation was 10.03 inches for treatments 1-6 and was 7.48 inches for treatments 7-12.
- Fertilizer:** 80N-60P-40K-25S-2.5Z, preplant, 50N through sprinkler after tuber set
- Herbicide:** Matrix @ 1.5 oz./A + Eptam@ 4.5 pt./A
- Insecticide:** None
- Fungicide:** Quadris @ 6.2 floz./A + Bravo WS @ 1.25 pt./A
- Vine Killer:** Rotobeat vines on September 9, 2010
- Harvested:** September 21 & 22, 2010

**DATA**

- Yield:** 1-20 foot row 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 was found and evaluated in the trial. Mean weight (kg) and percent of tubers with pink rot at harvest was calculated.

**Table 1.** Effects of Zeba soil amendment, applied in-furrow for increasing tuber yield and quality in the potato cultivars Russet Burbank, AC99375-IRU, and Rio Grande Russet, San Luis Valley, Colorado, 2010. Irrigation based on SLV ET Report for treatments 1-6. Irrigation based on soil moisture readings in Zeba plots for treatments 7-12.

Irrigation	Treatment/Rate	Cultivar	Percent <sup>a</sup>				US #2	Culls	Cwt/A <sup>b</sup>	Cwt/A <sup>c</sup> (w/o culls)	kg rot <sup>d</sup>	% rot <sup>e</sup>
			< 4 oz.	4-10 oz.	> 10 oz.							
ET	Control, no treatment	Russet Burbank	26.5 ab	50.3	14.1	0.0	9.1 a	405.5	366.1	0.0	0.0	
	Zeba @ 10 lb./A	Russet Burbank	26.2 ab	56.5	11.7	1.8	3.8 bc	421.1	406.3	0.0	0.0	
ZEBA	Control, no treatment	Russet Burbank	26.1 ab	54.2	13.5	0.9	5.5 abc	415.2	389.4	0.1	0.3	
	Zeba @ 10 lb./A	Russet Burbank	30.4 a	48.4	10.9	3.0	7.3 ab	415.6	385.6	0.0	0.0	
ET	Control, no treatment	AC99375-IRU	19.1 bc	46.1	29.5	1.6	3.7 bc	472.3	455.0	0.0	0.1	
	Zeba @ 10 lb./A	AC99375-IRU	14.3 c	58.1	25.4	0.8	1.4 c	515.9	509.2	0.1	0.3	
ZEBA	Control, no treatment	AC99375-IRU	22.8 abc	53.1	20.9	0.0	3.2 bc	415.9	403.5	0.0	0.2	
	Zeba @ 10 lb./A	AC99375-IRU	14.1 c	59.8	22.7	2.0	1.4 c	422.7	416.5	0.0	0.0	
ET	Control, no treatment	Rio Grande Russet	21.4 abc	61.0	15.1	0.8	1.7 c	427.5	419.9	0.0	0.0	
	Zeba @ 10 lb./A	Rio Grande Russet	27.2 ab	55.3	14.8	0.6	2.2 c	387.3	378.4	0.0	0.0	
ZEBA	Control, no treatment	Rio Grande Russet	20.2 bc	57.7	19.7	0.2	2.2 c	453.7	443.6	0.0	0.0	
	Zeba @ 10 lb./A	Rio Grande Russet	15.9 c	61.1	20.3	0.7	2.0 c	447.8	438.5	0.0	0.0	
LSD(P=0.05)			9.32	NS	NS	NS	4.71	NS	NS	NS	NS	

<sup>a</sup> Based on tuber weight in kilograms, mean of four replications.

<sup>b</sup> Total yield expressed as hundred weight per acre, 1-20 foot row per treatment per replication, mean of four replications.

<sup>c</sup> Total yield – culls, expressed as hundred weight per acre, 1-20 foot row per treatment per replication, mean of four replications.

<sup>d</sup> Average weight in kilograms of rotten tubers found at harvest.



**Table 2.** Effects of Zeba soil amendment, applied in-furrow for increasing tuber yield and quality in the potato cultivars Russet Burbank, AC99375-IRU, and Rio Grande Russet, San Luis Valley, Colorado, 2010. Irrigation based on SLV ET Report.

Program	Treatment/Rate	Cultivar	Percent <sup>a</sup>					Cwt/A <sup>c</sup> (w/o culls)	kg rot <sup>d</sup>	% rot <sup>e</sup>	
			< 4 oz.	4-10 oz.	> 10 oz.	US #2	Culls				Cwt/A <sup>b</sup>
1.	Control, no treatment	Russet Burbank	26.5	50.3	14.1	0.0	9.1	405.5	366.1	0.0	0.0
4.	Zeba @ 10 lb./A	Russet Burbank	26.2	56.5	11.7	1.8	3.8	421.1	406.3	0.0	0.0
LSD(P=0.05)			NS	NS	NS	NS	NS	NS	NS	NS	NS
2.	Control, no treatment	AC99375-IRU	19.1 a	46.1	29.5	1.6	3.7	472.3	455.0	0.0	0.1
5.	Zeba @ 10 lb./A	AC99375-IRU	14.3 b	58.1	25.4	0.8	1.4	515.9	509.2	0.1	0.3
LSD(P=0.05)			4.37	NS	NS	NS	NS	NS	NS	NS	NS
3.	Control, no treatment	Rio Grande Russet	21.4 b	61.0	15.1	0.8	1.7	427.5	419.9	0.0	0.0
6.	Zeba @ 10 lb./A	Rio Grande Russet	27.2 a	55.3	14.8	0.6	2.2	387.3	378.4	0.0	0.0
LSD(P=0.05)			4.17	NS	NS	NS	NS	NS	NS	NS	NS

<sup>a</sup> Based on tuber weight in kilograms, mean of four replications.

<sup>b</sup> Total yield expressed as hundred weight per acre, 1-20 foot row per treatment per replication, mean of four replications.

<sup>c</sup> Total yield – culls, expressed as hundred weight per acre, 1-20 foot row per treatment per replication, mean of four replications.

<sup>d</sup> Average weight in kilograms of rotten tubers found at harvest.

<sup>e</sup> Percent of rotten tubers at harvest based on total tuber weight.

**Table 3.** Evaluation of Zeba soil amendment, applied in-furrow, on tuber yield and quality in the potato cultivars Russet Burbank, AC99375-1RU, and Rio Grande Russet, San Luis Valley, Colorado, 2010. Irrigation based on soil moisture readings in Zeba plots.

Program	Treatment/Rate	Cultivar	Percent <sup>a</sup>					Cwt/A <sup>c</sup> (w/o culls)	kg rot <sup>d</sup>	% rot <sup>e</sup>	
			< 4 oz.	4-10 oz.	> 10 oz.	US #2	Culls				Cwt/A <sup>b</sup>
7.	Control, no treatment	Russet Burbank	26.1	54.2	13.5	0.9	5.5	415.2	389.4	0.1	0.3
10.	Zeba @ 10 lb./A	Russet Burbank	30.4	48.4	10.9	3.0	7.3	415.6	385.6	0.0	0.0
LSD(P=0.05)			NS	NS	NS	NS	NS	NS	NS	NS	NS
8.	Control, no treatment	AC99375-1RU	22.8	53.1	20.9	0.0	3.2	415.9	403.5	0.0	0.2
11.	Zeba @ 10 lb./A	AC99375-1RU	14.1	59.8	22.7	2.0	1.4	422.7	416.5	0.0	0.0
LSD(P=0.05)			NS	NS	NS	NS	NS	NS	NS	NS	NS
9.	Control, no treatment	Rio Grande Russet	20.2	57.7 b	19.7	0.2	2.2	453.7	443.6	0.0	0.0
12.	Zeba @ 10 lb./A	Rio Grande Russet	15.9	61.1 a	20.3	0.7	2.0	447.8	438.5	0.0	0.0
LSD(P=0.05)			NS	2.72	NS	NS	NS	NS	NS	NS	NS

<sup>a</sup> Based on tuber weight in kilograms, mean of four replications.

<sup>b</sup> Total yield expressed as hundred weight per acre, 1-20 foot row per treatment per replication, mean of four replications.

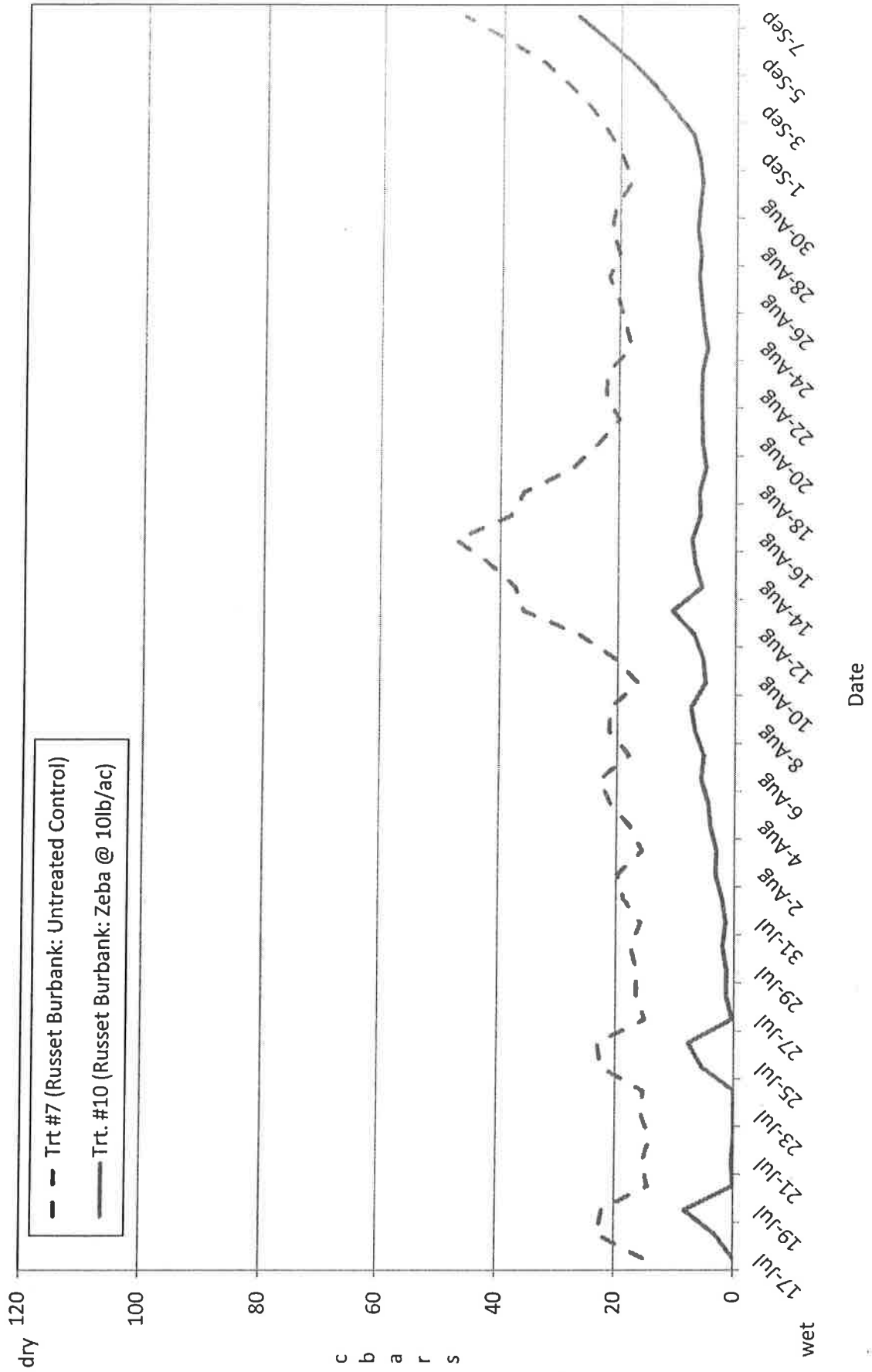
<sup>c</sup> Total yield – culls, expressed as hundred weight per acre, 1-20 foot row per treatment per replication, mean of four replications.

<sup>d</sup> Average weight in kilograms of rotten tubers found at harvest.

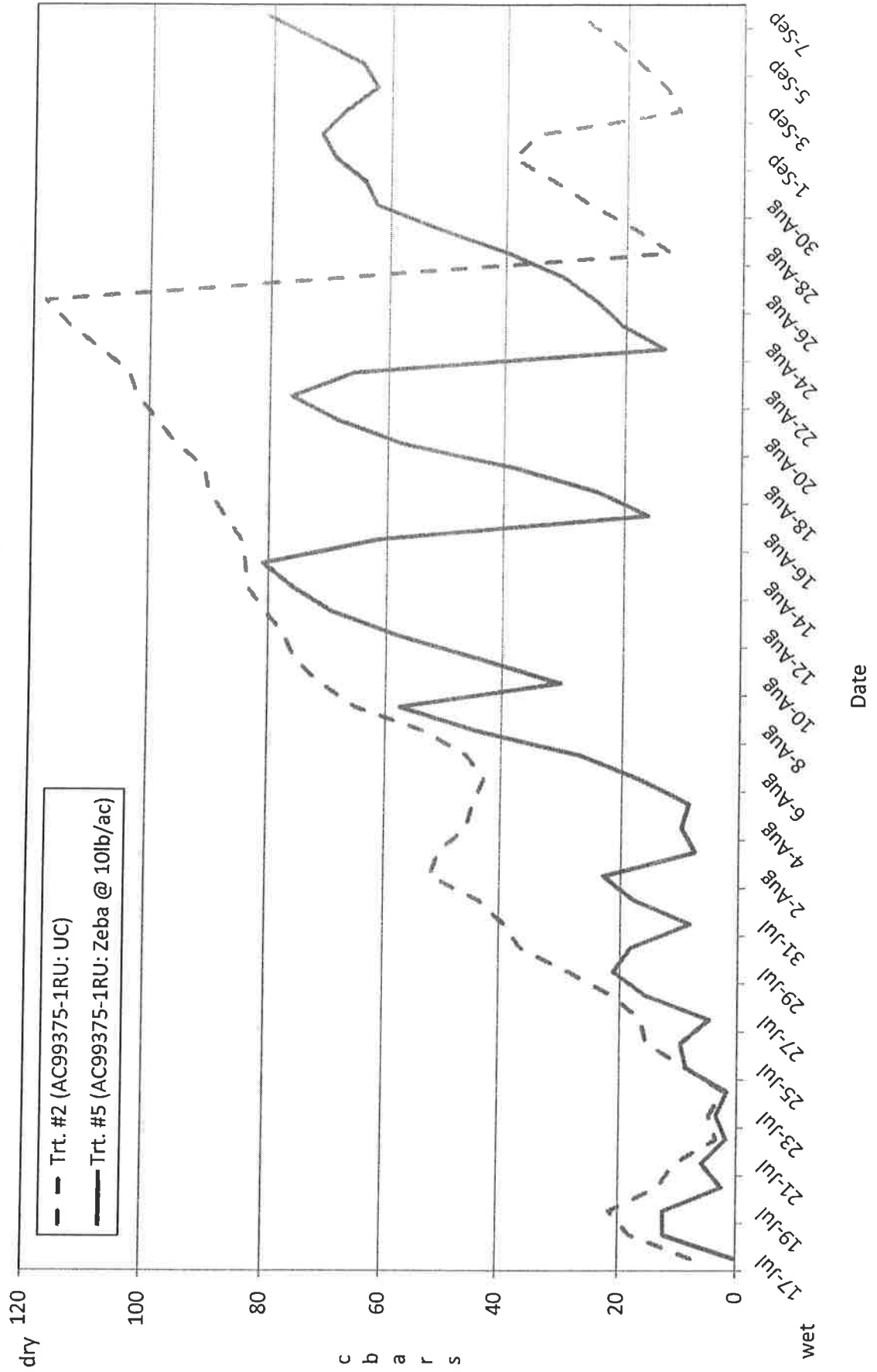
<sup>e</sup> Percent of rotten tubers at harvest based on total tuber weight.

**2010 Zeba Trial - Evaluating Zeba applied In-Furrow vs Untreated Control (Irrigation based on Soil Moisture Readings taken from plots with Zeba applied In-Furrow, starting on July 17, 2010)**

**Potato cultivar: Russet Burbank**

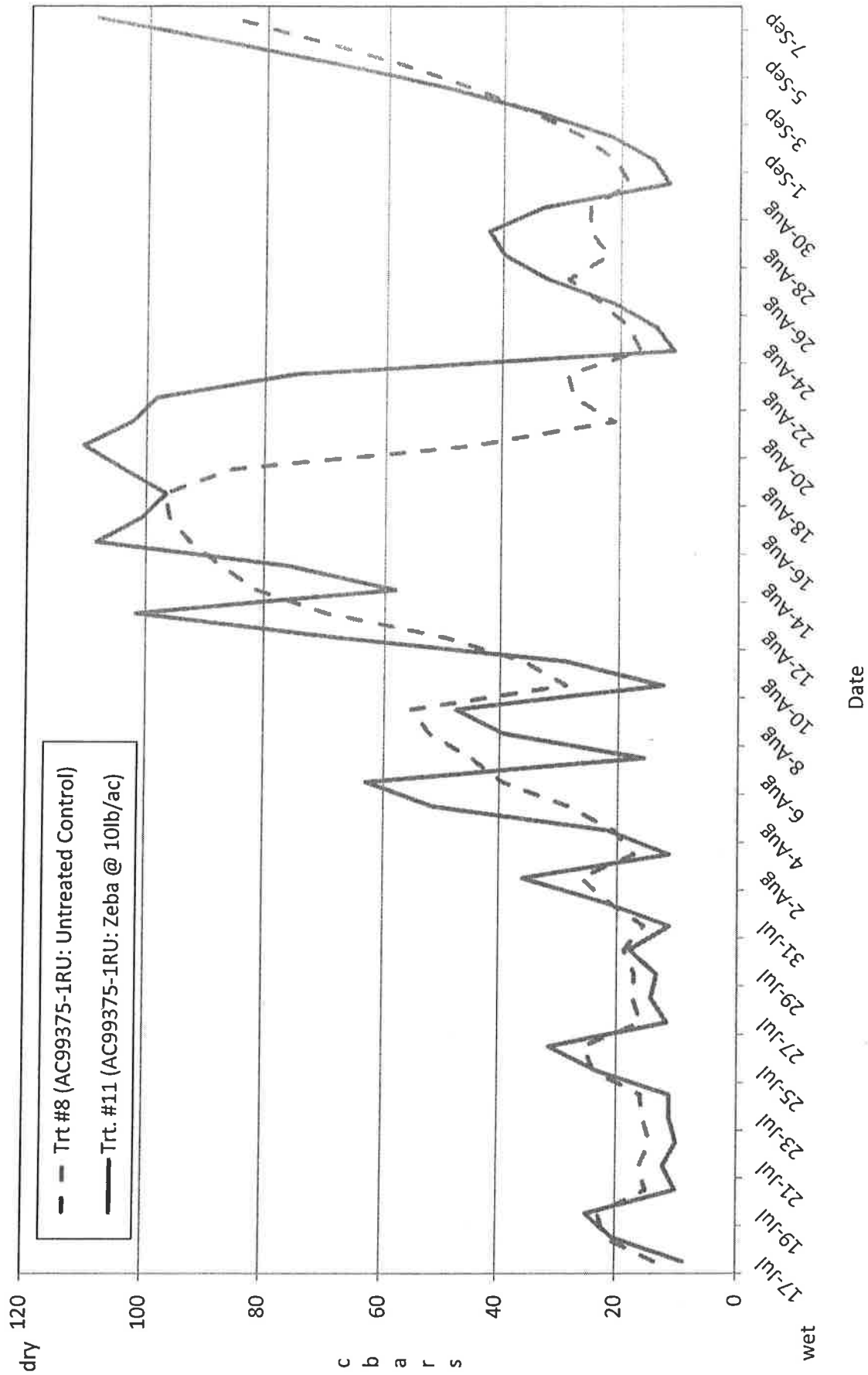


**2010 Zeba Trial - Evaluating Zeba applied In-Furrow vs Untreated Control  
(Irrigation based on SLV ET Report, Soil Moisture Readings starting on July 17, 2010)  
Potato cultivar: AC99375-1RU**

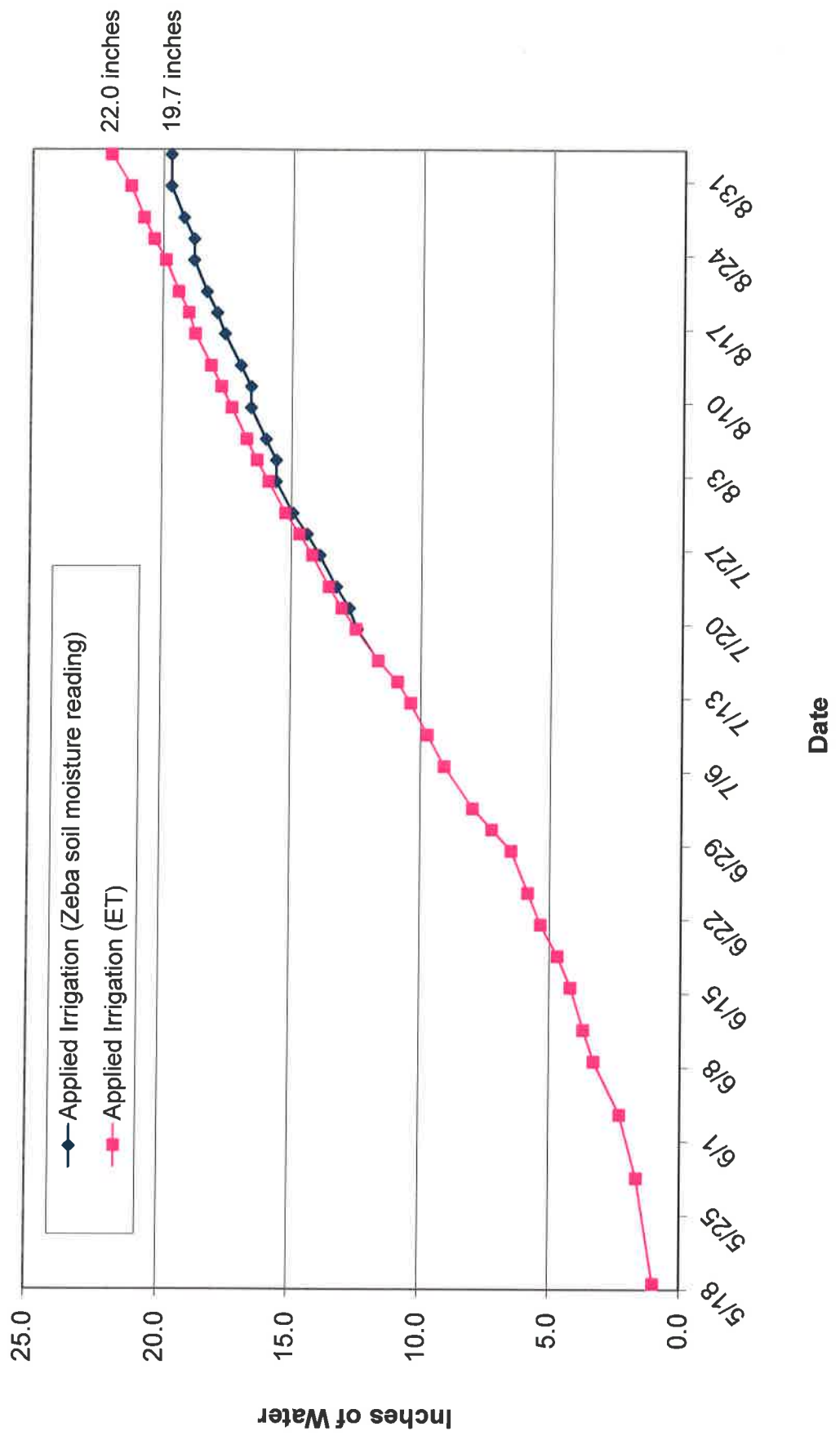


**2010 Zeba Trial - Evaluating Zeba applied In-Furrow vs Untreated Control (Irrigation based on Soil Moisture Readings taken from plots with Zeba applied In-Furrow, starting on July 17, 2010)**

**Potato cultivar: AC99375-1RU**



### Zeba Trial 2010 - Cumulative Irrigation Comparing ET Recommendations and Soil Moisture Readings from Zeba Treated Soil (SLV Research Center, Center, CO)



# Advanced Clone Disease Assessment Program

Research is devoted to screening all new cultivars prior to release to growers for the following diseases: bacterial ring rot, potato leafroll virus, PVY, *Fusarium* seed piece decay, *Erwinia carotovora* spp. (seedpiece decay), early blight tuber decay, powdery scab, and other diseases/pests as techniques become available or as warranted by SLV problems. Results from this research are presented annually in a report to the CPAC and, as cultivars are released, to the growers as Cultivar Management information sheets. The most current releases, Canela Russet, Colorado Rose, Mesa Russet, Mountain Rose, Rio Colorado, Rio Grande Russet, and Purple Majesty moved through this system.

In 2010, no results are available for the potato leafroll virus and PVY trials due to freezing temperatures at the trial location in Yuma, AZ. Also, no results are available for the *Erwinia* evaluation trial due to failure of inoculum.

## 2010 Bacterial Ring Rot Evaluation

- Location:** NW Corner, Selter's Farm, 9 North, ½ East of SLVRC
- Treatments:** 51 clones/cultivars - Non-inoculated controls consisted of 21 tubers cut lengthwise with no dipping. Inoculated treatments were obtained by placing 21 seed pieces (fresh cut lengthwise) into 2 liters of Ringer's solution (100 ml of 10x with 900 ml of cold water) for 5 minutes. Four Cms plates (Strain # CIC31) exhibiting good bacterial growth, with some agar, were scraped into the Ringer's. After four treatments were dipped, two more plates were added to the solution to finish out the last two treatments. Six clones were dipped per batch and the cold solution was not used for more than 45 minutes total time. Cms plates were 7-9 days old and inoculation took place on 5/12/10. Inoculated tubers were allowed to stay moist in paper sack overnight. After planting, tubers were immediately covered with soil.
- Plot Design:** Randomized complete block - 7 inoculated, 7 non-inoculated seed pieces/cultivar x 3 reps with non-inoculated controls planted north of inoculated treatments.
- Plant Date:** 5/14/10
- Cultivars:**
- |                       |                     |
|-----------------------|---------------------|
| 1. AC03433-1W         | 27. Russet Burbank  |
| 2. CO03017-2RU/Y      | 28. Sangre Sel. 10  |
| 3. CO03027-2R/R       | 29. Russet Norkotah |
| 4. CO03094-5R/RW      | 30. A98345-1        |
| 5. CO03187-1RU        | 31. A0008-1TE       |
| 6. CO03202-1RU        | 32. A00324-1        |
| 7. CO03243-3W         | 33. A01010-1        |
| 8. CO03276-4RU        | 34. AO96305-3       |
| 9. CO03276-5RU        | 35. AO00057-2       |
| 10. CO03308-3RU       | 36. PA00N14-2       |
| 11. CO04013-1W/Y      | 37. AOTX95265-1RU   |
| 12. CO04021-2R/Y      | 38. AOTX96216-2RU   |
| 13. CO04045-4P/P      | 39. AOTX96265-2RU   |
| 14. CO04061-1R/RW     | 40. BTX2332-1R      |
| 15. CO04117-5PW/Y     | 41. COTX94216-1R    |
| 16. AC00395-2RU       | 42. COTX94218-1R    |
| 17. AC01151-5W        | 43. A99326-1PY      |
| 18. CO02024-9W        | 44. A00286-3Y       |
| 19. CO02033-1W        | 45. POR03PG80-2     |
| 20. CO02321-4W        | 46. Yukon Gold      |
| 21. TC02072-3P/P      | 47. Frito Lay 1     |
| 22. WNC230-14RU       | 48. Frito Lay 2     |
| 23. Ute Russet        | 49. Frito Lay 3     |
| 24. CO85030-1RU       | 50. Frito Lay 4     |
| 25. CO85153-2RU       | 51. Frito Lay 5     |
| 26. Centennial Russet |                     |
- Irrigation:** Solid set sprinkler: rate based on ET and ppt. Total water for season was 17".
- Fertilizer:** 80:60:40:25(S):2.5(Zn) with 30 N from irrigation water.  
Total for season: 110:60:40:25(S):2.5(Zn).
- Herbicide:** Ground rig application: Eptam (4.5pt/A) + Matrix (1.5oz/A).
- Fungicide/ Insecticide:** Aerial applications: 7/20/09, 8/6/09 - Bravo Weatherstick (1.5pt/A)
- Harvest:** 9/9/10



**Table 1. Clonal Evaluation for Bacterial Ring Rot Foliar Symptom Expression (2010)**

Year	Clone	DAP to First Symptoms	# Reps Positive	# Plants Positive	% Plants Positive	Date 50% or More +	Total # Reps Positive	% Plants + 100 DAP	Summary of Symptoms	*Ave DAP to 1st Symptoms	Rating
10	AC03433-1W	91	1	1	4.7		1	9.5	IVC,IVN,MN,W		
10	CO03017-2RU/Y	45	1	1	4.7		3	47.6	All		
10	CO03027-2R/R	101	1	4	19.0		1	19.0	IVC,IVN,MN,W		
10	CO0394-5R/RW	45	1	1	4.7		3	28.6	All		
10	CO03187-1RU	45	2	2	9.5	84	3	81.0	All		
10	CO03202-1RU	63	2	2	9.5		3	23.8	All		
10	CO03243-3W	45	1	1	4.7	91	3	57.1	All		
10	CO03276-4RU	63	2	3	14.3	84	3	71.4	All		
10	CO03276-5RU	63	1	1	4.7		3	28.6	All		
10	CO03308-3RU	63	3	3	14.3	84	3	66.7	IVC,IVN,MN,W		
10	CO04013-1W/Y	63	3	4	19.0		3	38.1	IVC,IVN,MN,W		
10	CO04021-2R/Y	63	2	5	23.8		2	42.9	IVC,IVN,MN		
10	CO04045-4P/P	45	2	3	14.3	63	3	56.7	All		
10	CO04061-1R/RW	73	1	2	9.5		2	38.1	All		
10	CO04117-5PW/Y	45	1	1	4.7	73	3	81.0	All		
09	AC00395-2RU	58	2	7	36.8	100	3	57.9	All		
10		63	1	1	4.7		2	14.3	All	60 +/- 5	4
09	AC01151-5W	58	3	6	30.0	82	3	55.0	ED,R,IVC		
10		63	1	1	4.7		1	9.5	All	60 +/- 5	4
09	CO02024-9W	58	2	3	15.8		3	31.6	ED,R,IVC		
10		73	1	1	4.7	91	3	52.4	IVC,IVN,MN,W		
09	CO02033-1W	58	2	4	44.4	82	2	55.5	ED,R,IVC	65 +/- 5	4
10		63	2	3	14.3	91	3	52.4	All	60 +/- 5	5
09	CO02321-4W	58	1	2	9.5		2	14.2	ED,R,IVC		
10		73	1	1	4.7		3	33.3	All	65 +/- 5	4
09	TC02072-3P/P	58	2	3	18.8		2	18.8	ED,R,IVC		
10		45	1	3	14.3		3	33.3	All	52 +/- 10	4
09	A98345-1	58	1	2	10.0		2	15.0	ED,R,IVC,W		
10		63	1	4	19.0		3	33.3	All	60 +/- 5	4
08	A0008-1TE	66	1	1	4.8		1	4.8	W		
10		73	1	1	4.7		2	23.8	All	70 +/- 5	3
09	A00324-1	NR									
10		63	2	5	23.8	84	3	76.2	All		
09	A01010-1	NR									
10		63	2	4	19.0		2	23.8	IVC,IVN,MN,W		
09	AO96305-3	58	3	5	23.9		3	33.3	All		
10		63	3	4	19.0	84	3	57.1	All	60 +/- 5	5
09	AO00057-2	NR									
10		63	1	1	4.7		3	33.3	All		

Year	Clone	DAP to First Symptoms	# Reps Positive	# Plants Positive	% Plants Positive	Date 50% or More +	Total # Reps Positive	% Plants + 100 DAP	Summary of Symptoms	*Ave DAP to 1st Symptoms	Rating
09	PA00N14-2	68	1	1	12.5	100	1	50.0	All		
10		45	3	3	14.3		3	47.6	All	57 +/- 12	5
09	AOTX95265-1RU	NR									
10		45	1	1	4.7	91	3	90.5	All		
09	AOTX96216-2RU	NR									
10		63	1	2	9.5	84	3	52.4	All		
09	AOTX96265-2RU	NR									
10		45	2	3	14.3	91	3	85.7	All		
09	BTX2332-1R	NE									
10		73	1	1	4.7		2	19.0	All		
09	COTX94216-1R	68	1	1	6.3		2	12.5	All		
10		45	1	1	4.7		2	14.3	All	57 +/- 12	3
09	COTX94218-1R	NE									
10		45	1	1	4.7		3	33.3	All		
09	A99326-1P/Y	NR									
10		73	1	1	4.7		2	19.0	All		
09	A00286-3Y	68	1	1	14.3		1	42.9	ED,R,IVC		
10		45	1	1	4.7		3	33.3	IVC,IVN,MN,W	57 +/- 12	4
09	POR03PG80-2	58	3	4	23.5		3	41.2	All		
10		73	2	2	9.5		2	19.0	All	66 +/- 7	5
08	Yukon Gold	66	1	1	4.8		2	14.2	ED,R,IVC		
10		63	2	2	9.5		3	47.6	All	64	5
08	WNC230-14RU	61	2	2	9.5		3	14.2	ED,R,IVC		
09		58	1	1	6.7		2	13.3	ED,R,IVC		
10		73	2	3	14.2		2	14.2	ALL	64 (+/-5)	4
08	Ute Russet	66	2	5	23.8		2	23.8	ED,R,IVC		
09		58	1	1	5.6	100	3	50.0	ED,R,IVC		
10		63	3	3	14.3	91	3	61.9	ED,R,IVC	62 (+/-5)	4
08	Centennial Russet	100	1	1	4.8		1	4.8	IVC,IVN,MN		
09		58	2	3	33.3		2	33.3	ED,R,IVC		
10		91	1	1	4.8		1	4.7	ALL	83 (+/-20)	4
08	Russet Burbank	46	3	6	28.6	73	3	66.7	ALL		
09		58	2	4	28.6	82	2	57.1	ALL		
10		45	3	4	19.0		3	42.9	ALL	50 (+/-5)	5
08	Sangre	100	3	8	38.1		3	38.1	IVC,IVN,MN,W		
09		58	3	7	41.1		3	47.0	ALL		
10		73	1	1	4.8		2	23.8	ALL	77 (+/-20)	4
08	Russet Norkotah	46	3	3	14.3	61	3	85.7	ALL		
09		68	2	4	33.3	82	3	58.3	ALL		
10		45	2	5	23.8		3	47.6	ALL	53 (+/-15)	5



Table 2. Clonal Evaluation for Bacterial Ring Rot Tuber Symptom Expression

Year	Clone	# Reps Positive	# Tubers Positive	%Tubers Positive	Comments
10	AC03433-1W				
10	CO03017-2RU/Y	1	1	5	
10	CO03027-2R/R				
10	CO0394-5R/RW	1	1	5	PS2
10	CO03187-1RU				
10	CO03202-1RU				
10	CO03243-3W	2	2	10	PS1
10	CO03276-4RU				
10	CO03276-5RU				PR-1
10	CO03308-3RU				
10	CO04013-1W/Y				PS1
10	CO04021-2R/Y	2	2	10	PR-3
10	CO04045-4P/P				
10	CO04061-1R/RW	1	1	5	PS2
10	CO04117-5PW/Y				
09	AC00395-2RU				
10		2	3	15	
09	AC01151-5W				
10		1	1	5	PS1
09	CO02024-9W	1	1	5	
10					PS1
09	CO02033-1W				
10					PS3; PR-1
09	CO02321-4W				
10					PS1
09	TC02072-3P/P				
10					PS2
09	A98345-1				
10					PS2
09	A0008-1TE				
10					
09	A00324-1	NR			
10					PR-1
09	A01010-1	NR			
10					
09	AO96305-3				
10					
09	AO00057-2	NR			
10					
09	PA00N14-2				
10					
09	AOTX95265-1RU	NR			
10		1	1	5	
09	AOTX96216-2RU	NR			
10		1	3	15	
09	AOTX96265-2RU	NR			
10		1	1	5	
09	BTX2332-1R				
10					PS3
09	COTX94216-1R				
10					PS2; PR-2

Year	Clone	# Reps Positive	# Tubers Positive	%Tubers Positive	Comments
09	COTX94218-1R				
10		1	1	5	PS2
09	A99326-1P/Y				
10		1	2	10	PS3
09	A00286-3Y	NR			
10					
09	POR03PG80-2				
10		1	1	5	
08	Yukon Gold				
10		2	2	10	
08	WNC230-14RU				
09		1	1	5.0	
10					
08	Ute Russet				
09					
10					
08	Centennial Russet				
09					
10					
08	Russet Burbank				
09		1	1	5.0	
10					
08	Sangre				
09					PS1
10		1	1	5.0	PS1
08	Russet Norkotah				
09					
10					
Harvest dates - 9/12/08, 9/9/09, 9/9/10.					
10 tubers cut/treatment representing at least five plants/treatment with 2 of 3 reps tested (20 tubers total).					
NR=No results					
BRR tuber rating 1-5 with 1 = no symptoms and 5 = high % of tubers with good rot.					
Treatments with no values indicate zero tubers found with BRR symptoms.					
PS + = Powdery scab symptoms observed. Rating 1-3 with 1-light, 2-moderate, and 3-heavy scab symptoms.					
PR- = Pink rot number of tubers present in 20 tuber samples dug.					

## 2010 Clonal Evaluation for Storage Rots

**Treatments:** *Pectobacterium* - 50ul of  $1.6 \times 10^4$  cfu/ml into 3 inoculation sites, stem end.  
*Fusarium* - 50ul of 250 spores/tuber into 3 inoculation sites, stem end.

Tubers kept at 55-60<sup>0</sup>F after inoculation for 4 weeks.

**Inoculation/Reading:** Inoculation: 12/16/2010; Readings: 1/26/2011

<b>Cultivars:</b>	AC00395-2RU	Canela Russet
	AC01151-5W	Rio Grande Russet
	CO02024-9W	
	CO02321-4W	
	CO02033-1W	
	TC02072-3P/P	
	CO01399-10P/Y	
	AC03433-1W	
	CO03017-2RU/Y	
	CO03027-2R/R	
	CO03094-5RF/RW	
	CO03187-1RU	
	CO03202-1RU	
	CO03243-3W	
	CO03276-4RU	
	CO03276-5RU	
	CO03308-3RU	
	CO04013-1W/Y	
	CO04021-2R/Y	
	CO04045-4P/P	
	CO04061-1R/RW	
	CO04117-5PW/Y	

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

<i>Fusarium</i>	<i>Pectobacterium</i>	<i>Alternaria</i>
1 = No symptoms	1 = No symptoms	0 = No symptoms
2 = Localized damage	2 = Localized damage	1 = 1/8" dia./1peel
3 = 25-50% tuber damage	3 = 25-50% 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 2+ for *Fusarium*, 3+ for *Pectobacterium* and at 4 for *Alternaria*  
*Pectobacterium* - no results and *Alternaria* was not screened in 2010

<b>Table 3. Clonal Evaluation for Storage Rot</b>				
<b><i>Fusarium</i></b>				
<b>Inoculation</b>	<b>11/12/2008</b>	<b>1/28/2010</b>	<b>12/16/2010</b>	
<b>Reading</b>	<b>12/12/2008</b>	<b>2/25/2010</b>	<b>1/26/2011</b>	
<b>Clone</b>	<b>Avg Score</b>	<b>Avg Score</b>	<b>Avg Score</b>	<b>2/3 yr Avg</b>
AC00395-2RU		3.60	3.10	3.35
AC01151-5W		3.40	3.00	3.20
CO02024-9W		3.40	2.10	2.75
CO02033-1W		3.00	2.30	2.65
CO02321-4W		3.00	2.00	2.50
TC02072-3P/P		3.20	3.10	3.15
CO01399-10P/Y		3.20	4.00	3.60
AC03433-1W			3.50	
CO03017-2RU/Y			3.00	
CO03027-2R/R			3.00	
CO03094-5RF/RW			2.30	
CO03187-1RU			2.80	
CO03202-1RU			2.90	
CO03243-3W			4.00	
CO03276-4RU			3.00	
CO03276-5RU			2.80	
CO03308-3RU			3.00	
CO04013-1W/Y			3.20	
CO04021-2R/Y			3.00	
CO04045-4P/P			3.00	
CO04061-1R/RW			2.80	
CO04117-5PW/Y			3.50	
Canela RU		3.00	3.50	3.25
Rio Grande RU	3.40	3.30	3.00	3.23
RU Norkotah 3	3.20	2.90		3.05
RU Nugget	3.80	3.30		3.55
Sangre 10	2.70	2.90		2.80

1 = No symptoms, 2 = Localized damage

3 = 25-50% tuber damage, 4 = >50% tuber damage,

5 = 100% tuber damage. Grade loss occurs at 2.00+.

Highest severity of tubers was found in AC03433-1W, CO03243-3W, CO04117-5PW/Y, and CO04117-5PW/Y.

