

2009

Potato Research Report

Potato Disease Control Project



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Colorado State University San Luis Valley Research Center

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Early Blight Fungicide Trials

Early Blight Degree Days for the San Luis Valley

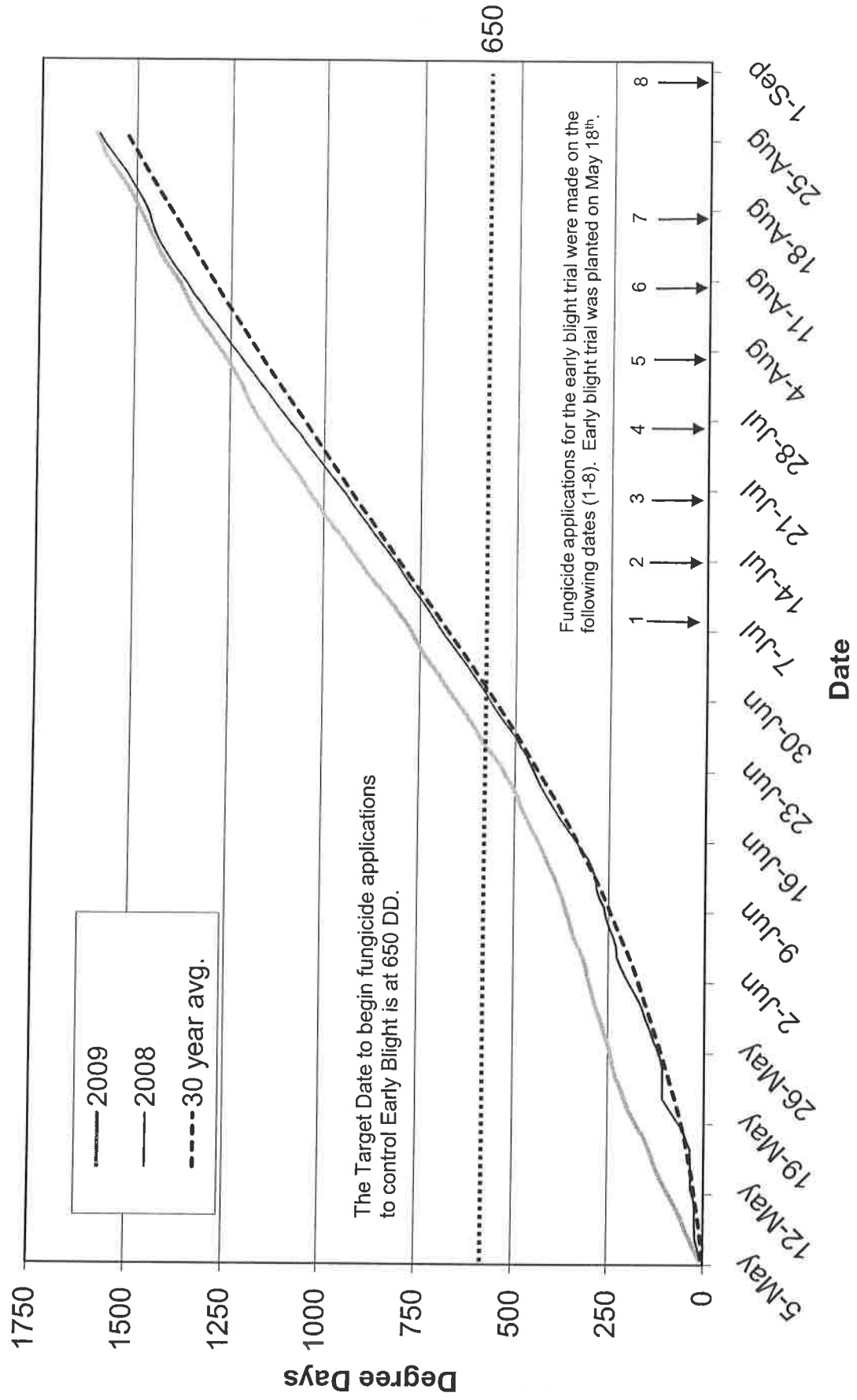


Table 1. Evaluation of Foliar Fungicide Programs for Early Blight Control in the years 2005, 2006, 2007 and 2009.

Treatment	AUDPC ^a					Mean	2009	Cost/A ^d
	2005	2006	2007	2008	2009			
1. Untreated Control	782.5 a	998.1 a	1281.1 a	1020.6 a	721.6 a ^b	-		
2. Strobilurin (4) ^c + Bravo (5) + Endura (6)	261.6 d	736.5 d	994.5 b	644.2 d	435.8 b ^c	\$46.54		
3. Dithane (4,6) + Bravo (5)	389.9 c	877.0 b	1028.9 b	765.3 b	443.4 b	\$35.03 ^f		
4. Dithane (1,4) + Quadris (3)	484.2 b	821.6 bc	1030.7 b	778.8 b	497.0 b	\$40.20 ^f		
5. Dithane (4,6) + Quadris (5)	328.7 cd	783.1 cd	1015.6 b	709.2 c	439.5 b	\$40.20 ^f		
LSD (P = 0.05)	69.00	60.01	36.32	30.70	66.52	-		

^a AUDPC is the Area Under the Disease Progress Curve, accumulated throughout the month of August.

^b For 2009, due to constraints in trial location, the untreated controls were located in close proximity to the five treatments, but did not represent true untreated controls.

^c For the 2009 data, the following application schedule was utilized; Strobilurin (2), Bravo (4), and Endura (6).

^d These prices do not include application costs. Total cost/acre was based on 2009 prices and were obtained from Wilbur Ellis.

^e 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.

^f 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 1. Evaluation of Foliar Fungicide Programs for Yield in the years 2005, 2006, 2007 and 2009.

Treatment	Yield (Cwt/A) ^a					Cost/A ^d
	2005	2006	2007	Mean	2009	
1. Untreated Control	389.6	353.4	328.2 bc	357.1 b	410.7 ^b	-
2. Strobilurin (4) ^e + Bravo (5) + Endura (6)	446.4	367.0	349.4 ab	387.6 a	387.5 ^c	\$46.54
3. Dithane (4,6) + Bravo (5)	403.3	334.1	369.7 a	369.0 ab	389.8	\$35.03 ^f
4. Dithane (1,4) + Quadris (3)	414.8	361.5	318.0 c	364.8 b	400.0	\$40.20 ^f
5. Dithane (4,6) + Quadris (5)	403.3	376.3	330.8 bc	370.1 ab	381.8	\$40.20 ^f
LSD (P = 0.05)	NS	NS	25.09	20.81	NS	-

^a Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of four replications.

^b For 2009, due to constraints in trial location, the untreated controls were located in close proximity to the five treatments, but did not represent true untreated controls.

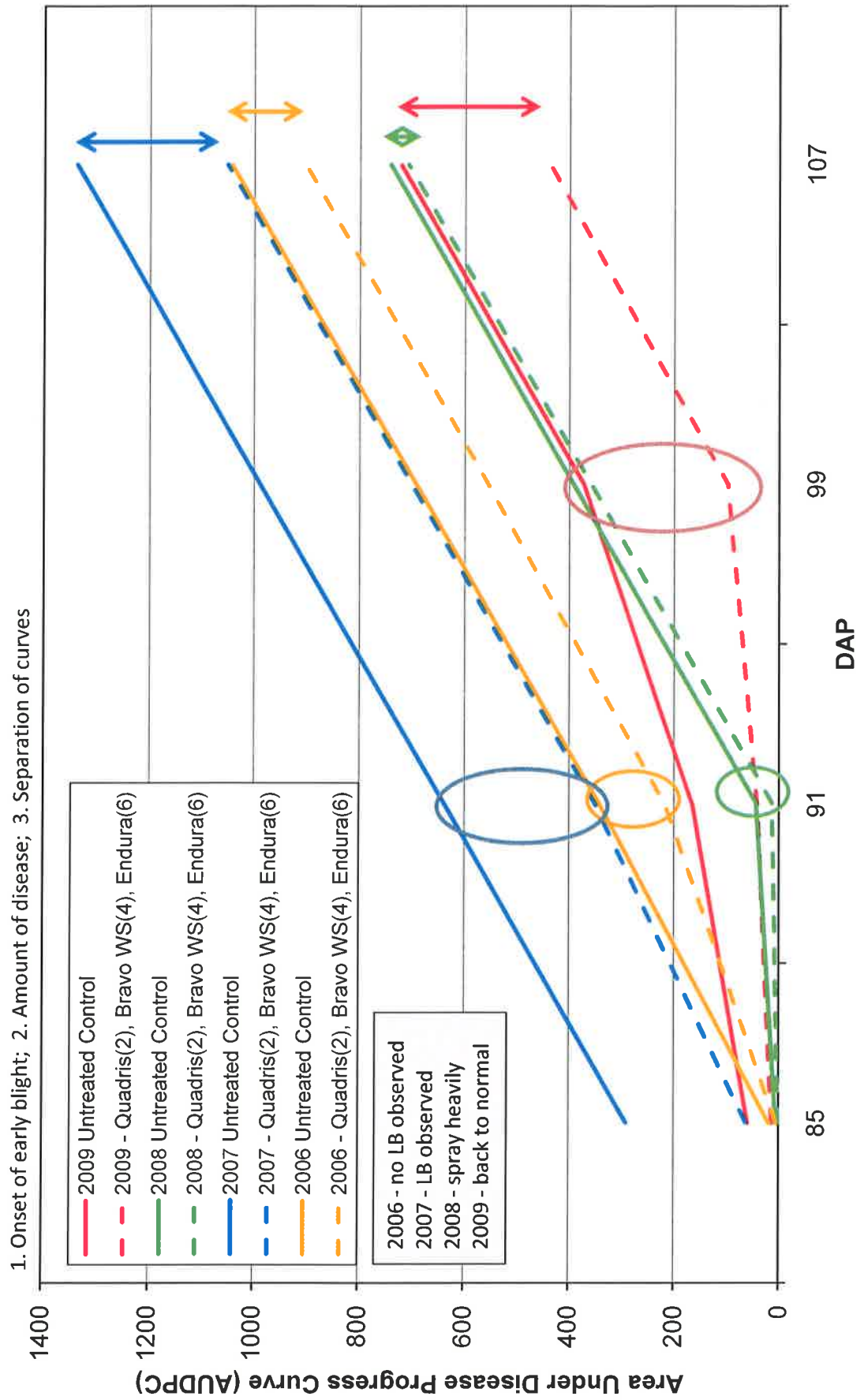
^c For the 2009 data, the following application schedule was utilized; Strobilurin (2), Bravo (4), and Endura (6).

^d These prices do not include application costs. Total cost/acre was based on 2009 prices and were obtained from Wilbur Ellis.

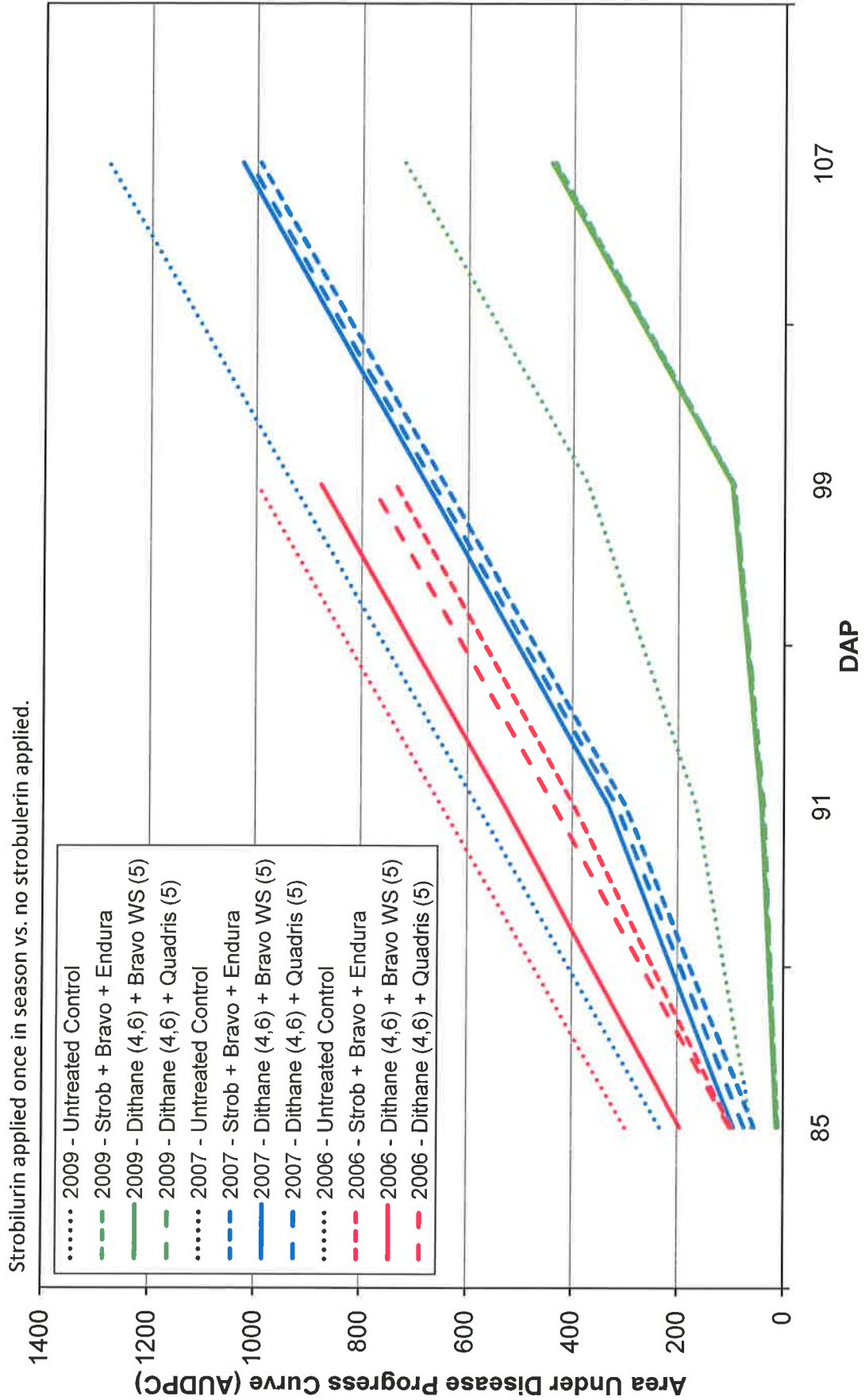
^e Fungicide applications began once the Early blight degree day model reached a value of 650DD, which typically occurs around the first week of July. The number in parentheses represents the week number after the threshold of 650DD was reached. For example: (1) = fungicide was applied the first week after 650DD was reached, (2) = the second week, etc.

^f 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 (2006 - 2009),
Colorado State University, San Luis Valley Research Center, Center, CO
Total Amount of Accumulated Early Blight Through Season on Russet Norkotah Sel 8



Area Under the Disease Progress Curve for Early Blight
Early Blight Fungicide Trial (2006, 2007, 2009),
 Colorado State University, San Luis Valley Research Center, Center, CO
Total Amount of Accumulated Early Blight Through Season on Russet Norkotah Sel 8



2009 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 CO₂ 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 9; July 14; July 20; July 27; August 3; August 10; August 17
- Planted:** May 18, 2009
- 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 8, 2009
- Harvested:** October 5, 2009
- DATA:**
- Disease:** Early blight disease incidence based on percent leaves infected, readings taken weekly starting August 5, 2009.
- AUDPC:** **Area Under the Disease Progress Curve (AUDPC) is a measure of the progression of Early Blight, starting on August 5th and ending with the last reading on September 3rd. 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 2009.

<u>Program</u>	<u>Products</u>	<u>Rate</u>	<u>Application Schedule^a</u>
1	Untreated Control	-	-
2	Quadris	6.1 floz/A	2
	Bravo WS	1.5 pt./A	4
	Endura	2.5 oz./A	6
3	Dithane Rainshield	2.0 lbs./A	4,6
	Bravo WS	1.5 pt./A	5
4	Dithane Rainshield	2.0 lbs./A	1,5
	Quadris	6.1 floz/A	3
5	Dithane Rainshield	2.0 lbs./A	4,6
	Quadris	6.1 floz/A	5
6	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

^a Schedule for applying treatments on a weekly basis, schedule started on July 9 (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, 2009; No Late Blight occurred within the trial.

Treatment	Percent Leaves Infected ^a (with one or more lesion)					AUDPC ^c
	August 5 ^b	August 12	August 19	August 26	September 3	
1	2.8 a	15.5 a	30.2 a	59.2 a	99.9 a	721.6 a
2	1.2 b	2.2 b	8.7 b	15.8 b	97.3 b	435.8 b
3	1.5 b	2.9 b	8.3 b	16.3 b	98.5 ab	443.4 b
4	1.0 b	3.3 b	11.3 b	28.8 b	98.1 ab	497.0 b
5	1.3 b	2.5 b	7.3 b	16.7 b	98.4 ab	439.5 b
6	1.0 b	3.0 b	8.5 b	20.4 b	94.7 c	444.8 b
LSD(P=0.05)	0.82	4.28	9.13	20.77	2.37	66.52

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

^b Readings were taken from only two replications due to the low levels of Early Blight present.

^c AUDPC is the Area Under the Disease Progress Curve, accumulated weekly from August 5 through September 3.

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, 2009.

Treatment	Percent ^a			US No 2's	Culls	Cwt/A ^b
	< 4 oz.	4-10 oz.	> 10 oz.			
1	32.6	46.7	18.8	0.1	1.8	410.73
2	36.3	47.3	13.9	0.2	2.3	387.47
3	35.7	46.3	15.1	0.2	2.6	389.79
4	32.2	47.8	17.4	0.3	2.3	399.95
5	34.0	47.4	16.6	0.1	1.9	381.76
6	33.7	50.4	14.4	0.0	1.5	387.47
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.

2009 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 CO₂ 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 9; July 20; August 3; August 17
- Planted:** May 18, 2009
- 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 8, 2009
- Harvested:** October 5, 2009
- DATA:**
- Disease:** Early blight disease incidence based on percent leaves infected, readings taken weekly starting August 5, 2009.
- AUDPC:** **Area Under the Disease Progress Curve (AUDPC) is a measure of the progression of Early Blight, starting on August 5th and ending with the last reading on September 3rd. 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 2009.

<u>Program</u>	<u>Products</u>	<u>Rate</u>	<u>Application Schedule^a</u>
1	Untreated Control	-	-
2	Proprietary	-	1,3,5,7
3	Echo ZN	2.0 pt./A	1,5
	Proprietary	-	3,7
4	Scala 60SC	7.0 oz./A	1,5
	Echo ZN	1.5 pt./A	1,5
	Echo ZN	2.0 pt./A	3,7
5	Echo ZN	2.0 pt./A	1,5
	Scala 60SC	7.0 oz./A	3,7
	Echo ZN	1.5 pt./A	3,7
6	Echo ZN	2.0 pt./A	1
	Proprietary	-	3
	Reason	4.0 oz./A	5
	Bond	0.1% v/v	5
	Scala 60SC	7.0 oz./A	7
	Echo ZN	1.5 pt./A	7
7	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

^a Schedule for applying treatments on a weekly basis, schedule started on July 9 (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, 2009; No Late Blight occurred within the trial.

Treatment	Percent Leaves Infected ^a (with one or more lesion)					AUDPC ^c
	August 5 ^b	August 12	August 19	August 26	September 3	
1	2.2	13.8 a	26.0 a	72.5 a	99.9 a	746.7 a
2	1.0	1.5 b	8.5 b	15.0 b	90.8 c	406.8 c
3	1.2	2.2 b	7.8 b	14.6 b	92.6 c	412.1 bc
4	2.0	3.8 b	9.4 b	20.0 b	96.5 b	457.3 b
5	1.7	3.2 b	8.6 b	16.7 b	98.1 ab	445.7 bc
6	1.3	2.5 b	8.4 b	19.6 b	97.0 ab	448.6 bc
7	1.3	3.4 b	8.1 b	16.7 b	96.2 ab	437.5 bc
LSD(P=0.05)	NS	4.22	4.62	8.87	3.12	50.46

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

^b Readings were taken from only two replications due to the low levels of Early Blight present.

^c AUDPC is the Area Under the Disease Progress Curve, accumulated weekly from August 5 through September 3.

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, 2009.

Treatment	Percent ^a					
	< 4 oz.	4-10 oz.	> 10 oz.	US No 2's	Culls	Cwt/A ^b
1	33.1	47.6	16.4	0.3	2.5	382.61
2	29.9	50.4	17.3	0.0	2.4	397.83
3	31.9	46.2	20.3	0.2	1.4	392.75
4	31.4	47.0	20.2	0.0	1.5	421.73
5	33.9	49.4	14.8	0.2	1.7	414.11
6	32.7	49.5	15.9	0.0	1.8	429.77
7	29.3	48.6	20.1	0.2	1.7	439.29
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.

2009 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 CO₂ 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 9; July 20; August 3; August 17; August 31
- Planted:** May 18, 2009
- 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 8, 2009
- Harvested:** October 5, 2009
- DATA:**
- Disease:** Early blight disease incidence based on percent leaves infected, readings taken weekly starting August 5, 2009.
- AUDPC:** **Area Under the Disease Progress Curve (AUDPC) is a measure of the progression of Early Blight, starting on August 5th and ending with the last reading on September 3rd. 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 2009.

<u>Program</u>	<u>Products</u>	<u>Rate</u>	<u>Application Schedule^a</u>
1	Untreated Control	-	-
2	Bravo WS	1.5 pt./A	1,3,5,7,9
3	Quadris Opti	1.6 pt/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
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
	SuperTin	2.5oz/A	9
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
	SuperTin	2.5 oz/A	9
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
	SuperTin	2.5 oz/A	9
7	Quadris Opti	1.6 pt./A	1
	Bravo WS	1.5 pt./A	3
	Quadris Top	8.0 floz/A	5
	Endura	2.5 oz/A	7
	SuperTin	2.5 oz/A	9

^a Schedule for applying treatments on a weekly basis, schedule started on July 9 (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, 2009; No Late Blight occurred within the trial.

Treatment	Percent Leaves Infected ^a (with one or more lesion)					AUDPC ^c
	August 5 ^b	August 12	August 19	August 26	September 3	
1	2.7	21.7 a	40.4 a	69.8 a	100.0 a	816.4 a
2	1.3	6.3 b	13.3 b	35.0 b	98.2 ab	537.0 b
3	1.0	2.8 c	8.8 b	19.6 bc	95.3 bc	444.2 c
4	1.2	2.5 c	10.0 b	19.2 bc	96.1 bc	449.2 c
5	1.5	4.4 bc	13.4 b	25.0 bc	95.2 bc	485.7 bc
6	1.2	3.8 bc	11.6 b	15.0 c	94.0 c	437.5 c
7	1.2	2.3 c	8.0 b	22.5 bc	95.5 bc	451.2 c
LSD(P=0.05)	NS	2.42	6.66	17.26	3.08	55.52

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

^b Readings were taken from only two replications due to the low levels of Early Blight present.

^c AUDPC is the Area Under the Disease Progress Curve, accumulated weekly from August 5 through September 3.

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, 2009.

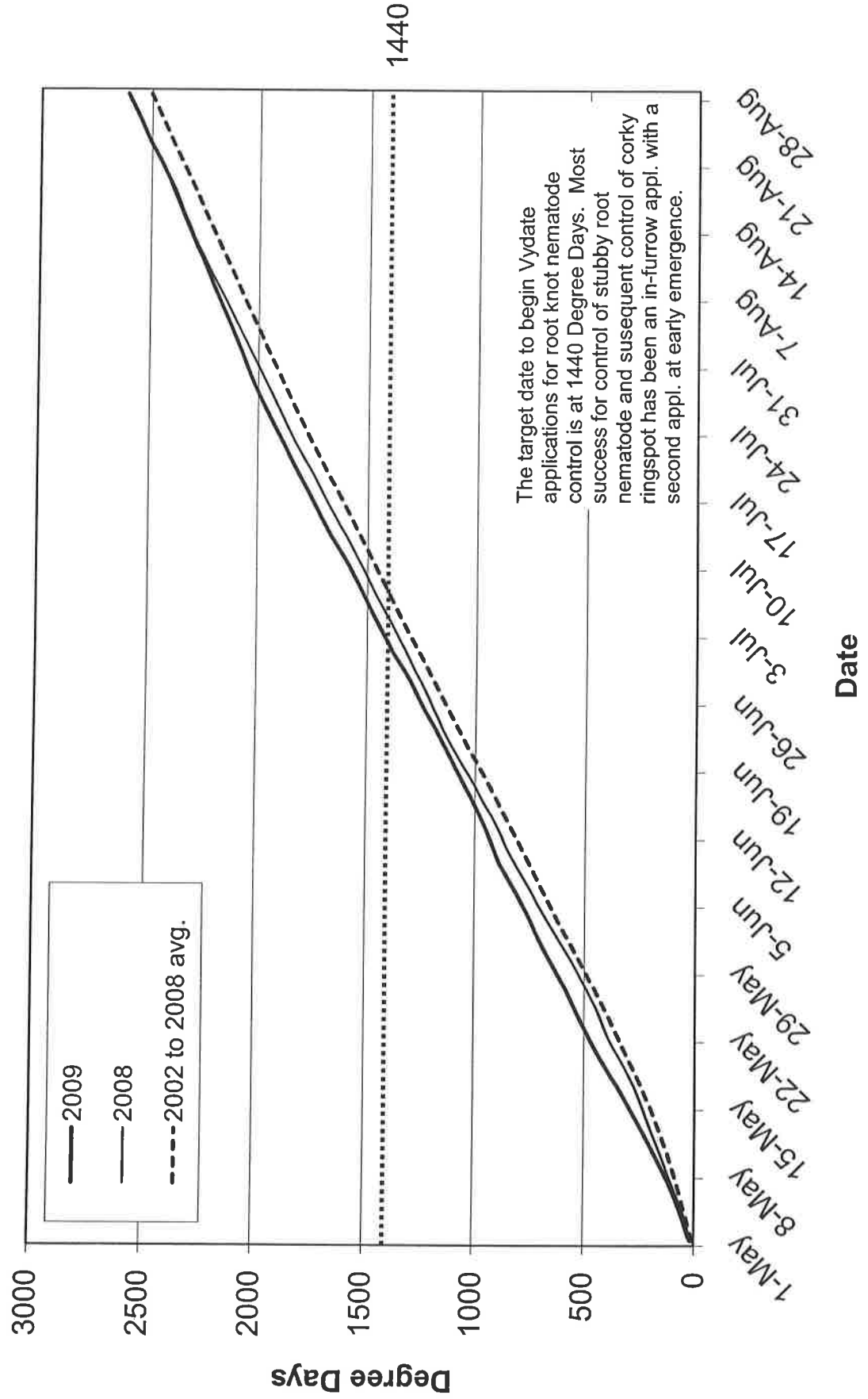
Treatment	Percent ^a					
	< 4 oz.	4-10 oz.	> 10 oz.	US No 2's	Culls	Cwt/A ^b
1	31.2	49.6	17.3	0.1	1.8	405.9
2	30.5	48.2	19.1	0.2	2.1	415.8
3	31.4	50.6	16.1	0.1	1.8	405.2
4	33.2	47.5	16.2	0.2	2.9	409.3
5	33.9	49.1	15.8	0.0	1.3	361.2
6	34.5	49.1	14.6	0.0	1.7	387.5
7	34.0	49.1	16.1	0.0	0.8	420.5
LSD(P=0.05)	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.

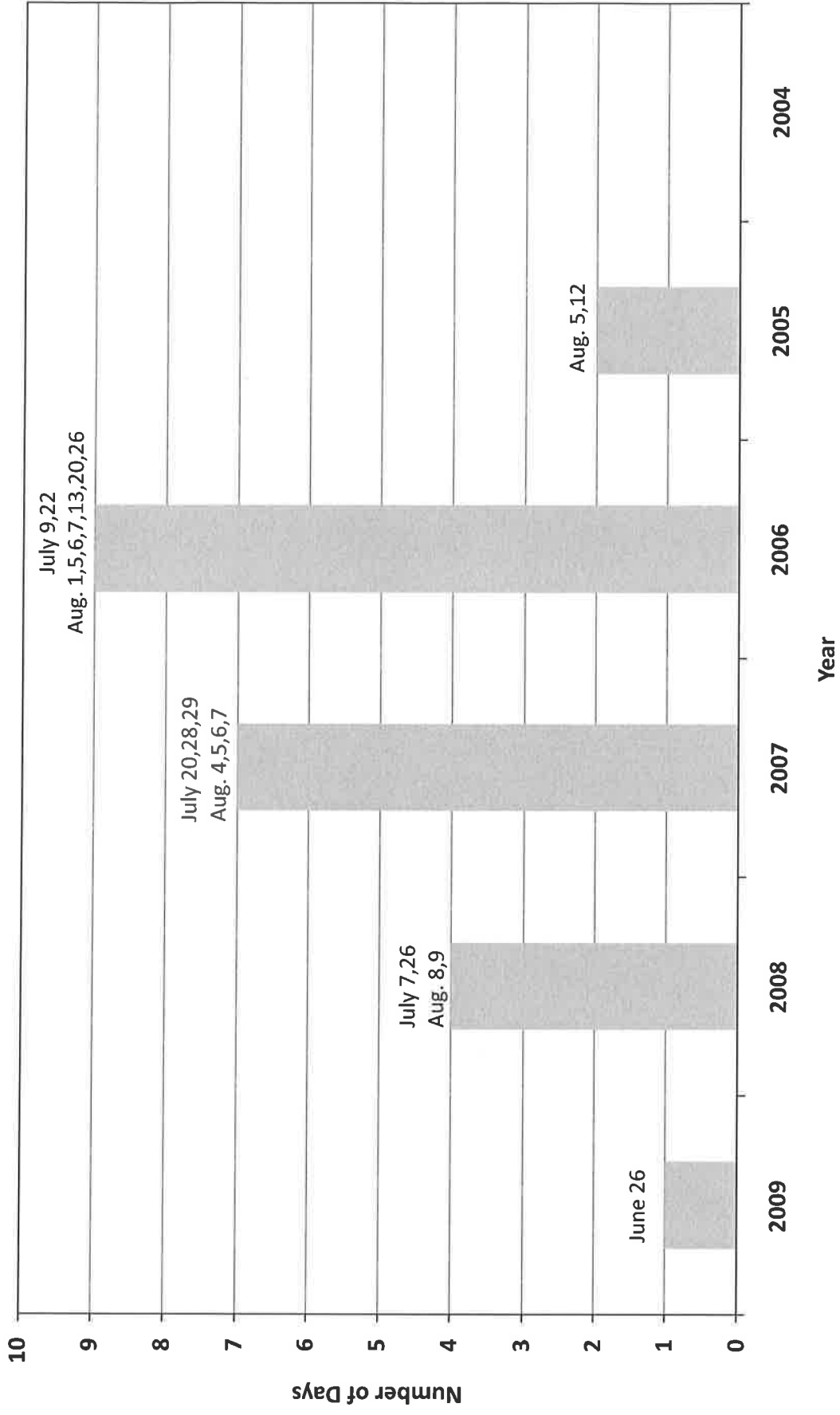
Root Knot Nematode Degree Days

Root Knot Nematode Degree Days for the San Luis Valley



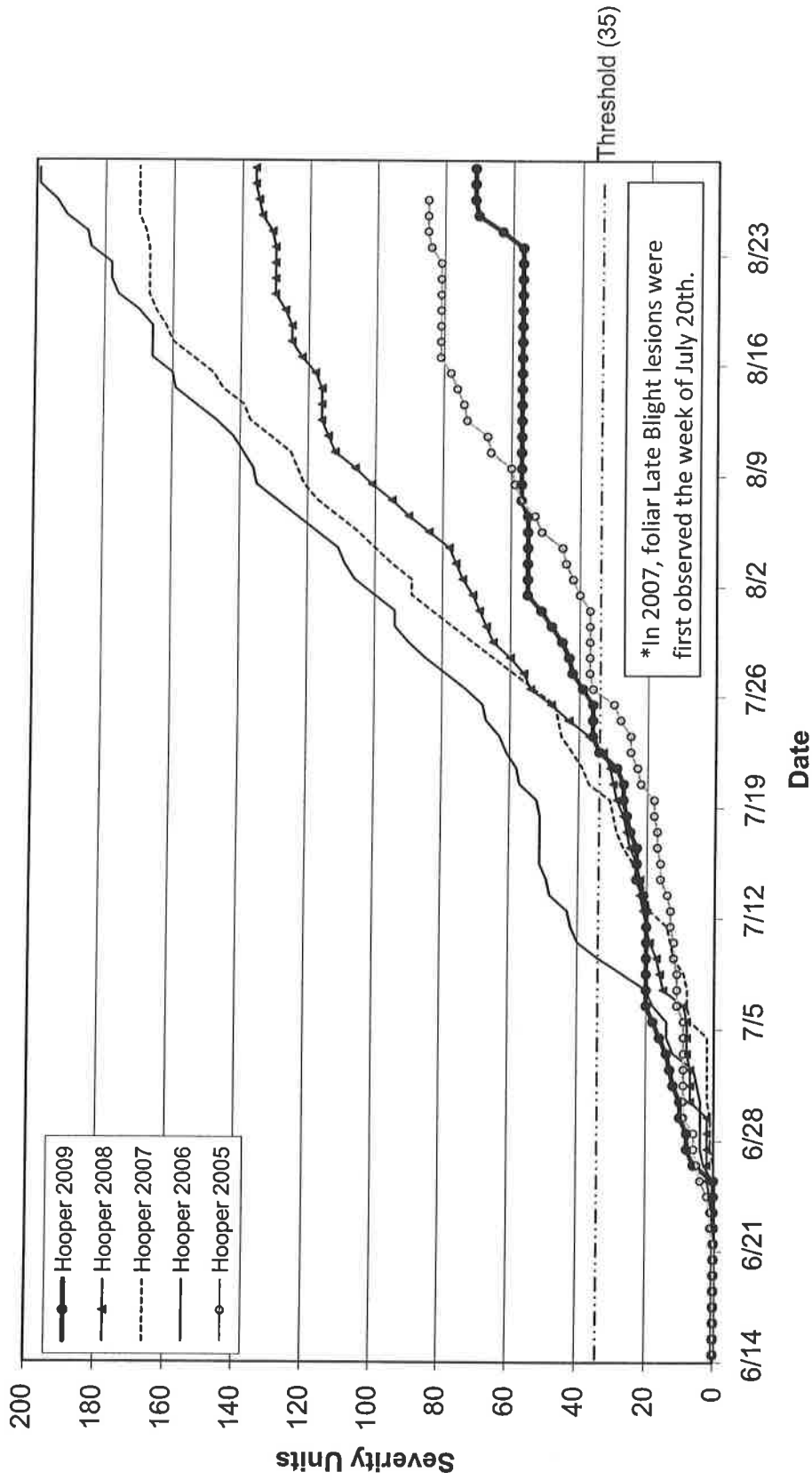
SLV Late Blight Forecasting

**Number of days when conditions were favorable for Late Blight Lesion formation.
Based on Smith Model for Hooper Area, 2004 - 2009.**



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

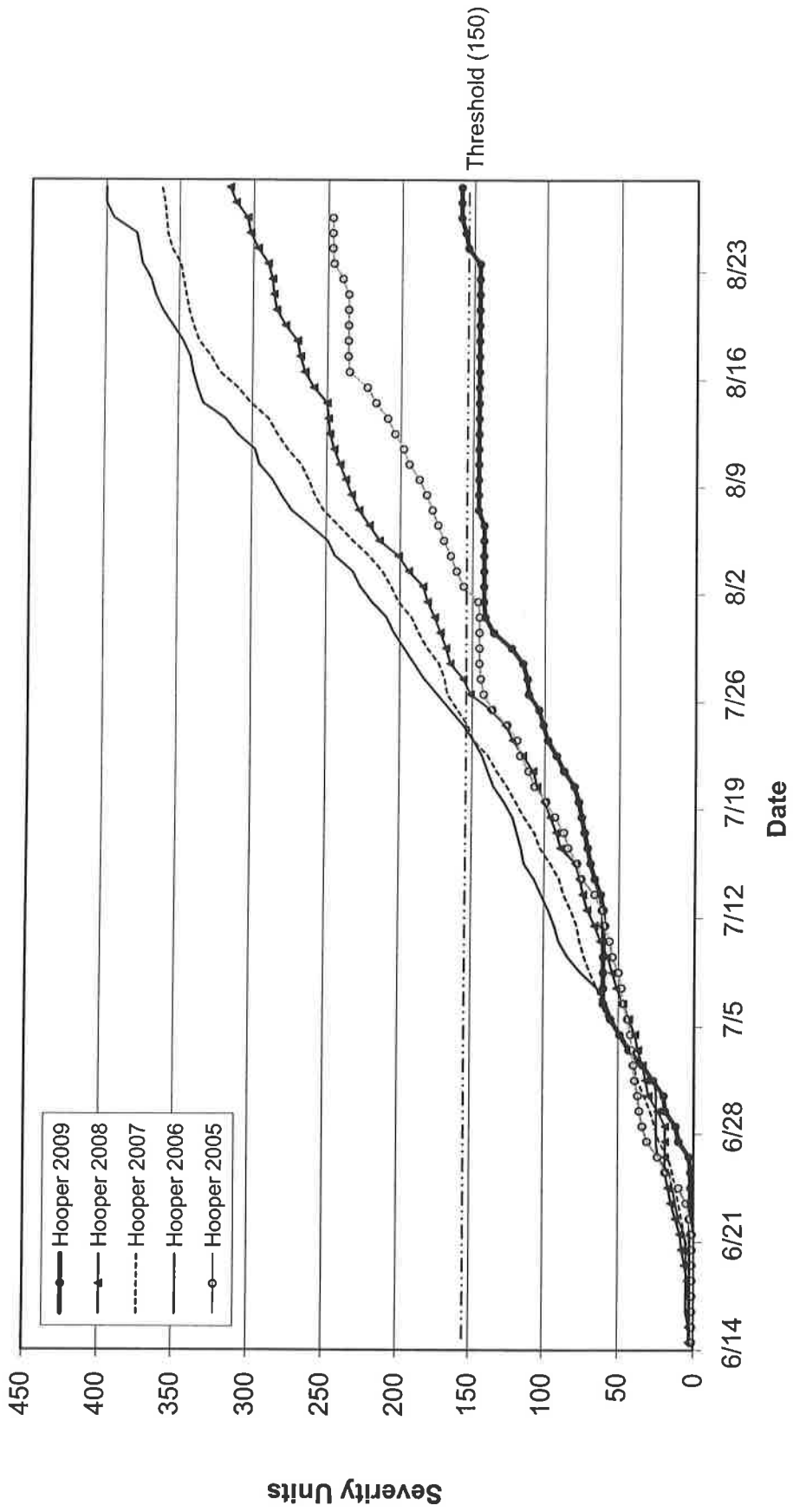
Potato Late Blight Fry Units, San Luis Valley (Hooper site), Colorado, 2005 - 2009
Moderate Susceptible Varieties



Footnote:

- The Fry Late Blight model was used to calculate the severity units.
- 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.
- The 2005 Hooper weather station was set up on June 8, 2005.

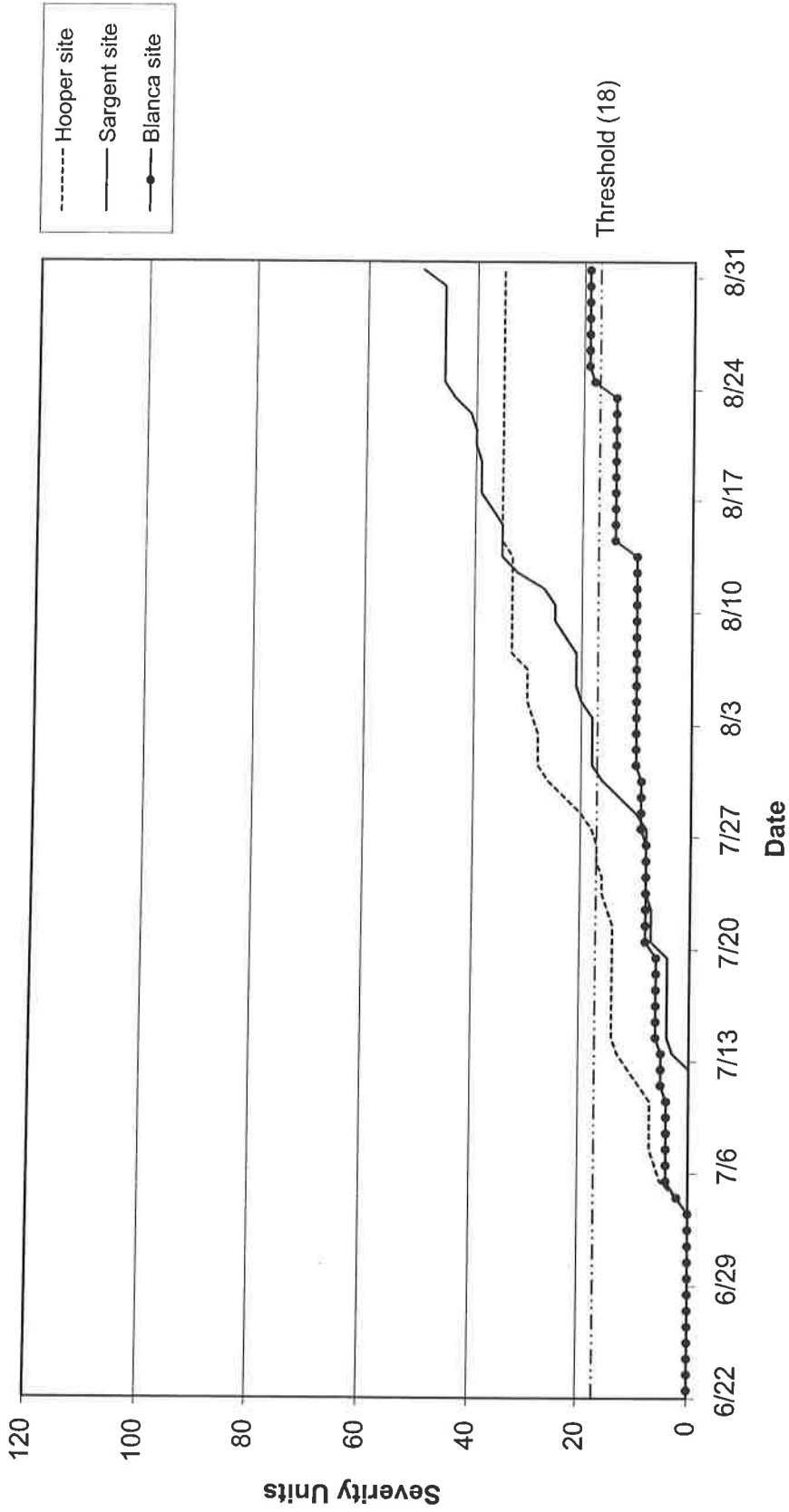
Potato Late Blight Negative Prognosis, San Luis Valley (Hooper site), Colorado, 2005 - 2009
 Moderate Susceptible Varieties



Footnote:

- The Negative Prognosis model was used to calculate the severity units.
- 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.
- The 2005 Hooper weather station was set up on June 8, 2005.

**Potato Late Blight Severity Values - Wallin Model,
San Luis Valley, Colorado, 2009**



Footnote:
 - The Sargent weather station began collecting data on June 5, 2009.
 - The Hooper weather station began collecting data on June 30, 2009.
 - The Blanca weather station began collecting data on June 30, 2009.

Pink Rot Trials

EVALUATION OF FUNGICIDES APPLIED WITH 2 NOZZLES (IF) FOR CONTROL OF PINK ROT ON POTATO, 2009

Researchers: Rob Davidson and Andrew Houser, Colorado State University, SLVRC
Location: San Luis Valley Research Center, Center, CO
Cultivar: Sangre S10, cut seed, 2-4 oz.
Objective: To evaluate the efficacy of various fungicides in controlling pink rot in potato.
Application: In-furrow (IF) treatments were applied using an R & D CO₂ 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 40 gal./A for the 2 nozzle applications. Single nozzle IF treatments were applied using an R & D CO₂ charged backpack sprayer at 35 PSI, with one XR 8002VS nozzle, at 20 gallons/acre as a directed IF application. At Hilling (AH) treatments were applied using an R & D CO₂ charged backpack sprayer at 35 PSI, with one XR 8002VS nozzles, at 10 gallons/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. Revus @ 0.503 floz/1000 row ft. (IF)
5. Revus @ 0.503 floz/1000 row ft. (IF) - 2 nozzles
6. Omega @ 1.5 pt./A (IF) - 2 nozzles
7. Omega @ 1.5 pt./A (IF) - 2 nozzles
Revus @ 0.503 floz/1000 row ft. (IF) - 2 nozzles
8. Revus @ 0.503 floz/1000 row ft. (IF)
Revus @ 7.0 floz/A (AH)

Planted: May 19, 2009
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: 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
Fungicide: Quadris @ 6.5 floz./A + Bravo WS @ 1.5 pt./A
Insecticide: None
Vine Killer: Vines chopped on September 8, 2009
Harvested: September 15 and 16, 2009

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 Sangre S10, San Luis Valley, Colorado, 2009.

Program	Treatment	Percent ^b								
		< 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	23.7	50.7	23.8 ab	1.9	0.0	492.8	31.0	9.2	46.2
2 (Standard)	Ridomil Gold @ 0.42 floz./1000 row ft. (IF)	21.5	48.5	29.7 a	0.0	0.3	577.2	2.5	0.5	2.6
3 (Standard)	Ridomil Gold @ 0.42 floz./1000 row ft. (IF) Phostrol @ 8.0 pt./A (IF)	25.1	44.3	29.7 a	0.3	0.6	543.2	8.5	1.9	9.4
4	Revus @ 0.503 floz./1000 row ft. (IF)	23.2	51.7	24.8 ab	0.3	0.0	517.5	15.3	5.2	25.0
5	Revus @ 0.503 floz./1000 row ft. (IF) - 2 nozzles	22.8	47.8	29.3 a	0.0	0.2	545.0	12.3	2.8	14.0
6	Omega @ 1.5 pt./A (IF) - 2 nozzles	28.6	51.1	19.1 b	0.8	0.5	503.8	14.0	3.8	18.4
7	Omega @ 1.5 pt./A (IF) - 2 nozzles Revus @ 0.503 floz./1000 row ft. (IF) - 2 nozzles	21.8	46.3	30.4 a	1.1	0.4	517.9	18.5	5.3	25.4
8	Revus @ 0.503 floz./1000 row ft. (IF) Revus @ 7.0 floz./A (AH)	24.5	51.3	23.9 ab	0.0	0.3	541.7	13.8	4.9	24.3
CV		15.48	9.21	18.44	233.26	192.05	10.57	152.39	167.28	170.47
F value		0.22	0.24	0.03	0.40	0.67	0.50	0.78	0.77	0.78
LSD(P=0.05)		NS	NS	7.14	NS	NS	NS	NS	NS	NS

^a Application Schedule Abbreviations (IF = In-Furrow on May 19, 2009; AH = At Hilling on June 24, 2009).

^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.

EVALUATION OF FUNGICIDES FOR CONTROL OF PINK ROT ON POTATO, 2009

- Researchers:** Rob Davidson and Andrew Houser, Colorado State University, SLVRC
- Location:** San Luis Valley Research Center, Center, CO
- Cultivar:** Sangre S10, cut seed, 2-4 oz.
- Objective:** To evaluate the efficacy of various fungicides in controlling pink rot in potato.
- Application:** In-furrow (IF) and At hilling (AH) treatments were applied using an R & D CO₂ charged backpack sprayer at 35 PSI, with one XR 8002VS nozzle, at 20 gallons/acre as a directed application. Applications were made on June 24 for AH treatments.
- 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. Proprietary
 5. Proprietary
 6. Proprietary
 7. Presidio @ .094 lbai/A (IF & AH)
 8. Presidio @ .125 lbai/A (IF & AH)
 9. Proprietary
 10. Proprietary
 11. Proprietary
 12. Ranman @ 6.7 floz/1000 row ft (IF) + Ranman @ 2.75 floz/A (AH)
 13. Proprietary
 14. Presidio @ .125 lbai/A (IF)
 15. Proprietary
- Planted:** May 20, 2009
- 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:** 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
- Fungicide:** Quadris @ 6.5 floz./A + Bravo WS @ 1.5 pt./A
- Insecticide:** Belay @ 0.1 lbai/A (IF)
- Vine Killer:** Vines chopped on September 8, 2009
- Harvested:** September 16 and 17, 2009

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 Sangre, San Luis Valley, Colorado, 2009.

Program	Treatment	Percent ^b								
		< 4 oz.	4-10 oz.	> 10 oz.	US #2's	Culls	cwt/A ^c	No. rot	% rot ^d	% rot x severity ^e
	Product/Rate & Application Schedule^a									
1	Untreated Control	29.7	56.7	12.8	0.0	0.8	446.6	18.7	4.74	23.71
2 (Standard)	Ridomil Gold @ 0.42 floz./1000 row ft. (IF)	30.3	56.2	11.0	2.3	0.2	467.3	3.3	0.76	3.79
3 (Standard)	Ridomil Gold @ 0.42 floz./1000 row ft. (IF)	33.9	53.1	11.1	1.9	0.0	509.9	3.0	0.54	2.38
	Phostrol @ 8.0 pt./A (IF)									
4	Proprietary	31.8	56.0	12.0	0.0	0.3	468.1	9.0	1.64	7.95
5	Proprietary	35.1	49.0	14.9	0.0	1.0	504.5	8.0	1.89	7.56
6	Proprietary	34.3	54.1	10.7	0.2	0.7	510.2	5.3	1.05	4.91
7	Presidio @ .094 lbai/A (IF & AH)	31.7	58.0	10.2	0.0	0.1	468.7	18.3	3.73	18.66
8	Presidio @ .125 lbai/A (IF & AH)	32.5	59.8	7.5	0.0	0.1	478.8	10.0	1.41	7.03
9	Proprietary	34.2	57.2	8.5	0.0	0.1	469.2	14.0	3.09	15.41
10	Proprietary	33.2	48.7	16.2	1.5	0.4	540.9	4.3	1.22	4.87
11	Proprietary	30.5	54.0	11.8	2.2	1.5	481.9	3.0	0.58	2.33
12	Ranman @ 6.7 floz/1000 row ft (IF)	28.5	57.9	13.5	0.0	0.1	481.1	17.7	4.51	19.01
	Ranman @ 2.75 floz/A (AH)									
13	Proprietary	31.8	47.4	20.1	0.3	0.4	446.1	18.7	5.25	22.45
14	Presidio @ .125 lbai/A (IF)	25.8	54.6	19.3	0.3	0.0	505.7	14.7	3.43	17.14
15	Proprietary	31.9	53.3	14.2	0.5	0.1	531.9	20.7	4.74	23.72
CV		16.84	11.34	37.67	246.36	236.49	8.63	102.51	107.06	104.44
F value		0.81	0.44	0.13	0.49	0.82	0.22	0.50	0.36	0.29
LSD(P=0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS

^a Application Schedule Abbreviations (IF = In-Furrow on May 20, 2009; AH = After Hilling on June 24, 2009, trial was hilled on June 10, 2009).

^b Based on tuber weight in kilograms, mean of three replications.

^c Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of three 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.

EVALUATION OF FUNGICIDES FOR CONTROL OF PINK ROT AND APHIDS ON POTATO, 2009

- Researchers:** Rob Davidson and Andrew Houser, Colorado State University, SLVRC
- Location:** San Luis Valley Research Center, Center, CO
- Cultivar:** Sangre S10, cut seed, 2-4 oz.
- Objective:** To evaluate the efficacy of various fungicides in controlling pink rot in potato.
- Application:** In-furrow (IF) treatments and treatments at tuber initiation (TI) were applied using an R & D CO₂ charged backpack sprayer at 35 PSI, with one XR 8002VS nozzle, at 20 gallons/acre as a directed application. Applications were made on July 13 for TI treatments.
- Treatments:**
1. Control, no treatment
 2. Presidio @ .125 lbai/A (IF & TI) + Belay @ 0.1 lbai./A (IF & TI)
 3. Proprietary
 4. Ranman @ 6.7 floz/1000 row ft + Admire Pro @ 0.31 lbai/A (IF) + Ranman @ 0.07 floz/A (TI)
 5. Presidio @ .125 lbai/A (IF) + Belay @ 0.2 lbai./A (IF)
 6. Presidio @ .125 lbai/A (IF & TI) + Belay @ 0.2 lbai./A (IF)
- Planted:** May 20, 2009
- 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:** 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
- Fungicide:** Quadris @ 6.5 floz./A + Bravo WS @ 1.5 pt./A
- Insecticide:** None
- Vine Killer:** Vines chopped on September 8, 2009
- Harvested:** September 16 and 17, 2009

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.
- Aphid #s:** Aphid counts were taken weekly starting July 21st and ending on August 26th. Average number of aphids per compound leaf per potato plant, 10 plants (1 leaf per plant)/treatment/replication/reading, mean of three replications.
- 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 Sangre, San Luis Valley, Colorado, 2009.

Program	Treatment	Percent ^b						No. rot	% rot ^d	% rot x severity ^e
		< 4 oz.	4-10 oz.	> 10 oz.	US #2's	Culls	cwt/A ^c			
1	Untreated Control	29.1	52.4	18.0	0.0	0.5	441.6	12.00	2.96	14.81
2	Presidio @ .125 lbai/A (IF & TI) Belay @ 0.1 lbai./A (IF & TI)	29.9	52.3	16.8	0.0	0.9	491.8	3.67	0.81	3.19
3	Proprietary	32.9	53.2	13.1	0.0	0.6	481.1	4.33	0.92	4.05
4	Ranman @ 6.7 floz/1000 row ft (IF) Admire Pro @ 0.314 lbai/A (IF) Ranman @ 0.072 floz/A (TI)	32.7	48.6	18.3	0.0	0.4	489.9	1.33	0.30	1.11
5	Presidio @ .125 lbai/A (IF) Belay @ 0.2 lbai./A (IF)	35.4	53.7	10.0	0.0	0.9	456.0	16.67	3.61	16.24
6	Presidio @ .125 lbai/A (IF & TI) Belay @ 0.2 lbai./A (IF)	35.2	53.6	10.4	0.0	0.8	465.0	3.67	0.79	3.95
CV		13.58	7.67	32.03	0.00	71.94	12.80	101.44	105.43	114.65
F value		0.45	0.65	0.17	1.00	0.67	0.88	0.14	0.16	0.19
LSD(P=0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS

^a Application Schedule Abbreviations (IF = In-Furrow on May 20, 2009; TI = Applied at tuber Initiation on July 13, 2009).

^b Based on tuber weight in kilograms, mean of three replications.

^c Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of three 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.

Table 2. Effect of applied products, for aphid management, in the cultivar Sangre, San Luis Valley, Colorado, 2009.

Program	Treatment	Avg. number of aphids per leaf ^b						Avg. number of leaves with aphids ^c			
		7/21/09	8/3/09	8/10/09	8/18/09	8/26/09	8/26/09	7/21/09	8/3/09	8/10/09	8/18/09
1	Product/Rate & Application Schedule ^a Untreated Control	0.20	0.40	1.80	2.3 a	0.77 ab	1.67 a	1.00	5.00	7.67 a	4.67
2	Presidio @ .125 lbai/A (IF & TI) Belay @ 0.1 lbai./A (IF & TI)	0.00	0.00	0.23	0.17 b	0.13 c	0.00 b	0.00	1.00	0.67 c	1.00
3	Proprietary	0.10	0.33	0.90	1.23 ab	0.90 a	0.33 b	2.33	4.00	5.00 ab	5.33
4	Ranman @ 6.7 floz/1000 row ft (IF) Admire Pro @ 0.314 lbai/A (IF) Ranman @ 0.072 floz/A (TI)	0.00	0.23	1.23	0.37 b	0.30 bc	0.00 b	1.00	2.33	2.33 bc	2.33
5	Presidio @ .125 lbai/A (IF) Belay @ 0.2 lbai./A (IF)	0.03	0.00	0.07	0.23 b	0.20 c	0.33 b	0.00	0.67	1.33 c	1.33
6	Presidio @ .125 lbai/A (IF & TI) Belay @ 0.2 lbai./A (IF)	0.00	0.00	0.17	0.07 b	0.07 c	0.00 b	0.00	0.67	0.67 c	0.33
CV		152.97	177.98	165.46	94.32	77.41	121.22	130.54	91.27	67.55	80.33
F value		0.08	0.36	0.47	0.02	0.03	0.01	0.07	0.11	0.01	0.06
LSD(P=0.05)		NS	NS	NS	0.56	0.86	0.86	NS	NS	3.62	NS

^a Application Schedule Abbreviations (IF = In-Furrow on May 20, 2009; TI = Applied at tuber Initiation on July 13, 2009).

^b Average number of aphids per compound leaf per potato plant, 10 plants (1 leaf per plant)/treatment/replication/reading, mean of three replications.

^c Average number of compound leaves with aphids per potato plant, 10 plants (1 leaf per plant)/treatment/replication/reading, mean of three replications.

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

Powdery Scab Trials

2009 EVALUATION OF OMEGA 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 Omega treatments in controlling powdery scab on potato.
Application: In-furrow treatments were applied using an R & D CO₂ 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 gallons of water per acre. Treatments applied prior to hilling were made with one XR 8002VS nozzle at 10 gallons of water per acre.

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 24, 2009)
7. Omega @ 1.5 pt./A (two nozzles), At Planting
Omega @ 1.5 pt./A (Applied just prior to hilling on June 24, 2009)
8. Omega @ 1.5 pt./A (two nozzles with extra soil mixing), At Planting
9. Omega @ 3.0 pt./A (two nozzles with extra soil mixing), At Planting

Planted: May 12 & 13, 2009
Plot Design: Randomized
Plot Size: 2 - 20 foot rows per treatment per replication
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Four (due to variability in the trial, only three reps were used for analysis)
Irrigation: Center pivot sprinkler, rate based on ET
Fertilizer: Unavailable
Herbicide: Unavailable
Insecticide: Unavailable
Fungicide: Unavailable
Vine Killer: Unavailable
Harvested: September 21, 22, 23, & 24, 2009

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 three 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, 2009

Treatment	Tuber symptoms				
	Percent Incidence ^a	Percent Healthy ^b	Severity Index ^c	Percent Unmarketable ^d	Severity Index (Unmarketable) ^e
1. Untreated Control	54.9 a	45.1 c	138.6	19.5	85.4
2. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting	37.3 c	62.8 a	91.3	12.8	50.1
3. Omega @ 3.0 pt./A (one nozzle dir. over seed), At Planting	38.5 c	61.5 a	85.2	13.5	54.1
^f 4. Omega @ 1.5 pt./A (two nozzles), At Planting	41.6 bc	58.4 ab	86.4	12.3	47.0
^f 5. Omega @ 3.0 pt./A (two nozzles), At Planting	33.7 c	66.3 a	73.7	10.0	38.1
6. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting	38.8 c	61.3 a	80.7	8.6	34.6
Omega @ 1.5 pt./A (Applied just prior to hilling)					
^f 7. Omega @ 1.5 pt./A (two nozzles), At Planting	41.2 bc	58.8 ab	84.0	11.1	39.0
Omega @ 1.5 pt./A (Applied just prior to hilling)					
^g 8. Omega @ 1.5 pt./A (two nozzles w/ extra soil mixing), At Planting	52.0 ab	48.0 bc	129.8	18.8	80.0
^g 9. Omega @ 3.0 pt./A (two nozzles w/ extra soil mixing), At Planting	36.9 c	63.1 a	72.2	7.3	27.8
LSD(P=0.10)	11.46	11.45	NS	NS	NS

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

^b Percent healthy = mean percent of the total number of tubers with zero powdery scab lesions at harvest. Mean of three 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 three 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.

Due to variability in the trial, rep 2 and treatment 2 from rep 3 were removed from the analysis.

Table 2. Evaluation of fungicide programs on tuber yield and quality in the cultivar Cherry Red, San Luis Valley, Colorado, 2009

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	21.4	58.8	17.3	2.5	428.4	331.9	-
2. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting	25.7	48.6	22.6	3.2	439.0	373.0	\$89.06
3. Omega @ 3.0 pt./A (one nozzle dir. over seed), At Planting	24.1	59.0	15.9	1.0	390.6	329.4	\$178.13
^e 4. Omega @ 1.5 pt./A (two nozzles), At Planting	23.9	52.9	21.6	1.5	419.1	350.5	\$89.06
^e 5. Omega @ 3.0 pt./A (two nozzles), At Planting	24.1	55.2	18.6	2.1	406.4	351.1	\$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)	18.8	43.6	30.5	7.3	438.5	373.4	\$178.13
^e 7. Omega @ 1.5 pt./A (two nozzles), At Planting Omega @ 1.5 pt./A (Applied just prior to hilling)	18.3	50.7	29.5	1.5	436.3	376.2	\$178.13
^f 8. Omega @ 1.5 pt./A (two nozzles w/ extra soil mixing), At Planting	22.0	55.0	20.4	2.6	492.4	381.3	\$89.06
^f 9. Omega @ 3.0 pt./A (two nozzles w/ extra soil mixing), At Planting	23.7	54.8	18.8	2.7	403.8	370.8	\$178.13
LSD(P=0.05)	NS	NS	NS	NS	NS	NS	-

^a Based on tuber weight in kilograms, mean of three replications.

^b Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of three 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 three replications.

^d These prices do not include application costs. Total cost/acre was based on 2009 prices and were obtained from Wilbur Ellis.

^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.

Due to variability in the trial, rep 2 and treatment 2 from rep 3 were removed from the analysis.

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

2009 EVALUATION OF COMPOST AND COMPOST TEA 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 compost treatments in controlling powdery scab on potato.
- Application:** In-furrow treatments were applied using an R & D CO₂ 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.
- Compost tea was applied using an R&D CO₂ charged backpack sprayer at 35psi, with two XR 8002 VS nozzles, at 20 gallons of water/acre. It was applied five times throughout the season, starting 49 DAP (July 1, July 14, July 29, August 4, and August 21).

- Treatments:**
1. Control, no treatment
 2. Omega @ 1.5 pt./A (one nozzle directed over seed), At Planting
 3. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting
Compost @ 4.0 tons/A (Applied in-furrow prior to planting)
 4. Compost @ 4.0 tons/A (Applied in-furrow prior to planting)
 5. Compost Tea @ 8.0 gal./A (Applied in-season)
 6. Compost @ 4.0 tons/A (Applied in-furrow prior to planting)
Compost Tea @ 8.0 gal./A (Applied in-season)

- Planted:** May 12 & 13, 2009
- Plot Design:** Randomized
- Plot Size:** 2 - 20 foot rows per treatment per replication
- Plant Spacing:** 12 inches
- Row Spacing:** 34 inches
- Replications:** Four (due to variability in the trial, only three reps were used for analysis)
- Irrigation:** Center pivot sprinkler, rate based on ET
- Fertilizer:** Unavailable
- Herbicide:** Unavailable
- Insecticide:** Unavailable
- Fungicide:** Unavailable
- Vine Killer:** Unavailable
- Harvested:** September 22-25, 2009

DATA

- Disease:** Mean percent of 40 tubers (gathered uniformly throughout each plot) with one or more powdery scab lesion at harvest, multiplied by the severity of the lesions, where 1 = not severe and 5 = very severe. Mean of three replications.

Table 1. Evaluation of compost on the incidence of powdery scab on tubers in the cultivar Cherry Red, San Luis Valley, Colorado, 2009

Treatment	Tuber symptoms					
	Percent Incidence ^a	Percent Healthy ^b	Severity Index ^c	Percent Unmarketable ^d	Severity Index (Unmarketable) ^e	
1. Untreated Control	98.7 a	1.3 c	342.22	71.73 ab	296.73 ab	
2. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting	92.02 bc	7.97 ab	307.64	66.35 bc	265.36 bc	
3. Omega @ 1.5 pt./A (one nozzle dir. over seed), At Planting Compost @ 4.0 tons/A (Applied in-furrow prior to planting)	89.17 c	10.82 a	274.57	54.88 c	215.52 c	
4. Compost @ 4.0 tons/A (Applied in-furrow prior to planting)	93.92 abc	6.07 abc	335.57	68.18 bc	282.35 bc	
5 ^f . Compost Tea @ 8.0 gal./A (Applied in-season)	97.38 ab	2.63 bc	324.92	72.53 ab	283.35 b	
6 ^f . Compost @ 4.0 tons/A (Applied in-furrow prior to planting) Compost Tea @ 8.0 gal./A (Applied in-season)	93.35abc	6.63 abc	363.78	82.65 a	350.26 a	
CV	4.85	77.16	12.65	16.15	18.92	
F value	0.10	0.10	0.11	0.07	0.07	
LSD(P=0.10)	5.71	5.71	NS	14.03	66.87	

^a Percent incidence = mean percent of 40 tubers (gathered uniformly throughout each plot) with one or more powdery scab lesion at harvest. Mean of four replications.

^b Percent healthy = mean percent of the 40 tubers (gathered uniformly throughout each plot) with zero powdery scab lesions at harvest. Mean of four replications.

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

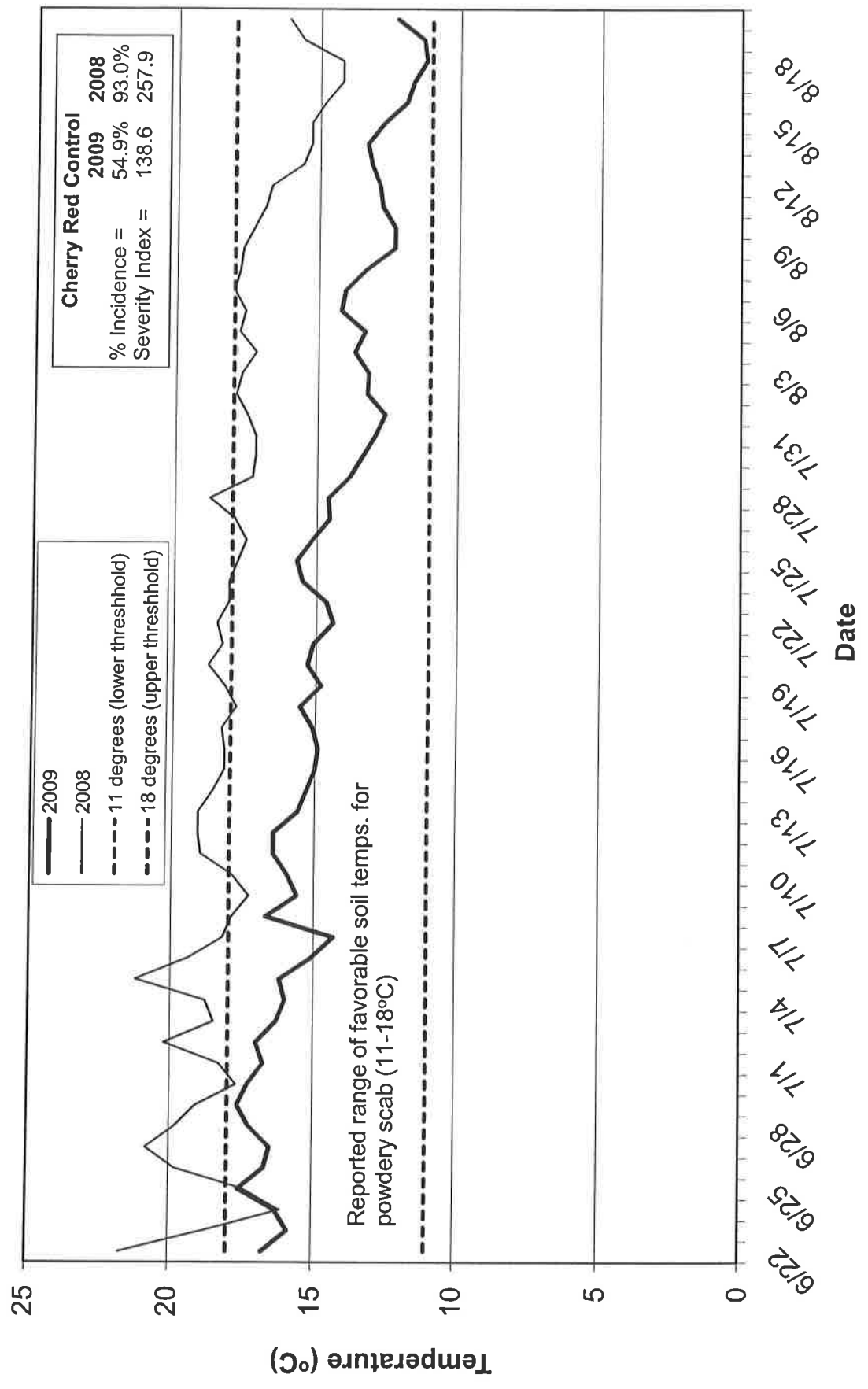
^d Percent Unmarketable = mean percent of the total number of evaluated tubers with a lesion severity rating of three or higher at harvest. Mean of four replications.

^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 Compost tea was applied using an R&D CO₂ charged backpack sprayer at 35psi, with two XR 8002 VS nozzles, at 20 gallons of water/acre. It was applied five times throughout the season, starting 49 DAP (July 1, July 14, July 29, August 4, and August 21). Means followed by the same letter are not significantly different at P=0.05.

Average Soil Temperature Readings 8" Under Potato Plant Canopy, Powdery Scab Trial, San Luis Valley, Colorado, 2008 & 2009



Advanced Clone Disease Assessment Program

2009 Bacterial Ring Rot Evaluation

Location: NW Corner, Selter's Farm, 9 North, 1/2 East of SLVRC

Treatments: 45 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, a fifth plate was 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 5/13/09. 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: 5/14/09

Cultivars:

1. AC00395-2RU	24. POR03PG23-1
2. AC01151-5W	25. ATTX98453-6R
3. CO02024-9W	26. ATTX98500-2P/Y
4. CO02033-1W	27. BTX2332-1R
5. CO02321-4W	28. COTX94216-1R
6. TC02072-3P/P	29. COTX94218-1R
7. CO01399-10P/Y	30. NDTX4784-7R
8. CO00291-5R	31. WNC230-14RU
9. A96814-65LB	32. Ute Russet
10. A97066-42LB	33. CO86030-1RU
11. A98345-1	34. CO86153-2RU
12. A0008-1TE	35. Centennial Russet
13. AO96305-3	36. Russet Burbank
14. AO96365-2	37. Sangre
15. NDA7985-1R	38. Russet Norkotah
16. PA96RR1-193	39. Bannock Russet
17. PA99N2-1	40. Frito Lay 1
18. PA99N82-4	41. Frito Lay 2
19. PA00N14-2	42. Frito Lay 3
20. POR02P637-2	43. Frito Lay 4
21. AO0286-3Y	44. Frito Lay 5
22. OR00068-11	45. Yukon Gold
23. POR01P645-5	

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: 9/9/09

Table 1. 2008/2009 Clonal Evaluation for Bacterial Ring Rot Foliar Symptom Expression

Year	Clone	DAP to First Symptoms	# Reqs Positive	# Plants Positive	% Plants Positive	Date 50% or More	Total # Reqs	% Plants + 100 DAP	Summary of Symptoms	SS	* Ave DAP to 1st Symptoms	Rating
09	AC00395-2RU	58	2	7	36.8	100	3	57.9	ALL			
09	AC01151-5W	58	3	6	30.0	82	3	55.0	ED,R,IVC			
09	CO02024-9W	58	2	3	15.8		3	31.6	ED,R,IVC			
09	CO02033-1W	58	2	4	44.4	82	2	55.5	ED,R,IVC			
09	CO02321-4W	58	1	2	9.5		2	14.2	ED,R,IVC			
09	TC02072-3P/P	58	2	3	18.8		2	18.8	ED,R,IVC			
09	A96814-65LB	58	2	4	19.0		3	28.5	ED,R,IVC			
09	A98345-1	58	1	2	10.0		2	15.0	ED,R,IVC,W			
09	AO96305-3	58	3	5	23.9		3	33.3	ALL			
09	AO96365-2	58	1	1	5.0		2	25.0	ED,R,IVC,W			
09	PA00N14-2	68	1	1	12.5	100	1	50.0	ALL			
09	AO0286-3Y	68	1	1	14.3		1	42.9	ED,R,IVC			
09	OR00068-11	68	1	1	6.3		2	25.0	ALL			
09	POR01PG45-5	NE										
09	POR03PG23-1	58	3	4	23.5		3	41.2	ALL			
09	ATTX98453-6R	58	3	4	23.5		3	29.4	ED,R,IVC			
09	BTX2332-1R	NE										
09	COTX94216-1R	68	1	1	6.3		2	12.5	ALL			
09	COTX94218-1R	NE										
09	NDTX4784-7R	100	1	1	50.0	100	1	50.0	IVC,MN,W			
09	Bannock Russet	58	2	4	23.5	100	3	52.9	ALL			
08	CO01399-10P/Y	46	1	3	14.3		3	23.8	ALL	-		
09		58	1	2	13.3		2	46.7	ALL		52 +/- 5	5
07	CO00291-5R	83	1	1	5.5		2	11.1	ALL	-		
08		100	1	1	4.8		1	4.8	IVC,IVN,MN			
09		0			0.0						92 +/- 10	2
08	A97066-42LB	61	2	3	14.3		2	23.8	ED,R,IVC	-		
09		58	1	2	9.5		1	23.8	ED,R,IVC		60 +/- 5	4
08	A0008-1TE	66	1	1	4.8		1	4.8	W		Retest in 2010	
09		0			0.0							
08	NDA7985-1R	100	1	1	4.8		1	4.8	IVC,IVN,MN,W			
09		58	1	1	7.7		2	38.5	ED,R,IVC		79 +/- 20	3
08	PA96RR1-193	61	1	1	4.8		2	19.0	ALL	-		
09		58	2	3	14.3		3	33.3	ALL		60 +/- 5	4

Year	Clone	DAP to First Symptoms	# Reps Positive	# Plants Positive	% Plants Positive	Date 50% or More	Total # Reps	% Plants + 100 DAP	Summary of Symptoms	SS	*Ave DAP to 1st Symptoms	Rating
08	PA99N82-4	61	2	5	23.8		3	33.3	ED,R,IVC	+		
09		100	2	2	40.0		2	40.0	IVC,IVN,MN,W		80 +/- 20	4
08	POR02-PG37-2	46	1	1	4.8		2	9.5	ED,R,IVC,W	+		
09		58	1	3	75.0	58	1	75.0	ED,R,IVC		52 +/- 5	4
08	PA99N2-1	46	1	2	9.5		3	33.3	ALL	+		
09		100	2	2	40.0		2	40.0	IVC,IVN,MN,W		73 +/- 25	4
07	ATTX98500-2PY	92	1	1	4.8		1	9.5	ED,R,IVC	-		
08		46	1	1	4.8		1	4.8	ED,R,IVC			
09		58	1	1	5.0		1	15.0	ED,R,IVC		65 +/- 20	3
08	Yukon Gold	66	1	1	4.8		2	14.2	ED,R,IVC	+	61 +/- 10	4
09		Not tested										
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		60 +/- 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		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		79 +/- 20	3
08	Russet Burbank	46	3	6	28.6	73	3	66.7	ED,R,IVC,W	+		
09		58	2	4	28.6	82	2	57.1	ALL		52 +/- 5	5
08	Sangre	100	3	8	38.1	100	3	38.1	IVC,IVN,MN,W	+		
09		58	3	7	41.1		3	47.0	ALL		79 +/- 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		57 +/- 10	5
<p>Planting date - 5/11/07. Key to symptoms: ED-Early Dwarf, R-Rosette, IVC-Interveinal Chlorosis, IVN-Interveinal Necrosis, MN - Marginal necrosis, and W - Wilt. All - All symptoms seen during season. DAP-days after planting. SS-stem squeeze. BRR foliar rating 1-5 with 1 = no symptoms; 2 = mild symptoms which appear late, acceptable ?; 3 to 5 = acceptable with 5 best.</p> <p>* Normal symptom expression for controls (compilation of several years) DAP to 1st symptoms (Rating) = WNC230-14RU, 90-100 DAP (4); Ute Russet, 100+ DAP (2-3); Centennial Russet, 90-100 DAP (2-3); Russet Burbank, 55-65 DAP (5); Sangre, 85-95 DAP (4); Russet Norkotah, 85-95 DAP (5). CO86030-1RU and CO86153-2RU are considered latent expressors of BRR in most years with symptoms rarely seen, even though Cms is present in the plants. Critical dates for seed certification range around 90-100 DAP or near the date of final inspection. Any clone demonstrating symptoms within this time frame at a level above 15-20% of the infected plants vs. stand is considered a reasonable risk for BRR detection. PA99N2-1, PA99N82-4, POR02PG37-2, NDTX4784-7R, POR01PG45-5, BTX2332-1R, and COTX94281-1R had no emergence or very low stand counts. CO00291-5R demonstrates very poor symptom timing and expression and should be viewed only after 95DAP + for BRR symptoms.</p>												

2009 Clonal Evaluation: PLRV, PVY, and Natural In-field Spread-PLRV

Location: NW Corner, Selter's Farm, 9 North, ½ mile east of SLVRC
Treatments: PLRV and PVY Infected and Healthy + Natural In-Field Spread of PLRV
Plot Design: PVY and PLRV - six seed pieces/cultivar.
PLRV/PVY - Mechanical inoculation for PVY in the CE was to plants 1-2; PLRV CE was not possible due to the die off of the GPA colony.
(numbered from the west)
NIFS -12 seed pieces x 3 reps - (Leafroll spacer between each treatment)

Plant Date: 5/8/09

Plot Size: 12" plant spacing x 34" row spacing

Cultivar:	CO00405-1R	CO00415-1R
	CO97232-1R/Y	CO97232-2R/Y
	ATC00293-2R/Y	CO86051-3RU
	Sangre	Russet Nugget
	TC02072-3P/P	WNC230-14RU
	CO02024-9W	Ute Russet
	AC00395-2RU	ATC00293-1W/Y
	AC01151-5W	CO01399-10P/Y
	CO01399-10P/Y	AC97306-1RU
	CO02321-4W	CO00379-2R/Y
	Russet Burbank	
	CO00291-5R	
	Centennial Russet	
	CO00270-7W	
	CO97233-3R/Y	

LR/PVY CE = 2,3,5-23, 25, 28, 30-33; NIFS = 4-17, 23-32

Irrigation: Solid set sprinkler: rate based on ET and ppt. Total water for season was approx. 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 (1.5pt/A)

Fungicide/ Insecticide: Aerial applications: 7/20/09; 8/6/09 - Bravo WS (1.5pt/A)

Harvest: 9/10/09

Table 3. 2009 Clonal Evaluation for PLRV and PVY Symptom Expression

Cultivar/Clone	PLRV (0-3+)	Symptoms	Cultivar/Clone	PVY (0-3+)	Symptoms
CO00405-1R					No emergence
CO97232-1R/Y				3+	
ATC00293-2R/Y					No symptoms
Sangre				3+	
TC02072-3P/P					No emergence
CO02024-9W	3+	ALL		3+	
AC00395-2RU					No symptoms
AC01151-5W					No symptoms
CO01399-10P/Y				3+	
CO02321-4W					No symptoms
Russet Burbank				3+	
CO02033-1W				3+	
Russet Norkotah 3				3+	
CO00291-5R				2+	
Centennial Russet					No symptoms
CO00270-7W				2+	
CO97233-3R/Y					No symptoms
CO00415-1R				1+	
CO97232-2R/Y				3+	
CO86051-3RU					No symptoms
Russet Nugget				3+	
WNC230-14RU					No symptoms
Ute Russet				2+	
ATC00293-1W/Y					No symptoms
CO01399-10P/Y				3+	
AC97306-1RU					No emergence
CO00379-2R/Y				3+	

All = WP - whole plant; LL - Lower leaf rolling,
 CC - color change; P = purpling along leaf margins.

Typical = mosaic type symptom with yellowing, vein
 burning, and stunting. Hypersensitive - severe stunting
 with leaf drop. Severe - showed extreme reaction.

Rating: 0 = no symptoms up to 3+ = typical symptoms which are easy to recognize visually.
 There was little to no leafroll spread in 2009 (aphid transmission from infected plants was not possible).
 Because of this, there were no results for the Natural in-field spread of leafroll.

2009 Clonal Evaluation for Storage Rots

Treatments: *Erwinia* - 50ul of 1.6×10^4 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°F after inoculation for 4 weeks.

Inoculation/Reading: Readings: 2/25/10

Cultivars:	AC00395-2RU	Canela Russet
	AC01151-5W	Rio Grande Russet
	CO02024-9W	Russet Norkotah Sel 3
	CO02033-1W	Russet Nugget
	CO02321-4W	Sangre Sel 10
	TC02072-3P/P	
	CO01399-10P/Y	
	ATC00293-1W/Y	
	CO00188-4W	
	CO00197-3W	
	CO00270-7W	
	CO00277-2R	
	CO00291-5R	
	CO00405-1R	
	CO00412-5W/Y	
	CO00415-1R	

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>Erwinia</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 *Erwinia* and at 4 for *Alternaria*
Alternaria was not screened in 2009

Table 4. Clonal Evaluation for Storage Rot			
<i>Fusarium</i>			
Inoculation	11/12/2008	1/28/2010	
Reading	12/12/2008	2/25/2010	
Clone	Avg Score	Avg Score	2 Yr. Avg
AC00395-2RU		3.60	
AC01151-5W		3.40	
CO02024-9W		3.40	
CO02033-1W		3.00	
CO02321-4W		3.00	
TC02072-3P/P		3.20	
CO01399-10P/Y		3.20	
ATC00293-1W/Y	2.90	3.00	2.95
CO00188-4W	3.00	4.00	3.50
CO00197-3W	3.20	3.90	3.55
CO00270-7W	3.00	3.20	3.10
CO00277-2R	3.50	3.80	3.65
CO00291-5R	3.40	3.00	3.20
CO00405-1R	3.70	3.00	3.35
CO00412-5W/Y	3.10	3.80	3.45
CO00415-1R	3.90	3.00	3.45
Canela RU		3.00	
Rio Grande RU	3.40	3.30	3.35
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+.

Table 5. Clonal Evaluation for Storage Rot

<i>Erwinia</i>			
Inoculation	11/12/2008	1/4/2010	
Reading	12/12/2008	2/25/2010	
Clone	Avg Score	Avg Score	2 yr Avg
AC00395-2RU		2.90	
AC01151-5W		2.80	
CO02024-9W		2.90	
CO02033-1W		1.70	
CO02321-4W		2.40	
TC02072-3P/P		2.80	
CO01399-10P/Y		2.40	
ATC00293-1W/Y	1.40	2.60	2.00
CO00188-4W	1.50	1.90	1.70
CO00197-3W	2.00	2.10	2.05
CO00270-7W	2.00	2.00	2.00
CO00277-2R	1.20	2.70	1.95
CO00291-5R	1.80	3.50	2.65
CO00405-1R	1.80	2.30	2.05
CO00412-5W/Y	2.30	2.60	2.45
CO00415-1R	1.00	1.90	1.45
Canela RU		1.40	
Rio Grande RU	2.00	1.70	1.85
RU Norkotah 3	2.00	2.00	2.00
RU Nugget	2.10	2.10	2.10
Sangre 10	1.90	2.70	2.30

1 = No symptoms, 2 = Localized damage
3 = 25-50% tuber damage, 4 = >50% tuber damage,
5 = 100% tuber damage. Grade loss occurs at 3.00.