CONTENTS

- Early Blight Fungicide Trials…….....….……..2
  - Early blight degree days - 2012.....3
  - Early blight fungicide trial.....4

- Root Knot Nematode Degree Days…….…….....……18

- SLV Late Blight Forecasting Data - 2011…….....…….....20
  - Late blight severity units – Wallin model (Hooper & Sargent).....21
  - Late blight Fry severity units – Blanca & Hooper sites.....22
  - Late blight Negative Prognosis Units – Blanca & Hooper sites.....23

- Pink Rot Trial……....…….....……..…..24
  - Pink rot fungicide evaluation trial 25

- Black scurf Fungicide Trial ……..…….....…….28

- Insecticide Trial

- Powdery Scab Trials……..…….....…….28
  - Powdery scab clonal evaluation trial (on-station greenhouse, SLV, CO).....29
  - Powdery scab soil inoculum trial (on-station greenhouse, SLV, CO)...
  - Powdery scab soil temperature and soil moisture readings at 6, 8, & 10 inch depths.....31

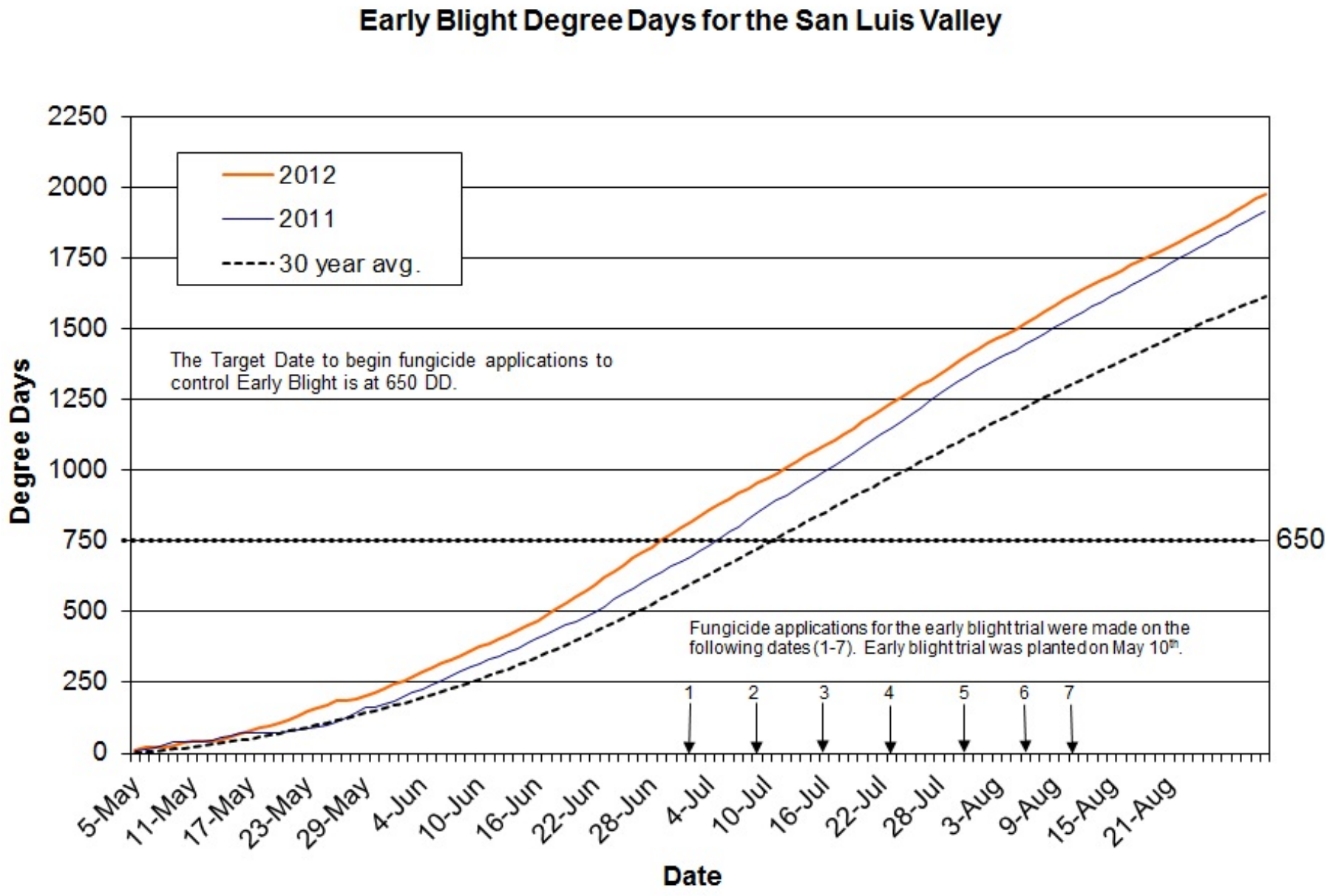
- Zeba Soil Amendment Trial…….....……33

- Advanced Clone Disease Assessment Project…….....……38
  - Bacterial ring rot evaluation
  - Storage rots (*Fusarium* and *Erwinia*) evaluation – note: no results due to failure of inoculum for *Erwinia* evaluation
  - Potato leafroll evaluation – note: no results due to frost in Yuma, AZ
  - PVY evaluation – note: no results due to frost in Yuma, AZ

Early Blight Fungicide Trials

Spraying schedules that include two or three fungicide applications during the season (with at least one of the fungicides being a strobulirin), starting once degree days for early blight have been reached and continuing fungicide applications every 14 to 21 days, have worked well in the San Luis Valley. Other products such as Endura, Bravo, Dithane, Polyram, Super Tin, and various numbered compounds have also had 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
2012
2011
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 (1-7). Early blight trial was planted on May 10th.
1
2
3
4
5
6
7
650
Degree Days
2250
2000
1750
1500
1250
1000
750
500
250
0
5-May
11-May
17-May
23-May
29-May
4-Jun
10-Jun
16-Jun
22-Jun
28-Jun
4-Jul
10-Jul
16-Jul
22-Jul
28-Jul
3-Aug
9-Aug
15-Aug
21-Aug
Date

2012 POTATO – EARLY BLIGHT FUNGICIDE TRIAL

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

Location: San Luis Valley Research Center, Center, CO

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

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

Spray Dates: July 2, July 9, July 16, July 23, July 30, August 6, and August 10

Planted: May 10, 2012
Plot Design: Randomized complete block
Plot Size: Two - 15 foot rows per treatment per replication.
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Four
Irrigation: Solid set sprinkler - rate based on ET for both.
Fertilizer: 80N-60P-40K-25S-2.5Z, preplant, 70N through sprinkler after tuber set.
Herbicide: Eptam @ 4.5 pt/A & Matrix @ 1.5 oz./A
Vine Killer: Rotobeat vines on September 5, 2012
Harvested: October 2, 2012

DATA:

Disease: Early blight disease incidence based on percent leaves infected, readings taken weekly starting August 3, 2012.

AUDPC: **Area Under the Disease Progress Curve (AUDPC) is a measure of the progression of Early Blight, starting on August 3rd and ending with the last reading on August 28th. AUDPC gives a better idea of the total amount of Early Blight in a plot during this time period, rather than just looking at the weekly percent incidence. The total AUDPC for the control plot (1) indicates the total amount of Early Blight that was present if no fungicides were used to suppress disease. The other treatments should be compared with the control to determine the effectiveness at reducing the disease. AUDPC is based on total percent leaflets infected with Early Blight, with readings taken on a weekly basis.**

Yield: 2-15 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 2012

Program	Products	Rate	Application Schedule
1	Untreated Control	-	-
2	Quadris	6.2 floz./A	2
	Bravo WS	1.5 pt./A	4
	Endura	2.5 oz./A	6
3	Quadris	6.2 floz./A	1
	Bravo WS	1.5 pt./A	3
	Endura	2.5 oz./A	5
4	Endura	5.5 oz./A	1
	Priaxor	4.0 oz./A	3
	Cabrio Plus	2.0 lb./A	5
	Echo ZN	1.5 pt./A	7
5	Endura	5.5 oz./A	1
	Priaxor	4.0 oz./A	3
	Headline	6.0 floz./A	5
	Echo ZN	1.0 pt./A	5
	Echo ZN	1.5 pt./A	7
6	Priaxor	4.0 oz./A	1
	Cabrio Plus	2.0 lb./A	3
	Endura	3.5 oz./A	5
	Echo ZN	1.5 pt./A	7
7	Priaxor	4.0 oz./A	1
	Endura	3.5 oz./A	3
	Cabrio Plus	2.0 lb./A	5
	Echo ZN	1.5 pt./A	7
8	Endura	35 oz./A	1
	Priaxor	4.0 oz./A	3
	Cabrio Plus	2.0 lb./A	5
	Echo ZN	1.5 pt./A	7
9	Quadris Top	8.0 floz./A	1
	Quadris Opti	1.6 pt./A	3
	Revus Top	5.5 floz./A	5
	Echo ZN	1.5 pt./A	7
10	Echo ZN	2.0 pt./A	1
	Luna Tranquility	8.0 floz./A	3,7
	Reason	5.5 floz./A	5
11	Echo ZN	2.0 pt./A	1
	Luna Tranquility	8.0 floz./A	3,7
	Scala	7.0 floz./A	5
	Echo ZN	1.5 pt./A	5
12	Echo ZN	2.0 pt./A	1
	Endura	2.5 oz./A	3,7
	Headline	9.0 floz./A	5
13	Echo ZN	2.0 pt./A	1,5
	Dithane Rainshield	2.0 lbs./A	3,7
14	Quash	2.5 oz./A	1,5
	LI 700	0.25% v/v	1,5
	Bravo WS	1.5 pt./A	3,7
15	Endura	2.5 oz./A	1,5
	Bravo WS	1.5 pt./A	3,7

[a] Schedule for applying treatments on a weekly basis, schedule started on July 2 i.e. 1 = week 1, 2 = week 2). Treatments 4 - 9 had SylTac adjuvent at a rate of 1% v/v tank mixed with each application.

Table 2. Early Blight Trial - Effect of fungicide programs on the incidence of early blight in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2012; No Late Blight occurred within the trial.

	Percent Leaves Infected[a] (with one or more lesion)				
Treatment	August 3[b]	August 9	August 22	August 28	AUDPC[c]
1	10.5	15.8 a	99.7 a	100.0 a	1032.1 a
2	2.5	5.4 b	87.5 abc	98.8 abc	890.0 b
3	3.5	4.9 b	90.4 ab	99.2 ab	912.3 ab
4	1.8	3.3 b	49.2 fg	97.9 a-d	629.8 ef
5	1.7	4.3 b	45.0 g	95.8 cd	598.6 f
6	2.2	3.2 b	50.0 fg	95.4 d	628.3 ef
7	2.0	4.0 b	57.5 efg	98.8 abc	689.0 def
8	1.8	4.7 b	50.8 fg	95.4 d	637.1 ef
9	3.7	3.8 b	53.8 fg	97.5 a-d	666.2 ef
10	1.3	3.8 b	52.5 fg	97.1 a-d	648.5 ef
11	1.5	3.8 b	51.3 fg	96.3 bcd	638.4 ef
12	1.8	5.2 b	66.3 def	97.9 a-d	746.3 cde
13	3.3	5.8 b	78.8 bcd	99.6 a	839.8 bc
14	4.2	6.5 b	72.1 cde	99.2 ab	800.2 bcd
15	2.8	5.1 b	54.6 fg	95.8 cd	667.5 ef
LSD(P=0.05)	NS	6.06	17.47	3.22	125.07

[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 3 through August 28.

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

Table 3. Early Blight Trial - Effect of fungicide programs on tuber yield and quality in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2012.

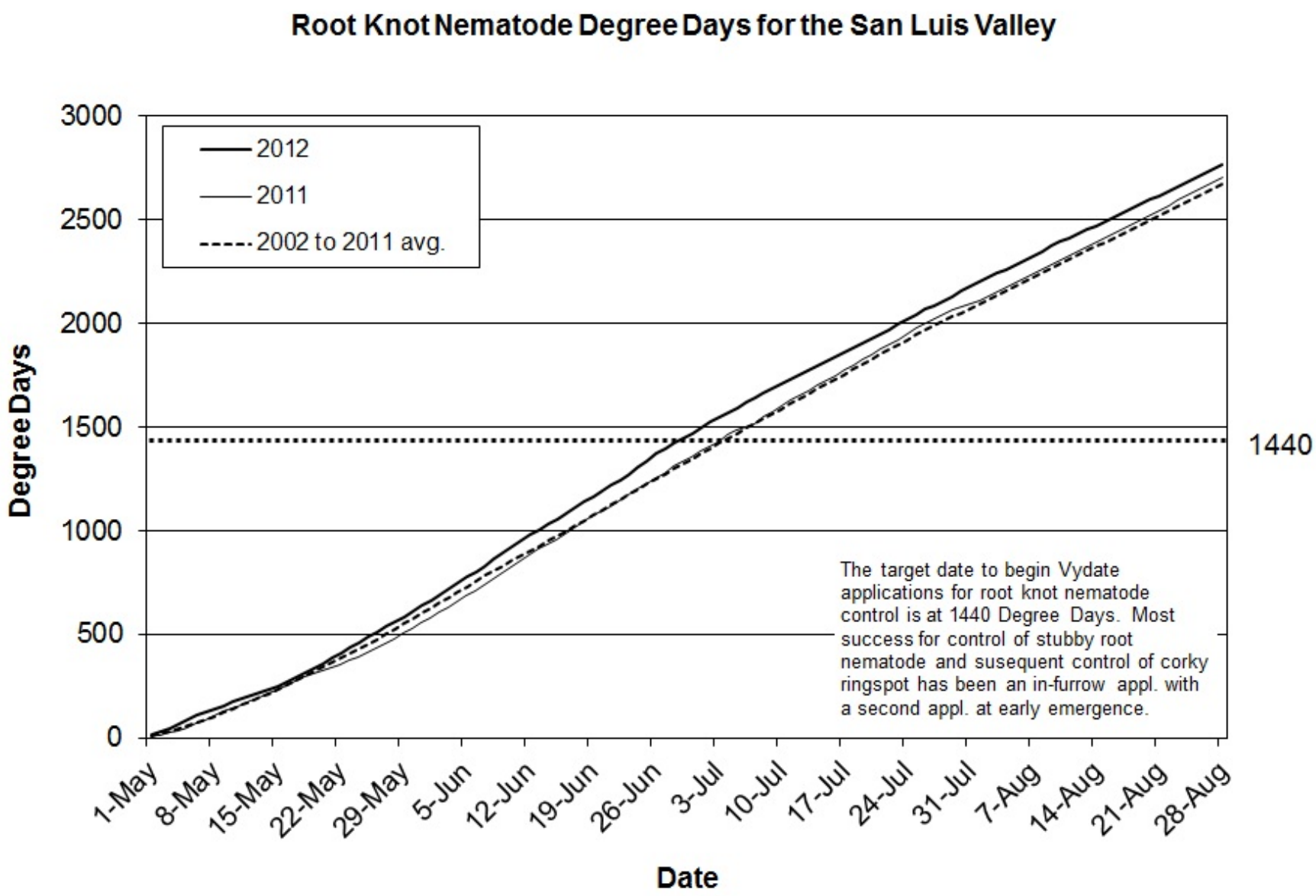
Treatment	Percent[a]				Cwt/A[b]	Cwt/A w/o culls[c]
	< 4 oz.	4-10 oz.	> 10 oz.	US No 2's & culls		
1	23.4	42.8	29.8	4.0	298.1	285.9
2	19.9	38.5	39.7	2.0	321.8	315.3
3	22.3	38.2	37.5	2.0	354.5	346.6
4	18.0	35.7	44.7	1.6	361.8	356.5
5	16.2	31.1	50.1	2.6	346.3	337.6
6	20.7	38.8	39.2	1.4	329.1	324.9
7	21.5	35.4	41.5	1.6	346.3	340.7
8	17.6	36.3	42.8	3.3	288.5	278.6
9	20.2	40.0	37.6	2.3	329.4	321.2
10	24.0	34.4	38.9	2.6	342.1	332.2
11	18.4	34.7	45.9	1.1	337.9	333.6
12	20.9	33.3	42.8	3.0	370.9	360.2
13	22.4	30.8	44.8	2.1	355.1	347.5
14	13.8	37.5	46.3	2.5	372.6	363.5
15	20.3	32.4	45.3	2.1	352.8	345.5
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, 2-15 foot rows per treatment per replication, mean of four replications.

[c] Total yield expressed as hundred weight per acre (culls are removed from the cwt/A), 2-15 foot rows per treatment per replication, mean of four replications.

Root Knot Nematode Degree Days

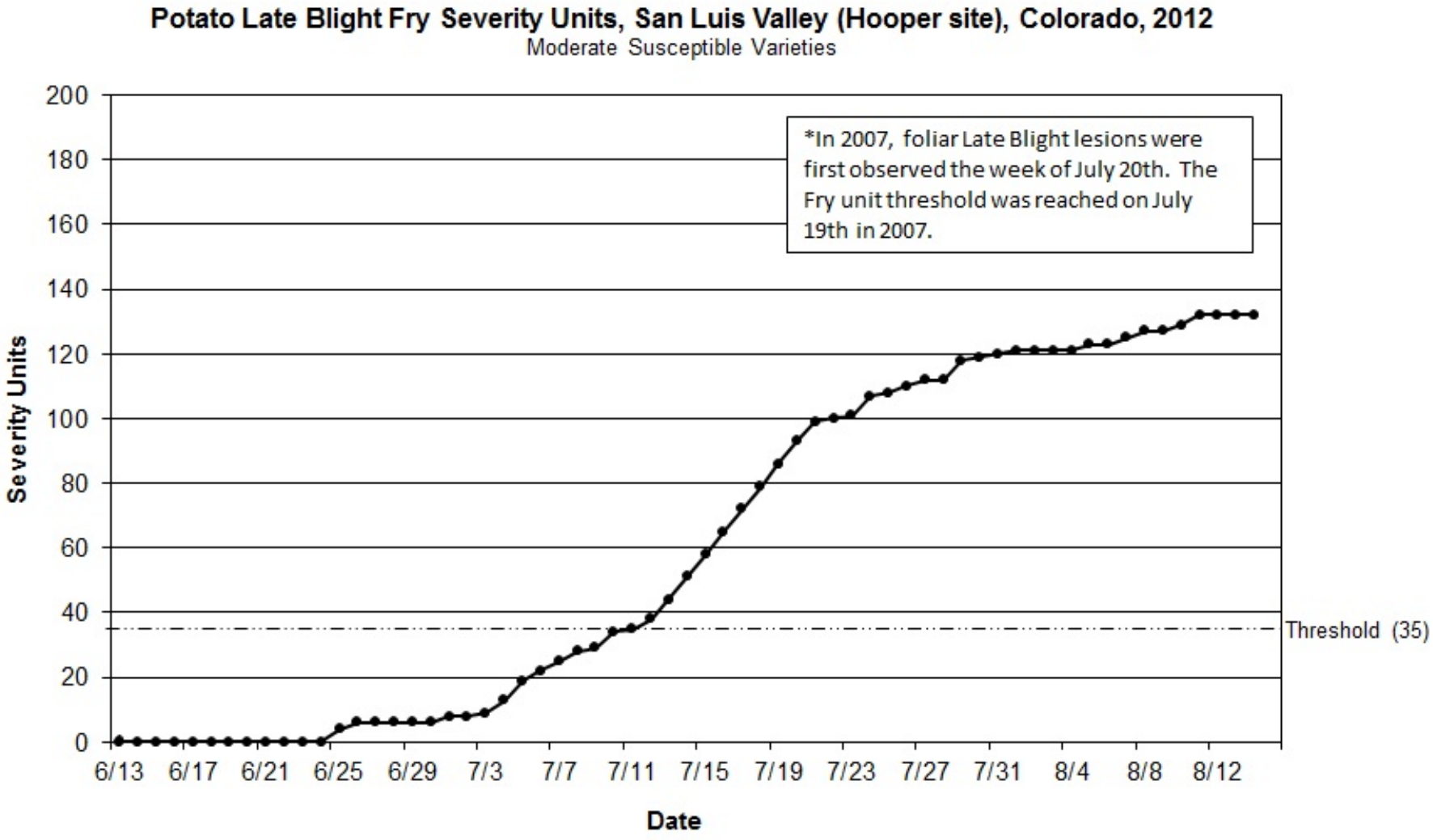

Root Knot Nematode Degree Days for the San Luis Valley
2012
2011
2002 to 2011 avg.
3000
2500
2000
1500
1000
500
0
Degree Days
1440
The target date to begin Vydate applications for root knot nematode control is at 1440 Degree Days. Most success for control of stubby root nematode and susequent control of corky ringspot has been an in-furrow appl. with a second appl. at early emergence.
1-May
8-May
15-May
22-May
29-May
5-Jun
12-Jun
19-Jun
26-Jun
3-Jul
10-Jul
17-Jul
24-Jul
31-Jul
7-Aug
14-Aug
21-Aug
28-Aug
Date

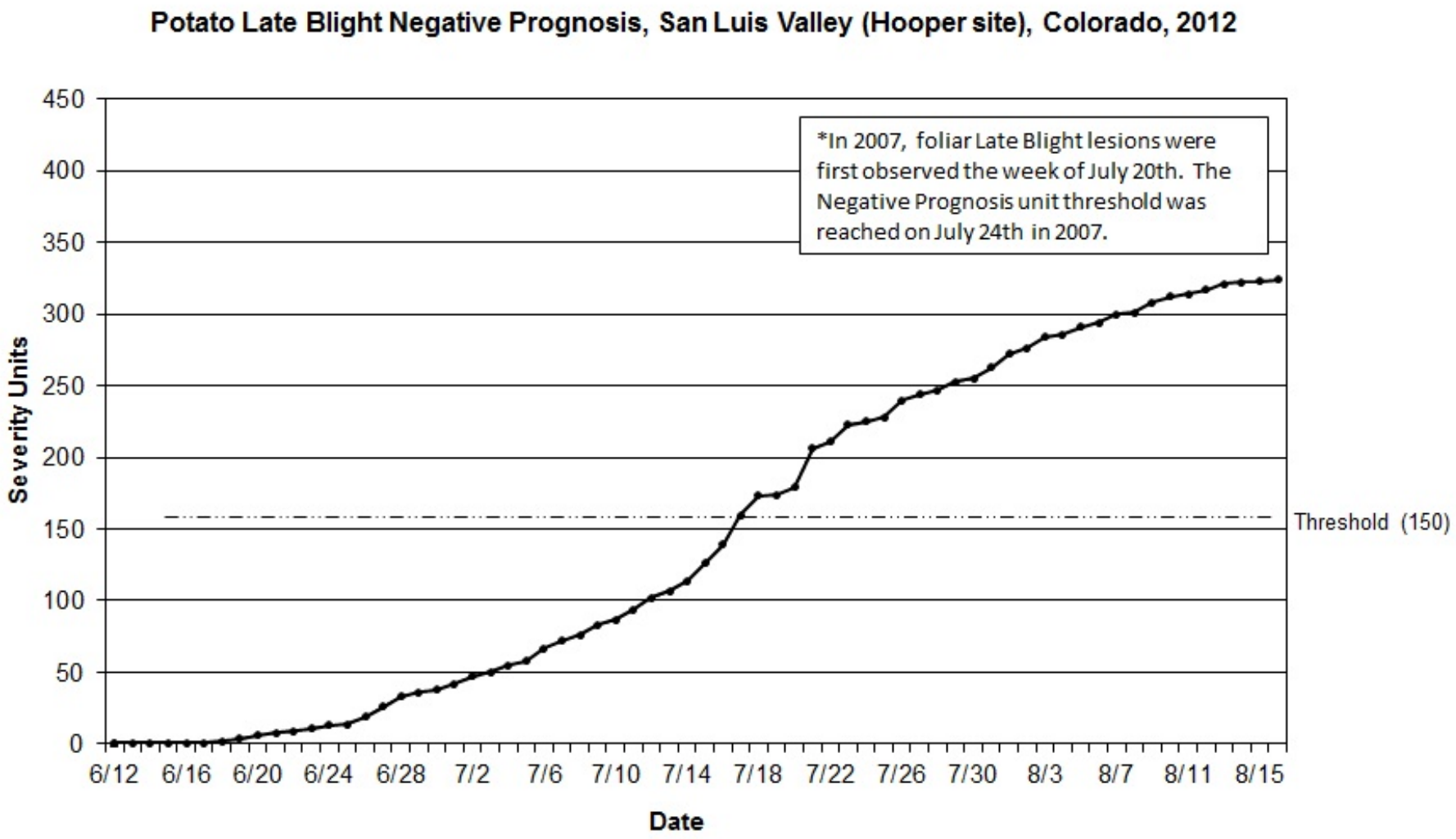
SLV Late Blight Forecasting

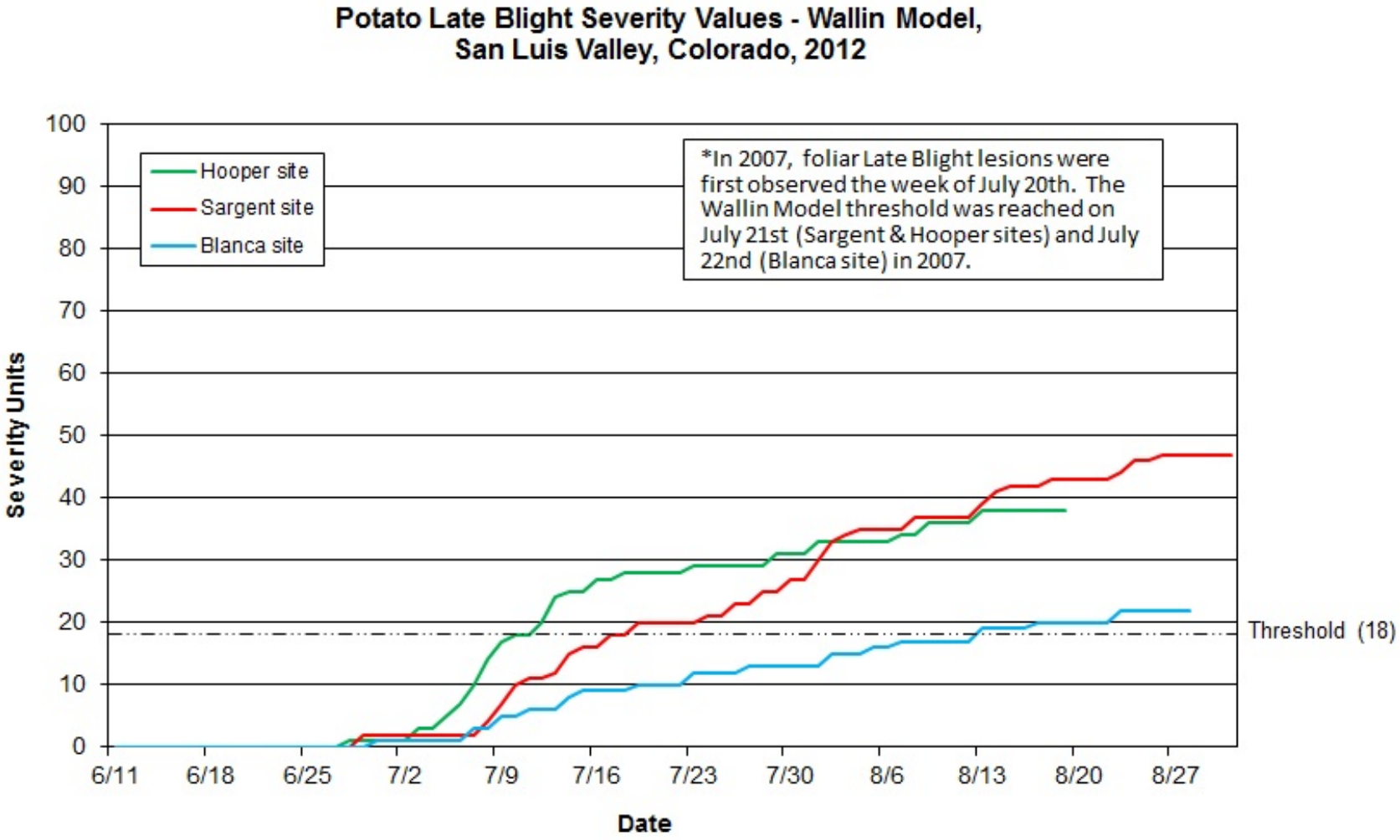
Over the last several years weather stations have been positioned at three locations around the San Luis Valley (Blanca, Hooper, & Sargent) in order to determine late blight severity units. This was continued in 2011 in order to determine the potential risk we have for late blight here in the valley.

A uMetos weather station was used at the Blanca and Hooper sites to determine late blight severity. This unit uses the Fry model and Negative Prognosis 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.

At the Sargent and Hooper 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 Severity Units, San Luis Valley (Hooper site), Colorado, 2012
Moderate Susceptible Varieties
*In 2007, foliar Late Blight lesions were first observed the week of July 20th. The Fry unit threshold was reached on July 19th in 2007.
Threshold (35)
Severity Units
200
180
160
140
120
100
80
60
40
20
0
6/13
6/17
6/21
6/25
6/29
7/3
7/7
7/11
7/15
7/19
7/23
7/27
7/31
8/4
8/8
8/12
Date


Potato Late Blight Negative Prognosis, San Luis Valley (Hooper site), Colorado, 2012
*In 2007, foliar Late Blight lesions were first observed the week of July 20th. The Negative Prognosis unit threshold was reached on July 24th in 2007.
Threshold (150)
Severity Units
450
400
350
300
250
200
150
100
50
0
6/12
6/16
6/20
6/24
6/28
7/2
7/6
7/10
7/14
7/18
7/22
7/26
7/30
8/3
8/7
8/11
8/15
Date



Footnote:
- The Sargent weather station began collecting data on June 11, 2012.
- The Hooper weather station began collecting data on June 12, 2012.
- The Blanca weather station began collecting data on June 12, 2012.

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 2011, several chemistries showed good to excellent results. Also, the biological agent Serenade was include in the trial with mixed results.

EVALUATION OF FUNGICIDES FOR CONTROL OF PINK ROT ON POTATO, 2012

Researchers: Rob Davidson and Andrew Houser, Colorado State University, SLVRC
Location: Off-station, San Luis Valley, CO
Cultivar: Russet Norkotah sel. 8, cut seed, 2-4 oz.
Objective: To evaluate the efficacy of various chemistries 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_2 charged backpack sprayer at 35 PSI, with one XR 8002VS nozzle, using 10 gallons of water/acre as a directed application. Applications were made on June 14 for AH treatments & July 13 for TI treatments. Three foliar applications of Phostrol (Trts. 9, 10, & 11) were made on July 13, July 26, and August 10th respectively.

Planted: May 15, 2012
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
Fertilizer: NA
Herbicide: NA
Fungicide: NA
Insecticide: NA
Vine Killer: NA
Harvested: September 19, 25, 26, & 27, 2012

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. Fungicide programs evaluated for Pink Rot control, San Luis Valley, Colorado 2012.

Program	Products & Rate	Application Schedule
1	Untreated Control	-
2	Serenade Soil @ 2.0 qt./A	In-Furrow[a]
3	Serenade Soil @ 4.0 qt./A	In-Furrow[a]
4	Serenade Soil @ 2.0 qt./A	In-Furrow[a]
	Phostrol @ 4.0 qt./A	Tuber Initiation[c]
5	Serenade Soil @ 4.0 qt./A	In-Furrow[a]
	Phostrol @ 4.0 qt./A	Tuber Initiation[c]
6	Phostrol @ 4.0 qt./A	Tuber Initiation[c]
7	Ridomil Gold @ 0.42 floz./1000 row ft.	In-Furrow[a]
	Phostrol @ 8.0 pt./A	In-Furrow[a]
	Phostrol @ 8.0 pt./A	Tuber Initiation[c]
8	Proprietary	
9	Ranman @ 0.42 floz./1000 row ft.	In-Furrow[a]
	Phostrol @ 10.0 pt./A	Three foliar applications[d]
10	Presidio @ 4.0 floz./A	In-Furrow[a]
	Phostrol @ 10.0 pt./A	Three foliar applications[d]
11	Phostrol @ 10.0 pt./A	Three foliar applications[d]
12	Ridomil Gold 465.2SL @ 0.42 floz./1000 row ft.	In-Furrow[a]
	Ridomil Gold Bravo 3.67SC @ 2.5 pt./A	After hilling[b]
13	Proprietary	
14	Proprietary	
15	Proprietary	
16	Proprietary	
17	Proprietary	
18	Untreated Control	

[a] In-furrow treatments were applied on May 15, 2012.
[b] After-hilling treatments were applied June 14, 2012.
[c] Tuber initiation treatments were applied on July 13, 2012.
[d] Foliar applications were applied on the following dates: July 13, July 26, and August 10, 2012.

Table 2. Effect of applied products, for control of pink rot, on tuber yield and quality in the cultivar Russet Norkotah sel. 8. San Luis Valley, Colorado, 2012.

		Percent[a]								
Treatment #	% Stand[b]	< 4 oz.	4-10 oz.	> 10 oz.	US #2's & culls	cwt/A[c]	cwt/A[d]	No. rot	% rot[e]	% rot x severity[f]
1.	96.3	20.6	49.5	28.2	1.7	239.3 b-e	235.1b-e	6.0	4.2	29.4
2.	98.1	20.3	44.9	33.0	1.9	263.6 abc	259.6 abc	6.3	2.7	18.0
3.	96.3	27.1	52.8	20.0	0.1	179.8 e	179.6 e	8.8	5.4	48.4
4.	99.4	25.6	46.8	25.4	2.2	226.8 cde	221.1 b-e	8.5	4.3	34.0
5.	91.9	24.6	40.2	33.3	2.0	197.4 de	194.0 de	1.3	0.7	4.9
6.	94.4	22.3	50.3	24.6	2.8	220.5 cde	214.1 cde	5.3	2.9	21.2
7.	98.1	25.2	44.6	29.4	0.8	248.4 a-d	246.5 a-d	4.3	1.8	10.7
8.	97.5	21.8	52.1	25.4	0.9	276.3 abc	274.0 ab	2.8	1.0	6.2
9.	96.9	31.7	47.0	19.7	1.6	249.4 a-d	245.6 a-d	0.0	0.0	0.0
10.	98.1	31.8	42.8	23.4	2.1	229.3 b-e	224.2 b-e	2.3	1.1	7.2
11.	96.3	25.5	49.2	23.8	1.5	259.9 abc	255.8 abc	3.5	1.9	12.5
12.	95.6	27.1	44.8	24.2	3.9	262.6 abc	253.1 a-d	6.3	3.9	18.3
13.	94.4	26.1	48.0	22.6	3.4	289.3 ab	279.3 ab	0.3	0.1	0.3
14.	96.3	24.5	46.8	27.2	1.5	276.6 abc	272.3 abc	0.3	0.1	0.3
15.	100.0	23.3	45.9	29.3	1.7	278.7 abc	274.0 ab	2.0	0.6	4.5
16.	98.1	28.4	49.8	20.2	1.7	274.4 abc	269.8 abc	3.8	1.0	7.7
17.	97.5	25.2	46.2	27.5	1.3	303.9 a	300.0 a	1.3	0.4	2.1
18.	97.5	21.9	47.7	28.7	1.7	278.7 abc	273.8 ab	1.5	0.5	2.5
LSD(P=0.05)	NS	NS	NS	NS	NS	60.7	59.3	NS	NS	NS

[a] Based on tuber weight in kilograms, mean of four replications.

[b] Plant stand counts were taken on June 14, 2012, 2-20 foot rows per treatment per replication, 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] Hundred weight per acre – US #2s and culls, 2-20 foot rows per treatment per replication, mean of four replications.

[e] Mean percent of tubers with pink rot at harvest per treatment per replication (i.e. 0.86 = 0.86%).

[f] 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.

Rhizoctonia Fungicide Trial

2012 POTATO – RHIZOCTONIA FUNGICIDE TRIAL

Researchers: Rob Davidson and Andrew Houser, Colorado State University, SLVRC
Location: San Luis Valley Research Center, Center, CO

Cultivar: Russet Nugget, cut seed, 2-4 oz.

Application: All treatments were applied in-furrow, using an R & D CO_2 charged backpack sprayer at 35 PSI, with two XR 8002VS nozzles, using 10 gallons of water/acre as a directed application.

Treatments:
1. Untreated Control
2. Priaxor @ 6.74 floz./A
3. Proprietary
4. Quadris @ 9.0 floz./A
5. Moncut @ 0.75 lb./A
6. Priaxor @ 8.0 floz./A

Planted: May 18, 2012
Plot Design: Randomized complete block
Plot Size: Two - 35 foot rows per treatment per replication.
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Four
Irrigation: Solid set sprinkler - rate based on ET for both.
Fertilizer: 80N-60P-40K-25S-2.5Z, preplant, 70N through sprinkler after tuber set.
Herbicide: Eptam @ 4.5 pt/A & Matrix @ 1.5 oz./A
Fungicide: Quadris Opti @ 1.6 pt./A, chemigated through solid set on July 19.
Vine Killer: Rotobeat vines on September 5, 2012
Harvested: October 4, 2012

DATA:

Plant stand count: Percentage of emerged plants per treatment per replication.
Seed piece decay: Soft-rot and dry-rot combined rated 0-100, where 0 = no decay and 100 = complete decay; 2 seed pieces/treatment/replication.
Stem canker: Percent stems infected with rhizoctonia; 2 plants/treatment/replication.
Severity index: Mean percent of stems infected with rhizoctonia, multiplied by the severity of damage, where 1 = small area of stem infected and 5 = entire stem infected.
Black scurf: Percentage of tubers with black scurf and black scurf severity post harvest, per treatment per replication.
Total no. of stems: Average number of stems per plant; 2 plants/treatment/replication.
Yield: 2-15 foot rows per treatment per replication, total yield expressed in 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. Effects of seed treatments on in-season plant development and incidence of disease in the cultivar Russet Nugget, San Luis Valley, Colorado, 2012.

Treatment	% Stand[a]			Total number of stems			% Stems w/Rhizoc.			Severity Index			% seed decay		
	June 14th	June 20th	June 20th	June 20th	July 5th	July 17th	June 20th	July 5th	July 17th	June 20th	July 5th	July 17th	June 20th	July 5th	July 17th
1	66.1	80.4 ab	4.4	3.2	2.8	15.9	36.5	67.2	28.6	68.8	67.2	2.5	35.9	-
2	70.0	83.6 ab	3.5	3.1	3.7	3.6	33.1	56.6	8.6	43.3	56.6	2.5	45.3	-
3	62.1	75.0 bc	3.3	2.8	2.9	11.3	37.5	66.0	15.1	58.1	66.0	17.3	49.0	-
4	70.7	84.6 a	3.4	3.1	3.0	8.5	32.6	56.7	16.9	45.4	56.7	15.1	42.0	-
5	56.4	67.5 c	3.3	2.9	3.4	14.3	49.0	61.7	30.2	76.1	61.7	16.9	50.0	-
6	68.6	80.4 ab	3.2	3.0	2.6	2.7	42.4	65.2	4.8	62.2	65.2	13.8	48.8	-
LSD (P=0.05)	NS	8.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-

[a] Percentage of plants emerged on June 14th and June 20th, 2012; mean of four replications.

[b] Mean number of stems per plant; 5 plants/treatment/replication. Stem numbers taken on June 20th, July 5th, & July 17th; mean of four replications.

[c] Mean percent stems with Rhizoctonia canker; 5 plants/treatment/replication. Readings taken on June 20th, July 5th, & July 17th; mean of four replications.

[d] Mean percent of stems infected with rhizoctonia, multiplied by the severity of damage, where 1 = small area of stem infected and 5 = entire stem infected. Readings taken on June 20th, July 5th, & July 17th; mean of four replications.

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

Table 2. Effect of applied products, for control of rhizoctonia, on tuber yield and quality in the cultivar Russet Nugget, San Luis Valley, Colorado, 2012.

	Percent[a]							
Treatment #	< 4 oz.	4-10 oz.	> 10 oz.	US #2's & culls	cwt/A[b]	cwt/A[c]	% black scurf[d]	black scurf severity index[e]
1.	45.0	43.1	11.9	0.0	306.2	306.2	31.6	68.6
2.	50.8	40.4	8.6	0.2	280.9	280.3	21.8	44.7
3.	41.4	46.7	11.5	0.4	286.5	285.4	49.6	132.2
4.	54.5	31.5	13.9	0.1	270.7	270.4	28.3	56.6
5.	54.0	38.4	7.5	0.1	199.0	198.7	20.7	46.5
6.	43.8	41.9	14.3	0.0	278.0	278.0	41.4	107.1
LSD(P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

[a] Based on tuber weight in kilograms, mean of four replications.

[b] Total yield expressed as hundred weight per acre, 2-15 foot rows per treatment per replication, mean of four replications.

[c] Hundred weight per acre – US #2s and culls, 2-15 foot rows per treatment per replication, mean of four replications.

[d] Mean percent of tubers with black scurf post harvest per treatment per replication. A tuber sample of 25 lbs was evaluated from each treatment/replication on November 16, 2012, mean of four replications.

[e] Mean percent of tubers with black scurf post harvest multiplied by disease severity from 1 to 5 (1 = less than 1% of tuber surface area with black scurf, 2 = 1 to 5 % surface area, 3 = 5 to 10 % surface area, 4 = 10 to 20 % surface area, and 5 = >20 % surface area), mean of four replications.

Insecticide Trial

2012 POTATO – INSECTICIDE TRIAL

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

Location: San Luis Valley Research Center, Center, CO

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

Application: All treatments applied using an R & D CO_2 charged tractor mounted plot sprayer with four XR 8002VS nozzles spaced seventeen inches apart at 60 psi pressure and applying 40 gallons/acre as a broadcast application. Applications were made on the following dates: July 9th and July 23rd. All treatments were tank mixed with LI-700 at a rate of 0.25 % v/v.

Treatments:

1. Untreated Control
2. Proprietary
3. Proprietary
4. Proprietary
5. Proprietary
6. Mustang Max @ 2.0 floz./A
7. Mustang Max @ 4.0 floz./A
8. Warrior T @ 1.92 floz./A
9. Warrior T @ 3.84 floz./A

Planted: May 15, 2012
Plot Design: Randomized complete block
Plot Size: Four - 25 foot rows per treatment per replication.
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Four
Irrigation: Solid set sprinkler - rate based on ET for both.
Fertilizer: 80N-60P-40K-25S-2.5Z, preplant, 70N through sprinkler after tuber set.
Herbicide: Eptam @ 4.5 pt/A & Matrix @ 1.5 oz./A
Fungicide: Quadris Opti @ 1.6 pt./A, chemigated through solid set on July 19.
Vine Killer: Rotobeat vines on September 5, 2012
Harvested: October 3, 2012

DATA:

Insect readings: Aphid and thrip readings were taken from 12 randomly selected plants (3 per row), per treatment per replication, mean of four replications. The total number of aphids and thrips was recorded from one compound leaf from each of the 12 plants. Insect readings were taken on the following dates: August 2, August 9, August 14, August 21 & August 28. The data is expressed as the total number of insects per compound leaf.

Yield: 2-25 foot rows per treatment per replication, total yield expressed in 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 insecticides, for management of aphids and thrips, on tuber yield and quality in the cultivar Russet Norkotah sel. 8, San Luis Valley, Colorado, 2012.

	Number of aphids per leaflet[a]					Number of thrips per leaflet[b]				
Treatment #	Aug. 2	Aug. 9	Aug. 14	Aug. 21	Aug. 28	Aug. 2	Aug. 9	Aug. 14	Aug. 21	Aug. 28
1. Untreated Control	0.02 ab	0.01	0.01	0.03	0.00	0.04 a	0.08	0.15	0.24	0.53
2. Proprietary	0.01 b	0.01	0.02	0.00	0.00	0.01 c	0.05	0.09	0.19	0.59
3. Proprietary	0.02 ab	0.01	0.01	0.03	0.00	0.01 bc	0.06	0.10	0.14	0.46
4. Proprietary	0.00 b	0.02	0.01	0.01	0.02	0.03 ab	0.08	0.12	0.27	0.64
5. Proprietary	0.04 a	0.01	0.02	0.03	0.01	0.01 c	0.05	0.10	0.26	0.65
6. Mustang Max @ 2.0 floz./A	0.01 b	0.04	0.01	0.00	0.01	0.01 bc	0.04	0.10	0.22	0.61
7. Mustang Max @ 4.0 floz./A	0.04 a	0.03	0.02	0.01	0.00	0.01 c	0.08	0.07	0.15	0.38
8. Warrior T @ 1.92 floz./A	0.02 ab	0.02	0.00	0.04	0.01	0.01 c	0.08	0.08	0.19	0.41
9. Warrior T @ 3.84 floz./A	0.00 b	0.00	0.01	0.02	0.01	0.01 c	0.02	0.06	0.08	0.42
LSD(P=0.05)	0.03	NS	NS	NS	NS	0.02	NS	NS	NS	NS

[a] Average number of aphids per potato leaflet per plant, 12 plants/treatment/replication/reading.
[b] Average number of thrips per potato leaflet per plant, 12 plants/treatment/replication/reading.
Means followed by the same letters are not significantly different at P=0.05.

Table 2. Effect of applied insecticides, for managment of aphids and thrips, on tuber yield and quality in the cultivar Russet Norkotah sel. 8, San Luis Valley, Colorado, 2012.

	Percent[a]					
Treatment #	< 4 oz.	4-10 oz.	> 10 oz.	US #2's & culls	cwt/A[b]	cwt/A[c]
1. Untreated Control	26.3 ab	38.5	31.5 cd	3.7 ab	334.9	321.4
2. Proprietary	19.3 c	45.1	32.4 cd	3.2 abc	372.5	360.2
3. Proprietary	19.8 c	33.1	44.9 ab	2.3 bc	427.2	417.5
4. Proprietary	18.4 c	40.4	40.3 abc	0.8 c	385.9	382.3
5. Proprietary	28.2 a	36.6	33.6 cd	1.6 bc	353.7	348.5
6. Mustang Max @ 2.0 floz./A	20.7 bc	44.3	32.5 cd	2.5 bc	399.3	389.6
7. Mustang Max @ 4.0 floz./A	19.5 c	38.3	37.1 bcd	5.1 a	386.7	366.8
8. Warrior T @ 1.92 floz./A	27.1 a	40.3	30.8 d	1.8 bc	369.5	362.5
9. Warrior T @ 3.84 floz./A	17.3 c	34.1	46.5 a	2.2 bc	370.5	362.2
LSD(P=0.05)	6.3	NS	9.1	2.4	NS	NS

[a] Based on tuber weight in kilograms, mean of four replications.
[b] Total yield expressed as hundred weight per acre, 2-25 foot rows per treatment per replication, mean of four replications.
[c] Hundred weight per acre without US #2s and culls, 2-25 foot rows per treatment per replication, mean of four replications.

Powdery Scab Trials

EVALUATION OF ADVANCED CLONES FOR SUSCEPTIBILITY TO POWDERY SCAB, 2012

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

Location: San Luis Valley Research Center, Center, CO

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

Clones:

1. Centennial L-1
2. Centennial L-1M
3. Centennial L-2
4. Centennial L-2M
5. Russet Nugget L-2
6. Russet Nugget L-2M
7. AC03433-1W
8. CO03187-1RU
9. CO03202-1RU
10. CO03243-3W
11. CO03276-4RU
12. CO03276-5RU
13. CO04013-1W/Y
14. CO04021-2R/Y
15. AC00395-2RU
16. AC01151-5W
17. CO02024-9W
18. CO02033-1W
19. CO02321-4W
20. Centennial Russet
21. Colorado Rose
22. DT6063-1R
23. Russet Nugget
24. Mesa Russet

Planted: May 30, 2012

Plot Design: Randomized complete block

Plot Size: One 6" pot 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: Overhead irrigation, rate predetermined based on the optimal irrigation regime for powdery scab symptom development.

Fertilizer: 20N-20P-20K, applied six times

Vine Killer: Vines were removed at harvest time on September 11, 2012

Harvested: September 11 & 12, 2012

DATA: Mean percent per pot showing galls on roots, rated 0 to 4; 0 = none, 4 = heavily infected.
Mean percent of per pot showing one or more powdery scab lesions at harvest multiplied by the severity of the lesions, where 1 = very little or no disease and 5 = heavily infested.
Mean percent of tubers per pot which are unmarketable due to powdery scab severity.
Both root gall and tuber readings were taken on December 17, 18, 19, and 20th, 2012.

Table 1. Evaluation of advenced clones for tuber susceptibility to powdery scab in a greenhouse environment, San Luis Valley, Colorado, 2012.

Treatment #	% Stand[a]	Tuber Symptoms % Incidence[b]	% Healthy[c]	Severity Index[d]	% Unmarketable[e]	Root Gall Rating[f]	Fresh Root Wt.[g]
1. Centennial L-1	100	0.0 e	100.0 a	0.0 h	0.0 d	0.5 hi	4.9 f-k
2. Centennial L-1M	88	18.6 e	81.4 a	52.2 fgh	15.0 d	0.3 i	2.0 jk
3. Centennial L-2	100	0.0 e	100.0 a	0.0 h	0.0 d	0.8 ghi	2.7 ijk
4. Centennial L-2M	88	9.8 e	90.2 a	9.8 gh	0.0 d	0.8 ghi	1.5 k
5. Russet Nugget L-2	100	0.0 e	100.0 a	0.0 h	0.0 d	0.5 hi	7.5 d-i
6. Russet Nugget L-2M	88	41.7 d	58.4 b	89.6 fg	6.3 d	1.5 e-h	13.7 bc
7. AC03433-1W	88	86.4 abc	13.6 cde	222.7 e	67.1 c	1.5 e-h	15.6 ab
8. CO03187-1RU	88	0.0 e	100.0 a	0.0 h	0.0 d	2.3 b-e	1.8 jk
9. CO03202-1RU	88	0.0 e	100.0 a	0.0 h	0.0 d	1.3 e-i	4.8 f-k
10. CO03243-3W	67	83.4 abc	16.7 cde	133.4 f	0.0 d	3.0 abc	9.5c-f
11. CO03276-4RU	63	8.3 e	91.7 a	8.3 gh	0.0 d	2.0 c-f	4.0 g-k
12. CO03276-5RU	88	0.0 e	100.0 a	0.0 h	0.0 d	1.8 d-g	8.7 c-g
13. CO04013-1W/Y	88	91.5 abc	8.5 cde	280.7 de	68.3 c	3.3 ab	4.0 g-k
14. CO04021-2R/Y	100	93.8 ab	6.3 de	368.8 bc	88.8 abc	4.0 a	6.9 e-j
15. AC00395-2RU	75	6.7 e	93.3 a	13.3 gh	0.0 d	0.3 i	12.4 bcd
16. AC01151-5W	38	100.0 a	0.0 e	350.0 bcd	83.4 abc	1.5 e-h	10.8 b-e
17. CO02024-9W	75	100.0 a	0.0 e	375.0 b	95.0 ab	1.8 d-g	5.3 f-k
18. CO02033-1W	50	75.0 bc	25.0 cd	375.0 b	75.0 bc	3.0 abc	8.6 c-h
19. CO02321-4W	75	100.0 a	0.0 e	433.3 ab	100.0 a	2.7 bcd	6.3 e-k
20. Centennial Russet	75	0.0 e	100.0 a	0.0 h	0.0 d	1.0 f-i	2.0 jk
21. Colorado Rose	100	71.3 c	28.8 c	291.3 cde	71.3 c	1.5 e-h	3.4 h-k
22. DT6063-1R	63	100.0 a	0.0 e	466.7 a	100.0 a	3.0 abc	2.3 ijk
23. Russet Nugget	75	0.0 e	100.0 a	0.0 h	0.0 d	1.0 f-i	20.0 a
24. Mesa Russet	100	0.0 e	100.0 a	0.0 h	0.0 d	0.3 i	5.2 f-k
LSD (P=0.05)	NS	20.4	20.4	83.6	22.3	1.1	5.3

[a] Percent Stand is based on the number of pots (four reps with two pots 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.

[b] Percent Incedence = Mean percent of tubers with powdery scab lesions.

[c] Percent Healthy = Mean percent of tubers with no powdery scab lesions.

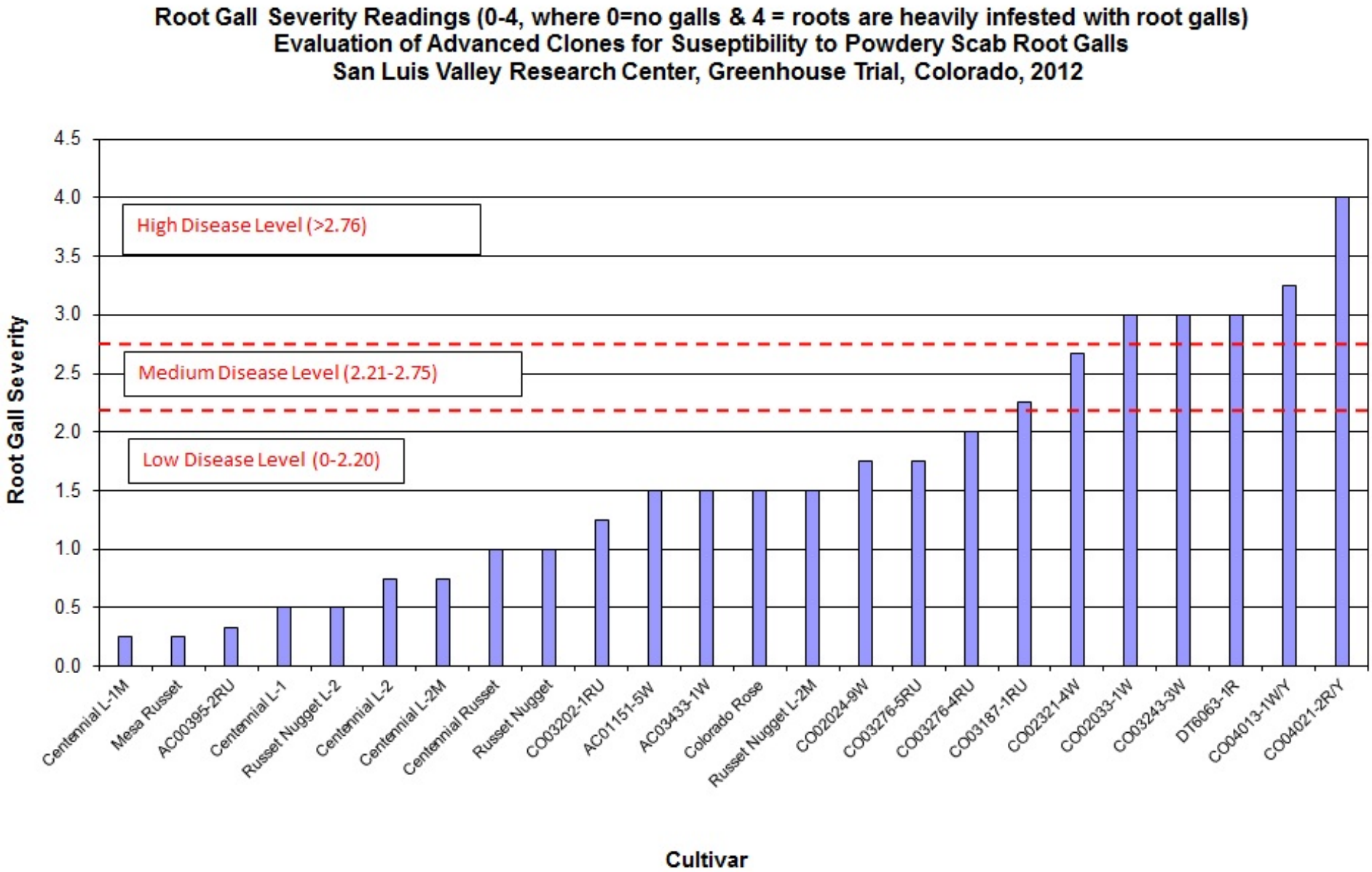
[d] Severity Index = mean percent of the number of affected tubers multiplied by the severity of the lesions, where 1 = very little or no disease and 5 = heavily infested.

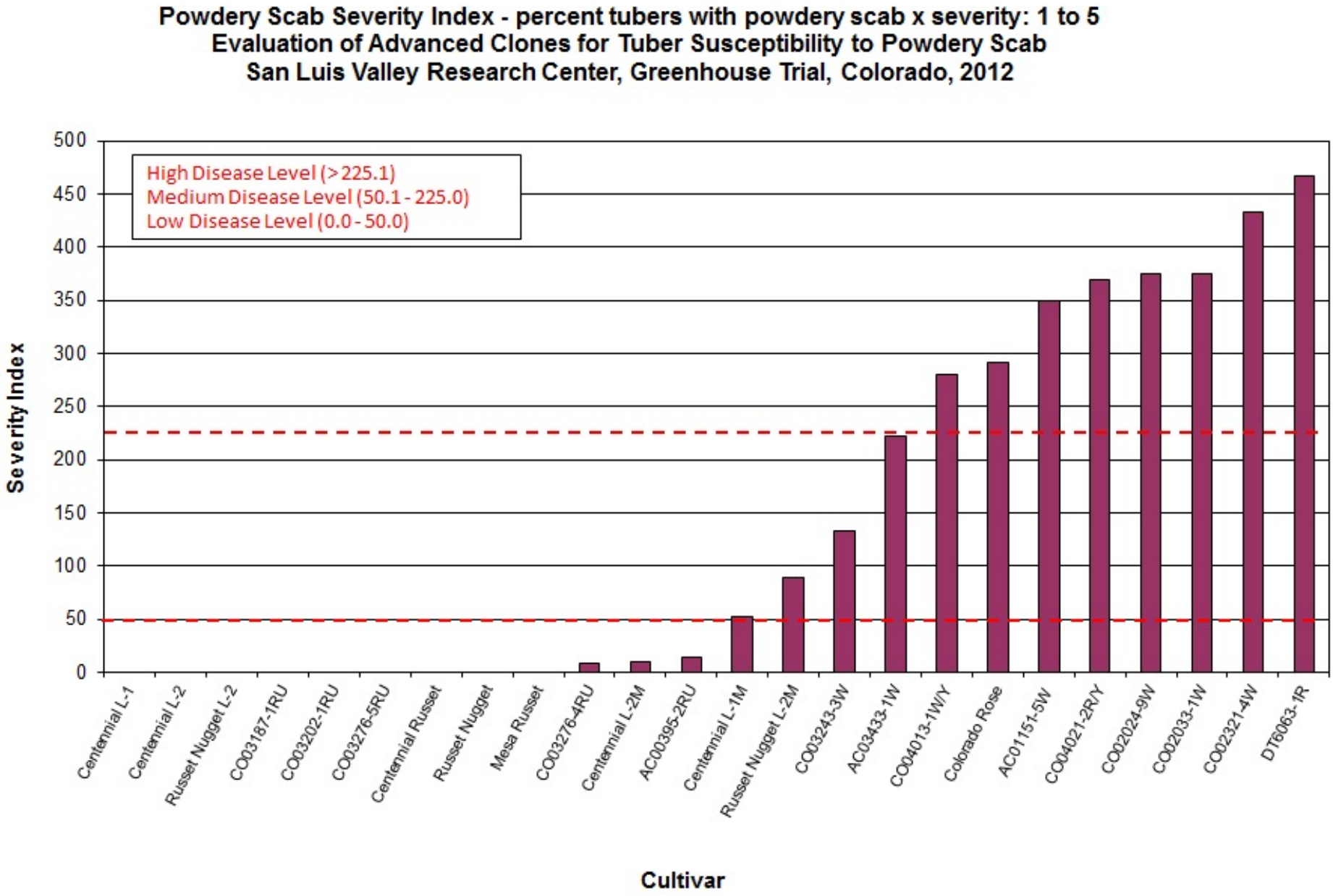
[e] Percent Unmarketable = Mean percent of tubers per pot which are unmarketable due to powdery scab severity (lesion severity >3).

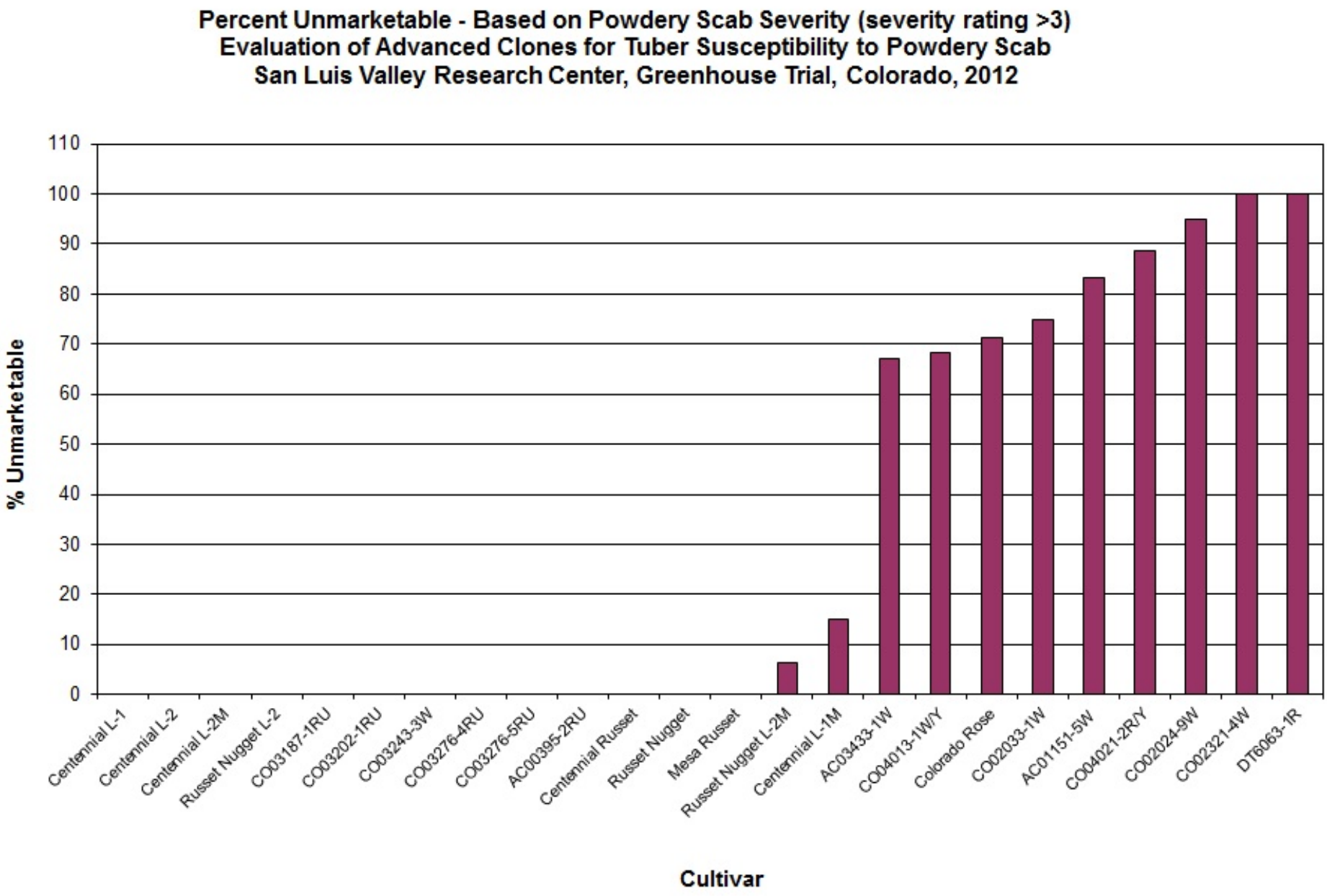
[f] Root Gall Rating = visual analysis of roots for the presence of powdery scab root galls, where 0 = no root galls and 4 = extensive root galls. All plants were rated.

[g] 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 (i.e. < 1 gram), root gall readings are questionable.

Means followed by the same letters 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 Suseptibility to Powdery Scab Root Galls
San Luis Valley Research Center, Greenhouse Trial, Colorado, 2012
High Disease Level (>2.76)
Medium Disease Level (2.21-2.75)
Low Disease Level (0-2.20)
Root Gall Severity
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Centennial L-1M
Mesa Russet
AC00395-2RU
Centennial L-1
Russet Nugget L-2
Centennial L-2
Centennial L-2M
Centennial Russet
Russet Nugget
CO03202-1RU
AC01151-5W
AC03433-1W
Colorado Rose
Russet Nugget L-2M
CO02024-9W
CO03276-5RU
CO03276-4RU
CO03187-1RU
CO02321-4W
CO02033-1W
CO03243-3W
DT6063-1R
CO04013-1W/Y
CO04021-2R/Y
Cultivar


Powdery Scab Severity Index - percent tubers with powdery scab x severity: 1 to 5
Evaluation of Advanced Clones for Tuber Susceptibility to Powdery Scab
San Luis Valley Research Center, Greenhouse Trial, Colorado, 2012
High Disease Level (>225.1)
Medium Disease Level (50.1 - 225.0)
Low Disease Level (0.0 - 50.0)
Severity Index
0
50
100
150
200
250
300
350
400
450
500
Centennial L-1
Centennial L-2
Russet Nugget L-2
CO03187-1RU
CO03202-1RU
CO03276-5RU
Centennial Russet
Russet Nugget
Mesa Russet
CO03276-4RU
Centennial L-2M
AC00395-2RU
Centennial L-1M
Russet Nugget L-2M
CO03243-3W
AC03433-1W
CO04013-1W/Y
Colorado Rose
AC01151-5W
CO04021-2R/Y
CO02024-9W
CO02033-1W
CO02321-4W
DT6063-1R
Cultivar


Percent Unmarketable - Based on Powdery Scab Severity (severity rating >3)
Evaluation of Advanced Clones for Tuber Susceptibility to Powdery Scab
San Luis Valley Research Center, Greenhouse Trial, Colorado, 2012
% Unmarketable
110
100
90
80
70
60
50
40
30
20
10
0
Centennial L-1
Centennial L-2
Centennial L-2M
Russet Nugget L-2
CO03187-1RU
CO03202-1RU
CO03243-3W
CO03276-4RU
CO03276-5RU
AC00395-2RU
Centennial Russet
Russet Nugget
Mesa Russet
Russet Nugget L-2M
Centennial L-1M
AC03433-1W
CO04013-1W/Y
Colorado Rose
CO02033-1W
AC01151-5W
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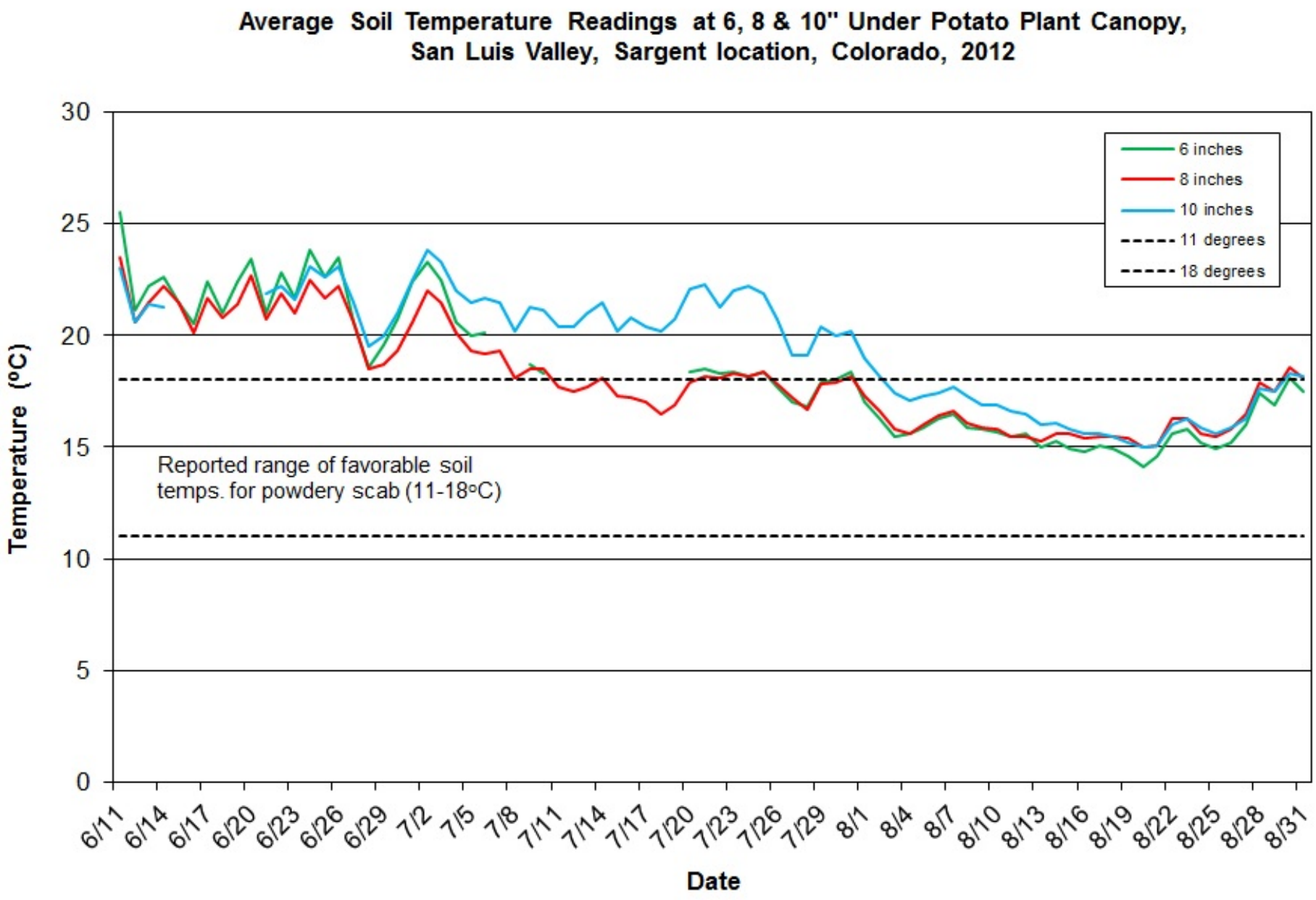
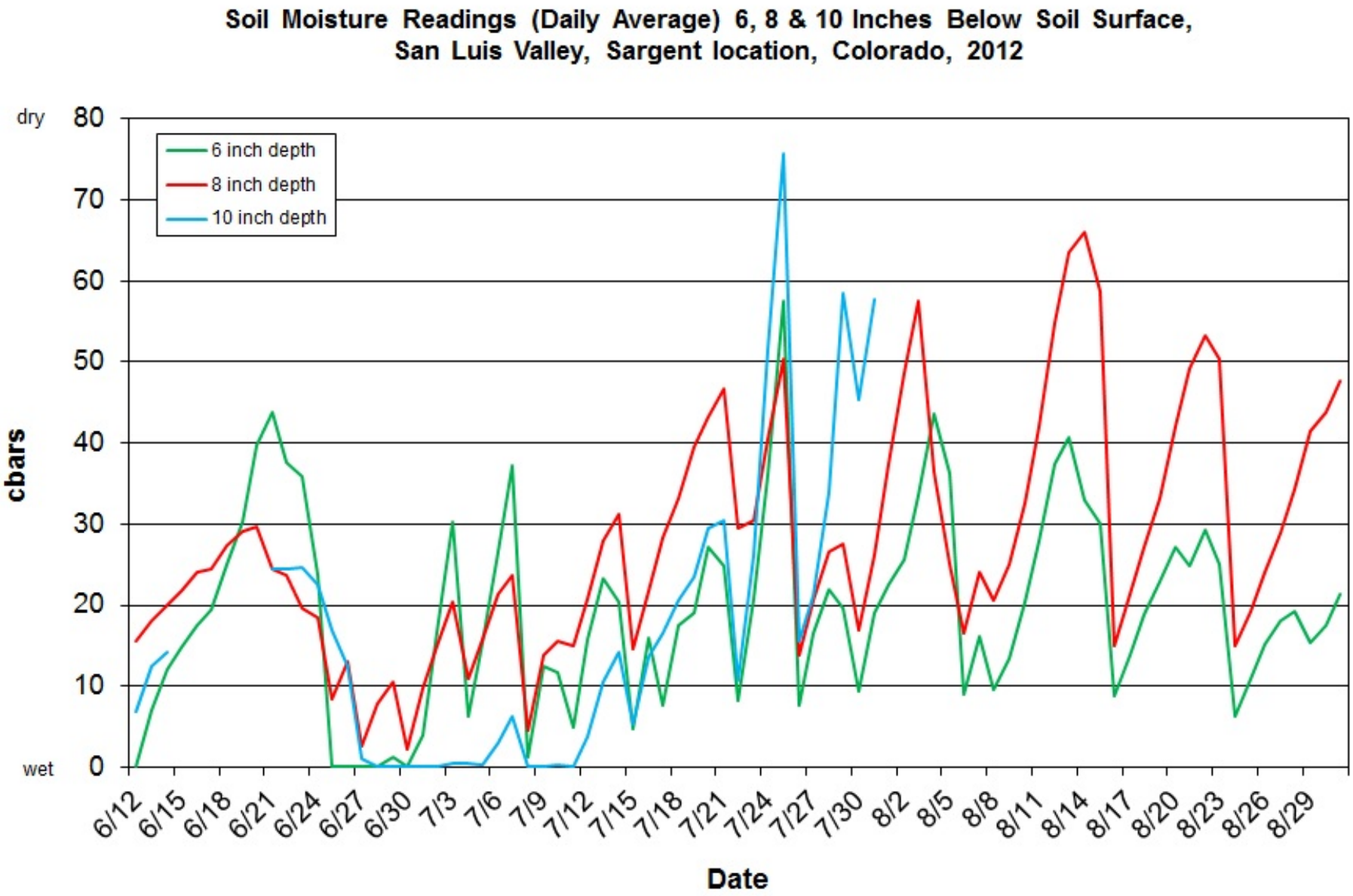
CO02024-9W
CO02321-4W
DT6063-1R
Cultivar


Average Soil Temperature Readings at 6, 8 & 10" Under Potato Plant Canopy,
San Luis Valley, Sargent location, Colorado, 2012
6 inches
8 inches
10 inches
11 degrees
18 degrees
Reported range of favorable soil
temps. for powdery scab (11-18°C)
Temperature (°C)
30
25
20
15
10
5
0
6/11
6/14
6/17
6/20
6/23
6/26
6/29
7/2
7/5
7/8
7/11
7/14
7/17
7/20
7/23
7/26
7/29
8/1
8/4
8/7
8/10
8/13
8/16
8/19
8/22
8/25
8/28
8/31
Date


Soil Moisture Readings (Daily Average) 6, 8 & 10 Inches Below Soil Surface,
San Luis Valley, Sargent location, Colorado, 2012
dry
wet
cbars
80
70
60
50
40
30
20
10
0
6 inch depth
8 inch depth
10 inch depth
6/12
6/15
6/18
6/21
6/24
6/27
6/30
7/3
7/6
7/9
7/12
7/15
7/18
7/21
7/24
7/27
7/30
8/2
8/5
8/8
8/11
8/14
8/17
8/20
8/23
8/26
8/29
Date

Zeba Soil Amendment Trials

Zeba is a soil amendment that allows for better water retention in the soil. We are continuing evaluations on this product, looking at three potato cultivars (Rio Grande Russet, AC99375-1RU, & Russet Burbank) with different water requirements. Three irrigation regimes have been utilized (one irrigation regime was based on ET recommendations, one was based on soil moisture readings taken from soil that was treated with Zeba, and the third was based on a 25% reduction of the Zeba irrigation regime).

Based on irrigation scheduling recommendations from all three regimes, irrigation levels were approximately three inches less over the course of the growing season in the Zeba plots (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, however major differences in yield were not observed in all potato cultivars. Cultivars that are less efficient at scavenging water from the soil may benefit from the application of Zeba. Additional evaluations need to be conducted on the effectiveness of ZEBA before recommendations can be made to the industry.

EVALUATION OF ZEBA PLANT AMENDMENT FOR INCREASED POTATO HEALTH AND YIELD ON THE CULTIVARS RUSSET BURBANK, AC99375-1RU, AND RIO GRANDE RUSSET, 2012

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.

Irrigation: Solid set sprinkler for entire trial. All irrigation rates were determined using the Evapo-Transpiration (ET) Report, which is calculated for grower use by CSU extension at the SLV Research Center, Center, CO. Starting on June 21, plots were irrigated using five different irrigation regimes: 65% of ET, 75% of ET, 85% of ET, 100% of ET, and 115% of ET.

Treatments:

	Russet Burbank	**AC99375-1RU**	**Rio Grande Russet**
65% ET	1. Untreated Control	1. Untreated Control	1. Untreated Control
	2. Zeba @ 10 lbs./A	2. Zeba @ 10 lbs./A	2. Zeba @ 10 lbs./A
75% ET	3. Untreated Control	3. Untreated Control	3. Untreated Control
	4. Zeba @ 10 lbs./A	4. Zeba @ 10 lbs./A	4. Zeba @ 10 lbs./A
85% ET	5. Untreated Control	5. Untreated Control	5. Untreated Control
	6. Zeba @ 10 lbs./A	6. Zeba @ 10 lbs./A	6. Zeba @ 10 lbs./A
100% ET	7. Untreated Control	7. Untreated Control	7. Untreated Control
	8. Zeba @ 10 lbs./A	8. Zeba @ 10 lbs./A	8. Zeba @ 10 lbs./A
115% ET	9. Untreated Control	9. Untreated Control	9. Untreated Control
	10. Zeba @ 10 lbs./A	10. Zeba @ 10 lbs./A	10. Zeba @ 10 lbs./A

Planted: May 16, 2012

Plot Design: Randomized complete block

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

Plant Spacing: 12 inches

Row Spacing: 34 inches

Replications: four

Fertilizer: 80N-60P-40K-25S-2.5Z, preplant, 70N through sprinkler after tuber set.

Herbicide: Dual Magnum @ 1.6 pt./A

Fungicide: Quadris @ 12.4 floz./A

Vine Killer: Rotobeat vines on September 8, 2011

Harvested: September 22, 2011

DATA

Yield: 2-10 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.