2005
RESEARCH REPORT

Extension Potato Disease Control Project

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SLV Research Center

* Richard Zink is no longer involved with the Extension Potato Disease Control Project

CONTENTS

Early Blight Fungicide Trial

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

Nine of the treatment schedules that were evaluated this year used chemicals that are currently available to producers. Each of these schedules used products with different chemistries to determine the effectiveness of combinations of chemistries for early blight control. Additionally, these schedules should decrease possible resistance to a particular chemistry (trt. 2, 9-16). Also, several schedules limit fungicide applications (2-4) during the season. The goal is to identify good early blight control with a reduction in total cost per acre. Several treatment schedules have reduced early blight levels with limited applications, which also result in a lower cost to the grower (see table 1 & 2).

Four of the remaining treatment schedules were determined by a DACOM weather station in cooperation with Plant-plus software. The software takes the weather data and predicts the potential of early blight infection. It then recommends fungicide applications based on the predicted infection potential. This is the second year we have looked at the DACOM/Plant-plus system to predict early blight infections. Results indicate that this system may be applied to a grower's operations to reduce early blight severity.

This year, the Plant-plus software recommended fungicide applications starting nearly four weeks after the 650 degree day threshold for early blight had been reached. Historically, it has been recommended that in order to control early blight, fungicides need to start being applied once the 650 DD threshold has been reached. Even with the late recommendation to apply fungicides, good control of early blight was still achieved in the Plant-plus trial plots. This naturally leads to the question of how treatments applied late in the season may impact early blight tuber decay. Studies in 2006 will examine this issue.

2005 POTATO - EARLY BLIGHT FUNGICIDE TRIALS

Researchers: Rob Davidson, Richard T. Zink 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 5; July 11; July 18; July 25; August 1; August 8; August 15

Planted: May 9, 2005

Plot Design: Randomized complete block

Plot Size: 4 - 20 foot rows per treatment per replication, treatments applied to center two rows and data will be 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, 20N through sprinkler after tuber set

Herbicide: Dual Magnum, 1.5 pt./A + Matrix, 1.5 oz./A

Insecticide: None

Vine Killer: Rotobeat vines on September 10, 2005

Harvested: October 11-13, 2005

DATA:

Disease: Early blight disease incidence based on percent leaves infected, readings taken weekly starting August 2, 2005.

AUDPC: **Area Under the Disease Progress Curve (AUDPC) is a measure of the progression of Early Blight, starting on August 2nd and ending with the last reading on August 27th. 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 pounds < 4 oz., 4-10 oz., > 10 oz., and culls.

Early Blight Degree Days for the San Luis Valley

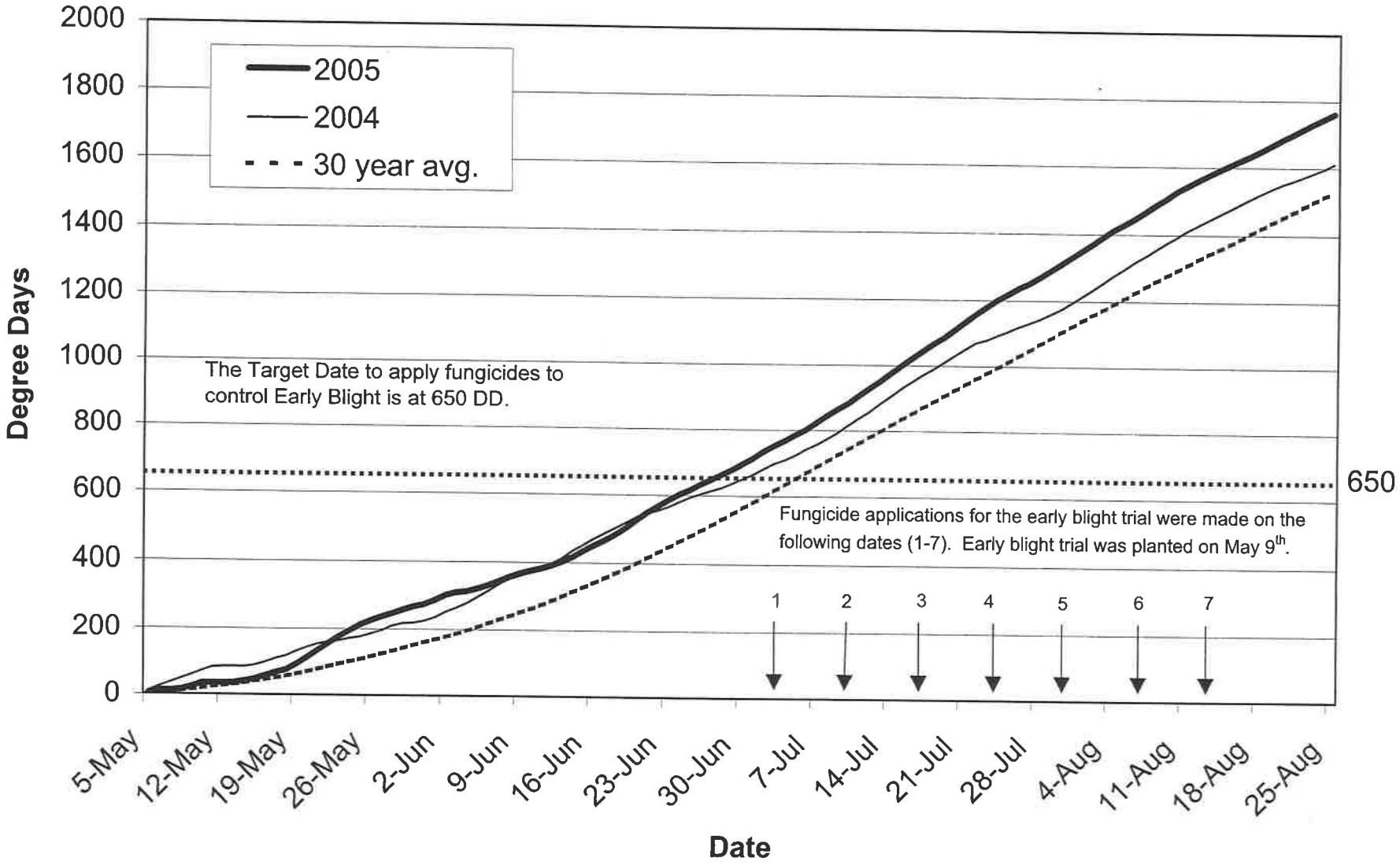


Table 1. Fungicide programs evaluated for early blight control, San Luis Valley, Colorado 2005.

Program	Products	Rate	Application Schedule[a]	Est. total cost/A[b]
1	Untreated Control			-
2	Dithane Rainshield Quadris	2.0 lb./A 6.1 fl.oz./A	1,5 3	$23.87
3	Proprietary	1.10 lb./A	1,2,3,4,5,6,7	-
4	Proprietary	1.35 lb./A	1,2,3,4,5,6,7	-
5	Proprietary	1.60 lb./A	1,2,3,4,5,6,7	-
6	Proprietary	1.80 lb./A	1,2,3,4,5,6,7	-
7	Proprietary	2.25 lb./A	1,2,3,4,5,6,7	-
8	Proprietary	2.70 lb./A	1,2,3,4,5,6,7	-
9	Reason Polyram DF Bond Polyram DF	4.0 fl.oz./A 1.5 lb./A 0.1%v/v 2.0 lb./A	1,3,5,7 1,3,5,7 1,3,5,7 2,4,6	-
10	Reason Dithane Rainshield Bond Dithane Rainshield	4.0 fl.oz./A 1.5 lb./A 0.1%v/v 2.0 lb./A	1,3,5,7 1,3,5,7 1,3,5,7 2,4,6	-
11	Reason Bravo 720 Bond Bravo 720	4.0 fl.oz./A 1.0 pt./A 0.1%v/v 1.5 pt./A	1,3,5,7 1,3,5,7 1,3,5,7 2,4,6	-
12	Headline Endura Dithane Rainshield	6.1 fl.oz./A 2.5 oz./A 2.0 lb./A	1 3 5	$33.04
13	Quadris Bravo WS	6.1 fl.oz./A 1.5 pt./A	1 4	$22.00
14	Headline Endura	6.1 fl.oz./A 2.5 oz./A	1 4	$27.54
15	Headline Dithane Rainshield Endura	6.1 fl.oz./A 2.0 lb./A 2.5 oz./A	1 3 5	$33.04
16	Endura Headline	2.5 oz./A 6.1 fl.oz./A	1 4	$27.54
17	Bravo WS Quadris Dithane Rainshield	1.5 pt./A 6.1 fl.oz./A 2.0 lb./A	4 5 6	$27.50
18	Dithane Rainshield Amistar	2.0 lb./A 4.0 oz./A	4,6 5	$35.56
19	Amistar Bravo WS Endura	4.0 oz./A 1.5 pt./A 4.5 oz./A	4 5 6	$61.82
20	Dithane Rainshield Bravo WS	2.0 lb./A 1.5 pt./A	4,6 5	$20.13

[a] Schedule for applying treatments on a weekly basis, schedule started on July 6 (i.e. 1 = week 1, 2 = week 2).
[b] These prices do not include application costs.

Table 2. Effect of fungicide programs on the incidence of early blight in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2005; No Late Blight occurred within the trial.

	Percent Leaves Infected				
Treatment	August 2	August 10	August 17	August 27	AUDPC[a]
1	6.0	29.6	88.2	99.8	782.5 a
2	2.5	7.1	48.3	80.4	484.2 bcd
3	1.2	3.6	17.4	44.6	233.6 jk
4	1.0	3.9	15.4	43.8	224.3 k
5	1.2	4.0	16.3	42.1	222.5 k
6	1.8	12.7	58.8	78.8	532.0 b
7	1.3	5.8	23.3	62.1	323.7 hij
8	1.2	7.3	27.1	63.3	346.2 f-i
9	1.7	6.9	24.2	54.2	304.2 h-k
10	1.5	5.8	29.3	51.3	307.4 h-k
11	1.0	4.7	15.3	42.1	220.8 k
12	1.2	3.8	38.6	75.8	418.0 d-g
13	2.3	9.2	52.5	82.9	514.2 bc
14	1.0	5.7	36.3	77.5	421.5 c-g
15	1.2	3.8	17.3	45.0	235.1 jk
16	1.3	4.4	45.0	82.8	467.5 b-e
17	3.7	12.0	43.3	62.1	423.8 c-f
18	2.5	12.2	26.3	52.9	328.7 ghi
19	2.0	9.7	24.3	38.8	261.6 ijk
20	3.3	14.2	31.0	62.9	389.9 e-h
LSD(P=0.05)	0.91	3.879	15.26	12.93	93.23

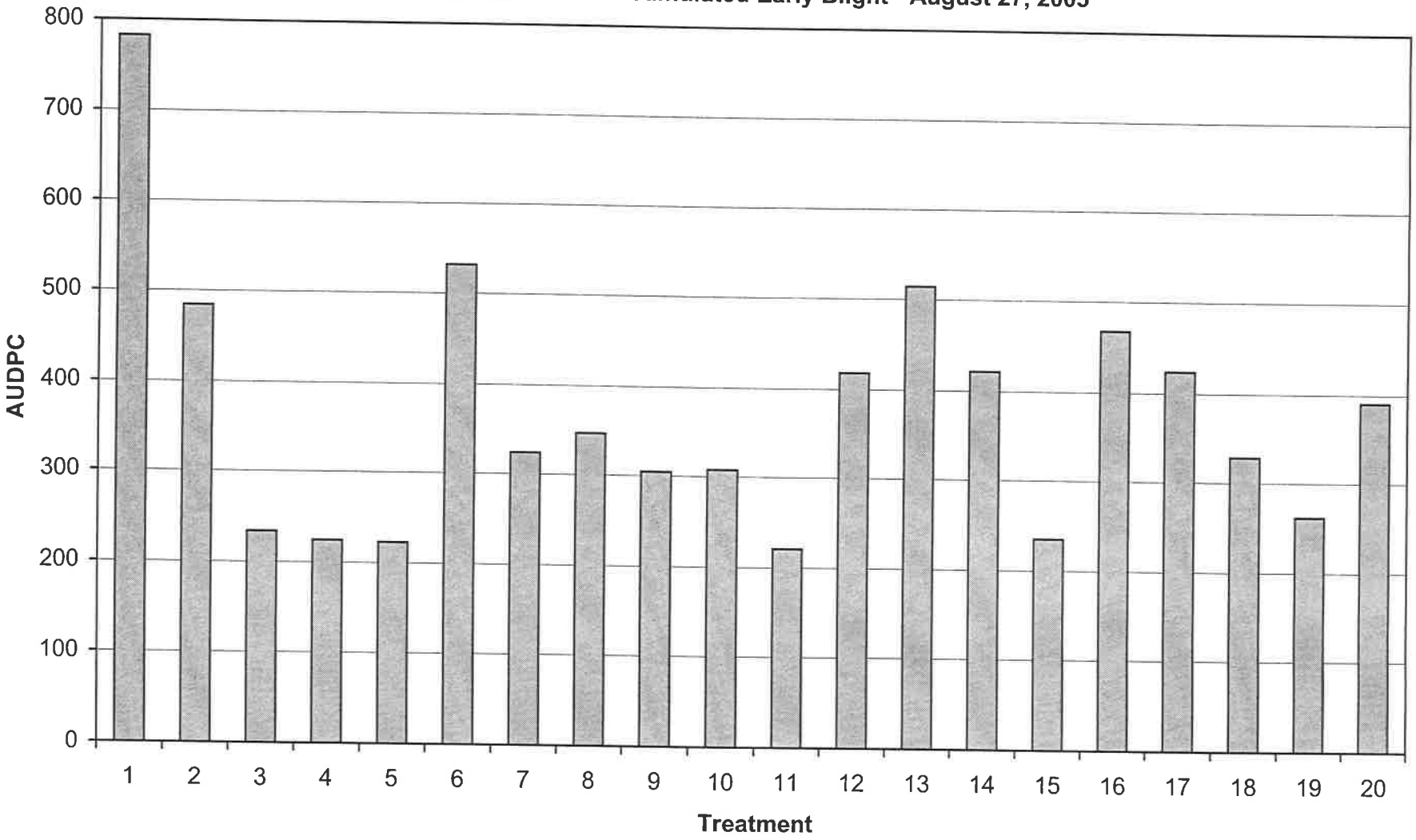
[a]AUDPC is the Area Under the Disease Progress Curve.
Means followed by the same letters are not significantly different at P=0.05 for AUDPC.

Table 3. Effect of fungicide programs on tuber yield and quality in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2005.

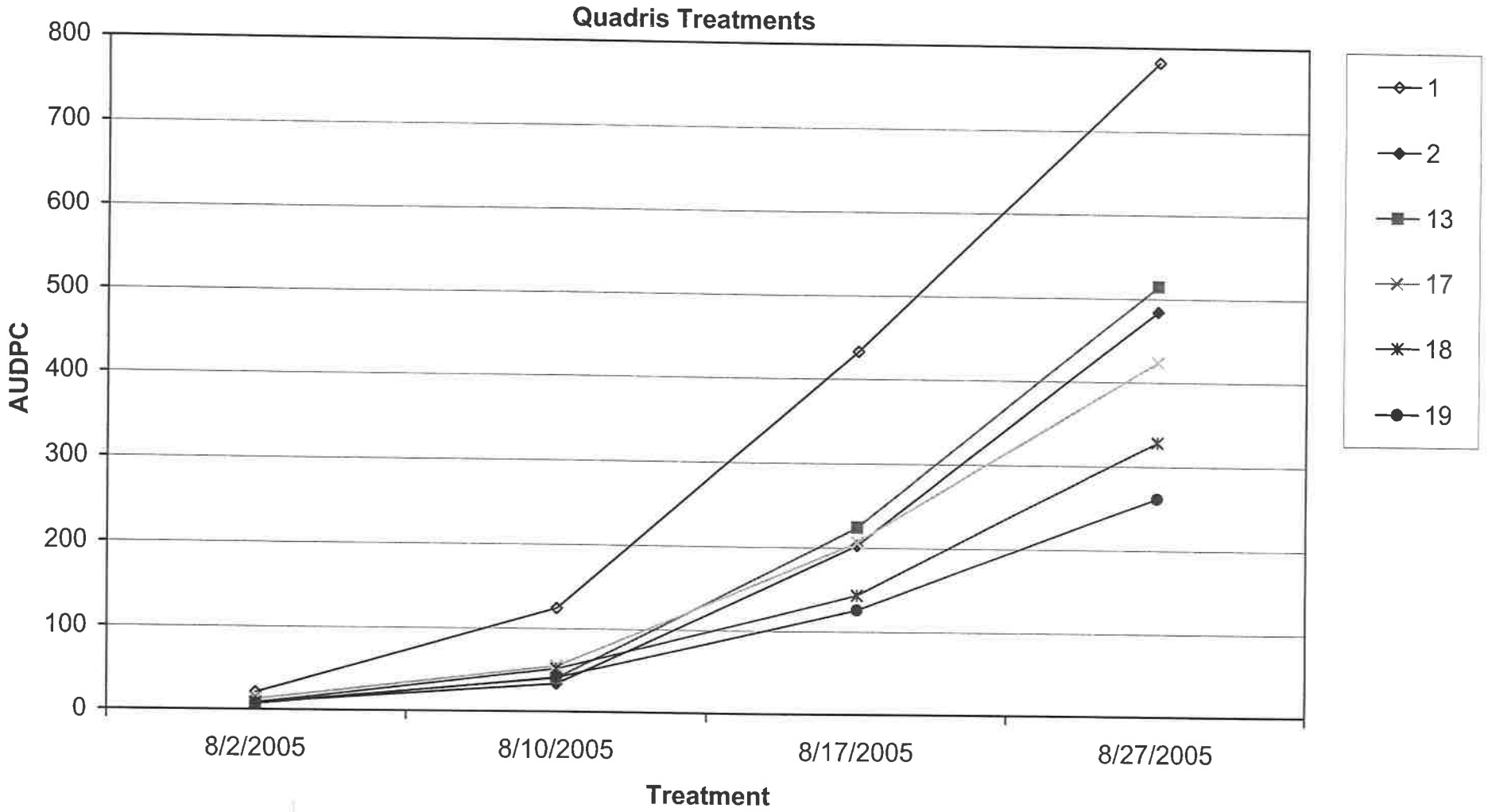
	Percent[a]				
Treatment	< 4 oz.	4-10 oz.	> 10 oz.	Culls	Cwt/A[b]
1	7.0 ab	52.2	33.7 def	7.2	389.6
2	6.0 bcd	47.7	38.6 a-e	7.8	414.8
3	5.6 bcd	51.7	35.7 c-f	7.1	398.1
4	5.2 bcd	46.7	40.0 a-e	8.1	425.8
5	5.8 bcd	43.5	45.4 a	5.4	420.0
6	6.2 bc	51.0	36.0 b-f	6.8	431.8
7	9.0 a	50.5	32.4 ef	8.2	386.2
8	5.1 bcd	47.3	39.9 a-e	7.7	400.0
9	5.1 bcd	48.4	37.3 b-f	9.2	393.8
10	5.0 bcd	45.8	43.6 abc	5.7	448.0
11	5.0 bcd	49.1	38.8 a-e	7.3	394.1
12	4.9 bcd	48.2	38.8 a-e	8.0	425.0
13	5.7 bcd	45.9	41.5 a-d	6.9	427.8
14	4.7 bcd	50.9	38.4 a-f	6.0	381.7
15	4.3 cd	46.2	37.6 a-f	11.9	369.7
16	6.2 bc	56.0	30.6 f	7.3	402.9
17	5.8 bcd	44.6	43.8 ab	5.8	428.9
18	3.7 d	47.3	39.7 a-e	9.3	403.3
19	3.8 d	46.6	41.6 a-d	8.0	446.4
20	5.6 bcd	48.3	36.4 b-f	9.7	403.3
LSD(P=0.05)	2.34	NS	7.95	NS	NS

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

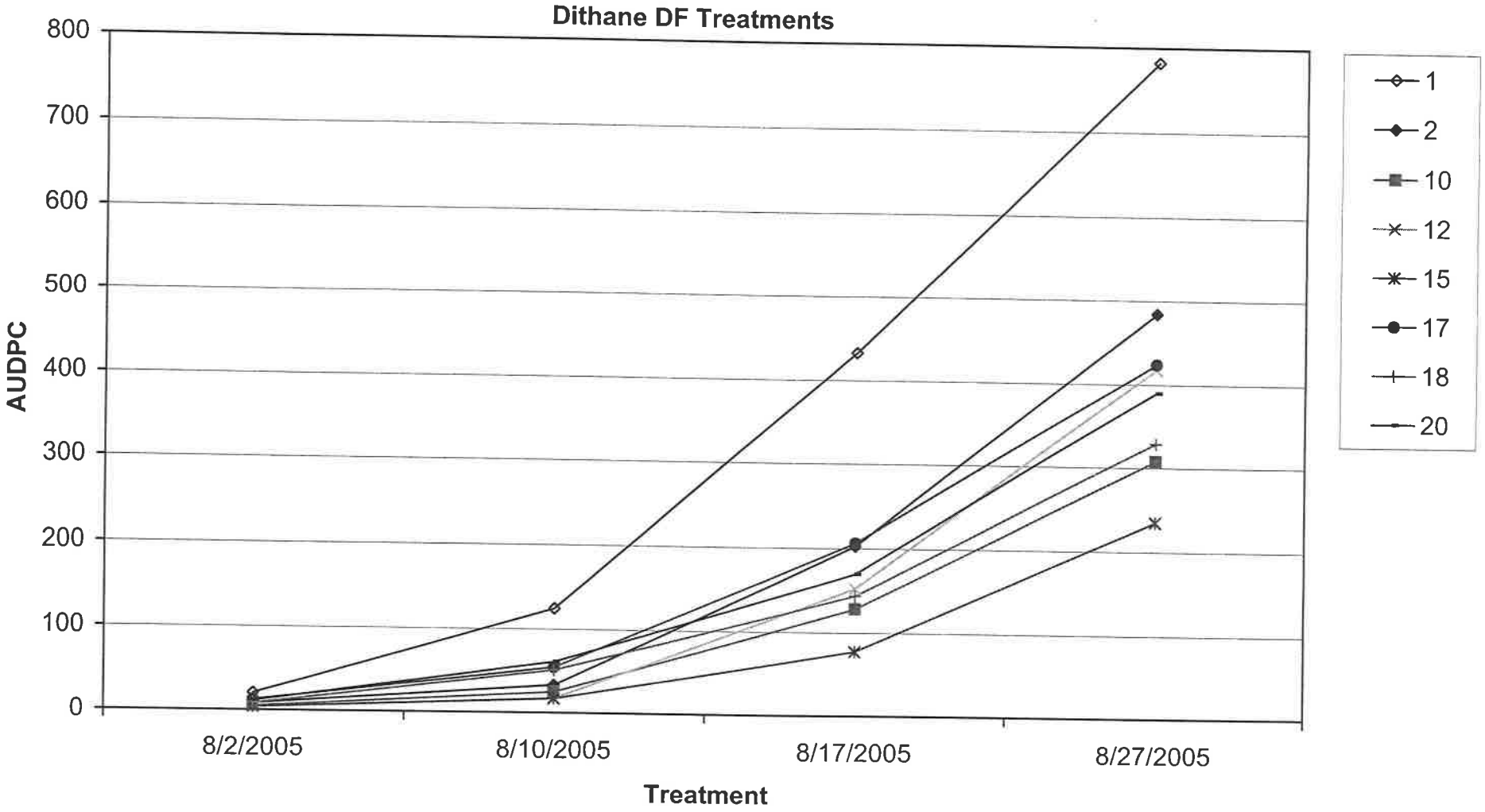
Area Under the Disease Progress Curve for Early Blight
2005 Fungicide Trial, Colorado State University
San Luis Valley Research Center, Center, CO
Total Amount of Accumulated Early Blight - August 27, 2005



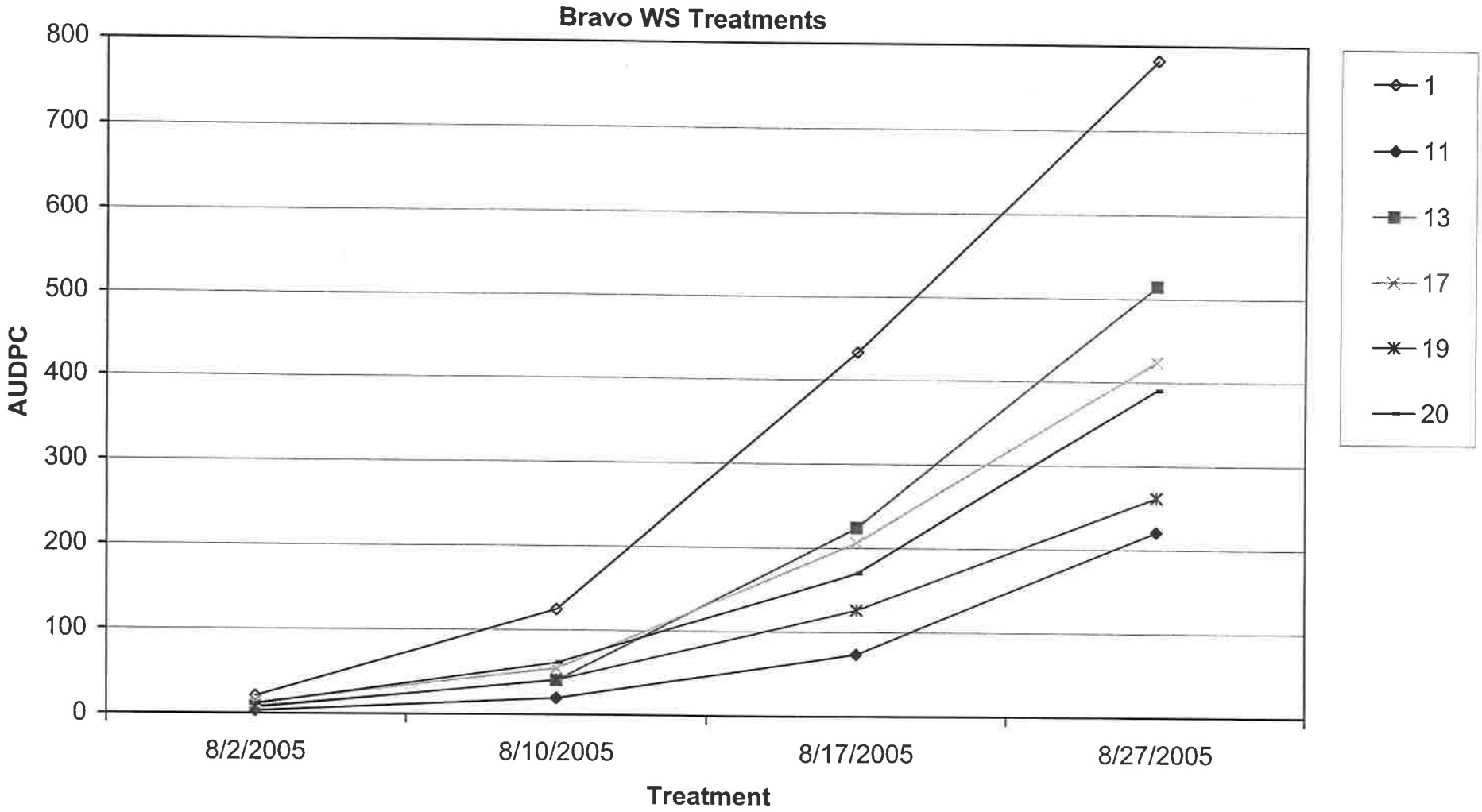
Area Under Disease Progress Curve for Early Blight
2005 Fungicide Trial, Colorado State University
San Luis Valley Research Center, Center, CO



Area Under Disease Progress Curve for Early Blight
2005 Fungicide Trial, Colorado State University
San Luis Valley Research Center, Center, CO



Area Under Disease Progress Curve for Early Blight
2005 Fungicide Trial, Colorado State University
San Luis Valley Research Center, Center, CO



Area Under Disease Progress Curve for Early Blight
2005 Fungicide Trial, Colorado State University
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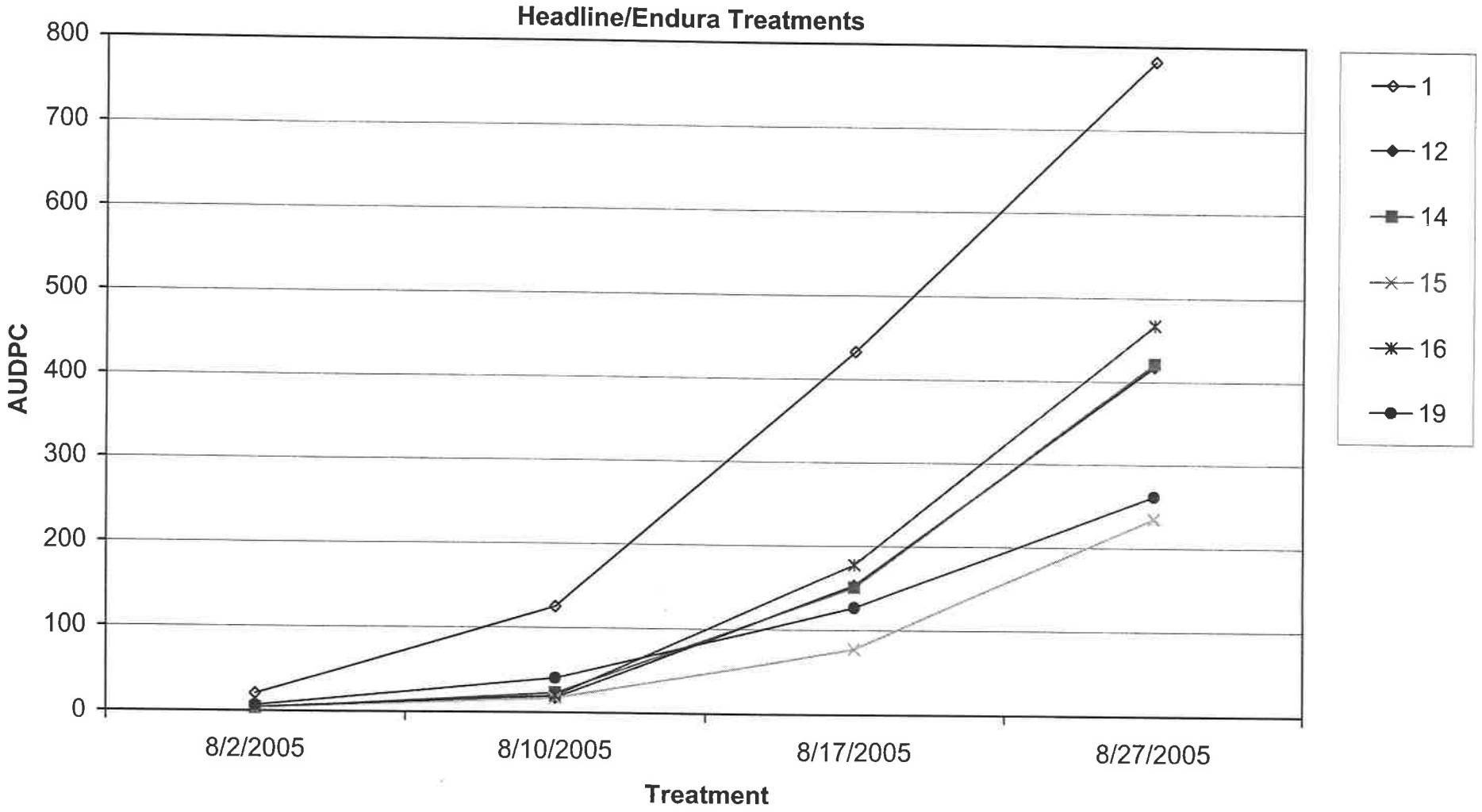
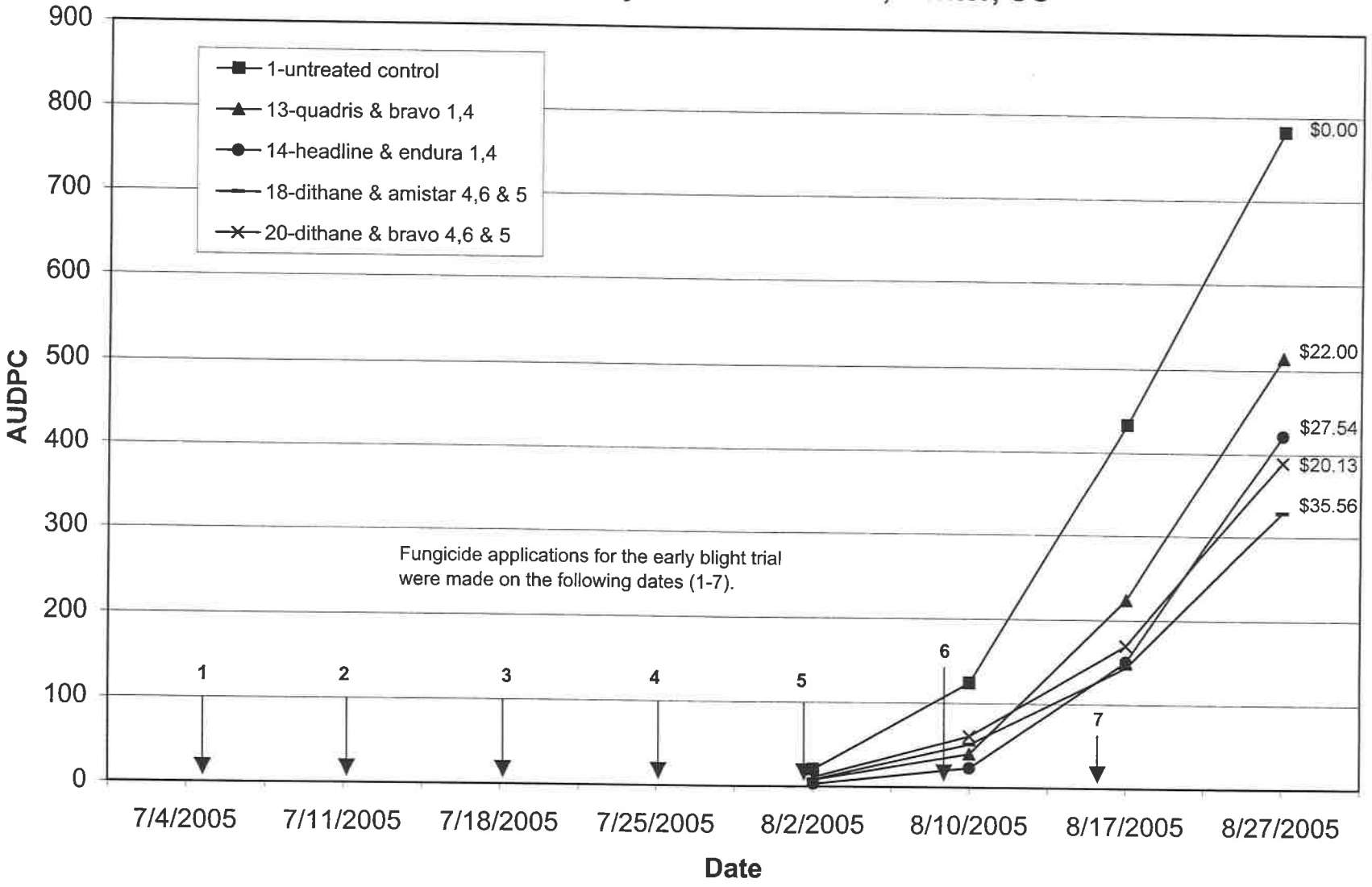


Area Under Disease Progress Curve for Early Blight
2005 Fungicide Trial, Colorado State University
San Luis Valley Research Center, Center, CO



SLV Late Blight Forecasting

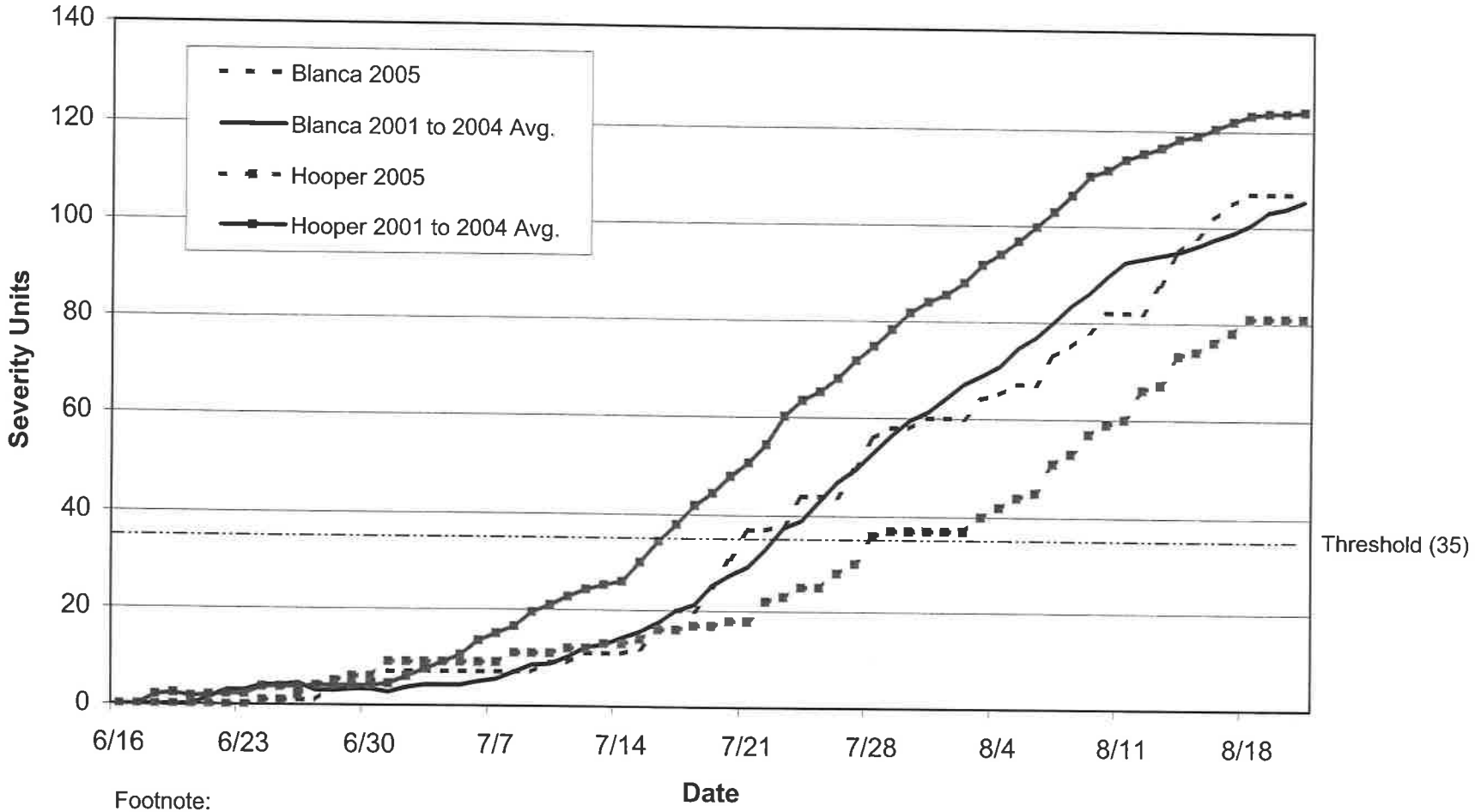
Over the last five years weather stations have been positioned at three locations around the San Luis Valley (Blanca, Hooper, & Sargent) in order to determine late blight severity units. This was continued in 2005 in order to determine the potential risk we have for late blight here in the valley.

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

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

Potato Late Blight Fry Units, San Luis Valley, Colorado, 2005

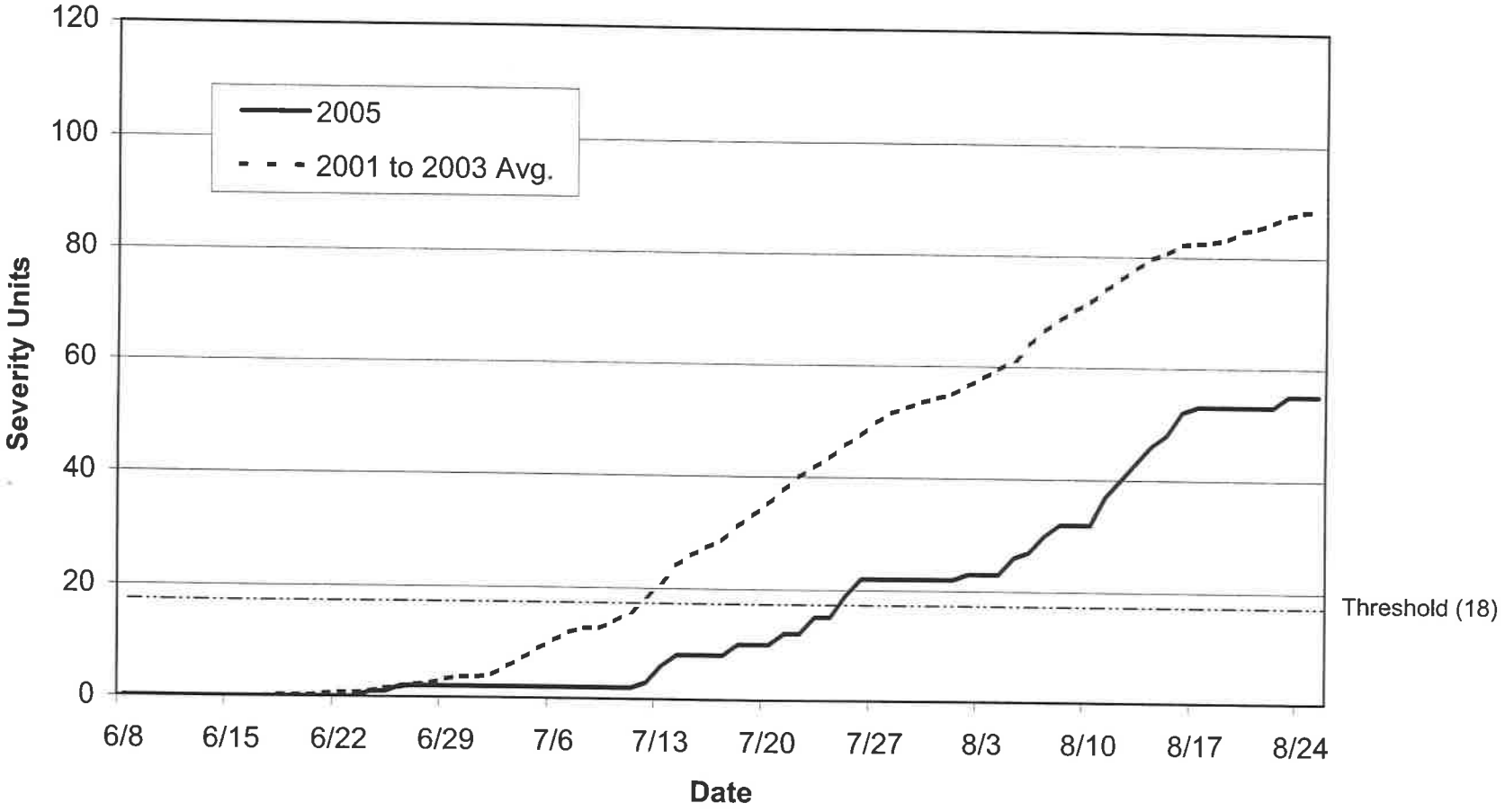
Moderate Susceptible Varieties



Footnote:

- The Fry Late Blight model was used to calculate the severity units.
- The Hooper weather station was set up on June 8 for the 2005 growing season.
- The Blanca weather station was set up on June 17 for the 2005 growing season.

Potato Late Blight Severity Values - Wallin Model,
San Luis Valley, Colorado, Sargent Site, 2005



Footnote:
-The Sargent weather station was set up on June 7 for the 2005 growing season.

Pink Rot Trial

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

EVALUATION OF REMEDIER FOR CONTROL OF PINK ROT ON POTATO, 2005

Researchers: Rob Davidson, Richard T. Zink 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.

Objective: To evaluate the efficacy of various fungicides in controlling pink rot in potato.

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

Treatments:

1. Control, no treatment
2. Remidier @ 2.5 kg/ha (Applied to soil one week prior to planting and applied 2 hrs prior to crop cultivation on May 31, 2005) - Active Ingredients in Remedier include *Tricoderma harzianum* strain ICC012 and *Tricoderma viride* strain ICC080.
3. Ridomil Gold 4EC @ 3.2 fl.oz./A (2 foliar applications – One at flowering on July 21 and one 14 days later on August 5)

Planted: May 16, 2005

Plot Design: Randomized complete block

Plot Size: 2 - 20 foot rows per treatment per replication

Plant Spacing: 12 inches

Row Spacing: 34 inches

Replications: six

Irrigation: Solid set sprinkler, rate based on ET

Fertilizer: 80N-60P-40K-25S-2.5Z, preplant, 20N through sprinkler after tuber set

Herbicide: Dual Magnum, 1.5 pt./A + Matrix, 1.5 oz./A

Insecticide: None

Vine Killer: Beat vines on September 10, 2005

Harvested: October 14, 2005

DATA

Disease: Mean percent of tubers with pink rot at harvest per treatment per replication. The plot received double the required amount of water over the course of a month (from August 1st until vine kill) to induce pink rot.

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

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

Table 1. Effects of products, applied at planting and in season for control of pink rot, on tuber yield and quality in the cultivar Russet Norkotah Selection 8, San Luis Valley, Colorado, 2005.

Program	Treatment			Percent[a]					
	Products	Rate	Application Schedule	< 4 oz.	4-10 oz.	> 10 oz.	Culls	Cwt/A[b]	% rotton[c]
1.	Control, no treatment	Control, no treatment	-	6.1	60.3	26.7	6.8	394.7	0.06 b
2.	Remidier Remidier	2.5 kg/ha on soil 2.5 kg/ha	May 10, 2005 May 31, 2005	7.9	59.6	25.2	7.3	395.1	0.87 a
3.	Ridomil Gold 4EC	3.2 fl.oz./A	July 25 & August 5, 2005	8.4	60.4	22.7	8.4	395.1	0.16 b
LSD(P=0.05)				NS	NS	NS	NS	NS	0.60

[a] Based on tuber weight in pounds, mean of six replications.
[b] Total yield expressed as hundred weight per acre, 2-20 foot rows per treatment per replication, mean of six replications.
[c] Mean percent of tubers with pink rot at harvest per treatment per replication.

Powdery Scab Trials

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

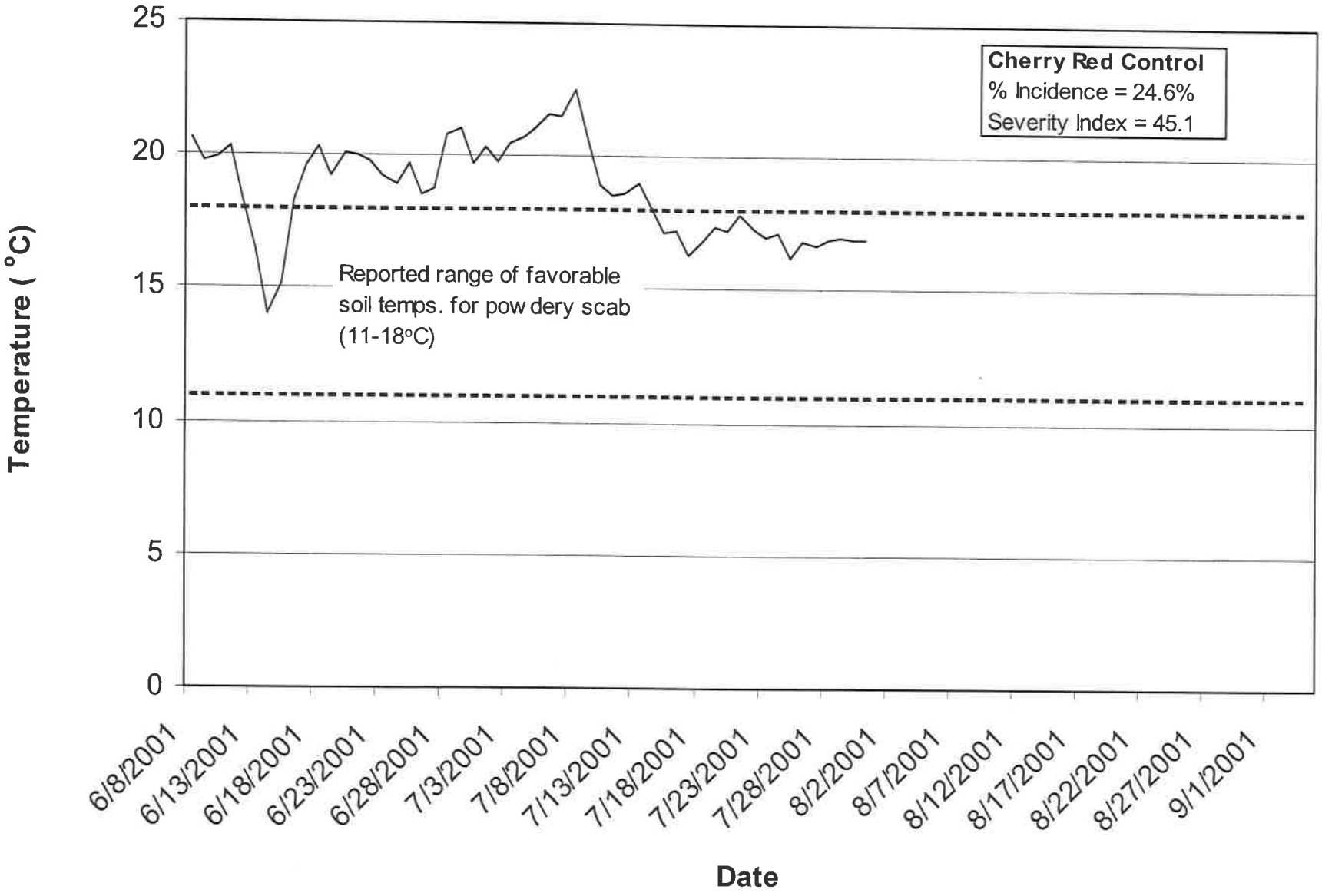
Results from this project indicate that as the environment in many other potato regions is moving away from critical soil temperatures for powdery scab infection and symptom development, the soil temperatures in the SLV are becoming more conducive for infection. Rotating susceptible cultivars with cultivars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

Soil temperatures and soil moistures were taken at varying depths in order to get a better understanding of field soil dynamics and to determine how powdery scab development in the SLV is affected by these soil parameters.

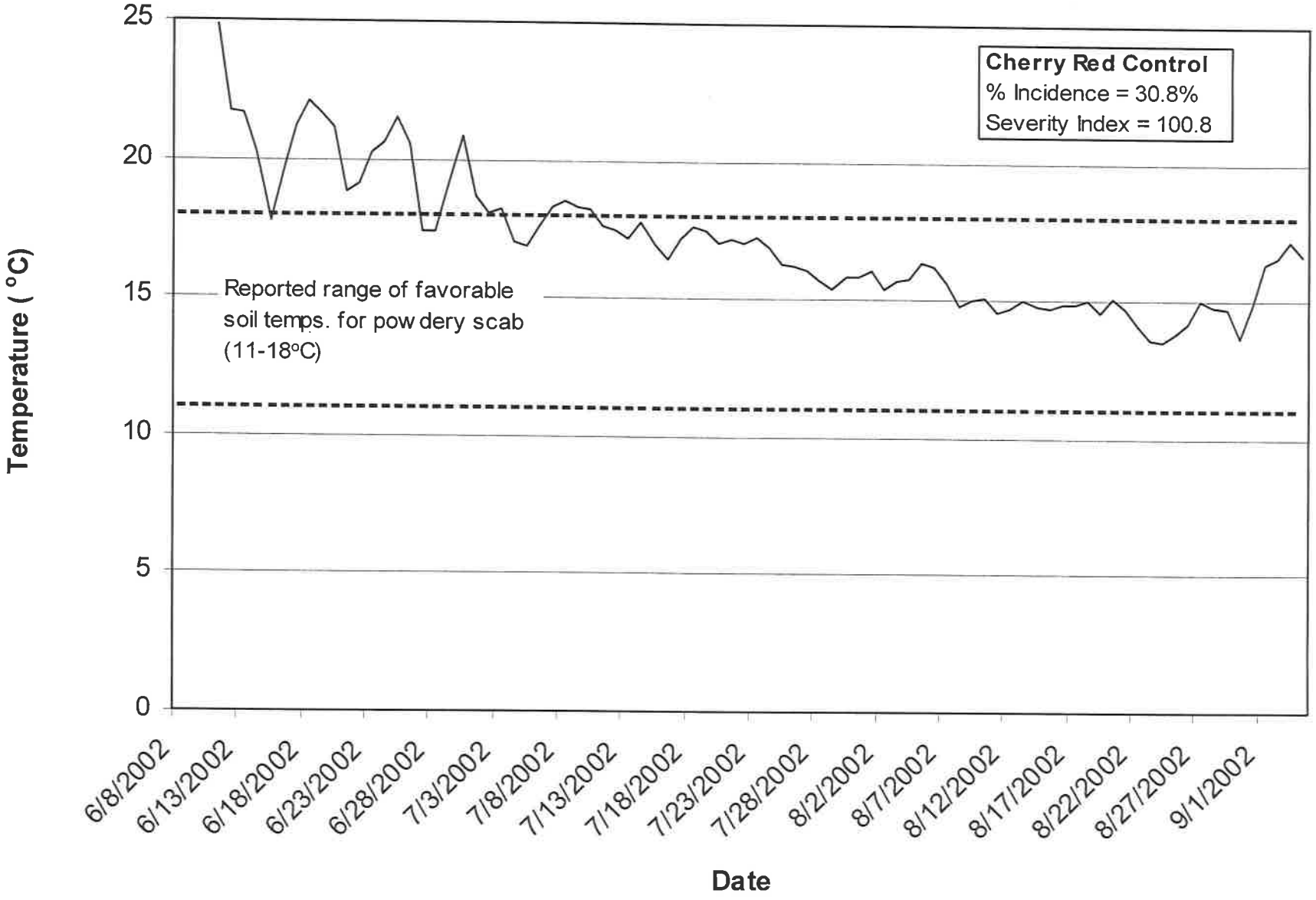
Russets with skin mutations (i.e. lacking a russet skin) were evaluated for powdery scab lesion severity. It was determined that development of a russet skin provides resistance to lesion development; presumably due to either impeding infection or the actual russet development.

Soil temperature readings taken at three soil depths (4, 8, & 12 in.) and soil moisture readings at two soil depths (4 & 12 in.) give a better understanding of field soil dynamics and help to determine how powdery scab development in the SLV is affected by these two soil parameters.

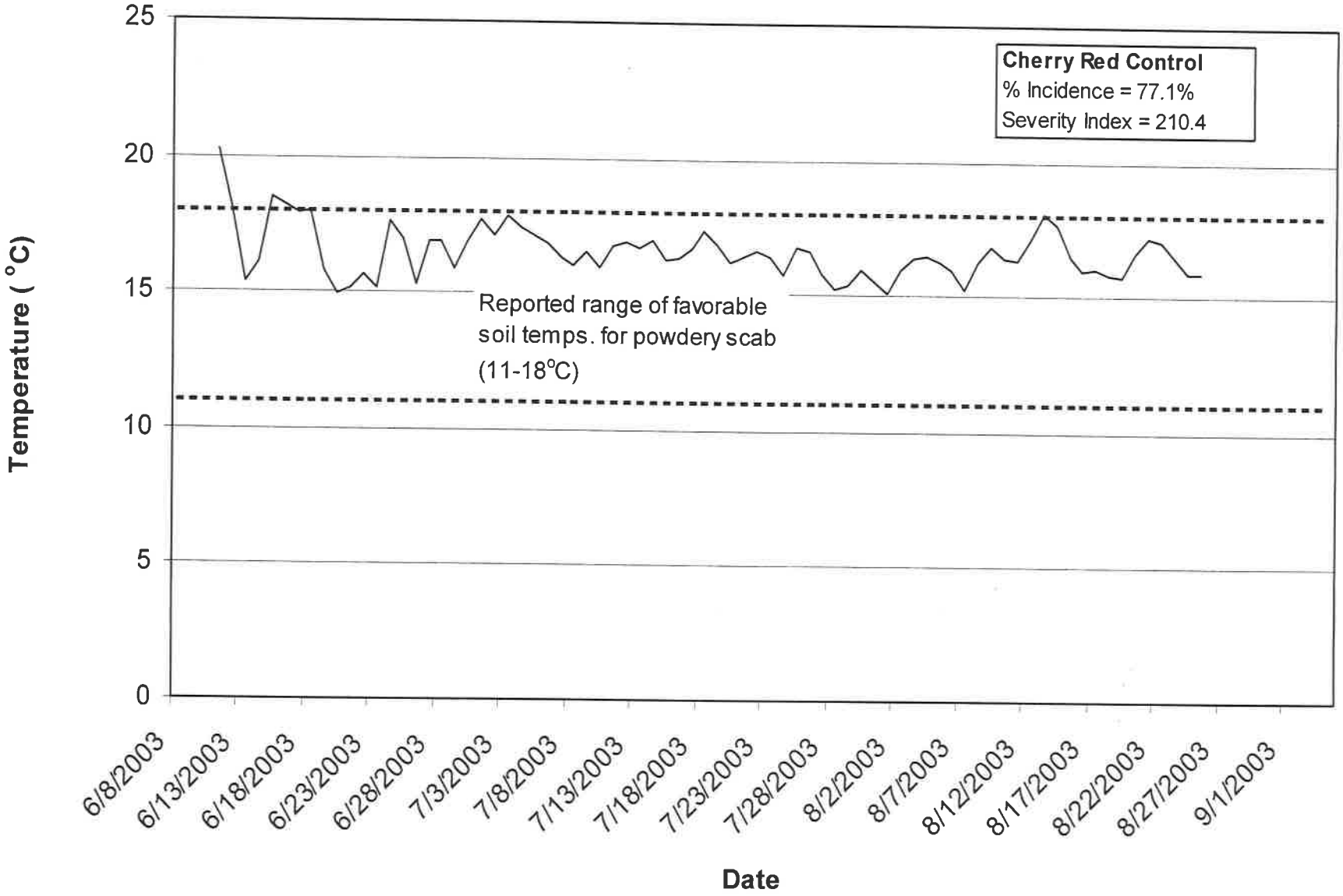
Avg. soil temperature readings at 8" under potato plant canopy, powdery scab trial, San Luis Valley, Colorado, 2001



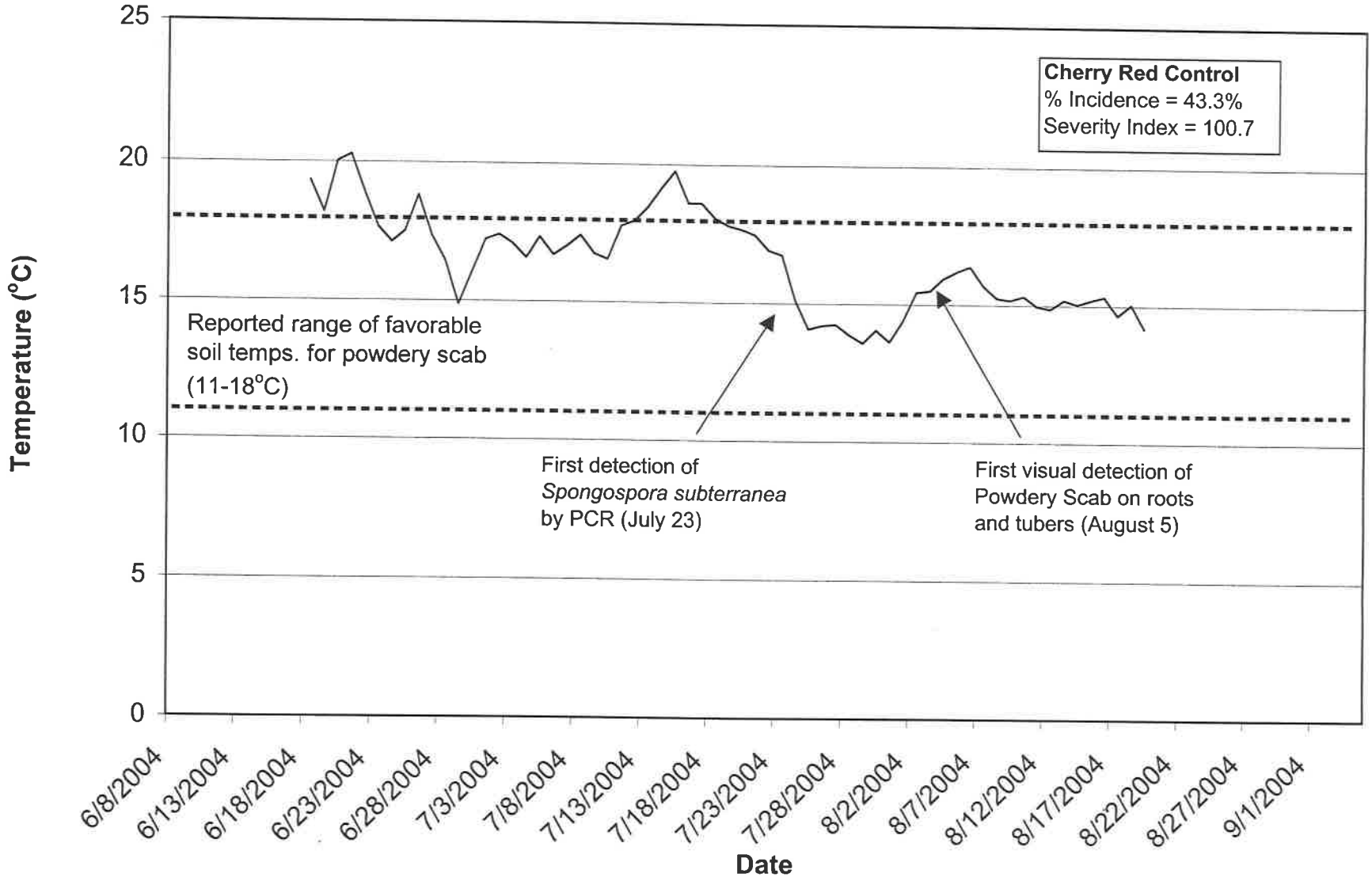
Avg. soil temperature readings at 8" under potato plant canopy, powdery scab trial, San Luis Valley, Colorado, 2002



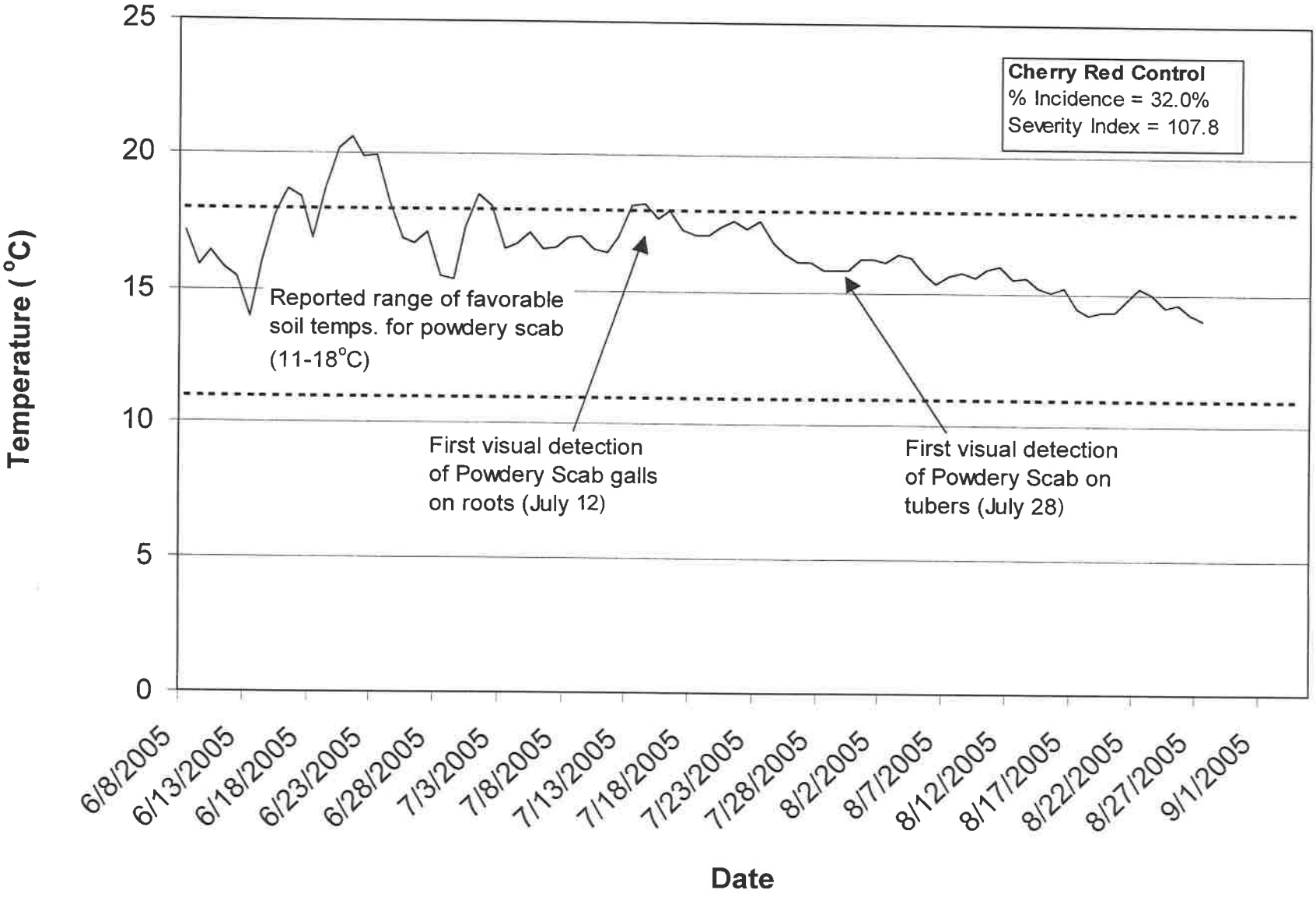
Avg. soil temperature readings at 8" under potato plant canopy, powdery scab trial, San Luis Valley, Colorado, 2003



Avg. soil temperature readings at 8" under potato plant canopy, powdery scab trial, San Luis Valley, Coloardo, 2004



Avg. soil temperature readings at 8" under potato plant canopy, powdery scab trial, San Luis Valley, Colorado, 2005



2005 EVALUATION OF FUNGICIDES APPLIED AT PLANTING FOR CONTROL OF POWDERY SCAB ON POTATO

Researchers: Robert Davidson, Richard Zink and Andrew Houser, Colorado State University

Location: Off-station trial, San Luis Valley, CO

Cultivar: Cherry Red, cut seed, 2-4 oz.

Objective: To evaluate the efficacy of various fungicide treatments in controlling powdery scab on potato.

Application: In-furrow treatments were applied using an R & D CO_2 charged backpack sprayer at 35 PSI, with one XR 8002VS nozzle, at 10 gallons/acre. On-seed treatments were applied directly to whole seed and planted within twenty-four hours.

Treatments:

1. Control, no treatment
2. Omega @ 1.5 pt./A, In-furrow
3. Remedier @ 2.5 kg/ha, In-furrow
4. Moncut 70DF @ 1.0 lb./A, In-furrow
5. Moncut 70DF @ 1.5 lb./A, In-furrow
6. Moncut 70DF @ 1.0 lb./A, One In-furrow and one foliar application
7. Moncut 70DF @ 1.0 lb./A, Foliar

Planted: May 17, 2005
Plot Design: Randomized
Plot Size: 2 - 15 foot rows per treatment per replication
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Three
Irrigation: Center pivot sprinkler, rate based on ET
Fertilizer: 0N-0P-210K-0S pre-plant, 70N-100P-0K-22S-0.5Cu-1.0Zn banded, 102N + 18S in-season
Herbicide: Eptam @ 4.5 pt./A + Sencor @ 4.0 oz./A, applied on May 24, 2005
Insecticide: Permethrin @ 6.5 oz./A + Vydate @ 2.1 pt./A
Fungicide: Penncozeb @ 2.0 lbs/A + Amistar @ 2.0 oz./A + Bravo Ultrex @ 1.17 lbs/A + AgriTin @ 3.8 oz./A
Vine Killer: Chopped vines on September 13, 2005
Harvested: September 27, 2005

DATA

Disease: Mean percent of the number of tubers showing >10 powdery scab lesions at harvest.

Yield: 2-15 foot rows per treatment per replication, total yield expressed as cwt/A.

Grade: By hand, percent tubers by weight in pounds < 4 oz., 4-12 oz., > 12 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, 2005

Treatment	Tuber symptoms			Root Gall Rating[d]	Est. total cost/A[e]
	Percent Incidence[a]	Percent Healthy[b]	Severity Index[c]		
1. Control	32.00 a	68.00	107.83	3.0	-
2. Omega @ 1.5 pt./A, in-furrow	14.60 b	85.40	43.73	2.0	$77.50
3. Remedier @ 2.5 kg/ha, in-furrow	36.03 a	63.97	122.47	2.0	-
4. Moncut 70DF @ 1.0 lb./A, in-furrow	32.03 a	67.97	96.07	3.0	$29.95
5. Moncut 70DF @ 1.5 lb./A, in-furrow	32.40 a	67.60	109.50	3.0	$44.93
6. Moncut 70DF @ 1.0 lb./A, one In-furrow and one foliar application	30.67 a	69.33	115.00	3.5	$59.90
7. Moncut 70DF @ 1.0 lb./A, foliar	32.17 a	67.83	96.47	1.5	$29.95
LSD(P=0.05)	10.86		NS	NS	-

[a] Percent incidence = mean percent of the total number of 4-12 oz. tubers with one or more powdery scab lesion at harvest. Mean of three replications.
[b] Percent healthy = mean percent of the total number of 4-12 oz. tubers with zero powdery scab lesions at harvest. Mean of three replications.
[c] Severity Index = mean percent of the number of affected 4-12 oz. tubers/treatment/replication multiplied by the severity of the lesions, where 1 = very little or no disease and 5 = heavily infested.
[d] Root Gall Rating = mean rating of plants infected with powdery scab root galls, where 0 = no root galls and 4 = extensive root galls.
[e] These prices do not include application costs.
Means followed by the same letter are not significantly different at P=0.05.

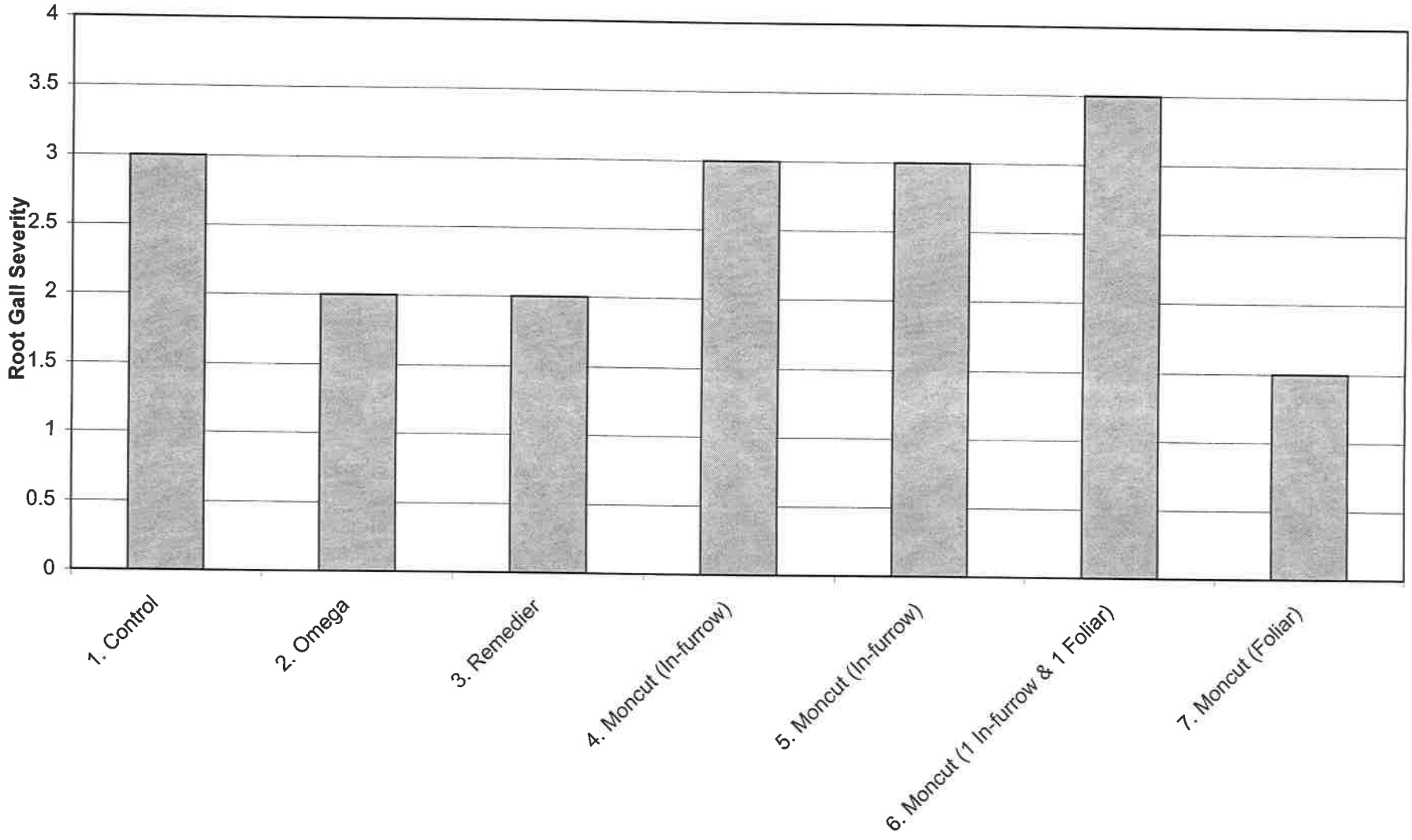
Robert D. Davidson, Associate Professor, Colorado State University

Table 2. Evaluation of fungicide programs on tuber yield in the cultivar Cherry Red, San Luis Valley, Colorado, 2005

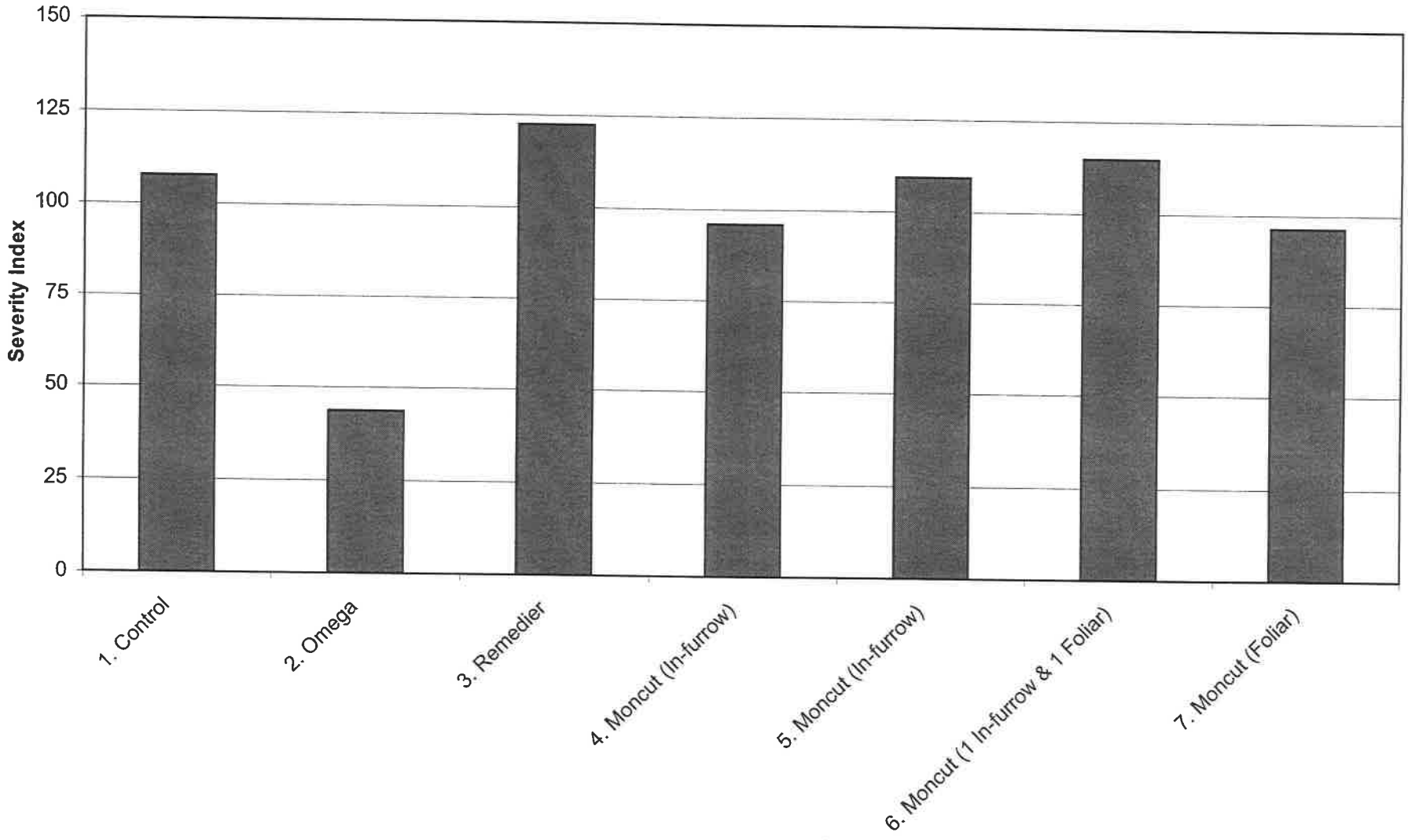
	Percent[a]			
Treatment	< 4 oz.	4-12 oz.	> 12 oz.	Cwt/A[b]
1. Control	18.2	70.5	11.3	514.0 c
2. Omega @ 1.5 pt./A, in-furrow	11.9	67.7	20.4	608.8 ab
3. Remedier @ 2.5 kg/ha, in-furrow	12.1	68.1	19.8	629.6 a
4. Moncut 70DF @ 1.0 lb./A, in-furrow	15.7	67.5	16.8	566.7 b
5. Moncut 70DF @ 1.5 lb./A, in-furrow	11.5	71.0	17.5	608.6 ab
6. Moncut 70DF @ 1.0 lb./A, one In-furrow and one foliar application	16.7	69.5	13.8	590.8 a
7. Moncut 70DF @ 1.0 lb./A, foliar	16.5	68.2	15.4	630.0 a
LSD(P=0.05)	NS	NS	NS	46.12

[a] Based on tuber weight in pounds, mean of three replications.
[b] Total yield expressed as hundred weight per acre, 2-15 foot rows per treatment per replication, mean of three replications.

Evaluation of fungicides for control of powdery scab root galls
San Luis Valley, Colorado, 2005



Evaluation of fungicides for control of powdery scab
San Luis Valley, Colorado, 2005



Evaluation of Omega (fluazinam) fungicide for control of powdery scab lesions on the cultivar Cherry Red, San Luis Valley, CO (2002, 2003, 2005)

Year	Treatment	% Incidence	Severity Index	Yield (Cwt/A)
2005	1. Control	32.0 a	107.8 a	514.0
	2. Omega @ 1.5 pt./A	14.6 b	43.7 b	608.8
	LSD (p=0.05)	4.5	59.2	NS
2003	1. Control, no treatment	92.4 a	322.0 a	-
	2. Omega @ 1.5 pt./A (IF)	77.1 ab	210.4 ab	-
	3. Omega @ 3.0 pt./A (IF)	68.0 b	119.2 b	-
	LSD (p=0.05)	19.7	155.3	-
2002	1. Control, no treatment	30.8	100.8 a	-
	2. Omega @ 3.0 pt./A, In-furrow	12.5	23.3 b	-
	LSD (p=0.05)	NS	61.27	-

1.5 pt of Omega costs $77.51/A.

EVALUATION OF ADVANCED CLONES FOR SUSCEPTIBILITY TO POWDERY SCAB, 2005

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

Location: Off-station trial, San Luis Valley, CO

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

Clones:

1. ATLANTIC
2. SUPERIOR
3. RANGER RUSSET
4. RUSSET BURBANK
5. AF2211-9
6. AF2291-10
7. B1816-5
8. B1952-2
9. B1992-166
10. FREEDOM RUSSET
11. MEGACHIP
12. W2128-8
13. A8893-1
14. A93157-6LS
15. A9045-7
16. GEMSTAR RUSSET
17. CO94035-15RU
18. CO94165-3P/P
19. CO94183-1R/R
20. CO95086-8RU
21. CO95172-3RU
22. VC0967-2R/Y
23. VC1002-3W/Y
24. AC96052-1RU
25. CO96141-4W
26. CO94157-2W/Y
27. VC1123-2W/Y
28. VC1009-1W/Y
29. CO95051-7W
30. VALISA
31. VC1015-7R/Y
32. US689-89
33. CO93001-11RU
34. AC92009-4RU
35. NDC5281-2R
36. SNOW WHITE
37. CHERRY RED

Planted: May 16, 2004
Plot Design: Randomized
Plot Size: 1 - 10 foot row per treatment per replication
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Three
Irrigation: Center pivot sprinkler, rate based on ET
Fertilizer: 0N-0P-210K-0S pre-plant, 70N-100P-0K-22S-0.5Cu-1.0Zn banded, 102N + 18S in-season
Herbicide: Eptam @ 4.5 pt./A + Sencor @ 4.0 oz./A, applied on May 24, 2005
Insecticide: Permethrin @ 6.5 oz./A + Vydate @ 2.1 pt./A
Fungicide: Penncozeb @ 2.0 lbs/A + Amistar @ 2.0 oz./A + Bravo Ultrex @ 1.17 lbs/A + AgriTin @ 3.8 oz./A
Vine Killer: Chopped vines on September 13, 2005
Harvested: September 26 & 27, 2005

DATA

Disease: Galls on roots rated 0 to 4, 0 = none, 4 = heavily infected, readings taken on August 5.
Mean percent of the number of tubers 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.

Table 1. Evaluation of advanced clones for tuber susceptibility to powdery scab, San Luis Valley, Colorado, 2005.

Cultivar	Tuber symptoms				Root Gall Rating[b]
	Percent Incidence	Percent Healthy	Severity Index[a]	% Unmarketable	
Atlantic	45.0 ijk	55.0 cd	82.5 j-n	6.7 ghi	3.0 ab
Superior	45.8 ijk	54.2 cd	91.7 i-m	4.2 hi	3.0 ab
Ranger Russet	16.7 lmn	83.3 ab	16.7 no	0.0 i	0.0 f
Russet Burbank	0.0 n	100.0 a	0.0 o	0.0 i	1.0 def
AF2211-9	58.3 f-j	41.7 c-g	140.0 f-k	22.5 d-g	2.5 bc
AF2291-10	80.0 a-d	20.0 i-l	270.0 bc	44.2 bc	3.0 ab
B1816-5	75.0 b-f	25.0 g-k	205.8 c-f	23.3 d-g	3.0 ab
B1952-2	60.0 e-j	40.0 c-h	145.8 f-j	20.0 e-h	2.0 bcd
B1992-166	84.2 abc	15.8 jkl	252.5 c	35.0 cde	2.0 bcd
Freedom Russet	1.7 n	98.3 a	1.7 o	0.0 i	0.5 ef
Mega Chip	65.0 d-h	35.0 e-i	221.7 cde	35.8 cde	1.2 def
W2128-8	56.7 g-j	43.3 c-f	135.0 f-k	15.8 ghi	0.3 ef
A8893-1	1.7 n	98.3 a	1.7 o	0.0 i	4.0 a
A93157-6LS	0.8 n	99.2 a	0.8 o	0.0 i	1.5 cde
A9045-7	50.0 h-k	50.0 cde	100.0 h-l	8.3 ghi	1.5 cde
Gemstar Russet	1.7 n	98.3 a	1.7 o	0.0 i	2.0 bcd
CO94035-15RU	0.0 n	100.0 a	0.0 o	0.0 i	0.2 f
CO94165-3P/P	61.7 e-i	38.3 d-h	160.0 e-i	16.7 f-i	3.0 ab
CO94183-1R/R	97.5 a	2.5 l	358.3 a	61.7 a	3.0 ab
CO95086-8RU	0.8 n	99.2 a	0.8 o	0.0 i	2.0 bcd
CO95172-3RU	0.0 n	100.0 a	0.0 o	0.0 i	0.5 ef
VC0967-2R/Y	77.5 b-e	22.5 h-k	232.5 cd	38.3 cd	4.0 a
VC1002-3W/Y	52.5 g-j	47.5 c-f	125.0 g-l	21.7 d-g	3.0 ab
AC96052-1RU	0.0 n	100.0 a	0.0 o	0.0 i	1.0 def
CO96141-4W	70.0 c-g	30.0 f-j	165.8 d-h	23.3 d-g	0.5 ef
CO94157-2W/Y	20.8 lm	79.2 b	26.7 mno	0.0 i	3.0 ab
VC1123-2W/Y	89.2 ab	10.8 kl	331.7 ab	60.8 ab	4.0 a
VC1009-1W/Y	85.0 abc	15.0 jkl	255.0 c	33.3 c-f	2.0 bcd
CO95051-7W	55.0 g-j	45.0 c-f	110.0 g-l	0.0 i	1.0 def
Valisa	42.5 jk	57.5 c	70.8 k-o	2.5 i	2.0 bcd
VC1015-7R/Y	60.0 e-j	40.0 c-h	180.0 d-g	21.7 d-g	3.0 ab
US689-89	7.5 mn	92.5 ab	7.5 o	0.0 i	3.0 ab
CO93001-11RU	0.0 n	100.0 a	0.0 o	0.0 i	2.5 bc
AC92009-4RU	0.0 n	100.0 a	0.0 o	0.0 i	2.5 bc
NDC5281-2R	91.7 ab	8.3 kl	366.7 a	65.0 a	2.0 bcd
Snow White	53.3 g-j	46.7 c-f	53.3 l-o	0.0 i	1.0 def
Cherry Red[c]	32.0 kl	68.0 cd	107.8 h-l	-	3.0 ab
LSD(P=0.05)	25.00	25.00	84.18	17.77	1.20

[a] Severity Index = mean percent of the number of affected tubers, 50 tubers/treatment/replication multiplied by the severity of the lesions, where 1 = very little or no disease and 5 = heavily infested.

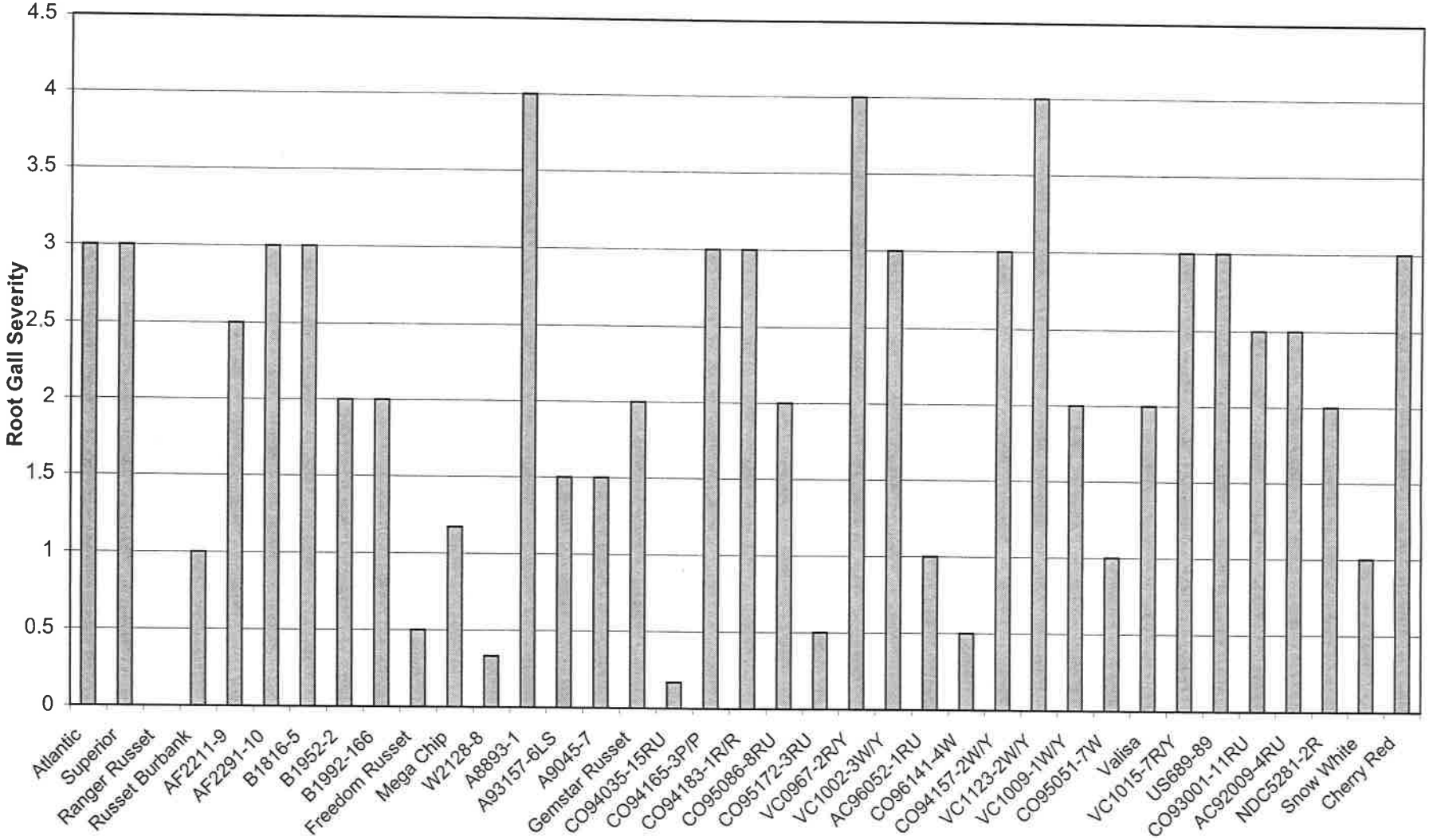
[b] Root Gall Rating = mean percent of plants infected with powdery scab root galls, where 0 = no root galls and 4 = extensive root galls.

[c] The % incidence and severity index values for Cherry Red were obtained from three replications. An average of 133 4-12oz tubers were rated per replication. Also, % unmarketable values were not recorded.

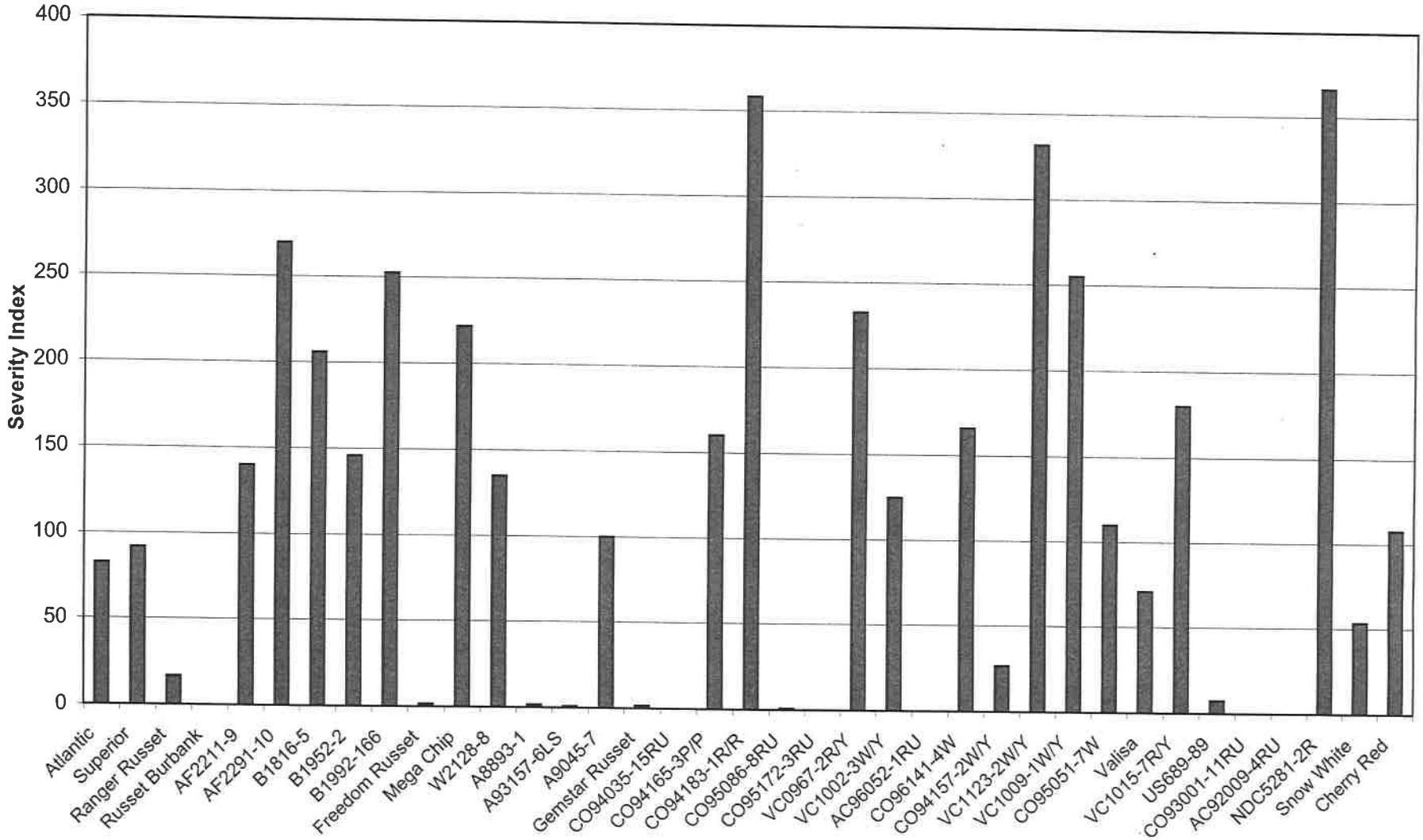
Means followed by the same letter are not significantly different at P=0.05.

Rob Davidson, Associate Professor, Colorado State University

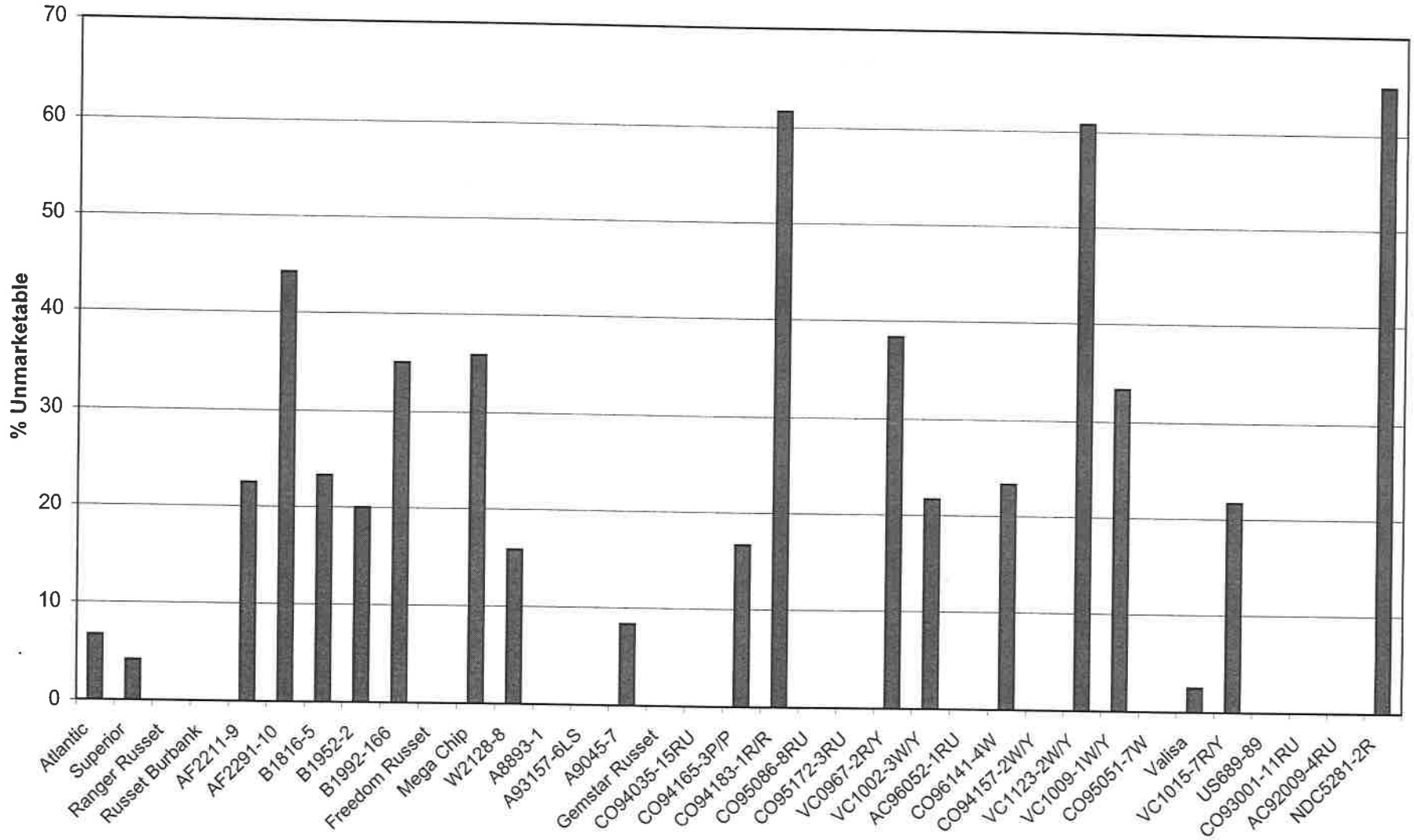
Evaluation of advanced clones for suseptibility to powdery scab root galls
San Luis Valley, Colorado, 2005



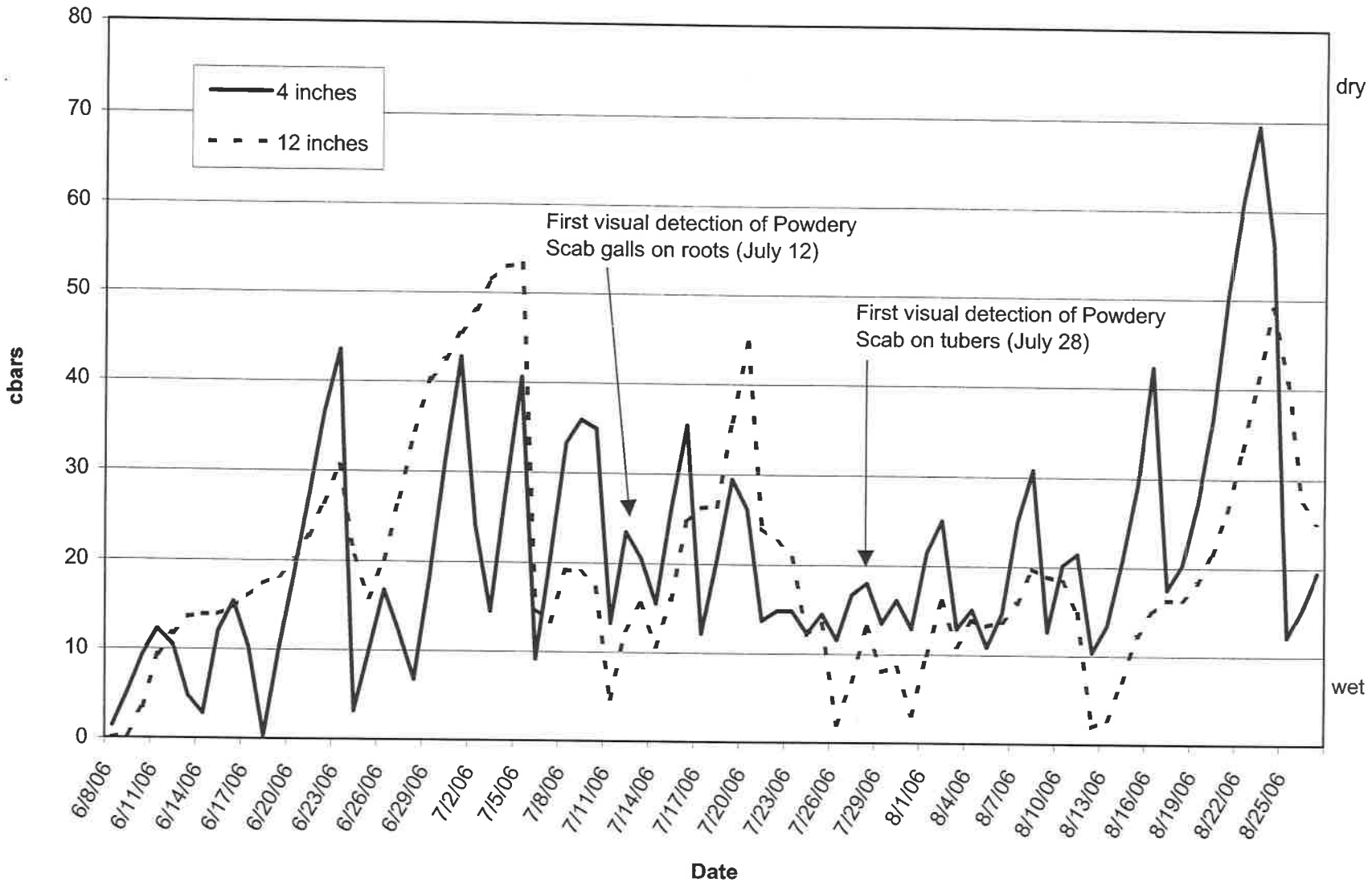
Evaluation of advanced clones for tuber susceptibility to powdery scab
San Luis Valley, Colorado, 2005



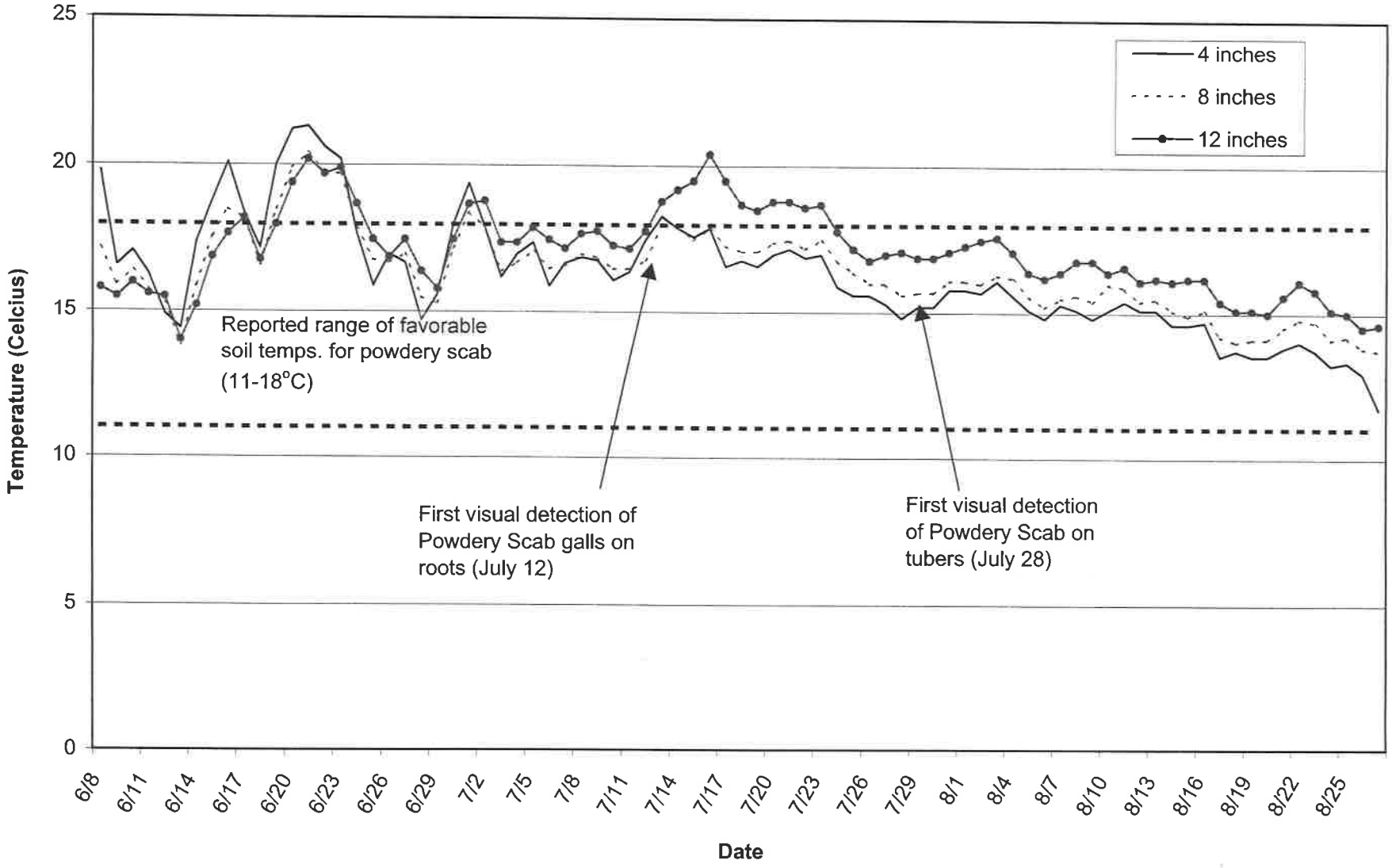
Evaluation of advanced clones for tuber susceptibility to powdery scab
San Luis Valley, Colorado, 2005



Soil Moisture Readings at 4 & 12 inches below soil surface, San Luis Valley, Coloardo, 2005

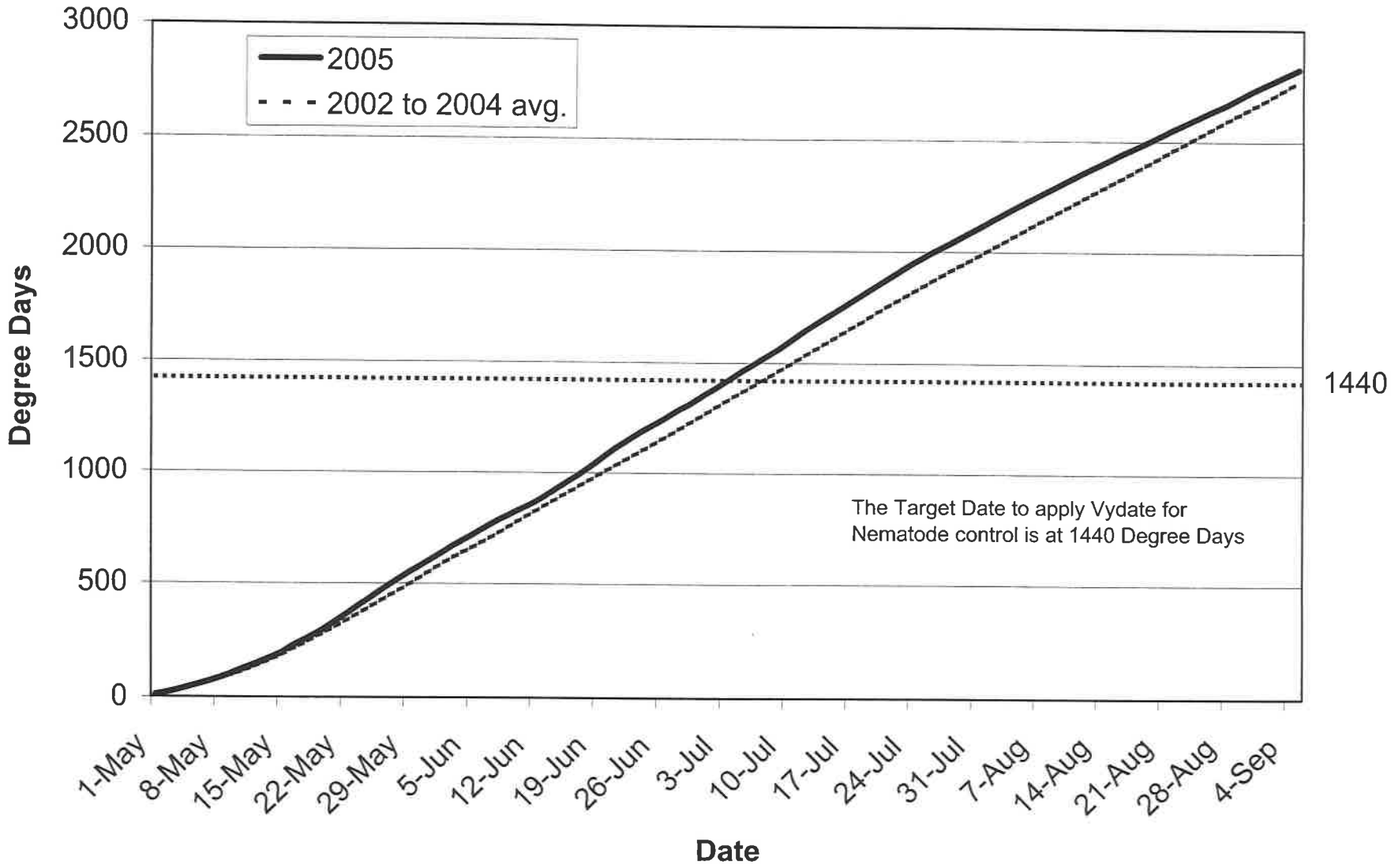


Avg. soil temperature at 4, 8, & 12 inches below soil surface, San Luis Valley, Coloardo, 2005



Root Knot Nematode Degree Days

Root Knot Nematode Degree Days for the San Luis Valley



Advanced Clone Disease Assessment Program

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

2005 Bacterial Ring Rot Evaluation

Location: NW Corner, Selter's Farm, 9 North, ½ East of SLVRC

Treatments: 64 clones/cultivars - Non-inoculated controls consisted of 21 seed pieces (fresh 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 or Five Cms plates (Strain #) exhibiting good bacterial growth, with some agar, were scraped into the Ringer's. After four treatments were dipped, a fourth and sometimes a fifth plate were added to the solution to finish out the last two treatments. Six clones were dipped per batch and the cold solution was not used for more than 45 minutes total time. Cms plates were 7-9 days old and inoculation took place on 4/29/05 and 5/2/05. 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: 5/9/05

Cultivars:

1. AC98350-2RU
2. ADTC9801-3P
3. CO98009-3RU
4. CO98012-5R
5. CO98067-7RU
6. CO98277-4W
7. CO98303-8W
8. CO98368-2RU
9. CO97215-2P/P
10. CO97216-3P/P
11. CO97222-1R/R
12. CO97227-2P/P
13. CO97274-2W/Y
14. ATC98444-1R/Y
15. ATC98495-1W/Y
16. ATC98509-1R/Y
17. ATC98515-1R/Y
18. AC97068-2RU
19. AC97097-14W
20. AC97521-1R/Y
21. CO97043-14W
22. CO97065-7W
23. CO97078-5R
24. CO97087-2RU
25. CO97090-4RU
26. CO97137-1W
27. CO97138-3RU
28. CO97138-7RU
29. CO97226-2R/R
30. CO97232-1R/Y
31. CO97232-2R/Y
32. CO97233-3R/Y
33. VC1123-2W/Y
34. A95074-6
35. A95109-1
36. AO96160-3
37. ATX91137-1RU
38. A95409-1
39. A96095-3
40. A96104-2
41. AO96164-1
42. AOA95154-1
43. AOA95155-7
44. MWTX2609-2RU
45. TXA549-1RU
46. COA96141-2C
47. COA96142-3C
48. A96741-1R
49. A96741-2R
50. Western Russet
51. WNC230-14RU
52. Ute Russet
53. Centennial Russet
54. Russet Burbank
55. Sangre
56. Russet Norkotah
57. FL 2072
58. FL 2048
59. FL 2101
60. FL 2061
61. FL 2086
62. FL 2085
63. FL 2049
64. FL 2095

Irrigation: Solid set sprinkler: rate based on ET and ppt. Total water for season was 18".

Fertilizer: 80:60:40:25(S):2.5:(Zn) with 10 N from irrigation water.
Total for season: 90:60:40:25(S):2.5(Zn).

Herbicide: Ground rig application: 5/26/2004 Eptam (4.5pt/A) + Spartan* (2.5oz/A).

Fungicide/ Insecticide: Aerial applications: 7/10/04 Actara (1.5oz./A), Bravo (1pt/A)
7/24/04 Bravo (1pt./A)

Harvest: 9/12/05

2005 Clonal Evaluation for Bacterial Ring Rot Foliar Symptom Expression									
^	Clone	DAP to First Symptoms	# Reps Positive	# Plants Positive	% Plants Positive	DAP 50% or More +	Total # Reps Positive	% Plants + 106 DAP	Summary of Symptoms
1	AC98350-2RU	54	1	1	5.0	96	3	55.0	ALL
1	ADTC9801-3P	44	1	1	4.8		3	47.6	ALL
1	CO98009-3RU	44	2	2	9.5	81	3	76.1	ALL
1	CO98012-5R	81	2	5	23.8	89	3	71.4	IVC,IVN,MN,W
1	CO98067-7RU	81	2	5	23.8	89	3	66.7	IVC,IVN,MN,W
1	CO98277-4W	81	1	1	4.8		2	19.0	IVC,IVN,MN,W
1	CO98303-8W	44	2	2	9.5	81	3	76.2	ALL
1	CO98368-2RU	44	1	1	4.8	96	3	66.7	ALL
1	CO97215-2P/P	44	1	1	5.3	96	3	63.2	ALL
1	CO97216-3P/P	54	1	2	9.5	81	3	61.9	ALL
1	CO97222-1R/R	68	1	1	4.8	89	3	57.1	ALL
1	CO97227-2P/P	68	1	2	9.5	96	3	71.4	ALL
1	CO97274-2W/Y	44	1	1	4.8	81	3	90.4	ALL
1	ATC98444-1R/Y	68	1	1	4.8		3	23.8	IVC,IVN,MN,W
1	ATC98495-1W/Y	54	1	1	4.8	89	3	66.7	ALL
1	ATC98509-1R/Y	54	1	2	9.5	96	3	52.3	ALL
1	ATC98515-1R/Y	44	1	2	9.5		3	33.3	ALL
2	AC97068-2RU	68	1	2	9.5	89	3	76.2	IVC,IVN,MN,W
2	AC97097-14W	54	1	1	4.8		3	47.6	ALL
2	AC97521-1R/Y	81	1	2	9.5	96	3	57.1	ED,R,IVC,IVN,MN
2	CO97043-14W	68	1	2	9.5	81	3	81.0	ALL
2	CO97065-7W	54	1	1	4.8	68	3	100.0	ALL
2	CO97078-5R	68	2	4	20.0		3	35.0	ALL
2	CO97087-2RU	68	2	5	23.8	81	3	85.7	ALL
2	CO97090-4RU	68	3	5	23.8	81	3	100.0	ALL
2	CO97137-1W	68	1	1	4.8	81	3	71.4	IVC,IVN,MN,W
2	CO97138-3RU	44	1	2	10.5	81	3	63.2	ALL
2	CO97138-7RU	44	1	2	9.5	89	3	57.1	ALL
2	CO97226-2R/R	68	2	4	19.0	81	3	85.7	ALL
2	CO97232-1R/Y	54	1	1	4.8		2	19.0	ALL
2	CO97232-2R/Y	44	1	1	4.8		3	47.6	ALL
2	CO97233-3RY	89	1	1	5.3		3	42.1	IVC,IVN,MN,W
3	VC1123-2W/Y	89	2	2	9.5	106	3	52.4	IVC,IVN,MN,W
1	A95409-1	68	3	10	47.6	74	3	90.5	ALL
1	A96095-3	68	1	1	5.3		2	21.0	ED,R,IVC,MN,W
1	A96104-2	74	1	1	4.8		3	33.3	IVC,IVN,MN,W
1	AO96164-1	74	1	1	5.3		2	36.8	IVC,IVN,MN,W
1	AOA95154-1	96	2	4	33.3		2	41.7	IVC,IVN,MN,W
1	AOA95155-7	54	1	1	4.8		3	47.7	ALL
1	MWTX2609-2RU	68	2	3	14.3		3	42.9	ALL

^	Clone	DAP to First Symptoms	# Reps Positive	# Plants Positive	% Plants Positive	DAP 50% or More +	Total # Reps Positive	% Plants + 106 DAP	Summary of Symptoms
1	TXA549-1RU	54	1	1	4.8		1	4.8	R
1	COA96141-2C	74	1	1	4.8		3	42.9	ALL
1	COA96142-3C	74	2	3	15.8		3	26.3	ALL
1	A96741-1R	74	1	1	4.8		3	38.1	ALL
1	A96741-2R	68	2	2	15.4		3	38.5	ALL
2	A95074-6	68	1	1	4.8		2	33.3	ALL
2	A95109-1	68	3	4	19.0	84	3	57.1	ALL
2	AO96160-3	44	1	2	9.5		3	47.6	ALL
2	ATX91137-1RU	68	3	4	19.0	96	3	52.3	ALL
1	Western Russet	81	2	7	33.3	96	3	52.4	ALL
	WNC230-14RU	68	1	1	5.0		3	35.0	ALL
	Ute Russet	54	1	1	4.8	89	3	57.1	ALL
	Centennial Russet	68	1	1	4.8		3	33.3	ED,R,IVC,IVN,MN
	Russet Burbank	44	1	1	4.8	81	3	66.7	ALL
	Sangre	44	1	1	4.8	96	3	90.5	ALL
	Russet Norkotah	68	3	5	25.0	89	3	75.0	ALL
^ Number of years tested. Planting date- 5/9/04. Key to symptoms: ED-Early Dwarf, R-Rosette, IVC-Interveinal Chlorosis,									
IVN-Interveinal Necrosis, MN-Marginal Necrosis, W-Wilt, All-all symptoms seen during season.									
Date vs. DAP (Days after planting): 6/21=DAP 44, 7/1=DAP 54, 7/15=DAP 68, 7/21=DAP 74, 7/28=DAP 81, 8/5=DAP 89, 8/12=DAP 96, 8/22=DAP 106									

2005 Clonal Evaluation for Bacterial Ring Rot			
Tuber Symptom Expression			
Clone	# Reps +	# Tubers +	%Tubers +
AC98350-2RU	0	0	0
ADTC9801-3P	2	3	15
CO98009-3RU	0	0	0
CO98012-5R	1	1	5
CO98067-7RU	1	1	5
CO98277-4W	0	0	0
CO98303-8W	1	2	10
CO98368-2RU	0	0	0
CO97215-2P/P	0	0	0
CO97216-3P/P	1	1	5
CO97222-1R/R	0	0	0
CO97227-2P/P	0	0	0
CO97274-2W/Y	1	1	5
ATC98444-1R/Y	0	0	0
ATC98495-1W/Y	1	1	5
ATC98509-1R/Y	1	2	10
ATC98515-1R/Y	1	1	5
AC97068-2RU	1	1	5
AC97097-14W	1	1	5
AC97521-1R/Y	2	2	10
CO97043-14W	2	3	15
CO97065-7W	2	3	15
CO97078-5R	1	1	5
CO97087-2RU	0	0	0
CO97090-4RU	0	0	0
CO97137-1W	1	1	5
CO97138-3RU	1	1	5
CO97138-7RU	1	1	5
CO97226-2R/R	0	0	0
CO97232-1R/Y	0	0	0
CO97232-2R/Y	0	0	0
CO97233-3RY	0	0	0
VC1123-2W/Y	0	0	0
A95074-6	1	2	10
A95109-1	0	0	0
AO96160-3	0	0	0
ATX91137-1RU	0	0	0
A95409-1	1	1	5
A96095-3	0	0	0
A96104-2	1	2	10
AO96164-1	0	0	0
AOA95154-1	0	0	0
AOA95155-7	0	0	0
MWTX2609-2RU	1	1	5
TXA549-1RU	0	0	0
COA96141-2C	2	2	10
COA96142-3C	0	0	0
A96741-1R	0	0	0
A96741-2R	1	1	5
Western Russet	0	0	0
WNC230-14RU	0	0	0
Ute Russet	0	0	0
Centennial Russet	0	0	0
Russet Burbank	2	4	20
Sangre	1	1	5
Russet Norkotah	0	0	0
2 of 3 reps screened with 10 tubers cut/treatment (at least 5 plants).			
% tubers (+) is based upon #pos/#cut. Harvest = 9/12/05			

2005 Clonal Evaluation for Leaf Roll Natural In-Field Spread				
Cultivar/Clone	# Pos / # Emerged	% Spread 2005	16 Yr. Avg.	Risk
AC98350-2RU	2/75	2.7		Low
ADTC9801-3P	0/73	0.0		Low
CO98009-3RU	0/74	0.0		Low
CO98012-5RU	No reading			
CO98067-7RU	0/10	0.0		Low
CO98277-4W	0/60	0.0		Low
CO98303-8W	0/60	0.0		Low
CO98368-2RU	4/72	5.6		Medium
CO97215-2P/P	32/66	48.5		Very High
CO97216-3P/P	0/15	0.0		Low
CO97222-1R/R	5/63	7.9		Medium
CO97227-2P/P	0/71	0.0		Low
CO97274-2W/Y	No reading			
ATC98444-1R/Y	0/52	0.0		Low
ATC98495-1W/Y	0/72	0.0		Low
ATC98509-1R/Y	0/50	0.0		Low
ATC98515-1R/Y	0/70	0.0		Low
Green Mountain	7/69	10.1	17.2	High
Houma	0/50	0.0	4.6	Low
Keswick	1/69	1.4	5.1	Medium
Penobscot	0/72	0.0	0.8	Low
Katahdin	2/75	2.7	3.3	Low
Centennial Russet	0/70	0.0	3.8	Low
Russet Burbank	0/71	0.0	12.3	High
Sangre	6/70	8.6	7.9	Medium
Russet Norkotah	0/63	0.0	23.3 (6 yr avg)	High
Russet Nugget	2/75	2.7	12.7	High

Data is generated using 2 tubers/plant, 12 plants/rep, and 3 reps/cultivar for a total of 72 tubers planted per clone per year.

Advanced clones only have one year of testing (1-15).

Risk assessment; Low = 0-4.9%, Medium = 5.0-9.9%, High = 10.0% and higher.

CO97227-2P/P had 15.5% of the plants grown with PVY - a relatively high % infection.

2005 Clonal Evaluation for PLRV and PVY Symptom Expression					
Cultivar/Clone	PLRV (0-3+)	Symptoms	Cultivar/Clone	PVY (0-3+)	Symptoms
AC98350-2RU	3+	WP, LL, CC		1+	mild
ADTC9801-3P	0			3+	severe
CO98009-3RU	3+	WP, LL, CC		3+	
CO98012-5RU	3+	WP, LL, CC		0	
CO98067-7RU	3+	WP, LL, CC		3+	
CO98277-4W	3+	LL, CC, P		3+	
CO98303-8W	2+	LL, CC		0	
CO98368-2RU	3+	WP, LL, CC		0	
CO97215-2P/P	3+	WP, LL, CC		0	
CO97216-3P/P	3+	WP, LL, CC		2+	
CO97222-1R/R	3+	WP, LL, CC		3+	severe
CO97227-2P/P	3+	ALL		3+	
CO97274-2W/Y	2+	LL, CC		0	
ATC98444-1R/Y	3+	WP, LL, CC		1+	mild
ATC98495-1W/Y	0			0	
ATC98509-1R/Y	0			3+	
ATC98515-1R/Y	0			3+	severe
AC97521-1R/Y	3+	WP, LL, CC		3+	severe
CO97232-1R/Y	0			0	
CO97232-2R/Y	3+	WP, LL, CC		0	
			CO97223-3R/Y	0	
			VC1123-2W/Y	0	
Centennial Russet	3+	WP, LL, CC		3+	
Russet Burbank	3+	WP, LL, CC		3+	
Russet Norkotah	3+	WP, LL, CC		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.