Comprehensive Research Report for 2000

Potato Pathology Studies

Submitted to:
SLV Research Center Committee
and the
Colorado Potato Administrative
Committee (Area II)

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2000 PROTOCOL FOR EVALUATION OF FUNGICIDES FOR CONTROL OF EARLY BLIGHT ON POTATO

Researcher: Richard T. Zink, Extension Potato Specialist, and Andrew Houser, Research Associate, Colorado State University

Location: San Luis Valley Research Center, Center, CO

Acknowledgements: We gratefully acknowledge the cooperation and financial support of Aventis, American Cyanamid Company, Colorado Potato Administrative Committee (Area II), Dupont Ag Products, Griffin L.L.C., Rohm and Haas Company, Syngenta, and United Agri Products.

Application: All treatments applied using an R & D CO_2 charged tractor mounted plot sprayer with four 8002VS nozzles spaced seventeen inches apart at 60 psi pressure and applying 40 gallons per acre water as a broadcast application. Nine applications were made beginning on July 3, 2000.

Spray Dates: July 3,4,6; July 10,12,13; July 17,18,19; July 24,25; July 31, August 1; August 7,8; August 14,15; August 21,22; August 28,29

Plot Design: Randomized complete block
Planted: May 8, 2000
Plot Size: 4 – 20 foot rows per treatment, treatments applied to center two rows and data taken on two center rows.
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Four
Cultivar: Russet Nugget
Irrigation: Solid set sprinkler, rate based on ET
Fertilizer: 104N-130P-52K banded preplant, + 50N total topdress N through sprinkler
Herbicide: Matrix + Dual by ground
Insecticide: Provado on June, 23, 2000 by ground
Vinekill: Allowed to die naturally
Harvested: September 21, 2000

DATA

Disease: Early blight disease incidence based on percent leaves infected, readings taken weekly starting Aug. 3, 2000.
Yield: 2 – 20 foot rows per treatment per replication expressed as cwt/A.
Grade: Percent tubers by weight < 4 oz, 4-10 oz, > 10 oz, U.S. no. 2, and culls.

Summary of Results

Thanks to the generous support of the Colorado Potato Administrative Committee (Area II) and several agricultural companies, full season comprehensive fungicide efficacy trials were conducted this past summer at the San Luis Valley Research Center (see protocol). Over the course of the growing season twenty seven different fungicide programs were assessed for blight control (Table 1). The trials depended on natural infection, early blight (*Alternaria solani*) developed within the trial however, late blight (*Phytophthora infestans*) did not.

The incidence of early blight within the trials was natural and similar to what occurred in commercial potato production across the San Luis Valley. At the time of final disease readings on August 29, early blight incidence had reached 100 percent in the untreated control. AUDPC values provide clear separation among fungicide programs. In general, disease suppression by fungicide program can be grouped into four categories. Early blight disease development was significantly reduced by all treatments over the untreated control. Treatments 2,3,4,5,7,8,9,13,14,15,18,19,20,24,25,26, and 27 reduced the disease by less than 50%. Treatments 6,12,16, and 28 reduced disease from 50-60%. Treatments 10, 11, and 17 reduced disease from 60-75%. Treatments 21, 22, and 23 reduced disease incidence by more than 75%. In general the highest degree of early blight control was achieved in programs where Quadris was utilized (Table 2). Post harvest evaluation of tubers however, showed that in this study foliar applications of Quadris did not reduce the incidence of black scurf on tubers (Table 4).

Suppression of foliar early blight did not, however, translate directly to increased tuber yields (Table 3). The lack of effect of fungicide program on yield is common in small replicated trials. This is likely due to the late onset of disease and the long season cultivar Russet Nugget. Early blight is a disease of senescence and generally has a much greater impact on an early maturing cultivar such as Russet Norkotah. Russet Nugget was selected for these trials in anticipation of late blight developing some time in August. Had this been the situation, Russet Nugget would have provided an additional three to four week period for fungicide program evaluation.

Table 1. Fungicide programs evaluated for early blight control, San Luis Valley, Colorado, 2000

Program	Products	Rate	Application	Est. total cost/A*
1	Control, no treatment			
2	Bravo WS	1.5 pt/A	1,2,3,4,5,6,7,8,9	$97.02/A
3	KQ667 68.8 WG	8.25 oz ai/A	1,2,3,4,5,6,7,8,9	NA
4	KQ667 68.8 WG	11 oz ai/A	1,2,3,4,5,6,7,8,9	NA
5	KQ667 68.8 WG	16.5 oz ai/A	1,2,3,4,5,6,7,8,9	NA
6	KQ667 68.8 WG	22 oz ai/A	1,2,3,4,5,6,7,8,9	NA
7	Manzate 75 DF	24 oz ai/A	2,4,6,8	NA
	KP481 50 WG	4 oz ai/A	1,3,5,7,9	
8	KP481 50 WG	5 oz/A	3,4,5,6,7,8,9	NA
	Manzate 75 DF	24 oz ai/A	1,2	
9	Gavel 75DF	2.0 lb/A	1,2,4,6,7	NA
	Dithane Rainshield	1.5 lb/A	3,5,8	
10	Gavel 75DF	2.0 lb/A	1,2,4,6,7,	NA
	Quadris 2.08F	6.2 oz/A	3,5,8	
11	Bravo WS	1.5 pt/A	1,2,4,6,7	$101.48/A
	Quadris 2.08F	6.2 oz/A	3,5,8	
12	Manzate 75DF	2.0 lb/A	1,2,3,4,5,6,7,8,9	$107.01/A
	+ SuperTin 80W	2.5 oz/A	1,2,3,4,5,6,7,8,9	
13	Equus 720 g/l	1.5 pt/A	1,2,3,4,5,6,7,8,9	$88.20/A
14	Bravo WS	1.0 pt/A	2,4,6,8	NA
	CGA279202 50WG	0.25 lb/A	1,3,5,7	
15	Bravo WS	1.0 pt/A	2,4,6,8,9	NA
	CGA279202 50WG	0.125 lb/A	1,3,5,7	
16	Bravo WS	1.0 pt/A	2,4,6,8,9	NA
	CGA279202 50WG	0.125 lb/A	1,3,5,7	
	+ Manzate 75 DF	1.07 lb/A	1,3,5,7	
17	Bravo WS	1.0 pt/A	2,4,6,8,9	NA
	CGA279202 50WG	0.25 lb/A	1,3,5,7	
	+ Manzate 75 DF	2.14 lb/A	1,3,5,7	
18	Bravo WS	1.5 pt/A	1,2,3,5,6,8,9	$96.02/A
	Acrobat 50 WP	5 oz/A	4,7	
	+ Manzate 75 DF	1.5 lbai/A	4,7	
19	Bravo WS	1.5 pt/A	1,2,3,5,6,8,9	$98.22/A
	Acrobat 50 WP	6.4 oz/A	4,7	
	+ Manzate 75 DF	1.5 lbai/A	4,7	
20	Bravo WS	1.5 pt/A	1,2,3,5,6,8,9	$94.46/A
	Acrobat 50 WP	4 oz/A	4,7	
	+ Manzate 75 DF	1.5 lbai/A	4,7	
21	Bravo WS	1.5 pt/A	1,3,5,7,8,9	$112.26/A
	Quadris 2.08F	6.2 oz/A	2,4,6	
22	Polyram 80DF	2 lb/A	1,3,5,7,8,9	$85.02/A
	Quadris 2.08F	6.2 oz/A	2,4,6	
23	Polyram 80DF	2 lb/A	1,3,5,6,7,8,9	$114.11/A
	+ Super Tin 80W	2.5 oz/A	1,3,5,6,7,8,9	
	Quadris 2.08F	6.2 oz/A	2,4	
24	Bravo WS	0.75 pt/A	1,2,3,4,5,6,7,8,9	$184.23/A
	+ Tattoo C 6.25F	1.3 pt/A	1,2,3,4,5,6,7,8,9	
25	Tattoo C 6.25 F	1.3 pt/A	1,2,4,5	$145.38/A
	Quadris 2.08 F	6.2 oz/A	3,6	
	Tattoo C 6.25 F	2.3 pt/A	7,8	
26	Bravo WS	0.75 pt/A	1,2,3	NA
	Reason 4.17 EC	0.35 pt/A	4,5,6,7,8,9	
	+ Bond 8.33 EC	4.0 fl oz/A	4,5,6,7,8,9	
27	Bravo WS	0.75 pt/A	1,2,3	NA
	Reason 4.17 EC	0.53 pt/A	4,5,6,7,8,9	
	+ Bond 8.33 EC	4.0 fl oz/A	4,5,6,7,8,9	
28	Walabi 150L	1.7 pt/A	1,2,3,4,5,6,7,8,9	NA

*These prices do not include application costs.

Table 2. Effect of fungicide program on the incidence of early blight in the cultivar Russet Nugget, San Luis Valley, Colorado, 2000

	Percent leaves infected					
Treatment #	Aug. 3-4	Aug. 9-11	Aug. 16-18	Aug. 23-25	Aug. 29-30	AUDPC[a]
1	4.5	8.8	53.3	99.5	100.0	1343 a
2	2.8	3.0	8.8	36.6	64.2	580 d-j
3	2.7	3.3	16.0	50.3	65.0	722 cde
4	2.4	3.0	14.3	39.4	53.8	638 d-g
5	2.6	3.4	10.0	37.4	51.3	524 e-k
6	2.2	2.5	13.8	28.8	49.2	435 g-m
7	3.0	3.0	11.7	36.9	69.2	662 def
8	3.7	3.9	14.1	68.6	88.7	918 b
9	3.8	3.3	14.6	67.1	88.9	887 bc
10	2.4	2.7	10.1	25.1	32.1	330 klm
11	2.6	2.9	9.0	25.9	26.3	408 i-m
12	2.5	2.6	10.6	24.9	42.5	396 j-m
13	2.7	2.8	9.7	50.9	65.4	667 def
14	2.6	3.2	13.1	50.1	59.2	614 d-I
15	2.6	2.8	11.4	41.9	64.2	617 d-h
16	2.3	3.1	10.0	41.6	49.2	516 e-l
17	2.2	3.0	12.5	26.7	32.5	469 f-m
18	3.6	2.3	12.6	36.2	52.1	630 d-g
19	2.4	2.6	9.9	43.2	61.7	647 def
20	2.9	3.0	12.1	43.8	67.1	614 d-I
21	2.2	3.0	8.3	17.4	22.1	288 m
22	2.6	2.8	11.3	17.7	22.1	312 lm
23	3.0	3.0	8.9	15.7	20.8	278 m
24	2.8	3.1	7.8	35.0	53.3	549 e-j
25	2.8	3.7	9.2	40.1	53.3	475 f-m
26	3.2	2.8	12.7	59.8	72.1	772 bcd
27	3.2	3.5	14.2	36.8	73.3	652 def
28	2.8	2.9	10.1	24.3	40.0	412 h-m
$LSD_{0.05}$	1.28	1.11	7.55	15.04	16.35	177.91

[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 program on tuber yield and quality in the cultivar Russet Nugget, San Luis Valley, Colorado, 2000

Treatment	Percent[a]					cwt/A[b]
	<4 oz	4-10 oz	>10 oz	#2's	Culls	
1	40.2	53.3	6.2	0.2	0.1	197.7 b
2	37.5	0.5	10.1	0.6	1.3	245.5 ab
3	47.8	43.5	7.4	0.8	0.6	238.6 ab
4	41.8	49.4	4.9	1.9	2.0	220.9 ab
5	42.3	47.5	8.2	0.7	1.3	232.2 ab
6	43.6	42.1	11.7	0.4	2.2	224.9 ab
7	38.8	49.6	9.9	1.2	0.5	210.3 ab
8	39.2	51.5	6.4	1.1	1.7	241.4 ab
9	39.0	50.2	8.9	0.7	1.2	233.9 ab
10	48.9	40.1	9.3	0.9	0.8	201.2 ab
11	41.1	44.9	11.8	0.5	1.7	222.5 ab
12	33.4	52.5	12.0	0.5	1.5	252.1 ab
13	42.2	48.2	8.7	0.0	0.8	227.7 ab
14	41.9	44.6	11.1	0.7	1.7	268.2 a
15	41.5	43.9	12.5	0.2	1.9	229.9 ab
16	37.8	50.1	10.6	0.0	1.5	237.9 ab
17	39.2	50.2	8.5	0.2	1.9	263.6 ab
18	36.3	50.3	11.4	0.7	1.3	241.3 ab
19	41.1	47.0	9.8	0.7	1.4	231.2 ab
20	48.0	39.4	10.4	1.1	1.1	211.6 ab
21	43.5	50.7	4.8	0.0	0.9	211.8 ab
22	30.1	57.5	11.7	0.6	0.1	223.0 ab
23	37.8	49.3	11.1	0.2	1.6	242.5 ab
24	48.3	44.3	5.7	0.6	1.1	194.9 b
25	50.1	40.3	8.6	0.6	0.4	247.8 ab
26	44.3	48.5	5.8	0.6	0.9	205.7 ab
27	51.4	39.9	7.7	0.9	0.1	214.4 ab
28	38.5	48.1	12.0	0.3	1.1	208.6 ab
$LSD_{0.05}$	12.79	9.62	7.15	1.23	1.71	56.55

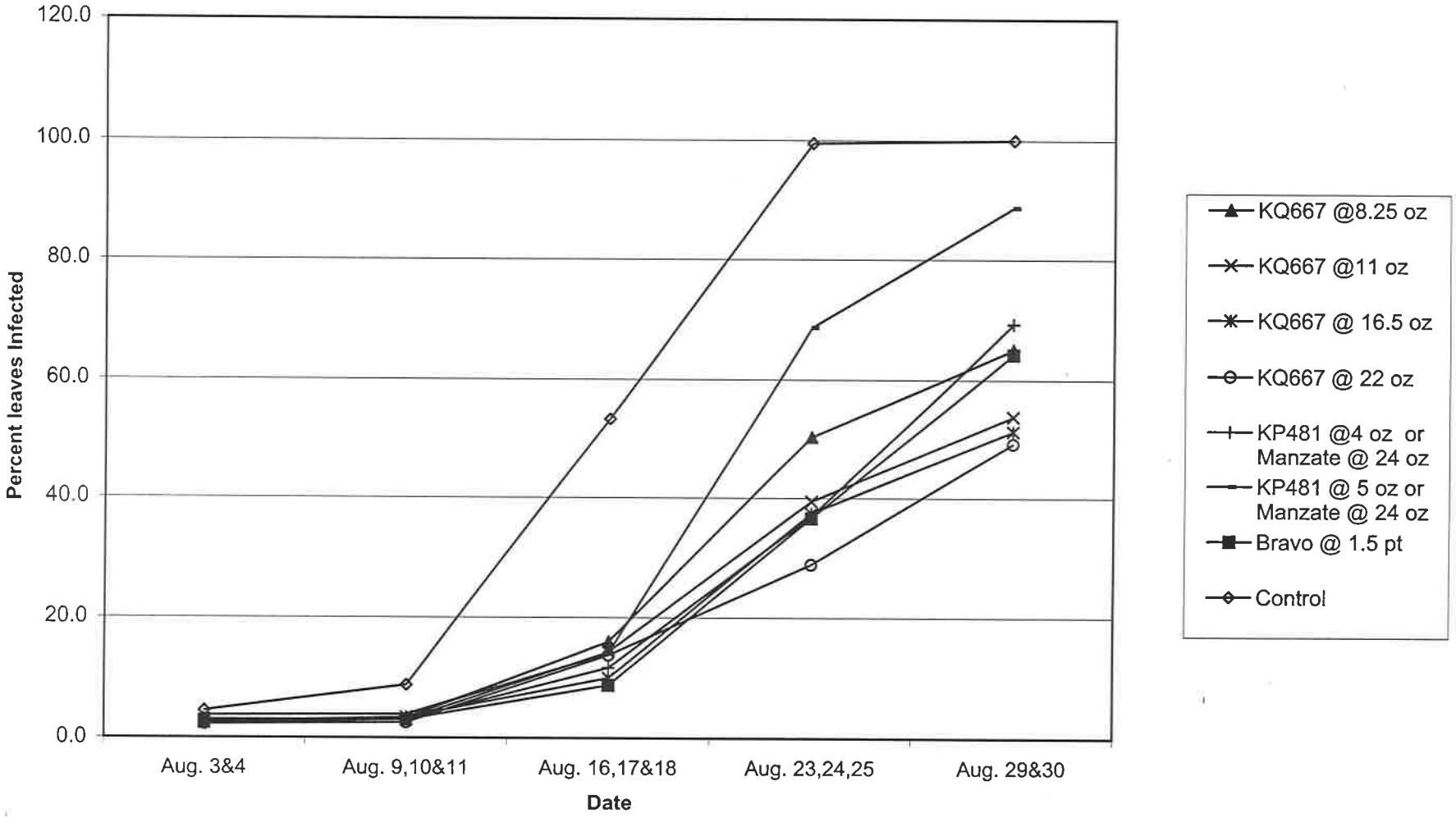
[a] Based on tuber weight, four replications.
[b] Total yield in hundred weight per acre based on 2-20 foot rows, four replications.
Means followed by same letters are not significantly different at P = 0.05 for yield.

Table 4. The effect of foliar Quadris on the severity of black scurf in the cultivar Russet Nugget, San Luis Valley, Colorado, 2000

Treatment	Product	Rate	Week of application	Black scurf[a] Severity Index
1	Control	No treatment		54.2
2	Bravo WS	1.5 pt/A	1,2,3,4,5,6,7,8,9	62.1
3	Quadris +Bravo WS	6.2 oz/A 1.5 pt/A	2,4,6 1,3,5,7,8,9	53.3
4	Quadris +Polyram 80DF	6.2 oz/A 2 lb/A	2,4,6 1,3,5,7,8,9	56.6
LSD (P=0.05)				NS

[a] Black scurf severity index = mean percent of the affected tuber surface area, 10 tubers/ treatment/replication multiplied by the severity of the sclerotia, where 1 = small sclerotia and 3 = large sclerotia.

Disease Progress Curve for Early Blight
2000 Fungicide Trial, Colorado State University
San Luis Valley Research Center, Center, CO



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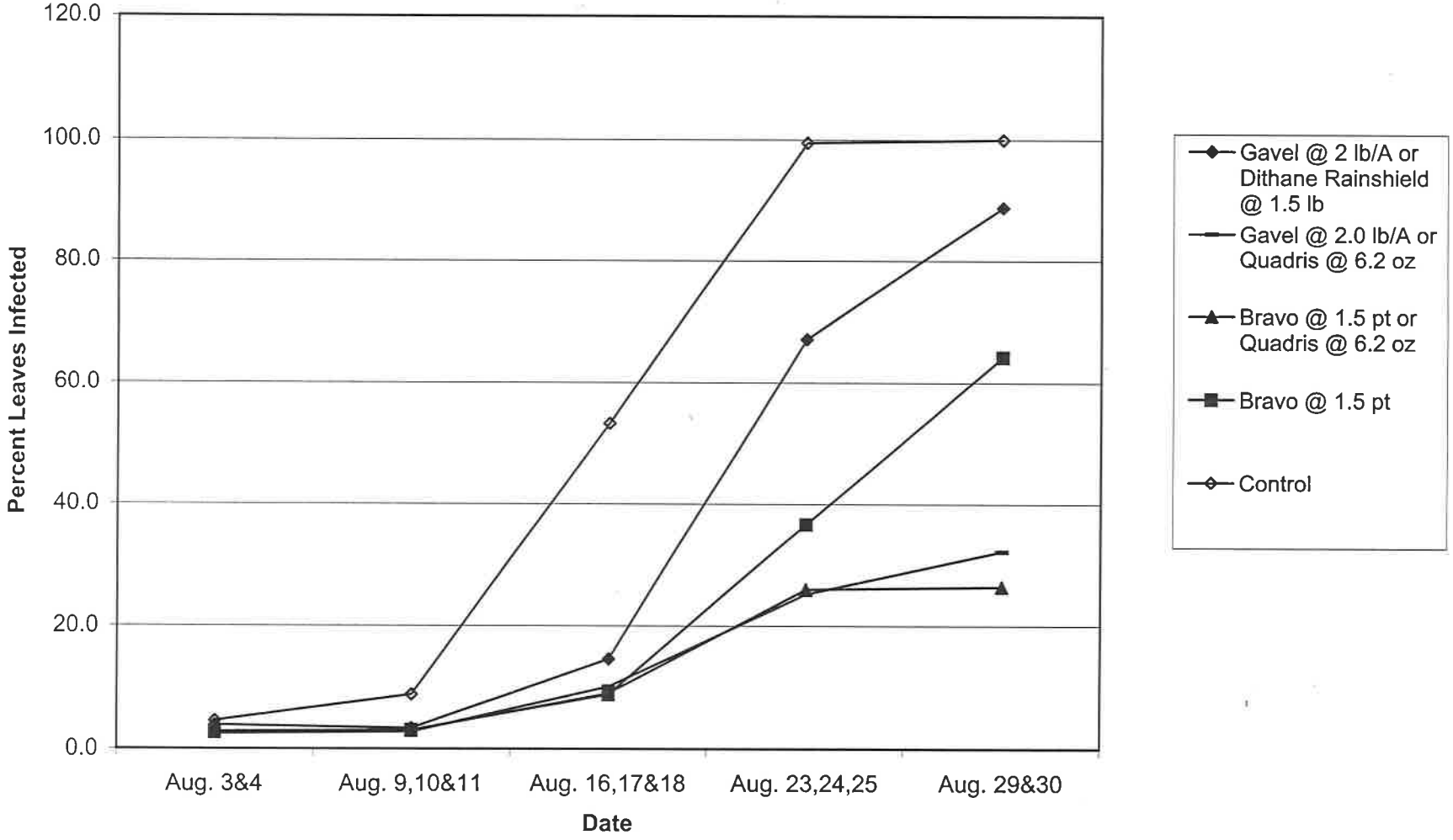
2000 Fungicide TrialColorado State University
San Luis Valley Research Center, Center, CO



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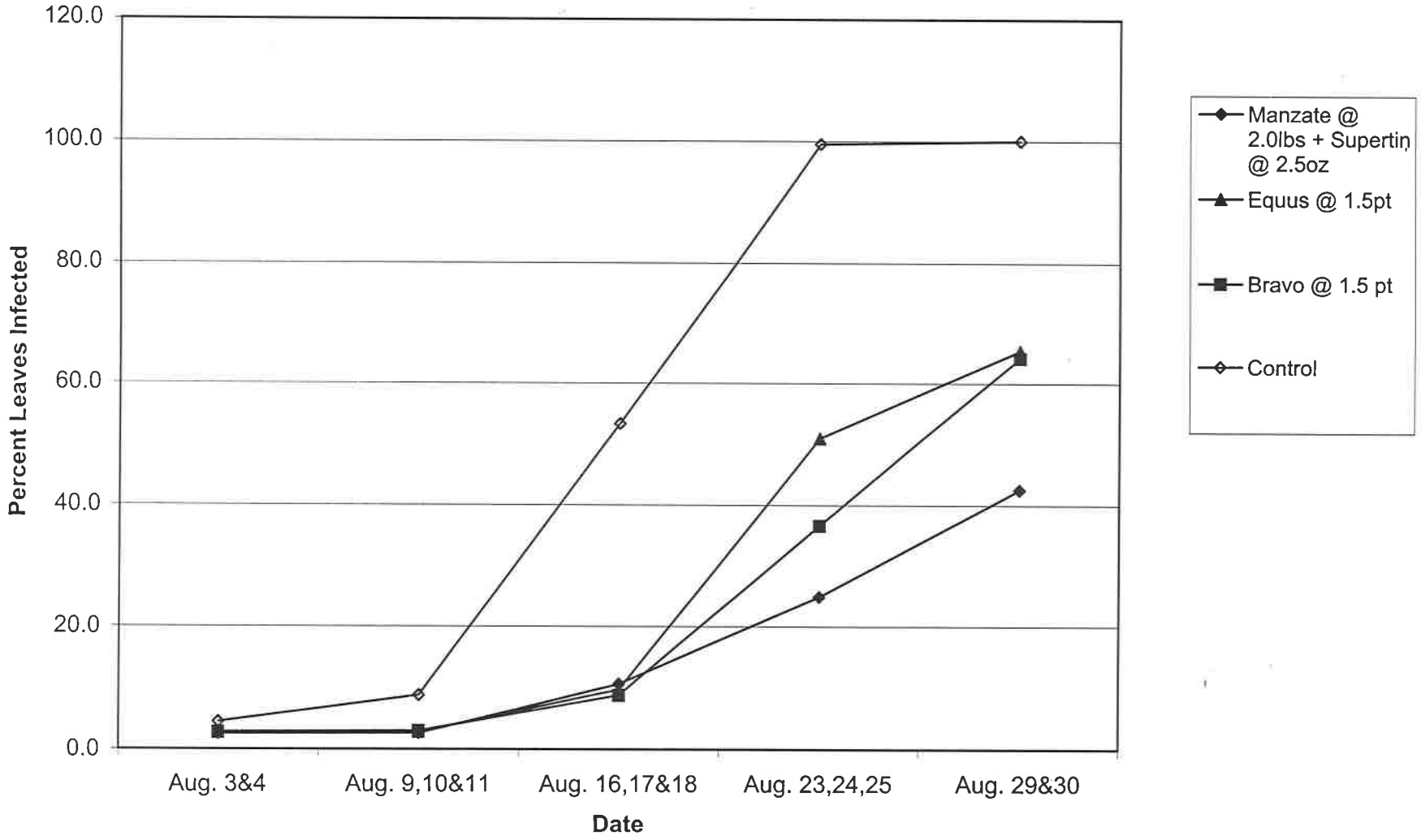
2000 Fungicide Trial, Colorado State University
San Luis Valley Research Center, Center, CO



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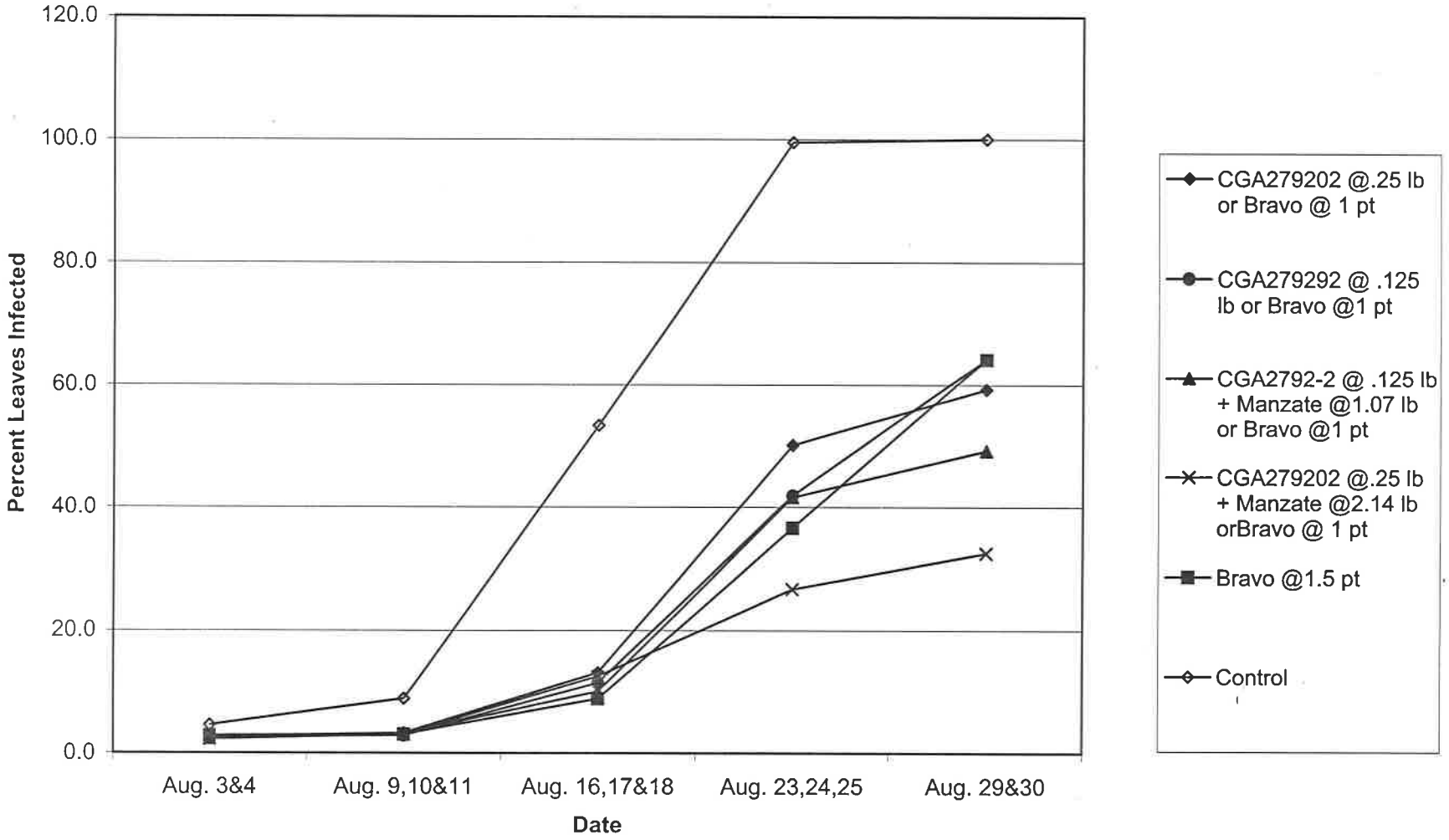
San Luis Valley Reserach Center, Center, CO



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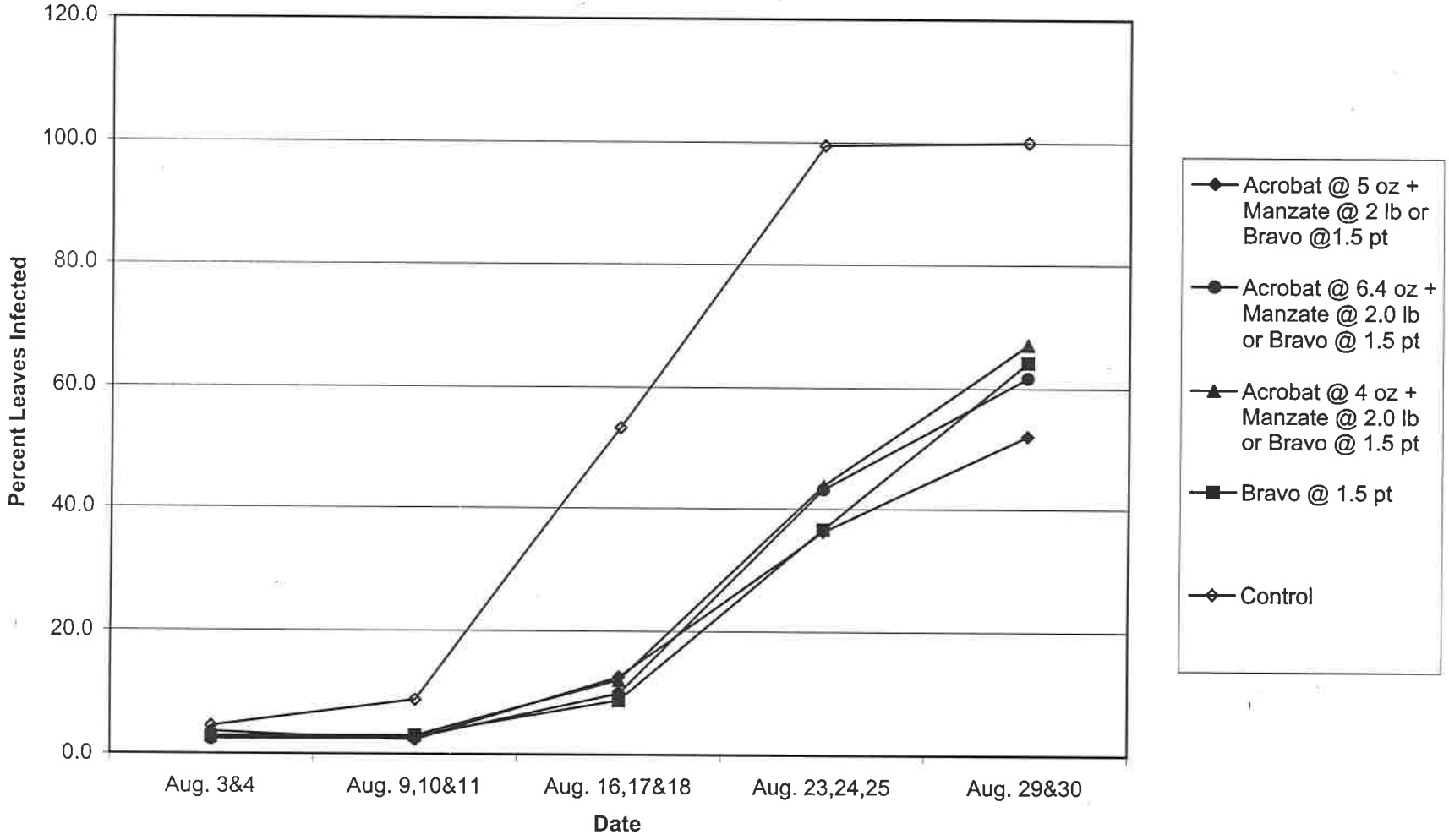
2000 Fungicide Trial, Colorado State University
San Luis Valley Research Center, Center, CO



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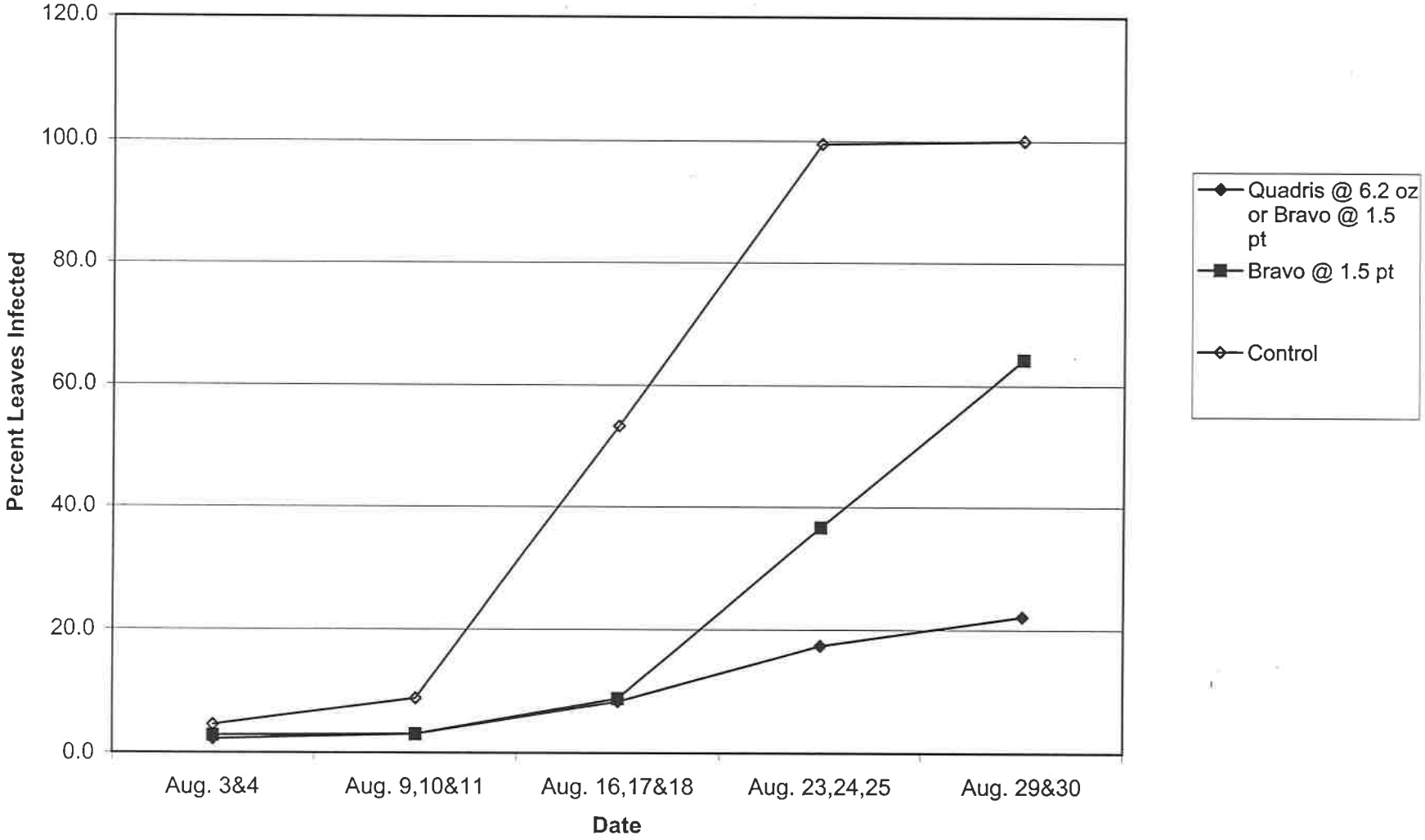

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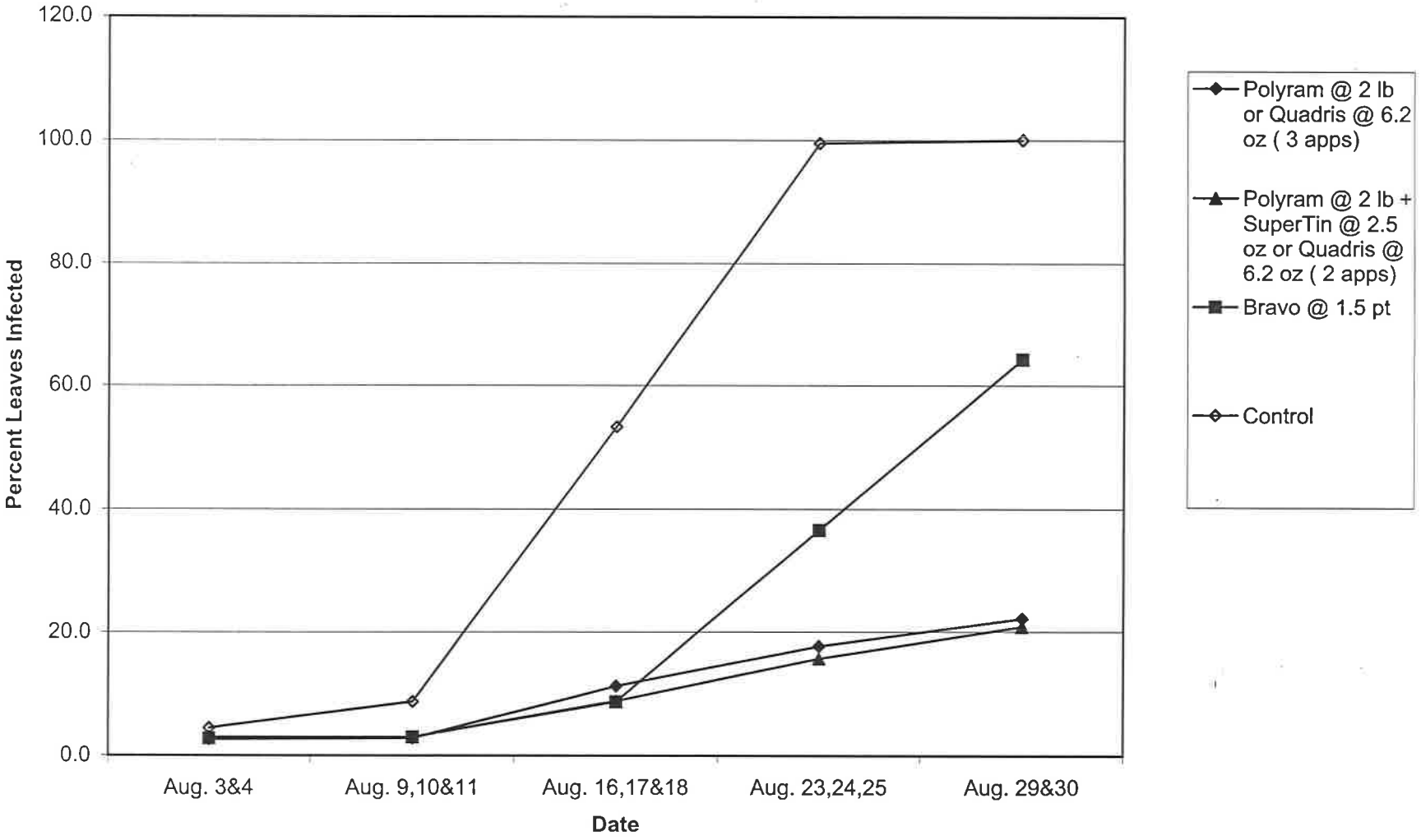

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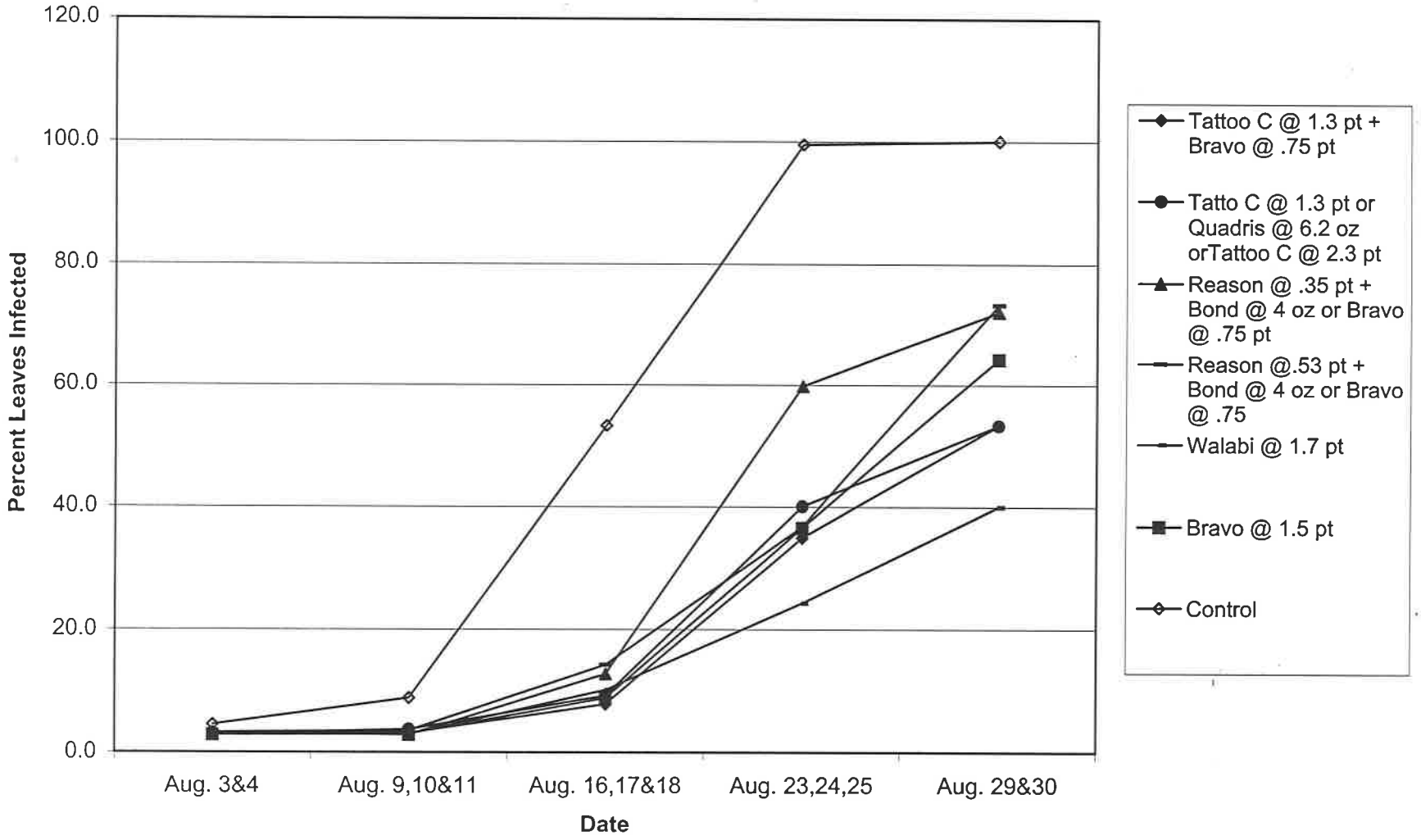


2000 PROTOCOL FOR EVALUATION OF SEED PIECE TREATMENTS APPLIED AT PLANTING FOR CONTROL OF SEED PIECE DECAY ON POTATO

Researchers: Richard T. Zink, Extension Potato Specialist, and Andrew Houser, Research Associate, Colorado State University, San Luis Valley Research Center

Location: San Luis Valley Research Center, Center, CO

Objective: To evaluate the efficacy of various seed piece treatments in preventing disease and seed piece decay.

Treatments: All treatments applied directly to fresh cut seed and planted within twenty four hours

1. Control, no treatment
2. Kocide 2000 at 2000 ppm
3. Kocide 2000 at 2000 ppm + 6% mancozeb at 1.0#/cwt
4. Kocide 2000 at 2000 ppm + liquid maxim at 0.08 floz/cwt
5. PCC553-2 at 0.5 lb/cwt
6. PCC553 at 1.0 lb/cwt
7. PCC555-2 at 0.5 lb/cwt
8. PCC555 at 1.0 lb/cwt
9. PCC555-3 at 1.0 lb/cwt
10. 6% MZ at 1.0 lb/cwt
11. 6% MZ + at 1.9 lb/cwt
12. Liquid Maxim at 0.08 fl oz/cwt
13. Liquid Maxim at 0.08 fl oz/cwt + streptomycin

Plot Design: Randomized complete block
Planted: May 10, 2000
Plot Size: 1 - 35 foot row per treatment per replication
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Four
Cultivar: Sangre cut seed
Irrigation: Solid set sprinkler, rate based on ET
Fertilizer: 104N-130P-52K preplant, 50N through sprinkler
Herbicide: Matrix and Dual by ground
Insecticide: Provado
Fungicides: Bravo WS, Quadris, Dithane, Dithane, Bravo WS
Vine killer: Sulfuric acid on August 31, 2000
Harvested: September 14, 2000

DATA

Stand: 1-35 foot row/treatment/replication, counts taken about 30 days after planting.
Seed Piece Decay: Soft-rot and dry-rot combined rated 1-100, 0 = no decay and 100 = complete decay; 5 seed pieces/treatment/replication.
Rhizoctonia stem canker: Percent stems infected; 5 plants/treatment/replication.
Blackleg: Percent stems infected; 5 plants/treatment/replication.
Plant vigor: Rated 1-4; 1 = poor and 4 = good; 5 plants/treatment/replication.
Stems: Average number of stems per plant; 5 plants/treatment/replication.
Yield: 1-30 foot row per/treatment/replication, total yield expressed in cwt/A.
Black scurf severity index: Mean percent of affected tuber surface area, 10 tubers per treatment per replication. multiplied by the severity of the sclerotia, where 1= small sclerotia and 3 = large sclerotia.

Table 1. Effect of seed treatments on plant development and incidence of disease in the cultivar Sangre, San Luis Valley, Colorado, 2000

Treatment[a]	Stand[b]	Vigor[c]	Stems[d]	%Stems with Rhizoctonia[e]	Seed piece decay[f]	Black Scurf Severity Index[g]
1. Control	85.8	3.3	5.0	0.1	6.0	16.6
2. Kocide @2000 ppm	72.0	2.7	5.6	0.0	26.3	4.9
3. Kocide @ 2000 ppm + 6% Mancozeb @ 1.0 lb/cwt	70.8	2.0	4.4	0.0	64.0	8.9
4. Kocide @ 2000 ppm + Maxim @ 0.08 fl oz/cwt	70.0	2.1	5.2	0.2	59.0	4.1
5. PCC553-2 @ 0.5 lb/cwt	86.8	3.4	5.1	0.0	0.5	0.8
6. PCC553-2 @ 1.0 lb/cwt	85.0	3.3	4.1	0.0	1.0	0.8
7. PCC555-2 @ 0.5 lb/cwt	88.0	3.5	3.9	0.0	0.5	13.4
8. PCC555 @ 1.0 lb/cwt	87.0	3.3	4.0	0.0	0.0	4.6
9. PCC555-3 @ 1.0 lb/cwt	85.8	3.2	4.9	0.0	0.0	11.8
10. 6% MZ @ 1.0 lb/cwt	95.0	3.4	4.7	0.6	1.0	19.8
11. 6% MZ + @ 1.0 lb/cwt	88.5	3.1	4.8	0.0	1.0	14.4
12. Liquid Maxim @ 0.08 fl oz/cwt	91.5	3.3	5.1	0.2	1.5	15.5
13. Liquid Maxim @ 0.08 fl oz/cwt + streptomycin	88.8	3.1	4.7	0.3	0.0	4.9
LSD (P=0.05)	10.47	0.66	0.94	NS	10.67	13.62

[a] All treatments were applied according to the manufacturer's recommendations. Treatments were applied directly to fresh cut 2 oz seed pieces and planted within twenty four hours.
[b] Percentage of plants emerged 32 days after planting, four replications.
[c] Mean percent vigor, 1 = poor, 4 = good, 5 plants/treatment/replication.
[d] Mean number of stems per seed piece 33 days after planting, 5 plants/treatment/replication.
[e] Mean percent stems with Rhizoctonia canker 33 days after planting; 5 plants/treatment/replication.
[f] Mean percent incidence of disease combined soft-rot and dry-rot 33 days after planting; rated 1-100; 0 = no decay, 100 = complete decay; 5 seed pieces/treatment/replication.
[g] Black scurf severity index = mean percent of the effected tuber surface area,10 tubers per treatment per replication, multiplied by the severity of the sclerotia, where 1 = small sclerotia, and 3 = large sclerotia.

Table 2. Effect of seed treatments on tuber yield and quality in the cultivar Sangre, San Luis Valley, Colorado, 2000

Treatment	Percent[a]					cwt/A[b]
	< 4 oz	4-10 oz	> 10 oz	#2's	Culls	
1. Control	38.2	50.1	10.6	0.0	1.1	383.4
2. Kocide @ 2000 ppm	39.6	49.1	11.0	0.1	0.1	361.5
3. Kocide @ 2000 ppm + 6% Mancozeb @ 1.0 lb/cwt	37.0	47.9	14.6	0.0	0.5	330.8
4. Kocide @ 2000 ppm + Maxim @ 0.08 fl oz/cwt	35.1	46.7	17.0	0.8	0.3	319.2
5. PCC553-2 @ 0.5 lb/cwt	38.7	54.5	6.3	0.3	0.3	395.4
6. PCC553-2 @ 1.0 lb/cwt	41.3	52.2	6.4	0.0	0.2	393.6
7. PCC555-2 @ 0.5 lb/cwt	33.0	58.1	8.8	0.2	0.0	399.2
8. PCC555 @ 1.0 lb/cwt	36.2	54.9	8.5	0.3	0.2	385.6
9. PCC555-3 @ 1.0 lb/cwt	34.8	52.5	12.4	0.2	0.0	418.7
10. 6% MZ @ 1.0 lb/cwt	36.1	53.3	9.5	0.4	0.7	349.7
11. 6% MZ + @ 1.0 lb/cwt	35.4	52.0	11.9	0.1	0.7	376.3
12. Liquid Maxim @ 0.08 fl oz/cwt	42.1	50.3	7.1	0.2	0.2	446.7
13. Liquid Maxim @ 0.08 fl oz/cwt + streptomycin	40.7	52.1	6.8	0.0	0.4	374.3
LSD (P=0.05)	7.43	7.38	6.21	0.64	0.67	78.9

[a] Based on tuber weight, four replications.
[b] Total yield in hundred weight per acre based on 1-35 foot row, per treatment per replication.

2000 PROTOCOL FOR EVALUATION OF FUNGICIDES APPLIED AT PLANTING FOR CONTROL OF POWDERY SCAB ON POTATO

Researcher: Richard T. Zink, Extension Potato Specialist, and Andrew Houser, Research Associate, Colorado State University

Location: Warsh/Myers Farm, Center, CO

Cultivar: Yukon Gold, whole seed infected with *Spongospora subterranea*

Treatments:

1. Control, no treatment
2. Fluazinam, 7 pt/A at planting over seed in furrow
3. Fluazinam, 7 pt/A 1/3 preplant in furrow, 1/3 over seed, 1/3 at closing
4. Fluazinam, 7 pt/A on top of closed row
5. Quadris, 2.3 pt/A over seed in furrow
6. Quadris, 4.5 pt/A over seed in furrow
7. Blocker 10G, 25 lbs/A over seed in furrow
8. Blocker 4F, 7pt/A over seed in furrow
9. Blocker 4F, 10pt/A over seed in furrow
10. Fluazinam, 3.5 pt/A + Blocker 4F 10pt/A over seed in furrow
11. Dimethomorph 50WP, 6.4oz A/A over seed in furrow
12. AgriCultures International Tonic

Application: Treatments were applied using an R & D CO_2 charged backpack sprayer at 60 PSI, with one 8002 nozzle, at 10 gallons/acre as a directed in-furrow application.

Planted: May 18, 2000
Plot Design: Randomized
Plot Size: 1 - 40 foot row/treatment
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: One
Irrigation: Center pivot sprinkler, rate based on ET
Fertilizer: 104N-130P-52K, preplant, with 50N through sprinkler after tuber set
Herbicide: Sencor
Fungicide: Bravo, Quadris, and Dithane
Vine killer: None
Harvested: By hand, September 11, 2000

DATA

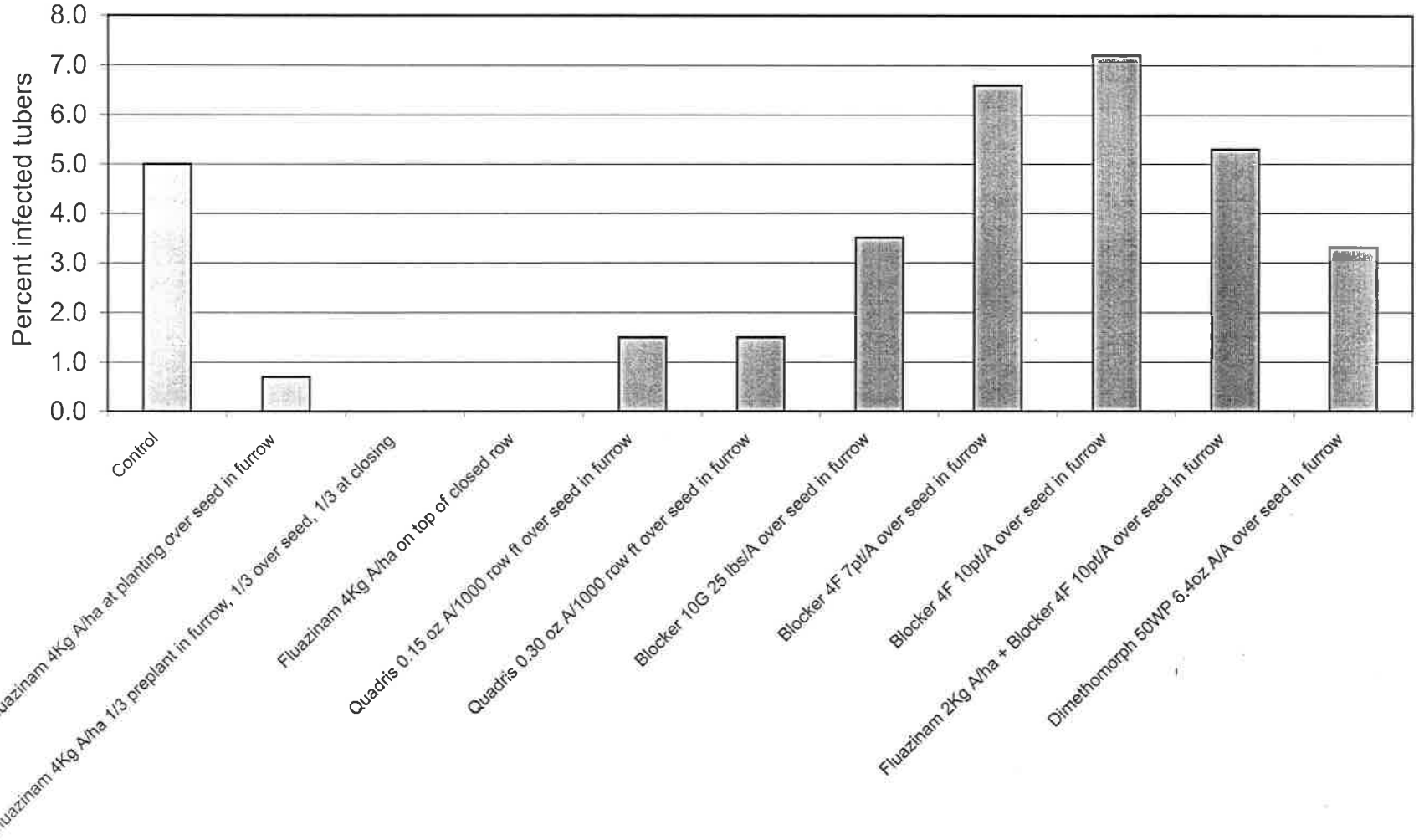
Disease: Percent tubers showing one or more powdery scab lesions.

Effect of fungicides applied at planting on the incidence of powdery scab in the cultivar Yukon Gold, San Luis Valley, Colorado, 2000

Treatment and Rate	Incidence %	% Healthy
1. Control	5.0	95.0
2. Fluazinam, 7 pt/A at planting over seed in furrow	0.7	99.3
3. Fluazinam, 7 pt/A 1/3 preplant in furrow, 1/3 over seed, 1/3 at row closing	0.0	100.0
4. Fluazinam,7 pt/A on top of closed row	0.0	100.0
5. Quadris, 2.3 pt/A over seed in furrow	1.5	98.5
6. Quadris, 4.5 pt/A over seed in furrow	1.5	98.5
7. Blocker 10G, 25 lbs/A over seed in furrow	3.5	96.5
8. Blocker 4F, 7pt/A over seed in furrow	6.6	93.4
9. Blocker 4F, 10pt/A over seed in furrow	7.2	92.8
10. Fluazinam, 3.5 pt/A + Blocker 4F 10pt/A over seed in furrow	5.3	94.7
11. Dimethomorph 50WP, 6.4oz A/A over seed in furrow	3.3	96.7
12. AgriCultures International Tonic	6.0	94.0

Richard T. Zink, Extension Potato Specialist, Colorado State University

Effect of fungicides applied at planting on the incidence of powdery scab in the cultivar Yukon Gold, San Luis Valley, Colorado, 2000



2000 PROTOCOL FOR EVALUATION OF FUNGICIDES APPLIED AT PLANTING FOR CONTROL OF RHIZOCTONIA ON POTATO

Researcher: Richard T. Zink, Extension Potato Specialist, and Andrew Houser, Research Associate, Colorado State University

Location: San Luis Valley Research Center, Center, CO

Cultivar: Sangre, cut seed

Treatments:
1. Control, no treatment
2. Quadris, 0.15 oz ai/1000 ft row
3. Quadris, 0.15 oz ai/1000 ft row + Blocker 10G, 1.65 lb/1000 ft row
4. Blocker 4F, 5.2 fl oz/1000 ft row
5. Blocker 4F, 10.4 fl oz/1000 ft row

Application: Treatments were applied using an R & D CO_2 charged backpack sprayer at 60 PSI, with one 8002 nozzle, at 10 gallons/acre as a directed in-furrow application.

Planted: May 11, 2000
Plot Design: Randomized complete block
Plot Size: 1 - 30 foot row/treatment/replication
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Four
Irrigation: Solid set sprinkler, rate based on ET
Fertilizer: 104N-130P-52K, preplant, with 50N through sprinkler after tuber set
Herbicide: Matrix and Dual
Fungicide: Bravo, Quadris, Dithane for blight control
Vine killer: Mechanical defoliation on September 11
Harvested: By hand, September 20, 2000

DATA

Disease: Percent of stems infected and tubers after harvest by percentage of affected surface area and severity of the sclerotia.
Yield: 1-30 foot row per treatment per replication expressed as cwt/A.
Grade: By hand, percent tubers by weight < 4 oz, 4-10 oz, > 10oz, misshapen, and culls.

Table 1. Effect of products applied at planting on plant development and incidence of disease in the cultivar Sangre, San Luis Valley, Colorado, 2000

Treatment	Rate	Stand[a]	Stems[b]	%Stems with Rhizoctonia[c]	Seed piece Decay[d]	Black Scurf Severity Index[e]
Control		96.8	4.1	2.1	67.1	19.5
Quadris	0.15 oz ai/1000 ft row	94.3	2.8	0.0	33.3	19.4
Quadris + Blocker 10G	0.15 oz ai/1000 ft row 1.65 lb prod /1000 ft row	96.0	2.6	0.0	15.0	15.5
Blocker 4F	5.2 fl oz /1000 ft row	96.8	3.0	0.0	19.2	12.8
Blocker 4F	10.4 fl oz/1000 ft row	97.5	3.3	0.0	60.8	16.8
LSD P=0.05		NS	0.84	NS	41.29	NS

[a] Percentage of plants emerged 34 days after planting, four replications.
[b] Mean number of stems per seed piece 63 days after planting, three plants/treatment/replication.
[c] Mean percent stems with Rhizoctonia canker 63 days after planting; three plants/treatment/ replication, four replications.
[d] Mean percent incidence of disease combined soft-rot and dry-rot 63 days after planting; rated 0-100; 0 = no decay, 100 = complete decay; three seed pieces/treatment/replication.
[e] Black scurf severity index = mean percent effected tuber surface area multiplied by the severity of the sclerotia, where 1 = small sclerotia, and 3 = large sclerotia , 10 tubers/treatment/replication.

Table 2. Effect of products applied at planting on tuber size, grade, and yield in the cultivar Sangre, San Luis Valley, Colorado, 2000

Treatment	Rate	Percent[a]					cwt/A[b]
		< 4 oz	4-10 oz	> 10 oz	#2's	Culls	
Control		24.9	46.1	26.5	0.5	2.0	392.6
Quadris	0.15 oz ai/1000 ft row	18.7	56.2	24.1	0.1	0.9	482.3
Quadris + Blocker 10G	0.15 oz ai/1000 ft row 1.65 lb prod /1000 ft row	24.7	63.8	11.5	0.1	0.0	442.5
Blocker 4F	5.2 fl oz /1000 ft row	28.6	58.4	12.7	0.2	0.1	425.9
Blocker 4F	10.4 fl oz/1000 ft row	26.3	55.0	17.7	0.2	0.9	447.6
LSD P=0.05		7.54	7.87	10.57	0.32	1.45	NS

[a] Based on tuber weight, four replications.
[b] Total yield in hundred weight per acre based on 1-30 foot row, four replications.

2000 PROTOCOL FOR EVALUATION OF FUNGICIDES APPLIED AT PLANTING FOR CONTROL OF PINK ROT ON POTATO

Researchers: Richard T. Zink, Extension Potato Specialist, and Andrew Houser, Research Associate, Colorado State University

Location: San Luis Valley Research Center, Center, CO

Cultivar: Sangre, cut seed

Treatments:
1. Control, no treatment
2. Ridomil Gold EC, 0.42 oz/1000 feet of row
3. Ultra-Flourish, 0.42 oz/1000 feet of row
4. Ultra-Flourish, 0.84 oz/1000 feet of row
5. Platinum 114 G A/Ha
6. A12425 342 G A/Ha

Application: Treatments were applied using an R & D CO_2 charged backpack sprayer at 60 PSI, with one 8002 nozzle, at 10 gallons/acre as a directed in-furrow application.

Planted: May 11, 2000
Plot Design: Randomized complete block
Plot Size: 1 - 30 foot row/treatment/replication
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Four
Irrigation: Solid set sprinkler, rate based on ET
Fertilizer: 104N-130P-52K, preplant, with 50N through sprinkler after tuber set
Herbicide: Matrix and Dual
Fungicide: Bravo, Quadris, Dithane for blight control
Vine killer: Mechanical defoliation on September 11, 2000
Harvested: By hand, September 20, 2000

DATA

Disease: Stand, percent of stems and seed pieces infected by disease, and tubers after harvest by challenge inoculation of pink rot.
Yield: 1-30 foot row per treatment per replication expressed as cwt/A
Grade: By hand, percent tubers by weight < 4 oz, 4-10 oz, > 10oz, misshapen, and culls.

Table 1. Effect of products applied at planting on plant development and incidence of disease in the cultivar Sangre, San Luis Valley, Colorado, 2000

Treatment	Rate	Stand[a]	Stems[b]	%Stems with Rhizoctonia[c]	Seed piece Decay[d]	Pink Rot[e]
Control		96.8	4.1	2.1	67.1	50
Ridomil Gold	0.24 Fl oz /1000ft row	97.5	3.8	6.3	70.8	41
Ultra Flourish	0.42 Fl oz /1000ft row	98.5	3.9	10.3	79.2	38
Ultra Flourish	0.84 Fl oz /1000ft row	97.5	3.5	20.0	91.7	33
Platinum	114 G A/Ha	96.5	4.3	9.7	87.5	not tested
A12425	342 G A/Ha	100.0	3.4	13.1	83.3	not tested
LSD P=0.05		NS	NS	NS	NS	NS

[a] Percentage of plants emerged 34 days after planting, four replications.
[b] Mean number of stems per seed piece 63 days after planting, three plants/treatment/replication.
[c] Mean percent stems with Rhizoctonia canker 63 days after planting; three plants/treatment/ replication.
[d] Mean percent incidence of disease combined soft-rot and dry-rot 63 days after planting; rated 0-100; 0 = no decay, 100 = complete decay; three seed pieces/treatment/replication.
[e] Pink Rot severity index, post harvest tuber inoculation, assays conducted by Dr. Neil Gudmestad at North Dakota State University- Fargo.

Table 2. Effect of products applied at planting on tuber size, grade, and yield in the cultivar Sangre, San Luis Valley, Colorado, 2000

Treatment	Rate	Percent[a]					cwt/A[b]
		< 4 oz	4-10 oz	> 10 oz	#2's	Culls	
Control		24.9	46.1	26.5	0.5	2.0	392.6
Ridomil Gold	0.24 Fl oz /1000ft row	27.5	52.3	17.1	0.6	2.5	461.4
Ultra Flourish	0.42 Fl oz /1000ft row	26.6	50.0	23.0	0.0	0.4	404.0
Ultra Flourish	0.84 Fl oz /1000ft row	24.0	54.2	19.8	0.0	2.1	412.9
Platinum	114 G A/Ha	21.4	58.1	19.2	0.1	1.1	490.5
A12425	342 G A/Ha	22.4	54.9	20.5	0.7	1.5	466.1
LSD P=0.05		NS	9.48	7.88	NS	NS	90.12

[a] Based on tuber weight, four replications.
[b] Total yield in hundred weight per acre based on 1-30 foot row, per treatment, four replications.

2000 PROTOCOL FOR EVALUATION OF AUXIGRO APPLIED DURING GROWING SEASON ON POTATO TUBER DEVELOPEMENT

Researchers: Richard T. Zink, Extension Potato Specialist, and Andrew Houser, Research Associate, Colorado State University

Location: San Luis Valley Research Center, Center, CO

Objective: To evaluate the effect of Auxigro on tuber size, quality and number.

Treatments: All treatments were applied using an R & D CO_2 charged tractor mounted plot sprayer with four 8002VS nozzles spaced 17 inches apart at 60 psi pressure and applying 40 gallons per acre. Application dates A=July 7, 2000;
B= July 17,2000.

Plot Design: Randomized complete block
Planted: May 10, 2000
Plot Size: 4 - 20 foot rows per treatment per replication, treatments applied to center two rows and data taken from center two rows.
Plant Spacing: 12 inches
Row Spacing: 34 inches
Replications: Four
Cultivar: Chipeta
Irrigation: Center pivot sprinkler, rate based on ET
Fertilizer: 90 N-100 P, preplant, 40N through sprinkler
Herbicide: Dual Magnum + Sencor, Poast
Fungicide: Dithane, Quadris, Bravo, AgriTin, Bravo, Dithane
Insecticide: Fullfill, Thiodan, and Ansana,
Vine killer: Sulfuric acid on August 12, 2000
Harvested: September 18, 2000

DATA

Yield: 2-20 foot row per/treatment/replication, total yield expressed in cwt/A and total number of tubers.
Grade: Percent tubers by weight < 4 oz, 4-10 oz, > 10 oz, US #2, and culls.

Table 1. Effect of Auxigro on tuber yield, quality and number in the cultivar Chipeta, San Luis Valley, Colorado, 2000

		< 4 oz		4-10 oz		> 10 oz		#2's		Culls		Total number tubers	Yield cwt/acre
Treatment	Application	%	No.	%	No.	%	No.	%	No.	%	No.		
Standard practice		39.3	128	57.6	101	1.5	1.5	0.2	0.3	1.4	2.0	233.3	255.4
Auxigro @ 5 oz	AB	44.4	165	52.0	108	1.5	1.5	0.0	0.0	1.1	1.8	276.3	282.8
Auxigro @ 4 oz	AB	41.3	137	56.4	120	1.2	1.3	0.3	0.5	0.8	1.3	261.0	283.7
Auxigro @ 3 oz	AB	43.4	153	51.1	95	3.4	3.0	0.7	1.0	1.3	2.3	254.3	257.9
Auxigro @ 4 oz	A	41.2	129	57.1	103	0.6	0.5	0.3	0.5	0.8	1.5	235.0	259.2
Auxigro @ 4 oz	B	41.3	141	53.6	93	3.4	3.0	0.2	0.3	1.50	2.8	241.0	263.4
LSD P=0.05		NS	28.7	NS	NS	NS	NS	NS	0.75	NS	NS	35.53	NS

[a] Application: A = application at first tuber set, (July 7) B = 10 days after tuber set (July 17).
[b] Total yield in hundred weight per acre based on 2 - 20 foot rows, per treatment, four replications.

2000 PROTOCOL FOR EVALUATION OF ASCEND PA IN FALL-FUMIGATED POTATO PRODUCTION SYSTEMS IN THE SAN LUIS VALLEY OF COLORADO

Researcher: Richard T. Zink, Extension Potato Specialist, and Andrew Houser, Research Associate, Colorado State University, San Luis Valley Research Center

Location: Four fall-fumigated (metam-sodium) fields in the San Luis Valley
Cultivars: Centennial Russet, Russet Nugget, Viking and Molli
Seed: A typical combination of cut and uncut seed tubers
Application: All treatments applied using a R & D CO_2 charged backpack plot sprayer at 60 psi and 10 gallons per acre.
Treatments:
1. Control, untreated
2. Ascend PA, 5 gallons per acre just after planting incorporated into soil above seedpiece

Field/Cultivar:	Martinez Farms/ Centennial Russet and Russet Nugget	Summit Farms/ Viking and Molli
Plot design:	Randomized	Randomized
Plot size:	2-15 foot rows/treatment/replication	2-15 foot rows/treatment/replication
Plant spacing:	10 inches	6 inches
Row spacing:	34 inches	34 inches
Replications:	Four	Four
Irrigation:	Provado and Tirgram	Vydate
Fungicide:	Polyram, Supertin, Bravo and Ridomil	Bravo and Ridomil
Vine killer:	Sulfuric Acid	Sulfuric Acid
Plant:	May 6, 2000	May 16, 2000
Harvest:	September 19, 2000	September 5, 2000

DATA

Stand: 2 - 30 foot rows/treatment/replication/field, counts taken about 35 days after planting.
Seed piece decay: Soft-rot and dry-rot combined rated 1-100, 0 = no decay and 100 = complete decay; 5 seed pieces, treatment/replication/field approximately 50 days and 70 days after planting.
Rhizoctonia stem canker: Percent stems infected; 5 plants/treatment/replication/field approximately 50 days and 70 days after planting.
Blackleg: Percent stems infected; 5 plants/treatment/replication/field approximately 50 days and 70 days after planting.
Plant vigor: Rated 1 - 4, 1 = poor and 4 = good; 5 plants/treatment/replication/field approximately 50 days and 70 days after planting.
Stems: Average number of stems per plant; 5 plants/treatment/replication/field approximately 50 days and 70 days after planting.
Stolons: Average number of stolons per stem per plant; 5 plants/treatment/replication/field approximately 50 days and 70 days after planting.
Tubers: Average number of developing tubers per plant; 5 plants/treatment/replication/field 70 days after planting.
Root development: Rated 1 - 4, 1 = poor and 5 = extensive; 5 plants/treatment/replication/field approximately 50 days and 70 days after planting.
Yield: By hand, 2 - 15 foot rows/treatment/replication/field expressed as cwt/A.
Grade: By hand, percent tubers by weight < 4 oz., 4-10 oz., > 10 oz. and misshapen.

Table 1. Effect of Ascend PA on potato plant development and incidence of disease, San Luis Valley, Colorado, 2000

Cultivar	Treatment[a]	Stand[b]	Stems[c]	Stolons[d]	Vigor[e]	Rhiz[f]	%Rot[g]	BL[h]	Stems[c]	Tubers[i]	Roots[j]
		44 days after planting							65 days after planting		
Molli	Ascend PA	57	4.2	15.1	4.0	0.2	0.0	0.0	3.8	5.7	3.1
	control	59	4.5	10.5	3.5	0.5	12.5	0.0	4.2	5.6	2.6
Viking	Ascend PA	33	2.2	7.0	2.9	0.0	33.0	0.0	2.6	2.3	1.3
	control	31	2.8	4.1	2.6	0.0	34.5	0.0	2.4	2.2	1.1
		54 days after planting							75 days after planting		
Centennial Russet	Ascend PA	38	4.7	16.8	4.7	2.5	0.0	0.0	5.2	9.0	4.0
	control	37	4.8	15.4	4.3	1.7	2.5	0.0	4.3	8.0	3.5
Russet Nugget	Ascend PA	33	4.4	25.9	4.9	1.5	4.0	0.0	5.0	12.3	4.9
	control	33	4.4	21.5	4.6	2.9	0.0	0.0	4.9	9.0	4.7
Overall mean 4 varieties, 4 locations	Ascend PA	40	3.9	16.2	4.1	1.1	9.3	0.0	4.2	7.3	3.3
	control	40	4.1	12.9	3.8	1.3	12.4	0.0	4.0	6.2	3.0

[a]All treatments were applied according to manufacturers recommendations.
[b]Mean number of plants per 30 feet of row; 2 rows/treatment/replication.
[c]Mean number of stems per plant; five plants/treatment/replication.
[d]Mean number of stolons per plant; five plants/treatment/replication.
[e]Mean plant growth rated 1 – 4, 1 = poor, 4 = good; five plants/treatment/replication.
[f]Mean percent stems with Rhizoctonia canker; five plants/treatment/replication.
[g]Mean percent incidence of disease combined soft-rot and dry-rot; five seed pieces/treatment/replication.
[h]Mean percent incidence of blackleg disease; five plants/treatment/replication.
[i]Mean number of tubers per plant; five plants/treatment/replication.
[j]Mean root development rated 1-5, 1 = poor and 5 = extensive; five plants/treatment/replication.

Table 2. Effect of Ascend PA on potato tuber number, size, and quality, San Luis Valley, Colorado, 2000

Cultivar	Treatment	Percent[a]								Total tubers	Total lbs.	CWT/A[c]
		< 4 oz	tubers	4-10 oz	tubers	> 10 oz	tubers	MS[b]	tubers			
Molli	Ascend PA	40.8	63.4	57.7	36.1	1.3	0.4	0.2	0.2	123.0	25.6	256
	control	40.6	62.3	58.8	37.5	0.5	0.2	0.0	0.0	141.0	28.1	281
Viking	Ascend PA	11.0	31.2	50.7	49.4	38.3	19.4	0.0	0.0	70.5	29.3	293
	control	10.3	31.7	56.1	51.8	32.4	16.2	1.2	0.4	65.0	22.6	226
Centennial Russet	Ascend PA	9.6	24.7	72.6	66.8	17.7	8.5	0.0	0.0	125.0	46.7	467
	control	8.7	25.0	68.8	64.3	22.5	10.7	0.0	0.0	126.5	48.3	483
Russet Nugget	Ascend PA	14.5	31.1	74.2	64.4	11.3	4.5	0.0	0.0	164.0	46.0	460
	control	15.4	33.8	74.3	62.3	10.3	3.9	0.0	0.0	139.8	42.3	423
Overall mean 4 varieties, 4 locations	Ascend PA	19.0	37.6	63.8	54.2	17.2	8.2	0.1	0.1	120.6	36.9	369
	control	18.8	38.2	64.5	54.0	16.4	7.8	0.3	0.1	118.1	35.3	352

[a] Based on tuber weight and numbers, mean of four replications.
[b] Misshaped tubers.
[c] Total yield in hundred weight per acre based on 2-15 foot rows/treatment, mean of four replications.

2000 European Potato Cultivar Trial, San Luis Valley, Colorado

Table 1. Tuber yield and quality

Cultivar	Percent[a]				Yield[b]	
	under 4 oz. (50mm)	4-10 oz. (50-65mm)	over 10 oz. (65mm)	Misshapen	total	Mt/Ha
Caesar	10.7	59.1	30.2	0.0	46.5	50.7
Divina	13.3	61.1	25.7	0.0	56.5	61.6
Fabula	6.6	56.2	37.0	0.0	67.5	73.6
Florissant	21.4	78.7	0.0	0.0	36.2	39.5
Innovator	41.6	52.9	6.5	0.0	51.2	55.8
Latona	12.8	61.5	25.6	0.0	39.0	42.5
Morning Gold	14.1	74.3	11.5	0.0	39.0	42.5
Serria	15.3	65.5	19.0	0.0	47.3	51.6
Vivaldi	6.8	68.6	24.7	0.0	62.7	68.3
Yukon Gold	17.0	75.0	7.9	0.0	44.0	48.0
German Butterball	42.1	57.8	0.0	0.0	51.0	55.6

[a]Percent tubers by weight of total yield.
[b]Total is pounds of tubers from 15 feet of row, 2 replications. Mt/Ha is estimated total yield expressed as metric tons per hectare.

Planted: May 10, 2000
Plant Spacing: 12 inches (Fabula, 8 inches)
Row Spacing: 34 inches
Irrigation: Center Pivot
Fertilizer: 150 lbs/A N, 180 lbs/A P, 100 lbs/A K, 60 lbs/A S
Herbicide: Eptam
Fungicide: Bravo, Manzate and Supertin
Insecticide: Pounce
Harvest: September 15, 2000

Table 2. Tuber rating for appearance

Variety	Size	Regularity of Size	Shape	Regularity of Shape	Skin Color	Skin Brightness	Total Impression
Caesar	7	7	5	5	6	6	7
Divina	7	7	7	6	5	6	8
Fabula	9	9	7	8	7	7	9
Florissant	8	8	7	7	7	8	8
Innovator	6	7	7	7	8	7	8
Latona	7	8	7	7	7	8	8
Morning Gold	8	9	9	8	8	8	9
Serria	7	6	8	8	6	6	7
Vivaldi	8	7	7	8	7	7	7
Yukon Gold	8	8	9	9	7	7	8
German Butterball	6	7	7	8	7	6	7

Rating system is from 1 to 10; 1 = poor, 10 = excellent.

Post harvest evaluation of European cultivars, San Luis Valley, Colorado, 1999 crop

Cultivar	Pressure bruise[a]	Internal[b]	Sprouting[c]	Silver Scurf[d]	Dry Rot[e]	Black Scurf[f]	Early Blight[g]	Stem end[h]	Condition (1-5)[i]	Overall (1-5)[j]
Caesar	None	None	None	None	1 with 2%	None	None	None	5	4
Concurrent	None	None	None	None	5 with 3%	None	None	None	4	3
Dali	None	None	None	None	None	None	None	None	5	5
Divina	None	None	None	None	9 with 1-2%	None	None	None	5	3
Fabula	None	None	None	None	3 with <1%	None	None	None	5	5
Gallia	None	None	None	None	1 with <1%	None	None	None	5	5
Innovator	None	None	None	None	3 with <1%	None	None	None	5	5
Latona	None	None	None	None	None	None	None	None	5	5
M. Gold	None	None	None	None	1 with trace	1 with 2%	None	None	5	5
Obelix	None	None	None	None	None	None	None	None	4	4
Symfonia	1 with 5%	None	None	1 with 5%	1 with 1%	None	None	None	5	5
Victoria	None	None	None	None	None	None	None	None	5	5
Vivaldi	None	None	None	None	1 with <1%	None	None	None	5	5
Yukon Gold	3 with 5%	None	None	2 with 10%	6 with 5%	2 with 5%	None	None	4	3

At harvest, 25 pound samples of each cultivar were collected in poly mesh sacks. The sacks were then placed among bulk potatoes in a commercial potato storage bin. The bin held about 10,000 cwt. Samples were covered by approximately 10 feet of bulk potatoes throughout a seven month storage period. The bin in which the samples were stored was treated with SPROUTNIP.
At the end of the storage period the samples were recovered. A 15 tuber sub-sample was randomly selected from each cultivar for evaluation. Tubers were scored for the following factors.

[a] Percent tuber surface area with flattened or depressed areas with or without underlying discoloration.
[b] Any form of internal discoloration.
[c] Extent of sprout development.
[d] Percent tuber surface area effected by silver scurf.
[e] Percent tuber tissues effected by *Fusarium* dry rot.
[f] Percent tuber surface area effected by black scurf.
[g] Percent tuber surface area effected by *Alternaria* tuber rot.
[h] Percent of vascular discoloration at the tuber stem end.
[i] Condition of tubers as a factor of dehydration during storage, rated 1-5; 1 = extreme dehydration and 5 = no apparent water loss, firm tissue and smooth skin.
[j] Overall visual condition of tuber sub-sample, rated 1-5; 1 = poor and 5 = excellent.

2000 PROTOCOL FOR EVALUATION OF KOCIDE 2000 AND QUADRIS APPLIED POST HARVEST FOR CONTROL OF EARLY BLIGHT ON POTATO

Researcher: Richard T. Zink, Extension Potato Specialist, and Andrew Houser, Research Associate, Colorado State University

Location: San Luis Valley Research Center, Center, CO

Objective: Evaluate the efficacy of Kocide 2000 and Quadris for the control of *Fusarium* and *Alternaria* tuber rot in stored potatoes.

Acknowledgements: We gratefully acknowledge the cooperation and support of Griffin L.L.C.

Cultivar: Sangre whole tubers, 10 to 12 ounce size

Treatments:

1. Wounded
2. Wounded, and inoculated with *Alternaria solani*
3. Wounded, and inoculated with *Alternaria solani*, then sprayed with a solution of 2000 ppm ai Kocide 2000 in water
4. Wounded, and inoculated with *Alternaria solani,* then sprayed with a solution of 100 ppm ai Quadris in water
5. Wounded, and inoculated with *Alternaria solani*, then sprayed with a solution of 200 ppm ai Quadris in water

Replications: Four replications/treatment, twenty tubers/treatment/replication

Method: Tubers were harvested by hand on October 3, 2000. Directly following harvest all tubers were wounded uniformly in a large tumbler to simulate a rough commercial harvesting operation. Inoculum of *Alternaria solani* was applied during the wounding operation. Following wounding and inoculation, either Kocide 2000 or Quadris were applied to tubers as a low volume spray, also to simulate a commercial post harvest treatment. All tubers were then held at 50° F, 80% RH for 11 weeks after which, disease ratings were taken on each tuber in each replication.

DATA

Disease: Extent of tuber damage rated on the number of passes with a vegetable peeler required to remove all rotted tissue from each wound on each tuber.

RESULTS Application of Kocide 2000 at 2000 ppm increased the incidence of tuber rot in stored tubers over all other treatments. Quadris at both rates reduced the incidence of tuber rot compared to the wounded inoculated control and wounded control.

Post Harvest Evaluation of Fungicides for Control of Tuber Rot

20 tubers / replication x 4 / treatment

Treatment #

	1		2		3		4		5	
	Total # peels	**Total # lesions**	**Total # peels**	**Total # lesions**	**Total # peels**	**Total # lesions**	**Total # peels**	**Total # lesions**	**Total # peels**	**Total # lesions**
I	628	195	869	159	1152	176	295	131	355	146
II	497	145	899	167	1055	192	330	131	315	118
III	549	190	686	136	1253	179	391	153	346	133
IV	534	184	1018	164	1177	209	331	142	338	135
Totals	2208	714	3472	626	4637	756	1347	557	1354	532

	Treatment #1	**Treatment #2**	**Treatment #3**	**Treatment #4**	**Treatment #5**
Incidence (Avg. # of lesions)	8.93	7.83	9.45	6.96	6.65
Severity (Avg. # of peels)	3.09	5.55	6.13	2.42	2.55
Severity Index (Incidence x Severity)	27.60	43.40	57.96	16.84	16.93

Treatments

#1 Wounded

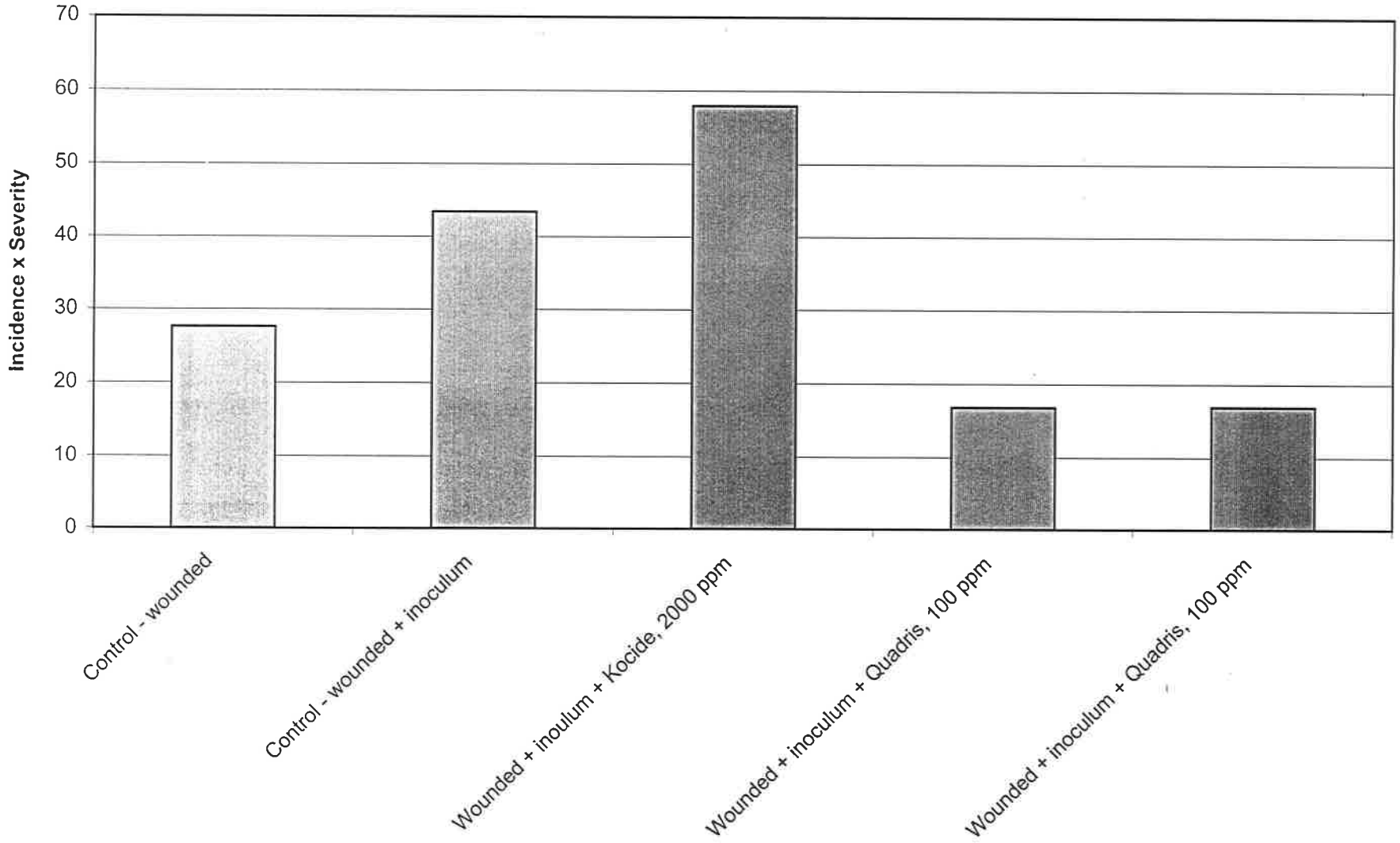
#2 Wounded, and inoculated with *Alternaria solani*

#3 Wounded, and inoculated with *Alternaria solani*, then sprayed with a solution of 2000 ppm ai Kocide 2000 in water

#4 Wounded, and inoculated with *Alternaria solani*, then sprayed with a solution of 100 ppm ai Quadris in water

#5 Wounded, and inoculated with *Alternaria solani*, then sprayed with a solution of 200 ppm ai Quadris in water

Post Harvest Evaluation of Fungicides for Control of Tuber Rot



Significant Accomplishments for 2000 in the Advanced Clone Disease Assessment Program:

In 2000, seven advanced clones were evaluated to their response to potato leafroll and twenty seven advanced clones and cultivars for their response to bacterial ring rot. All of the advanced selections screened for potato leafroll had adequate expression to the disease. In addition, they all showed very significant levels of in-field spread of the disease ranging from 58-94% infection as compared with the check cultivars in the range of 0-85% infection. Given the season and the major flights of green peach aphid, this is not unexpected. All of the evaluated material would fit into the high to very high category for risk of leafroll spread. In addition, all of the clones demonstrated symptoms to potato virus Y, another virus which the clones will be evaluated against in the future (Tables 1 & 2).

All but one of the twenty seven advanced clones and cultivars demonstrated symptom expression to bacterial ring rot. The cultivar Huckleberry did not show any disease symptoms during the season. In addition, three clones, CO92059-8, CO92077-2 and TC1675-1, which have been evaluated more than one year, still demonstrated low levels of infection by the end of the season. While these levels and the timing of expression are adequate, they do fall into the higher risk category. Of the advanced clones being tested for the first year, only one, CO93037-6, fell into the low symptom, higher risk category. Finally, two of the cultivars, Crispin and Huckleberry, will be tested for a second year because of their inadequate reaction to the disease (Tables 3 & 4).

Testing of the advanced selections for reaction to the tuber problems, *Erwinia carotovora* subspp., *Fusarium* spp., and *Alternaria solani*, is ongoing. Additional pathogens will be added to the evaluation scheme in 2001 including potato virus Y (foliar) and powdery scab.

2000 Potato Leafroll Clonal Evaluation

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

Treatments: PLRV Infected and Healthy

Plot Design: RCB - 5 seedpieces or reps/cv x two treatments

Plant Date: 5/2/00

Plot Size, etc.: See plot map; 12" plant spacing x 34" row spacing

Cultivars:

AC93026-9	Sangre
AC93047-2	Centennial Russet
CO93001-11	WNC230-14
CO93016-3	Ute Russet
CO93024-2	Russet Nugget
CO93037-6	Russet Norkotah
Russet Burbank	Russet Legend (COO83008-1)

Irrigation: Ground sprinkler: rate based on ET. Irrigated 47 hours over season, approximately 0.6"/hr for a total of 28" over season.

Fertilizer: Planting fertilizer of approximately 80:100:40 using liquid fertilizer at 67 gal/a. Soil test results indicated a total of 60#/a soil residual and N from the water equaled approximately 34#/a over the season when irrigating 28" and a foliar application during the season on 7/10/00 for a total of 15#/a. The grand total is 189:100:40.

Herbicide/ Eptam 4 pts/a, Matrix 1.5 oz/a applied on 5/31/00 + Matrix 1.5 oz/a applied on 6/12/00 on the south end of the field (BRR plots).

Fungicide/ 1.0 #/a Bravo-Ultrex on 6/27/00, 8/5/00 + 1.5 pt/a Bravo Weatherstick 1720 on 7/15/00.

Insecticide/ No insecticide used during the summer

Harvest: 9/10/00

Table 1. 2000 PLRV Symptom Expression in Advanced Clones and Standard Cultivars

Cultivar/Clone	PLRV Reaction (0-3+)	Symptoms	MO Symptoms
AC93026-9	3+ 100%	LL,CC,WP,P	Positive
AC93047-2	3+ 100%	LL,CC,WP	Positive
CO93001-11	3+ 100%	LL,CC,WP	Positive
CO93016-3	3+ 80%	LL,CC,WP	Positive
CO93024-2	3+ 80%	LL,CC,WP	Negative
CO93037-6	3+ 80%	LL,CC,WP,P	Negative
Russet Burbank	3+ 100%	LL,CC,WP	Positive
Sangre	3+ 100%	LL,CC,WP,P	Positive
Centennial Russet	3+ 100%	LL,CC,WP	Negative
WNC230-14	1+ 25%	LL,CC	Positive
Ute Russet	3+ 80%	LL,CC,WP	Positive
Russet Nugget	3+ 80%	LL,CC,WP,P	Positive
Russet Norkotah	3+ 100%	LL,CC,WP	Positive
Russet Legend	3+ 60%	LL,CC,WP	Negative

Key - Rating for the symptom expression is 0 = No symptoms to 3+ = Strong typical symptoms. % based on the number of plants total versus the number positive for LR. LL = lower leaf rolling, CC = good color change evident (yellowing or bronzing), WP = whole plant involvement and P = purpling evident on leaf margins.

2000 Potato Leafroll Natural In-Field Spread

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

Treatments: Healthy with LR+ between treatments

Plot Design: RCB - 12eedpieces/cultivar x 3 reps with LR+ between-treatments

Plant Date: 5/2/00

Plot Size, etc.: See plot map; 12" plant spacing x 34" row spacing

Cultivars:

AC93026-9	Sangre	Houma
AC93047-2	Centennial Russet	Katahdin
CO93001-11	WNC230-14	Keswick
CO93016-3	Ute Russet	Penobscot
CO93024-2	Russet Nugget	Russet Legend
CO93037-6	Russet Norkotah	
Russet Burbank	Green Mountain	

Irrigation: Ground sprinkler: rate based on ET. Irrigated 47 hours over season, approximately 0.6"/hr for a total of 28" over season.

Fertilizer: Planting fertilizer of approximately 80:100:40 using liquid fertilizer at 67 gal/a. Soil test results indicated a total of 60#/a soil residual and N from the water equaled approximately 34#/a over the season when irrigating 28" and a foliar application during the season on 7/10/00 for a total of 15#/a. The grand total is 189:100:40.

Herbicide/ Eptam 4 pts/a, Matrix 1.5 oz/a applied on 5/31/00 + Matrix 1.5 oz/a applied on 6/12/00 on the south end of the field (BRR plots).

Fungicide/ 1.0 #/a Bravo-Ultrex on 6/27/00, 8/5/00 + 1.5 pt/a Bravo Weatherstick 1720 on 7/15/00.

Insecticide/ No insecticide used during the summer

Harvest: 9/10/00

Table 2. 2000 Natural In-Field Spread of Leafroll to Advanced Clones

Cultivar/Clone	# pos / # emerged	% Spread 2000	% Spread 11 yr Avg	Risk
AC93026-9	32/47	68.0		
AC93047-2	62/66	93.9		
CO93001-11	54/61	88.5		
CO93016-3	56/70	80.0		
CO93024-2	34/58	58.6		
CO93037-6	38/58	65.5		
Russet Burbank	49/57	85.9	6.9	Medium
Sangre	24/43	55.8	5.6	Medium
Centennial Russet	29/54	53.7	3.0	Low
WNC230-14	0/64	0.0	0.0	Very Low
Ute Russet	35/48	72.9	12.8	High
Russet Nugget	35/44	79.5	14.5	High
Russet Norkotah	42/72	58.3		
Russet Legend	52/70	74.2		
Green Mountain	40/60	66.6	13.6	High
Houma	44/70	62.8	3.2	Low
Katahdin	24/72	33.3	3.5	Low
Keswick	26/51	50.9	5.2	Medium
Penobscot	9/61	14.7	0.5	Very Low

Data is from two tubers/plant, 12 plants/rep, and three replications/cultivar for a total of 72 tubers planted per clone in each year. Advanced clones have been tested for one year only. Risk assessment - Low = 0 - 4.9%, Medium = 5.0 - 9.9% and High = >/= 10.0%. The 11 year averages are from the 1999 season because of the excessively high readings for 2000. Also, risk assessments were not performed on the clones, again because of the excessively high readings.

2000 Bacterial Ring Rot Clonal Evaluation

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

Treatments: 1) BRR inoculated: 6-7 plates of Cms scraped into 2 liters of cold Ringer's solution. Tubers cut lengthwise and immersed in solution for 5 minutes. BRR suspension changed every five treatments and kept no longer than 30 minutes total.
2) Healthy control: Tubers cut lengthwise and planted.

Plot Design: RCB - 7 seedpieces/cultivar x 3 reps with healthy planted west of infected.

Plant Date: Inoculation 5/4/00; Planting 5/8/00

Plot Size, etc.: See plot map; 12" plant spacing x 34" row spacing

Cultivars:

AC92009-4	DT6063-1R	FL1867
CO92027-2	Valisa	FL1900
CO92059-8	Avalanche	FL1909
CO92077-2	Crispin	FL1930
NDC5281-2	Molli	Russet Burbank
NDC5372-1	Delikat	Sangre
TC1675-1	French Fingerling	Centennial Russet
AC93026-9	Kipfel	WNC230-14
AC93047-1	Austrian Crescent	Ute Russet
CO93001-11	German Butterball	Russet Norkotah
CO93016-3	Banana	
CO93024-2	Rose Finn Apple	
CO93037-6	Huckleberry	
Russet Legend	FL1851	

Irrigation: Ground sprinkler: rate based on ET. Irrigated 47 hours over season, approximately 0.6"/hr for a total of 28" over season.

Fertilizer: Planting fertilizer of approximately 80:100:40 using liquid fertilizer at 67 gal/a. Soil test results indicated a total of 60#/a soil residual and N from the water equaled approximately 34#/a over the season when irrigating 28" and a foliar application during the season on 7/10/00 for a total of 15#/a. The grand total is 189:100:40.

Herbicide/ Eptam 4 pts/a, Matrix 1.5 oz/a applied on 5/31/00 + Matrix 1.5 oz/a applied on 6/12/00 on the south end of the field (BRR plots).

Fungicide/ 1.0 #/a Bravo-Ultrex on 6/27/00, 8/5/00 + 1.5 pt/a Bravo Weatherstick 1720 on 7/15/00.

Insecticide/ No insecticide used during the summer

Harvest: 9/12/00

Table 3. 2000 Clonal Evaluation for Bacterial Ring Rot Foliar Symptom Expression.

^	Clone	Date of First Symptoms	# of Reps Positive	# of Plants Positive	% Plants Positive	Date 50% or More +	% Plants + 100 DAP	Summary of Symptoms	Stem Squeeze
2	AC92009-4	7/14	2	5	23.8	-----	42.8	ED,R,IVC,MN	'+'
2	CO92027-2	6/30	2	11	52.4	6/30	90.4	ED,R,IVC,IVN,MN,W	'+'
2	CO92059-8	6/30	1	1	4.8	-----	9.5	ED,R,IVN,MN	-
2	CO92077-2	7/21	1	1	4.8	-----	23.8	ED,R,IVC,IVN,MN,W	'+'
2	NDC5281-2	7/14	1	1	5.0	-----	15.0	ED,R,IVC,MN,W	-
2	NDC5372-1	6/30	3	11	55.0	6/30	80.0	ED,R,IVC,W	-
2	TC1675-1	6/30	1	1	4.8	-----	9.5	ED,R,IVC,IVN	-
1	AC93029-9	6/30	2	4	19.0	8/4	52.3	ED,R,IVC,MN,W	-
1	AC93047-1	7/14	2	2	9.5	8/11	57.1	IVC,IVN,MN,W	-
1	CO93001-11	6/30	1	1	4.8	8/4	76.2	ED,R,IVC,IVN,MN,W	'+'
1	CO93016-3	7/14	1	1	4.8	-----	38.1	ED,R,IVC,MN,W	-
1	CO93024-2	8/4	3	16	76.2	8/4	76.2	IVC,IVN,MN,W	-
1	CO93037-6	6/30	1	2	9.5	-----	14.3	ED,R,IVC,MN,W	ND
2	Russet Legend	6/30	2	2	9.5	-----	42.9	ED,R,IVC,IVN,MN,W	-
2	DT6063-1R	6/30	1	1	4.8	-----	33.3	ED,R,IVC,IVN,MN	-
1	Valisa	7/14	1	1	4.8	-----	44.6	ED,R,IVC,IVN,MN,W	-
1	Avalanche	8/11	2	2	9.5	-----	23.8	IVC,IVN,W	-
1	Crispin	6/30	1	1	4.8	-----	9.5	ED,R	-
1	Molli	7/21	1	1	4.8	-----	33.3	ED,R,IVC,IVN,MN,W	-
1	Delikat	6/30	3	8	38.1	8/4	61.9	ED,R,IVC,W	-

^	Clone	Date of First Symptoms	# of Reps Positive	# of Plants Positive	% Plants Positive	Date 50% or More +	% Plants + 100 DAP	Summary of Symptoms	Stem Squeeze
1	French Fingerling	8/4	1	1	4.8	-----	23.8	IVC,IVN,MN,W	'+'
1	Kipfel	7/14	1	1	5.0	-----	20.0	ED,R,IVC,IVN,MN,W	-
1	Austrian Crescent	6/30	1	1	4.8	-----	47.6	ED,R,IVC,IVN,MN,W	ND
1	German Butterball	6/30	2	3	15.8	-----	26.3	ED,R,IVC,MN	-
1	Banana	7/14	1	1	4.8	8/11	61.9	ED,R,IVC,IVN,W	ND
1	Rose Finn Apple	6/30	2	2	9.5	-----	23.8	ED,R,IVC	ND
1	Huckleberry	-----	-----	-----	-----	-----	-----	-----	ND
	Russet Burbank	6/30	2	9	42.8	7/21	71.4	ED,R,IVC,IVN,MN,W	ND
	Sangre	8/11	1	2	9.5	-----	14.3	IVC,IVN,MN,W	ND
	Centennial Russet	8/11	1	1	4.8	-----	4.8	IVC,IVN,MN	ND
	WNC230-14	6/30	1	1	4.8	-----	14.3	ED,R,IVC,IVN,MN,W	ND
	Ute Russet	-----	-----	-----	-----	-----	-----	-----	ND
	Russet Norkotah	6/30	2	6	28.6	8/4	61.9	ED,R,IVC,IVN,MN,W	ND

^ Number of years tested, Planting date - 5/8/00. Key to symptoms; ED - Early dwarf, R - Rosette, IVC - Interveinal chlorosis, IVN - Interveinal necrosis, MN - Marginal necrosis and W - Wilt. ND - Not done.

Table 4. 2000 Clonal Evaluation for Bacterial Ring Rot
Tuber Symptom Expression

^	Clone	# Reps +	# Tubers +	% Tubers +
2	AC92009-4			0
2	CO92027-2			0
2	CO92059-8	1	1	5
2	CO92077-2	1	1	5
2	NDC5281-2			0
2	NDC5372-1			0
2	TC1675-1	1	2	10
1	AC93026-9			0
1	AC93047-1	1	1	5
1	CO93001-11	1	1	5
1	CO93016-3			0
1	CO93024-2			0
1	CO93037-6			0
2	Russet Legend			0
2	DT6063-1R	1	1	5
1	Valisa			0
1	Avalanche	1	1	5
1	Crispin			0
1	Molli			0
1	Delikat			0
1	French Fingerling			0
1	Kipfel	1	1	5
1	Austrian Crescent			0
1	German Butterball			0
1	Banana			0

^	Clone	# Reps +	# Tubers +	% Tubers +
1	Rose Finn Apple			0
1	Huckleberry			0
	Russet Burbank	1	1	5
	Sangre			0
	Centennial Russet			0
	WNC230-14			0
	Ute Russet			0
	Russet Norkotah			0

^ Numbers of years tested; Two of three reps, ten tubers/rep.