

# ANNUAL REPORT 1998

Submitted by:

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## Introduction:

Potato disease recognition and management strategies are becoming increasingly important to the growers trying to produce a high quality, high yielding potato crop while maintaining production costs at reasonable levels. Many new diseases, such as late blight, will be confusing the production picture even more and will substantially add to the cost of production if not managed correctly. In addition, the unique environmental conditions found in the San Luis Valley further complicate disease diagnosis and management, requiring that much of the research be completed within the confines of the Valley. The primary focus of this project has been the reduction of five major disease problems; potato leafroll, tuber soft rot and blackleg (*Erwinia* spp.), bacterial ring rot, potato viruses causing foliar mosaic symptoms (PVX, PVS, PVY, PVM and PVA), and early blight tuber decay (*Alternaria solani*). Research projects have keyed in on the reduction of these disease problems in certified seed potato lots providing clean stocks to the commercial trade, understanding the epidemiology of these diseases under SLV conditions, improved testing methods to detect problems before they become serious, and providing growers with management strategies to assist in control of these diseases when they are present. This report summarizes the results from 1998. Two objectives, clonal evaluation for symptom expression to BRR, PLRV and common storage diseases, and early blight tuber decay studies will be covered. In addition, two other miscellaneous studies (PVY inoculation project and Russet Norkotah yield studies) are included at the back of the report for informational purposes.

## Results and Discussion:

**Objective 1)** Seventeen (BRR) and twelve (PLRV) advanced clones and six established cultivars were screened for symptom expression to BRR and PLRV. Also, tubers were evaluated for symptom expression to *Erwinia* spp., *Fusarium sambucinum* and *Alternaria solani*.

All of the clones tested had adequate symptom expression to leafroll as shown in Tables 1 and 2. One clone, CO86051-3, which had been screened previously, finally demonstrated adequate leafroll symptoms, albeit weaker than the standards. Several clones demonstrated high risk for in-field spread of leafroll and should be considered for their potential to have problems in the field. BRR expression was marginal to adequate for the majority of clones tested (see Tables 3 and 4). Clones tested for the second year had acceptable symptom expression and symptoms were within a normal time frame for expression. NDC4655-1 was an exception, however, demonstrating for the second year very weak symptoms to BRR. It will be tested for a third year. Results for the post harvest tuber evaluations are recorded in Tables 5 and 6. There were many differences between clones and expression of storage diseases which should be explored. Information on these clones will be used to prepare the cultivar specific management sheets and to help recognize and manage potential problems of individual clones in storage.

**Objective 2)** (in conjunction with R.T. Zink, A. Thompson and D.G. Holm) Research related to using an integrated approach to early blight management on potato demonstrated results quite similar to 1997. Production scenarios for four cultivars with varying degrees of susceptibility to early blight tuber decay (Russet Norkotah, Centennial Russet, Russet Nugget and Ranger Russet) were compared under SLV conditions to assess their potential to cause tuber blight. Again, the results were fairly straight forward and expected (see Tables 7 through 9 and Figures 1 through 8). After two years of plot work, the following practices were ranked according to their potential impact upon tuber blight...

1. **Cultivar grown** - the more susceptible the cultivar the greater the risk.
2. **Fertility** - the higher the fertility...the greater the risk for predisposing the tubers to early blight, the greater the risk of immature tubers and thus, poor skin set.
3. **Cooling of tubers immediately after harvest** - the quicker the cool down following harvest, the less the risk of tuber decay.
4. **Vine kill** - use of sulfuric acid or propane burning to kill vines, either chopped or unchopped, reduces the inoculum load on the soil surface and thus, reduces the number of *A. solani* spores available for infection.
5. **Tuber inoculation** - inoculating tubers with *A. solani* spores increases the risk of tuber decay only if the tubers are predisposed to the disease by cultivar susceptibility, immaturity, etc. Otherwise, tubers with proper maturity and skin set are quite resistant to decay, cultivar notwithstanding.

Table 9 indicates that certain production and management practices can influence the amount of early blight tuber decay present. Throughout the project, cultivar grown had a major impact on early blight tuber decay with Ranger Russet being the most susceptible, Russet Nugget mid-range and Centennial Russet and Russet Norkotah the least susceptible.

Fertility level is a known factor in production of immature tubers and physiologically different tubers. In previous studies of grower's fields, high fertility was directly linked to production of tubers physiologically suited to high amounts of early blight tuber decay. However, it is difficult to reproduce these types of situations in small plots. So, while the results from two years of trials did not demonstrate meaningful differences in the tubers' predisposition to develop early blight tuber decay under differing levels of fertility, other evidence suggests that fertility does play a major role in tuber susceptibility. The higher the fertility, the greater the risk for early blight tuber decay.

Timing of fungicide applications also appears to play a major role in tuber predisposition to early blight decay. The tighter the interval for fungicide application, the less the risk of tuber decay. The results from this project indicate a consistent trend toward reduced levels of early blight tuber decay under treatments with shorter fungicide application intervals. The two year average of the data shows the following;

	Percent Tubers Infected	
	21 Day Interval	14 Day Interval
Centennial Russet	4.0	2.3
Russet Norkotah	3.9	3.4
Russet Nugget	5.6	4.4
Ranger Russet	7.7	5.6

By increasing the frequency of fungicide applications to control the foliar phase of the disease, the risk to early blight is decreased. This may be due to a decreased production of spores for tuber inoculum or spores that are less fit, or it may be a response to the plant producing tubers which have better skin set and are less physiologically prone to early blight tuber decay.

Finally, cooling of the storages when tubers are first placed into the bins can have an impact upon symptom development of early blight tuber decay. The two year average of the data demonstrates that rapid early cooling will reduce percent tubers infected with early blight;

	Percent Tubers Infected	
	Rapid Cooling	Gradual Cooling
Centennial Russet	2.4	4.5
Russet Norkotah	2.4	4.2
Russet Nugget	3.2	4.7
Ranger Russet (1 yr)	0	10.7

While none of the tubers examined during the two year project demonstrated levels of early blight tuber decay which would reduce grade, the results do expose many of the factors involved in early blight tuber decay. Growers must take into account many variables including cultivar grown (susceptibility), fertility levels in the field, fungicide applications, vine killing methods, and initial storage conditions to really manage early blight tuber decay in their crop.

There were no indications of *A. solani* isolates which differed greatly in their virulence from the twenty + isolates collected. Finally, work with different chemistries to control early blight tuber decay is still continuing and will be ongoing into the future. It appears there are some good products in the in-vitro trials, but they are not demonstrating the same level of control in the field trials.

**Miscellaneous projects:** (Russet Norkotah yield studies) Twenty Russet Norkotah plants each, either visually infected with PVY mosaic or healthy, were evaluated for yield and grade on four commercial fields representing the average SLV growing conditions. Plants were staked by Agro Engineering one week prior to vine death. Two weeks after vine death and just prior to harvest, the plants were dug by Potato Certification Service personnel and data was collected. Average yield reductions between healthy and PVY infected plants ranged between 35 - 40%. Yield reduction on PVY infected plants was due in part to decreased numbers of tubers per plant and in large part to reduced yield of larger (>10 oz) tubers. Average infections in the fields screened were between ten and twenty percent resulting in a yield loss of between 17 to 33 cwt/acre from PVY alone!

**Average Per Plant Yields (lbs).**

Field	Healthy	Mosaic	Percent Reduction
A	4.0	2.5	37
B	4.0	1.9	52
C	3.1	2.3	26
D	3.4	2.4	30
<b>OVERALL Ave.</b>	<b>3.6</b>	<b>2.3</b>	<b>37</b>

**Average Per Plant Tuber Numbers plus Numbers by Grade.**

	Tuber #		Grade					
			> 10 oz.		4-10 oz		< 4 oz.	
Field	Healthy	Mosaic	Healthy	Mosaic	Healthy	Mosaic	Healthy	Mosaic
A	9.0	5.6	1.7	0.9	3.9	1.9	3.3	1.9
B	9.6	7.7	1.6	---	2.0	1.9	5.3	5.8
C	7.2	6.8	0.7	0.4	2.0	1.5	4.5	4.8
D	9.9	8.6	0.6	0.6	2.6	1.5	6.8	7.0
<b>Overall Ave.</b>	<b>8.9</b>	<b>7.2</b>	<b>1.3</b>	<b>0.5</b>	<b>2.6</b>	<b>1.7</b>	<b>5.0</b>	<b>4.9</b>

Two items are of note when looking at the results. First, average yield per plant is reduced by 37% if the plant is infected with a mosaic virus. Considering an ideal stand at 15,000 plants per acre, the potential yield would be 540 cwt/acre (3.6 lbs. x 15,000 / 100 = 540). Then, at a 1% infection level approximately 2 cwt/acre would be lost (540 x 0.01 x 0.37 = 2). At a 10% infection level, about 20 cwt/acre would be lost. Keep in mind, however, that this does not reflect the decrease in size of larger, marketable tubers and the decrease in tuber numbers produced per plant. All things considered, the overall yield loss is much higher than only the cwt lost.

(PVY inoculation timing vs. symptom expression) Four cultivars, Russet Norkotah, Crestone Russet, Centennial Russet and AC83064-6, were screened for their ability to express PVY mosaic symptoms based upon differential inoculation dates. Ten plants per cultivar per treatment were used in the experiment with a control (no inoculation) and two inoculation dates. Aphids were force fed on PVY infected plants, placed on the treatment plants and allowed to feed and then killed after eight hours. Inoculation of the plants was done on July 21<sup>st</sup> and July 31<sup>st</sup> with leaf samples of each plant taken on 7/2/98, 7/29/98, 8/11/98 and 8/18/98 and tested with ELISA to check for the presence of PVY. Results from the leaf samples indicated no positives on any plants prior to inoculation (7/2/98), and only two to five positives for PVY over all treatments on the other three dates. Two tubers from each plant were harvested and grown at the post harvest test plots in Oceanside, CA during the winter. Results shown below indicate that the cultivars acted somewhat differently than expected with the earliest inoculation date producing lower infection rates than the later inoculation date. The controls also picked up PVY indicating that there was some spread during the season. Further studies will be completed in 1999 to verify these findings.

	Control	Percent Tubers Infected	
		7/21/98 inoc.	7/28/98 inoc.
Crestone Russet	11	28	44
AC83064-6	50	50	57
Russet Norkotah	26	17	47
Centennial Russet	6	0	0

## 1998 Potato Leafroll Clonal Evaluation

**Location:** Corner, 9 miles North, ½ mile East

**Treatments:**

- 1) LR infected (Green peach aphids fed on leafroll infected plants in cages for one week. Average of 10 aphids placed on each plant to be infected and allowed to feed for 3 days. Aphids killed and plants inspected for live aphids after this time.)
- 2) Healthy (No inoculation)

**Plot Design:** Randomized Complete Block - 5 seedpieces healthy planted west of 5 seedpieces LR infected.

**Plant Date:** 5/7/98

**Plot Size:** (See Plot Map)

**Plant Spacing:** 12 inches

**Row Spacing:** 34 inches

**Replications:** Two (Healthy and Virus Infected)

**Cultivars:**

AC91014-2	BC1447-1	WNC230-14
AC90636-3	CO90217-4	Centennial Russet
AC91365-1	RC93007-2	Russet Burbank
AC91698-3	NDC4069-4	Russet Nugget
AC91848-1	TXAV657-27	Sangre
AC91848-2	CO86051-3	

**Irrigation:** Solid set ground sprinkler, rate based on ET

**Fertilizer:** Planting fertilizer of 80# N, 60# P, 0# K; No foliar applications during season since soil test results indicated adequate residual available from previous year.

**Herbicide:** 6/4/98 Eptam 4.5 pts/A, Matrix 1.5 oz/A; 7/3/98 Matrix 1.5 oz/A

**Insecticide/Fungicide:** 7/25/98 Asana 8 oz/A; 7/10/98, 7/22/98 Bravo 1.5 pt/A

**Vine Kill/Harvest Date:** 9/4/98 with Sulfuric Acid; 9/21/98 - no yield data taken

**Table 1. 1998 PLRV Symptom Expression in Advanced Clones and Standard Cultivars**

<b>Cultivar/clone</b>	<b>PLRV Reaction (0-3+)</b>	<b>Symptoms</b>
AC91014-2	3+ 100%	LL,CC,WP
AC90636-3	3+ 30%	LL,CC,WP,P
AC91365-1	3+ 70%	LL,CC,WP
AC91698-3	3+ 100%	LL,CC,WP
AC91848-1	3+ 90%	LL,CC,WP,P
AC91848-2	3+ 60%	LL,CC,WP,P
BC1447-1	3+ 40%	LL,CC,WP
CO90217-4	3+ 60%	LL,CC,WP,P
RC93007-2	3+ 60%	LL,CC,WP,P
NDC4069-4	3+ 100%	LL,CC,WP,P
TXAV657-27	3+ 100%	LL,CC,WP
CO86051-3	2+ 20%	LL,CC
WNC230-14	0	-----
Centennial Russet	3+ 50%	LL,CC,WP
Russet Burbank	3+ 60%	LL,CC,WP
Russet Nugget	3+ 30%	LL,CC,WP,P
Sangre	3+ 100%	LL,CC,WP,P

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

## 1998 Potato Leafroll Natural-in-Field Spread

**Location:** Corner, 9 miles North, ½ mile East

**Treatments:**

- 1) LR infected (Natural infection based upon number of aphids moving into the plots)

**Plot Design:** Randomized Complete Block - LR + between each set of 12 healthy seedpieces/cultivar

**Plant Date:** 5/7/97

**Plot Size:** (See Plot Map)

**Plant Spacing:** 12 inches

**Row Spacing:** 34 inches

**Replications:** Three

**Cultivars:**

AC91014-2	RC93007-2	Russet Burbank
AC90636-3	NDC4069-4	Sangre
AC91365-1	TXAV657-27	Centennial Russet
AC91698-3	Green Mountain	WNC230-14
AC91848-1	Houma	Ute Russet
AC91848-2	Katahdin	Russet Nugget
BC1447-1	Keswick	
CO90217-4	Penobscot	

**Irrigation:** Ground Sprinkler, rate based on ET

**Fertilizer:** Planting fertilizer of 80# N, 60# P, 0# K; No foliar applications during season since soil test results indicated adequate residual available from previous year.

**Herbicide:** 6/4/98 Eptam 5 pts/A, Matrix 1.5 oz/A; 7/3/98 Matrix 1.5 oz/A

**Insecticide/Fungicide:** 7/25/98 Asana 8 oz/A; 7/10/98, 7/22/98 Bravo 1.5 pt/A

**Vine Kill/Harvest Date:** 9/4/98 with Sulfuric Acid; 9/21/98 - no yield data taken

**Table 2. 1998 Natural-in-field Spread of Leafroll to Advanced Clones**

Cultivar/clone	# pos / # emerged	% Spread		Risk
		1998	10 yr. ave.	
AC91014-2	12/47	25.5		High
AC90636-3	0/53	0.0		Low
AC91365-1	13/56	23.2		High
AC91698-3	2/58	3.4		Low
AC91848-1	21/57	36.8		Very High
AC91848-2	3/54	5.6		Medium
BC1447-1	0/56	0.0		Low
CO90217-4	2/60	3.3		Low
RC93007-2	7/58	12.1		High
NDC4069-4	7/50	14.0		High
TXAV657-27	9/60	15.0		High
WNC230-14	0/53	0.0	0.0	Low
Centennial Russet	0/58	0.0	3.0	Low
Russet Burbank	3/33	9.1	6.4	Medium
Russet Nugget	6/56	10.7	13.8	High
Sangre	1/37	2.7	5.9	Medium
Green Mountain	3/41	7.3	13.4	High
Houma	1/58	1.7	2.3	Low
Katahdin	0/53	0.0	2.4	Low
Keswick	0/47	0.0	5.3	Medium
Penobscot	1/52	1.9	0.6	Low
Ute Russet	10/60	16.7	12.0	High

Data is from two tubers/plant, 12 plants/replication, 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 =  $\geq$  10.0%.



## 1998 Bacterial Ring Rot Clonal Evaluation

**Location:** Corner, 9 miles North, ½ mile East

**Treatments:**

- 1) Cms Inoculated - placed 4-6 plates of Cms into 2 liters of Ringer's solution with bacteria scraped from plate and agar crushed and added to the solution. Tubers were cut lengthwise in half and placed in the BRR suspension for 3 minutes. BRR suspension was changed every five treatments and never kept longer than 30 minutes total time.
- 2) Healthy Control

**Plot Design:** Randomized Complete Block - 7 healthy seedpieces planted west of 7 Cms infected seedpieces for each cultivar/clone for each replication.

**Plant Date:** 5/11/98

**Plot Size:** (See Plot Map)

**Plant Spacing:** 12 inches

**Row Spacing:** 34 inches

**Replications:** Three

**Cultivars:**

AC91014-2	CO90217-4	AC89653-3	Russet Burbank
AC90636-3	RC93007-2	NDC4655-1	Russet Norkotah
AC91365-1	NDC4069-4	NDC4438-1	Ute Russet
AC91698-3	RC92003-2	FL1 - 1815	Sangre
AC91848-1	TXAV657-27	FL2 - 1833	
AC91848-2	AC90017-2	WNC230-14	
BC1447-1	AC89536-5	Centennial Russet	

**Irrigation:** Ground Sprinkler, rate based on ET

**Fertilizer:** Planting fertilizer of 80# N, 60# P, 0# K; No foliar applications during season since soil test results indicated adequate residual available from previous year.

**Herbicide:** 6/04/98 Eptam 5 pts/A, Matrix 1.5 oz/A; 7/3/98 Matrix 1.5 oz/A

**Insecticide/Fungicide:** 7/25/98 Asana 8 oz/A; 7/10/98, 7/22/98 Bravo 1.5 pt/A

**Vine Kill/Harvest Date:** 9/4/98 with Sulfuric Acid; 9/21/98 - no yield data taken

Table 3. 1998 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	AC90017-2	7/13/98	3	6	28.6	8/5/98	52.4	ED,R,IVC,W	'+'
2	AC89536-5	7/27/98	2	4	19.0	-----	28.6	ED,R,IVC,W	-
2	AC89653-3	7/13/98	1	2	9.5	-----	19.0	ED,R,IVC,MN,W	'+'
2	NDC4655-1	7/17/98	1	1	4.8	-----	9.5	ED,R,IVC,W	-
2	NDC4438-1	8/5/98	1	1	4.8	-----	28.6	IVC,W	-
1	AC91014-2	7/13/98	2	2	9.5	-----	19.0	ED,R,IVC,W	'+'
1	AC90636-3	7/13/98	2	2	9.5	8/13/98	66.7	ED,R,IVC,IVN,MN,W	'+'
1	AC91365-1	7/13/98	1	1	4.8	-----	14.3	ED,R,W	'+'
1	AC91698-3	7/13/98	1	1	4.8	-----	14.3	ED,R,IVC	-
1	AC91848-1	7/13/98	1	1	4.8	-----	19.0	ED,R,IVC,MN	-
1	AC91848-2	7/13/98	1	1	4.8	-----	4.8	ED,R	-
1	BC1447-1	7/13/98	2	2	9.5	8/13/98	52.3	ED,R,IVC,IVN,MN,W	-
1	CO90217-4	7/13/98	3	6	28.6	8/5/98	66.7	ED,R,IVC,IVN,MN,W	-
1	RC93007-2	7/13/98	1	1	4.8	-----	9.5	ED,R,IVC,W	-
1	NDC4069-4	8/20/98	1	1	4.8	-----	4.8	ED,R	-
1	RC92003-2	7/13/98	1	3	14.3	-----	28.6	ED,R,IVC,W	-
1	TXAV657-27	7/13/98	2	2	9.5	-----	14.3	ED,R,W	-
	WNC230-14	7/13/98	1	1	4.8	-----	4.8	ED,R,IVC	-
	Centennial	-----	0	0	0.0	-----	0.0		
	Russet Burbank	7/13/98	3	10	47.6	7/17/98	66.7	ED,R,IVC	'+'
	Russet Norkotah	7/13/98	3	8	38.1	8/5/98	61.9	ED,R,W,IVC,IVN	'+'
	Ute Russet	8/5/98	1	3	14.2	-----	14.2	ED,R,IVC	-
	Sangre	8/5/98	1	1	4.8	-----	4.8	W,IVC,MN	-

^Number of years tested, Planting date - 5/11/98. Key to symptoms; ED-early dwarf, IVC-intervascular chlorosis, IVN-intervascular necrosis, MN-marginal necrosis, and W-wilt.

**Table 4. 1998 Clonal Evaluation for Bacterial Ring Rot  
Tuber Symptom Expression**

^	Clone	# Reps +	# Tubers +	% Tubers +
2	AC90017-2			0
2	AC89536-5	1	1	3
2	AC89653-3	2	5	17
2	NDC4655-1			0
2	NDC4438-1	1	1	3
1	AC91014-2	2	2	10
1	AC90636-3			0
1	AC91365-1			0
1	AC91698-3	3	7	23
1	AC91848-1			0
1	AC91848-2	1	1	3
1	BC1447-1	2	3	15
1	CO90217-4	2	3	15
1	RC93007-2	1	1	3
1	NDC4069-4			0
1	RC92003-2			0
1	TXAV657-27			0
	WNC230-14			0
	Centennial			0
	Russet Burbank	2	2	7
	Russet Norkotah	2	2	10
	Ute Russet	1	2	7
	Sangre	1	1	3

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

## 1998/99 Clonal Disease Evaluation

18 cultivars x 4 treatments x 5 tubers/treatment x 3 reps

### Treatments:

- 1) Control
- 2) *Alternaria solani*
- 3) *Erwinia carotovora* var. *atroseptica*
- 4) *Fusarium sambucinum*

### Cultivars:

- |              |                                  |
|--------------|----------------------------------|
| 1) AC87084-3 | 10) CO89037-7                    |
| 2) AC87079-3 | 11) CO89097-2                    |
| 3) AC87318-4 | 12) CO89036-10                   |
| 4) AC87340-2 | 13) COO83008-1 (Legend Russet)   |
| 5) AC88042-1 | 14) TXAV657-27 (Stampede Russet) |
| 6) AC88165-3 | 15) Chipeta                      |
| 7) BC0894-2  | 16) Russet Burbank               |
| 8) CO85026-4 | 17) Russet Nugget                |
| 9) CO86218-2 | 18) Sangre                       |

### Tuber Inoculation:

#### *Alternaria (A. solani)*

- Washed spores off of five *Alternaria* growth plates with sterile water
- Added spores to field soil with small rocks (approximately 4 liters of soil) - Trying to reach a concentration of approximately 10 spores/gm of soil
- Added inoculated soil to cement mixer
- Placed 15 tubers (three replications) into mixer and tumbled for 20 seconds
- The same inoculated soil was used for nine treatments and then it was changed
- Tubers were placed in brown paper bags and placed in a 50°F cooler

#### *Erwinia (Eca)*

- Washed 48 hour old *Erwinia* growth plates with sterile water and centrifuged solution for 10 minutes at 5100 rpm
- Diluted pellet into 1 ml of sterile water
- Used spectrophotometer to read absorbancy at 420 and adjusted the suspension to a dilution of  $1 \times 10^4$  cfu/ml (see chart)
- Three holes were poked in the stem end of each tuber to be inoculated
- 50 $\mu$ l of bacterial suspension was placed into each hole and sealed with petroleum jelly
- Tubers were placed in brown paper bags and placed in a 50°F cooler

### *Fusarium (F. sambucinum)*

- Washed *Fusarium* spores off of growth plates with sterile water
- Diluted spore suspension to 500-1000 spores/50 l
- Three holes were poked in the stem end of each tuber to be inoculated
- 50µl of bacterial suspension was placed into each hole and sealed with petroleum jelly
- Tubers were placed in brown paper bags and placed in a 50°F cooler

### Summary of Treatments:

<u>Treatment</u>	<u>Date Inoculated</u>	<u>Inoculum</u>	<u>Date Evaluated</u>
<i>Erwinia</i>	12/15/98	50µl of $1 \times 10^4$ cfu/ml	3/23/99
<i>Alternaria</i>	12/15/98	10 spores/gm soil	3/23/99
<i>Fusarium</i>	12/15/98	50µl of 500-1000 spores/tuber	3/23/99

### Notes on Tuber Evaluation (Rating scale):

#### *Alternaria*

- 0 - no symptoms
- 1 - 1/8" diameter, 1 peel
- 2 - 1/4" diameter, 2 peels
- 3 - 1/2" diameter, 3 peels, <10% tuber infection, no grade loss
- 4 - >10% tuber infection or multiple 3's, loss in grade
- 5 - 100% tuber infection, loss in grade

#### *Erwinia*

- 1 - no symptoms
- 2 - localized damage evident
- 3 - <50% tuber infection, systemic, can still see individual inoculation sites, loss in grade
- 4 - >50% tuber infection, systemic, loss in grade
- 5 - 100% tuber infection, systemic, loss in grade

#### *Fusarium*

- 1 - no symptoms
- 2 - localized damage evident, isolated spots
- 3 - <50% tuber infection, systemic, can still see individual inoculation sites, loss in grade
- 4 - >50% tuber infection, systemic, loss in grade
- 5 - 100% tuber infection, systemic, loss in grade

**Table 5. 1998 Clonal Disease Evaluation**

Clone				% Grade Loss
	<i>Erwinia</i>	<i>Fusarium</i>	<i>Alternaria</i>	<i>Alternaria</i>
AC87084-3*	1.9	3.5	0.3	7
AC87079-3	4.9	3.0	0.1	0
AC87318-4	2.0	2.7	0.1	0
AC87340-2	3.4	3.9	0.1	0
AC88042-1*	4.5	3.2	0.1	0
AC88165-3*	2.3	3.8	0.7	13
BC0894-2*	2.9	2.6	0.3	7
CO85026-4	1.7	2.6	0.1	0
CO86218-2*	2.9	2.3	0.9	20
CO89037-7	2.7	2.8	0.1	0
CO89097-2	2.1	4.3	0.3	0
CO89036-10	1.9	3.2	0.4	0
COO83008-1	4.5	2.5	0.5	0
TXAV657-27	3.1	2.5	0	0
Chipeta*	2.1	2.8	0	0
Russet Burbank*	2.5	3.3	0.3	0
Russet Nugget*	2.3	3.9	0.2	0
Sangre*	4.0	2.5	0	0

\*Clones or cultivars tested for more than one year.

Rating scale for each pathogen; *Erwinia* = 1-5, *Fusarium* = 1-5 and *Alternaria* = 0-5  
with 0 or 1 being no symptoms and 5 being 100% damage.

Grade loss due to *Erwinia* = 3+, *Fusarium* = 3+ and *Alternaria* = 4+.

**Table 6. 1997/98 Clonal Disease Evaluation (Two year Average)**

Clone	Average Ratings per Tuber (3 reps x 5 tubers)			% Grade Loss
	<i>Erwinia</i>	<i>Fusarium</i>	<i>Alternaria</i>	<i>Alternaria</i>
AC87084-3	1.8	4.0	1.5	27
AC88042-1	3.8	3.9	0.4	4
AC88165-3	1.7	4.3	2.0	40
BC0894-2	2.2	3.7	0.4	4
CO86218-2	2.2	3.0	0.9	10
Chipeta	1.7	3.4	0.1	0
Russet Burbank	1.8	4.1	0.7	7
Russet Nugget	3.4	4.5	0.2	0
Sangre	3.2	2.7	0.4	0

Rating scale for each pathogen; *Erwinia* = 1-5, *Fusarium* = 1-5 and *Alternaria* = 0-5 with 0 or 1 being no symptoms and 5 being 100% damage.

Grade loss due to *Erwinia* = 3+, *Fusarium* = 3+ and *Alternaria* = 4+.

## 1998 Early Blight Fertility Trial

**Location:** Corner, 9 miles North, ½ mile East

**Treatments:**

1. Centennial Russet, low fertility, sustainable fungicide (21 day interval)
2. Russet Nugget, low fertility, sustainable fungicide (21 day interval)
3. Russet Norkotah, low fertility, sustainable fungicide (21 day interval)
4. Ranger Russet, low fertility, sustainable fungicide (21 day interval)
5. Centennial Russet, high fertility, sustainable fungicide (21 day interval)
6. Russet Nugget, high fertility, sustainable fungicide (21 day interval)
7. Russet Norkotah, high fertility, sustainable fungicide (21 day interval)
8. Ranger Russet, high fertility, sustainable fungicide (21 day interval)
9. Centennial Russet, high fertility, optimum fungicide (14 day interval)
10. Russet Nugget, high fertility, optimum fungicide (14 day interval)
11. Russet Norkotah, high fertility, optimum fungicide (14 day interval)
12. Ranger Russet, high fertility, optimum fungicide (14 day interval)

**Plot Design:** Randomized Complete Block

**Plant Date:** 5/7/98

**Plot Size:** (See Plot Map)

**Plant/Row Spacing:** 12 inches x 34 inches

**Replications:** Four x 25 seedpieces/rep

**Cultivars:** See Treatments above

**Irrigation:** Solid set ground sprinkler, rate based on ET

**Fertilizer:** Planting fertilizer of 80# N, 60# P, 0# K; High rate equaled planting fertilizer plus foliar applications during the season at three different times, on 7/17/98, 8/4/98 & 8/14/98 for a total of 60#/A N; for a grand total of 140#N, 60#P, 0#K.

**Herbicide:** 6/4/98 Eptam 4.5 pts/A, Matrix 1.5 oz/A; 7/3/98 Matrix 1.5 oz/A

**Insecticide/Fungicide:** 7/25/98 Asana 8 oz/A; Bravo as indicated above beginning on 7/7/98 and finishing on 8/18/98

**Inoculation data:** Inoculated with *A. solani* – Foliage 7/2/98, Tubers 9/28/98 (by trt)

**Petiole Sample Dates:** 7/13/98, 7/23/98, 8/7/98, 8/20/98

**Soil Sample Dates for *A. solani* analysis:** 7/2/98, 7/16/98, 8/27/98, 9/10/98

**Vine Kill/Harvest Date:** 9/4/98 with Sulfuric Acid; 9/28/98 - no yield data taken



# EARLY BLIGHT FERTILITY TRIAL

Disease Progress Curve (Mean 4 reps)

Figure 1. Centennial Russet

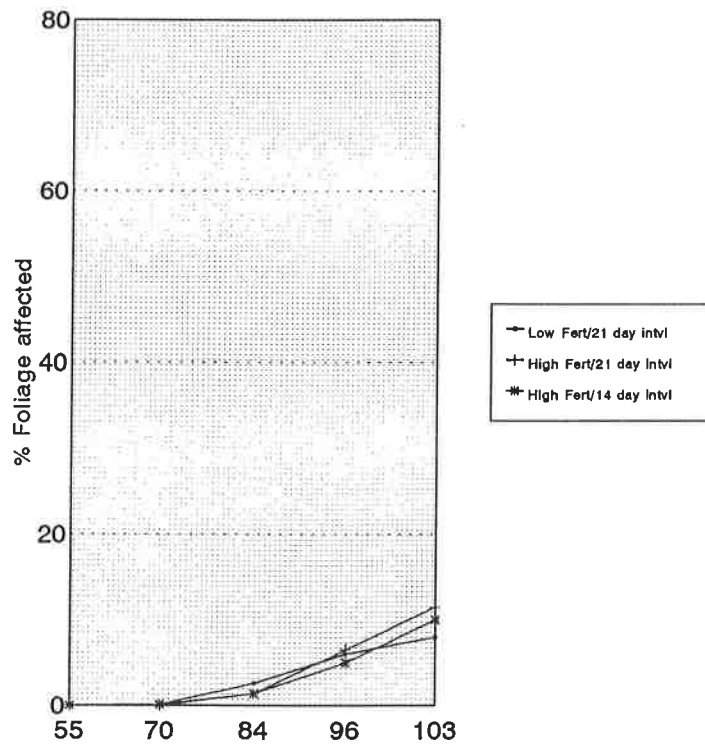
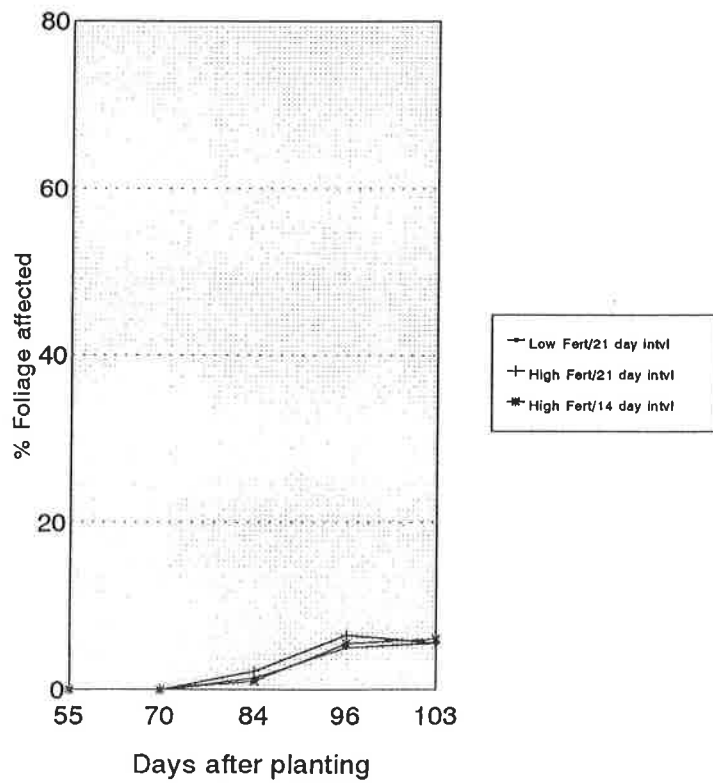


Figure 2. Russet Nugget



# EARLY BLIGHT FERTILITY TRIAL

Disease Progress Curve (Mean 4 reps)

Figure 3. Ranger Russet

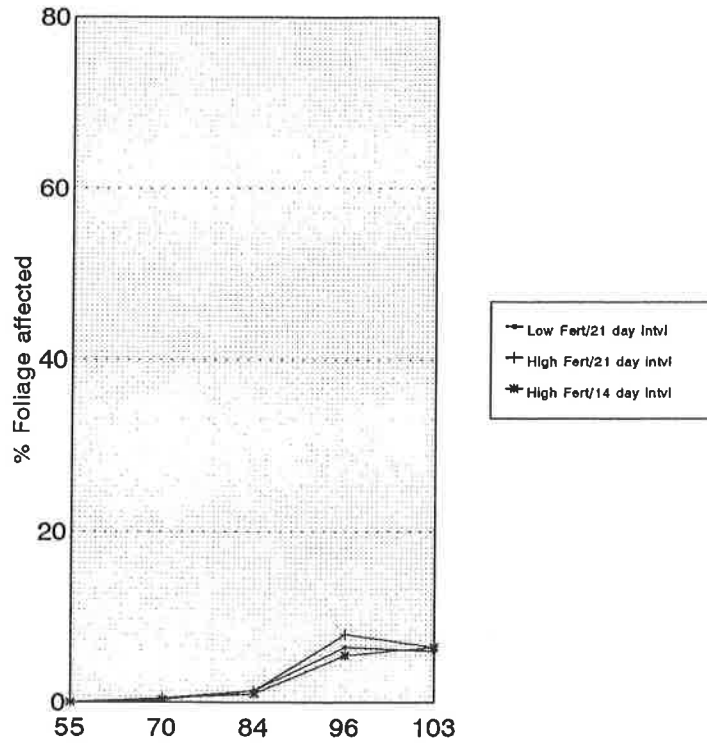
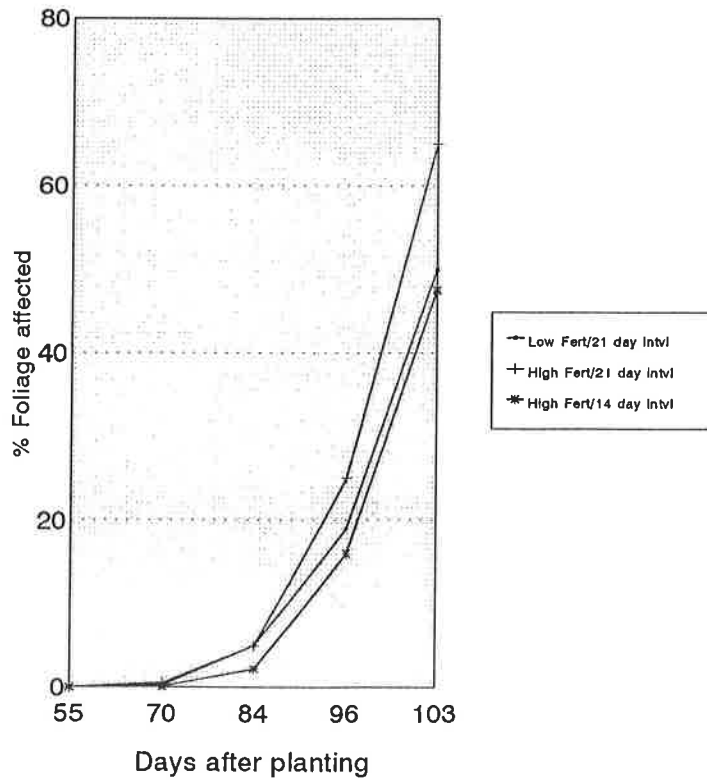


Figure 4. Russet Norkotah



**Table 7. 1998 Early Blight Fertility - Tuber Evaluation**

Variety	Fertility	Fungicide	Tuber EB Inoculation	% Tubers Infected	Ave. Severity Rating	# of Tubers Sampled
Centennial Russet	Low	Sustain-21 day intvl	no	8.2	1.3	122
Centennial Russet	Low	Sustain-21 day intvl	yes	8.6	1.5	116
Russet Nugget	Low	Sustain-21 day intvl	no	8.5	1.6	118
Russet Nugget	Low	Sustain-21 day intvl	yes	16.7	1.8	120
Russet Norkotah	Low	Sustain-21 day intvl	no	2.6	1.3	117
Russet Norkotah	Low	Sustain-21 day intvl	yes	9.1	1.5	121
Ranger Russet	Low	Sustain-21 day intvl	no	19.0	1.5	121
Ranger Russet	Low	Sustain-21 day intvl	yes	3.3	1.5	120
Centennial Russet	High	Sustain-21 day intvl	no	5.0	1.2	120
Centennial Russet	High	Sustain-21 day intvl	yes	2.5	1.6	120
Russet Nugget	High	Sustain-21 day intvl	no	5.0	1.3	120
Russet Nugget	High	Sustain-21 day intvl	yes	5.0	1.3	120
Russet Norkotah	High	Sustain-21 day intvl	no	4.2	1.0	120
Russet Norkotah	High	Sustain-21 day intvl	yes	5.8	1.4	120
Ranger Russet	High	Sustain-21 day intvl	no	11.8	1.4	119
Ranger Russet	High	Sustain-21 day intvl	yes	7.5	1.3	120
Centennial Russet	High	Optimum-14 day intvl	no	4.2	1.2	119
Centennial Russet	High	Optimum-14 day intvl	yes	1.7	1.0	120
Russet Nugget	High	Optimum-14 day intvl	no	11.7	1.1	120
Russet Nugget	High	Optimum-14 day intvl	yes	1.7	1.0	120
Russet Norkotah	High	Optimum-14 day intvl	no	6.6	1.8	120
Russet Norkotah	High	Optimum-14 day intvl	yes	4.2	1.0	120
Ranger Russet	High	Optimum-14 day intvl	no	6.7	1.4	120
Ranger Russet	High	Optimum-14 day intvl	yes	3.3	1.2	120

## 1998 Early Blight Model/Storage Trial

**Location:** Corner, 9 miles North, ½ mile East

### **Treatments:**

1. Russet Norkotah, foliage inoculated, stored at 38°F, rapid cool down
2. Centennial Russet, foliage inoculated, stored at 38°F, rapid cool down
3. Russet Nugget, foliage inoculated, stored at 38°F, rapid cool down
4. Ranger Russet, foliage inoculated, stored at 38°F, rapid cool down
5. Russet Norkotah, foliage inoculated, stored at 38°F, gradual cool down
6. Centennial Russet, foliage inoculated, stored at 38°F, gradual cool down
7. Russet Nugget, foliage inoculated, stored at 38°F, gradual cool down
8. Ranger Russet, foliage inoculated, stored at 38°F, gradual cool down
9. Russet Norkotah, foliage uninoculated, stored at 38°F, rapid cool down
10. Centennial Russet, foliage uninoculated, stored at 38°F, rapid cool down
11. Russet Nugget, foliage uninoculated, stored at 38°F, rapid cool down
12. Ranger Russet, foliage uninoculated, stored at 38°F, rapid cool down
13. Russet Norkotah, foliage uninoculated, stored at 38°F, gradual cool down
14. Centennial Russet, foliage uninoculated, stored at 38°F, gradual cool down
15. Russet Nugget, foliage uninoculated, stored at 38°F, gradual cool down
16. Ranger Russet, foliage uninoculated, stored at 38°F, gradual cool down

**Plot Design:** Randomized Complete Block

**Plant Date:** 5/7/98

**Plot Size:** (See Plot Map)

**Plant/Row Spacing:** 12 inches x 34 inches

**Replications:** Four x 25 seedpieces/rep

**Cultivars:** See Treatments above

**Irrigation:** Solid set ground sprinkler, rate based on ET

**Fertilizer:** Planting fertilizer of 80# N, 60# P, 0# K

**Herbicide:** 6/4/98 Eptam 4.5 pts/A, Matrix 1.5 oz/A; 7/3/98 Matrix 1.5 oz/A

**Insecticide/Fungicide:** 7/25/98 Asana 8 oz/A; Bravo at 1.5 pt/A on 14 day intervals beginning on 7/7/98 and finishing on 8/18/98

**Inoculation data:** Inoculated with *A. solani* – Foliage 7/2/98, Tubers 9/28/98 (by trt)

**Petiole Sample Dates:** 7/13/98, 7/23/98, 8/7/98, 8/20/98

**Soil Sample Dates for *A. solani* analysis:** 7/2/98, 7/16/98, 8/27/98, 9/10/98

**Vine Kill/Harvest Date:** 9/4/98 with Sulfuric Acid; 9/28/98 - no yield data taken

# EARLY BLIGHT MODEL/STORAGE TRIAL

Disease Progress Curve (Mean 4 reps)

Figure 5. Russet Norkotah

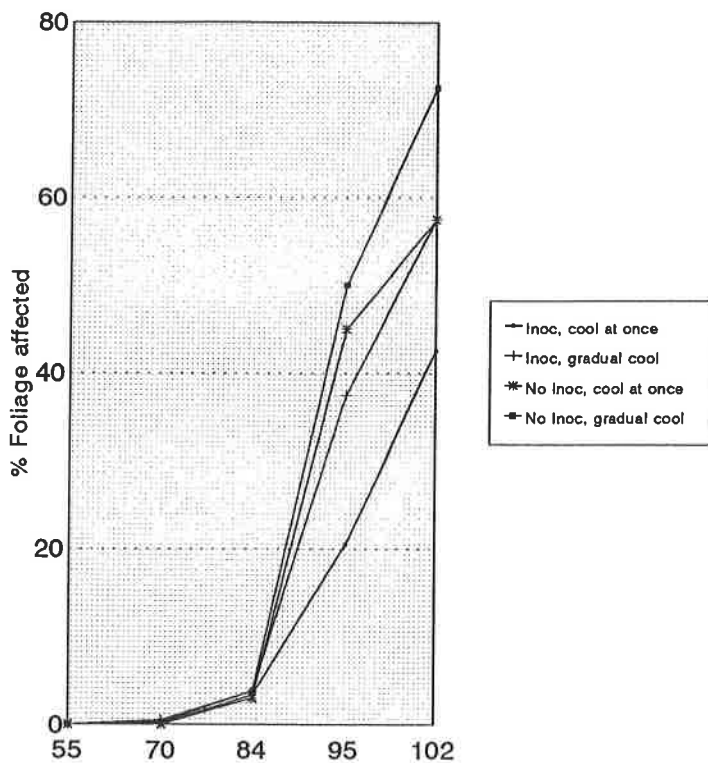
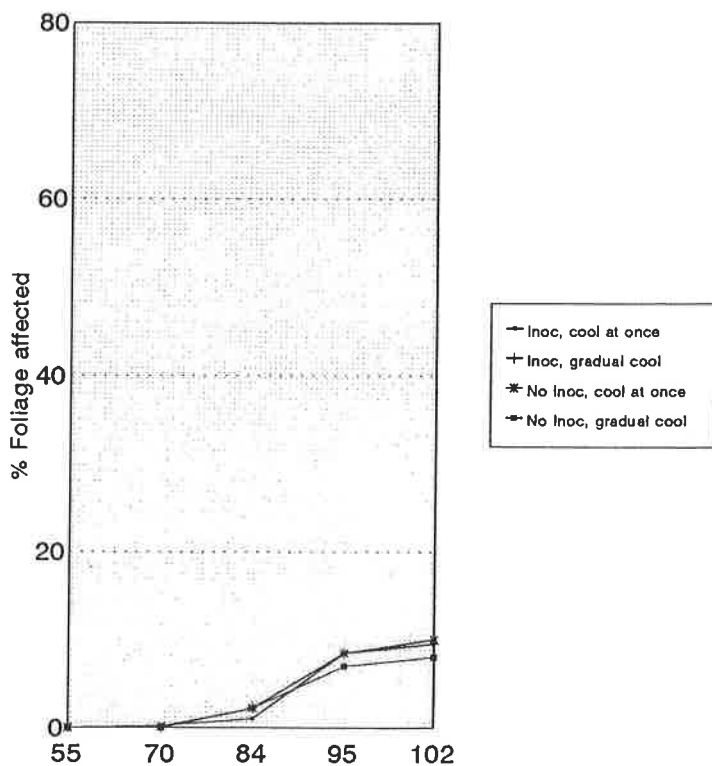


Figure 6. Centennial Russet



# EARLY BLIGHT MODEL/STORAGE TRIAL

Disease Progress Curve (Mean 4 reps)

Figure 7. Russet Nugget

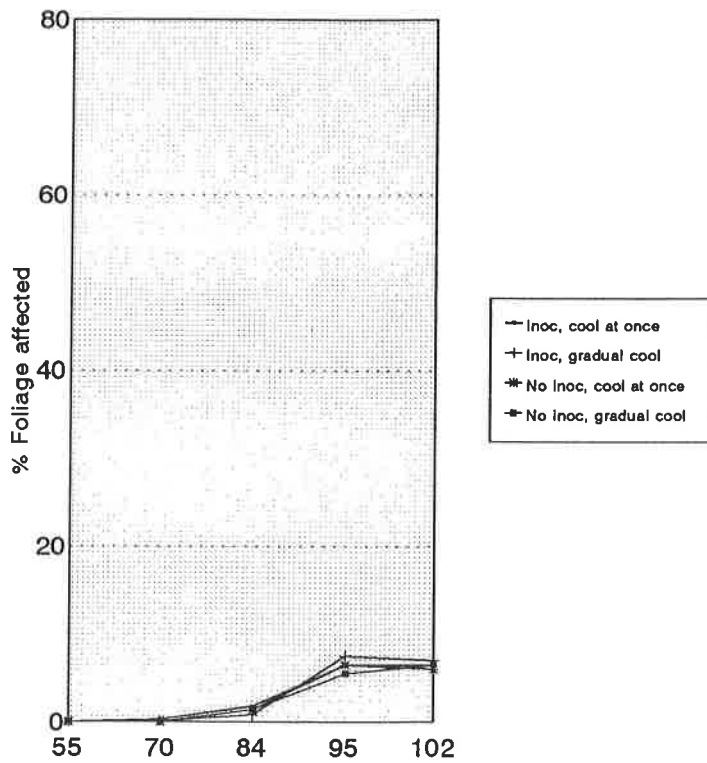


Figure 8. Ranger Russet

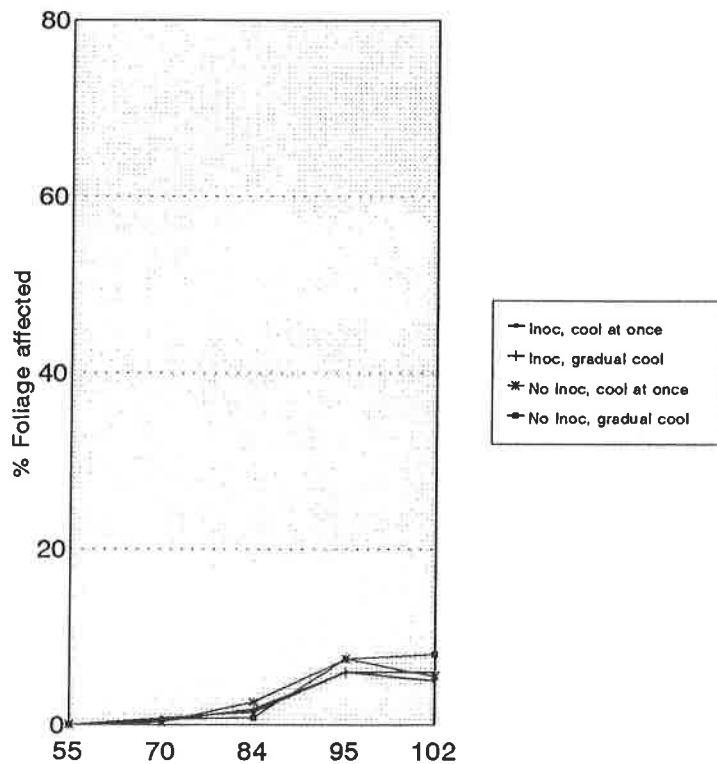


Table 8. 1998 Early Blight Model/Storage - Tuber Evaluation

Variety	Field Inoculation	Storage	Tuber EB Inoculation	% Tubers Infected	Ave. Severity Rating	# of Tubers Sampled
Russet Norkotah	yes	38°F -rapid cooling	no	0	0	120
Russet Norkotah	yes	38°F -rapid cooling	yes	1.7	1.0	118
Centennial Russet	yes	38°F -rapid cooling	no	0	0	120
Centennial Russet	yes	38°F -rapid cooling	yes	0	0	120
Russet Nugget	yes	38°F -rapid cooling	no	0	0	120
Russet Nugget	yes	38°F -rapid cooling	yes	0	0	120
Ranger Russet	yes	38°F -rapid cooling	no	0	0	120
Ranger Russet	yes	38°F -rapid cooling	yes	0	0	120
Russet Norkotah	yes	38°F -gradual cooling	no	0	0	120
Russet Norkotah	yes	38°F -gradual cooling	yes	1.7	1.0	120
Centennial Russet	yes	38°F -gradual cooling	no	0	0	120
Centennial Russet	yes	38°F -gradual cooling	yes	11.7	1.5	120
Russet Nugget	yes	38°F -gradual cooling	no	0	0	120
Russet Nugget	yes	38°F -gradual cooling	yes	7.5	1.9	120
Ranger Russet	yes	38°F -gradual cooling	no	0	0	120
Ranger Russet	yes	38°F -gradual cooling	yes	11.7	1.5	120

Variety	Field Inoculation	Storage	Tuber EB Inoculation	% Tubers Infected	Ave. Severity Rating	# of Tubers Sampled
Russet Norkotah	no	38°F -rapid cooling	no	0	0	120
Russet Norkotah	no	38°F -rapid cooling	yes	0.8	1.0	120
Centennial Russet	no	38°F -rapid cooling	no	0	0	120
Centennial Russet	no	38°F -rapid cooling	yes	0	0	120
Russet Nugget	no	38°F -rapid cooling	no	0	0	120
Russet Nugget	no	38°F -rapid cooling	yes	0	0	120
Ranger Russet	no	38°F -rapid cooling	no	0	0	120
Ranger Russet	no	38°F -rapid cooling	yes	0	0	120
Russet Norkotah	no	38°F -gradual cooling	no	0.8	1.0	120
Russet Norkotah	no	38°F -gradual cooling	yes	6.7	1.1	120
Centennial Russet	no	38°F -gradual cooling	no	0	0	90
Centennial Russet	no	38°F -gradual cooling	yes	0.8	1.0	120
Russet Nugget	no	38°F -gradual cooling	no	0	0	120
Russet Nugget	no	38°F -gradual cooling	yes	4.4	1.3	90
Ranger Russet	no	38°F -gradual cooling	no	0	0	120
Ranger Russet	no	38°F -gradual cooling	yes	9.7	1.2	120



**Table 9. Summary Early Blight Fertility and Model/Storage (1997/1998)**  
 (Data given is average % tubers infected across treatments)

Fertility			Fungicide			Storage		
Treatment	1997	1998	Treatment	1997	1998	Treatment	1997	1998
Low CR	1.9	8.4	21 Day CR	1.8	6.1	Rapid CR In	4.0	0
High CR	1.7	3.4	14 Day CR	1.6	3.0	Rapid CR UnIn	5.6	0
Low NU	2.3	12.6	21 Day NU	2.4	8.8	Gradual CR In	3.7	11.7
High NU	2.3	5.9	14 Day NU	2.0	6.7	Gradual CR UnIn	1.6	0.8
Low NK	1.8	5.9	21 Day NK	2.3	5.5	Rapid NU In	8.5	0
High NK	2.0	5.2	14 Day NK	1.3	5.4	Rapid NU UnIn	4.0	0
Low RR	2.8	11.2	21 Day RR	4.9	10.4	Gradual NU In	4.6	7.5
High RR	6.5	7.3	14 Day RR	6.1	5.0	Gradual NU UnIn	2.1	4.4
						Rapid NK In	4.5	1.7
						Rapid NK UnIn	2.5	0.8
						Gradual NK In	5.7	1.7
						Gradual NK UnIn	2.5	6.7
						Rapid RR In		0
						Rapid RR UnIn		0
						Gradual RR In		11.7
						Gradual RR UnIn		9.7

## 1999 Potato Leafroll Clonal Evaluation

**Location:** NW Corner, Selter's farm, 9 North, ½ mile East of SLVRC

**Treatments:** PLRV infected and Healthy

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

**Plant Date:** 5/9/99

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

**Cultivars:**

AC92009-4	TC1682-1
CO92027-2	RC92003-2
CO92059-8	Russet Burbank
CO92077-2	Sangre
NDC5118-2	Centennial Russet
NDC5281-2	WNC230-14
NDC5372-1	Ute Russet
NDC5433-5	Russet Nugget
TC1675-1	Russet Norkotah

**Irrigation:** Ground sprinkler; rate based upon ET

**Fertilizer:** Planting fertilizer of approximately 90:100:0 using liquid fertilizer at 42 gal/acre. Soil test results indicated a total of 22#+ (N from the water equaled approximately 22# over the season when irrigating 18") + foliar application during the season on 7/20/99 for a total of 20# N, for a grand total of 132:100:0.

**Herbicide/  
Fungicide/  
Insecticide:** Eptam 4 pts/A, Matrix 1.5 oz/A applied on 6/9/99  
1.5 pts/A Bravo-Ultrex on 7/9/99 & 7/31/99  
No insecticides used during the summer.

**Harvest date:** 9/14/99

**Table 1. 1999 PLRV Symptom Expression in Advanced Clones and Standard Cultivars**

<b>Cultivar/clone</b>	<b>PLRV Reaction (0-3+)</b>	<b>Symptoms</b>
AC92009-4	3+ 50%	LL,CC
CO92027-2	3+ 75%	LL,CC,WP
CO92059-8	3+ 100%	LL,CC,WP
CO92077-2	3+ 100%	LL,CC,WP
NDC5118-2	3+ 43%	LL,CC,P
NDC5281-2	3+ 63%	LL,CC,WP
NDC5372-1	2+ 30%	LL,CC
NDC5433-5	3+ 70%	LL,CC,WP
TC1675-1	3+ 33%	LL,CC,WP
TC1682-1	3+ 89%	LL,CC,WP
RC92003-2	3+ 30%	LL,CC,WP
Russet Burbank	2+ 50%	LL,CC,WP
Centennial Russet	3+ 45%	LL,CC,WP
WNC230-14	0	-----
Russet Nugget	3+ 25%	LL,CC,WP,P
Ute Russet	3+ 70%	LL,CC,WP
Russet Norkotah	3+ 75%	LL,CC,WP
Sangre	3+ 38%	LL,CC,WP,P

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

## 1999 Potato Leafroll Natural In-field Spread

**Location:** NW Corner, Selter's farm, 9 North, ½ mile East of SLVRC

**Treatments:** Healthy with LR+ between treatments

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

**Plant Date:** 5/9/99

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

**Cultivars:**

AC92009-4	TC1682-1	COO83008-1
CO92027-2	RC92003-2	Green Mountain
CO92059-8	Russet Burbank	Houma
CO92077-2	Sangre	Katahdin
NDC5118-2	Centennial Russet	Keswick
NDC5281-2	WNC230-14	Penobscot
NDC5372-1	Ute Russet	
NDC5433-5	Russet Nugget	
TC1675-1	Russet Norkotah	

**Irrigation:** Ground sprinkler; rate based upon ET

**Fertilizer:** Planting fertilizer of approximately 90:100:0 using liquid fertilizer at 42 gal/acre. Soil test results indicated a total of 22#+ (N from the water equaled approximately 22# over the season when irrigating 18") + foliar application during the season on 7/20/99 for a total of 20# N, for a grand total of 132:100:0.

**Herbicide/  
Fungicide/  
Insecticide:** Eptam 4 pts/A, Matrix 1.5 oz/A applied on 6/9/99  
1.5 pts/A Bravo-Ultrex on 7/9/99 & 7/31/99  
No insecticides used during the summer.

**Harvest date:** 9/14/99

**Table 2. 1999 Natural-in-field Spread of Leafroll to Advanced Clones**

Culivar/clone	# pos / # emerged	% Spread		Risk
		1999	11 yr. ave.	
AC92009-4	1/61	1.6		Low
CO92027-2	13/71	18.3		High
CO92059-8	39/56	69.6		Very High
CO92077-2	48/65	73.8		Very High
NDC5 <sup>5281-2</sup> 118-2	6/51	11.8		High
NDC5372-1	6/49	12.2		High
NDC5433-5	6/59	10.2		High
TC1675-1	18/57	31.6		Very High
TC1682-1	23/64	35.9		Very High
RC92003-2	9/60	15.0		High
Legend Russet	7/59	11.9		High
Russet Norkotah	11/69	15.9		High
WNC230-14	0/60	0.0	0.0	Very Low
Centennial Russet	2/73	2.7	3.0	Low
Russet Burbank	5/42	11.9	6.9	Medium
Russet Nugget	13/62	21.0	14.5	High
Sangre	1/32	3.1	5.6	Medium
Green Mountain	6/39	15.4	13.6	High
Houma	6/50	12.0	3.2	Low
Katahdin	9/60	15.0	3.5	Low
Keswick	2/52	3.8	5.2	Medium
Penobscot	0/54	0.0	0.5	Very Low
Ute Russet	13/62	21.0	12.8	High

Data is from two tubers/plant, 12 plants/replication, 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%.

NDC5281-2 had no emergence in the plot.

## 1999 Bacterial Ring Rot Clonal Evaluation

**Location:** NW Corner, Selter's farm, 9 North, ½ mile East of SLVRC

**Treatments:** 1) BRR inoculated: 6-7 plates of Cms scraped into 2 l of cold Ringer's solution. Tubers cut lengthwise and immersed in solution for 3 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 5/10/99; FL 5/12/99 Planting 5/11/99; FL 5/13/99

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

**Cultivars:**

AC92009-4	AC90636-3	FL1867
CO92027-2	AC91365-1	FL1889
CO92059-8	RC93007-2	FL1879
CO92077-2	NDC4069-4	FL1833
NDC5118-2	TXAV657-27	Russet Burbank
NDC5281-2	NDC4655-1	Sangre
NDC5372-1	NDC4438-1	Centennial Russet
NDC5433-5	COO83008-1	WNC230-14
TC1675-1	DT6063-1R	Ute Russet
TC1682-1	FL1831	Russet Norkotah
RC92003-2	FL1930	FL1851

**Irrigation:** Ground sprinkler; rate based upon ET

**Fertilizer:** Planting fertilizer of approximately 90:100:0 using liquid fertilizer at 42 gal/acre. Soil test results indicated a total of 22# + (N from the water equaled approximately 22# over the season when irrigating 18") + foliar application during the season on 7/20/99 for a total of 20# N, for a grand total of 132:100:0.

**Herbicide/  
Fungicide/  
Insecticide:** Eptam 4 pts/A, Matrix 1.5 oz/A applied on 6/9/99  
1.5 pts/A Bravo-Ultrex on 7/9/99 & 7/31/99  
No insecticide used during the summer.

**Harvest date:** 9/14/99

Table 3. 1999 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 RC92003-2	7/19/99	2	2	9.5	8/6/99	66.7	IVC, IVN, MN, W	'+'
2 AC91014-2	7/13/99	2	3	14.2	8/6/99	81.0	ED, R, IVC, IVN, MN, W	'+'
2 AC90636-3	7/13/99	2	4	19.0	8/16/99	71.4	ED, R, IVC, IVN, MN	'+'
2 NDC4655-1	7/28/99	1	1	4.8	-----	28.6	IVC, IVN, MN, W	-
2 NDC4438-1	7/28/99	1	1	4.8	-----	42.8	IVC, IVN, W	'+'
2 AC91365-1	7/28/99	2	3	14.2	-----	23.8	ED, R, IVC	'+'
2 RC93007-2	7/28/99	1	2	9.5	8/24/99	52.4	IVC, IVN, MN, W	-
2 NDC4069-4	8/16/99	2	2	14.2	-----	14.2	IVC, MN, W	'+'
2 Stampede Russet	7/13/99	1	2	9.5	-----	28.6	ED, R, IVC, IVN, MN, W	-
1 Legend Russet	7/13/99	2	3	14.2	8/16/99	61.9	ED, R, IVC, IVN, MN	'+'
1 Cherry Red	7/19/99	1	1	4.8	-----	23.8	ED, IVC, MN	-
1 AC92009-4	7/13/99	2	3	14.2	7/28/99	76.2	ED, R, IVC, IVN, MN, W	'+'
1 CO92027-2	7/13/99	3	6	28.6	8/4/99	76.2	ED, R, IVC, IVN, MN	'+'
1 CO92059-8	7/28/99	1	1	4.8	-----	33.3	IVC, IVN, MN	-
1 CO92077-2	8/16/99	3	5	23.8	-----	23.8	IVC, IVN, MN, W	-
1 NDC5118-2	7/13/99	2	3	14.2	7/28/99	85.7	ED, R, IVC, IVN, MN, W	-
1 NDC5281-2	7/28/99	1	1	4.8	8/6/99	61.9	IVC, IVN, MN, W	'+'
1 NDC5372-1	7/13/99	2	5	23.8	7/28/99	85.7	ED, R, IVC, IVN, MN, W	'+'
1 NDC5433-5	7/13/99	1	1	4.8	-----	47.6	ED, R, IVC, IVN, W	'+'
1 TC1675-1	7/19/99	2	2	9.5	-----	28.6	IVC, MN, W	-
1 TC1682-1	7/28/99	2	4	20.0	-----	45.0	ED, R, IVC, MN, W	'+'
WNC230-14	7/28/99	2	3	14.2	-----	23.8	ED, R, IVC, IVN, MN, W	-
Centennial Russet	7/19/99	1	1	4.8	-----	38.1	IVC, IVN, MN, W	'+'
Russet Burbank	7/13/99	2	4	19.0	7/19/99	66.7	ED, R, IVC, IVN, MN, W	'+'
Russet Norkotah	7/19/99	2	6	28.6	7/28/99	90.0	ED, R, IVC, IVN, MN, W	'+'
Ute Russet	8/24/99	2	3	14.2	-----	14.2	IVC, IVN, MN, W	-
Sangre	8/16/99	3	3	14.2	-----	23.8	IVC, IVN, MN, W	'+'

^Number of years tested, Planting date - 5/11/98. Key to symptoms; ED-early dwarf, R-rosette, IVC-interveinal chlorosis, IVN-interveinal necrosis, MN-marginal necrosis, and W-wilt.

**Table 4. 1999 Clonal Evaluation for Bacterial Ring Rot  
Tuber Symptom Expression**

^	Clone	# Reps +	# Tubers +	% Tubers +
2	RC92003-2	1	1	5
2	AC91014-2			0
2	AC90636-3	1	1	5
2	NDC4655-1			0
2	NDC4438-1			0
2	AC91365-1			0
2	RC93007-2			0
2	NDC4069-4			0
2	Stampede Russet			0
1	Legend Russet			0
1	Cherry Red			0
1	AC92009-4			0
1	CO92027-2	1	1	5
1	CO92059-8			0
1	CO92077-2	1	1	5
1	NDC5118-2			0
1	NDC5281-2			0
1	NDC5372-1			0
1	NDC5433-5			0
1	TC1675-1			0
1	TC1682-1			0
	WNC230-14			0
	Centennial			0
	Russet Burbank			0
	Russet Norkotah	1	3	15
	Ute Russet			0
	Sangre	1	1	5

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



## Cultural Management Options for Control of *Rhizoctonia solani* Scurf on Tubers

**Objective:** To compare levels of *Rhizoctonia solani* sclerotia on the surface of Viking tubers at harvest under two treatments; 1) undercutting of the vines after vine kill and 2) no undercutting.

**Materials/Methods:** Undercutting of the vines took place six to ten days after vine kill with a control plot (no undercutting of six rows x 50') being left for evaluation purposes. Harvest date: 9/17/99. Five representative hills from each treatment were dug with all tubers harvested from each hill. Tubers were washed and scored for levels of sclerotia present based upon the percentage of surface area covered... 0 = 0, 1 = 1%, 2 = 1-5%, 3 = 5-10%, 4 = 10-25%.

**Results:**

**Undercut**  
Tuber readings = 0,0,0,0,0,1,1,1,1,1,1,1,1,2,2,2,2,2,2,3,3

Percentage over 1% damage = 38%  
Percentage over 5% damage = 9%  
Mean rating = 1.24 or 2.0% of the surface area covered by sclerotia

**No Undercut**  
Tuber readings = 1,1,1,1,1,1,1,1,1,1,1,2,2,2,2,2,2,2,2,2,2,3,3,3,4,4

Percentage over 1% damage = 62% with no zero damage  
Percentage over 5% damage = 17%  
Mean rating = 1.86 or 4.4% of the surface area covered by sclerotia

**Conclusions:** While the sample was too small to readily perform statistical analysis, it is very apparent that there is a positive effect due to undercutting on the levels of sclerotia found on the tuber surface. There is a full two-fold reduction on the levels found when undercutting is employed. Additional work should focus on the best methods/equipment for undercutting and the optimum time frame after vine kill for performing the operation. Also, emphasis should be on coupling this operation with other field operations currently in use (i.e., vine chopping or stem pulling).

**1999 Tuber Survey (Internal pigmentation)  
Russet Norkotah Selection 3  
Harvest date 9/27/99**

**Objective:** To examine tuber placement within the hill, size, and distance from the edge of the hill in regards to internal pigmentation occurring in the Russet Norkotah 3.

**Materials/ Methods:** Hills were individually selected and soil dug from around the tubers. Hill placement and distance from the edge of the hill were recorded. Each tuber was sized and then cut to verify presence or absence of internal pigmentation.

**Observations:** Three observations are pertinent with this data. First, it does not appear that if internal pigmentation (pink color) is found in one tuber it will be found in all of the other tubers in the hill. Second, there is an association with light and closeness to the edge of the hill in many cases, however, many other cases showed no association with light or closeness to the edge of the hill. Third, the bud end showed the most prevalent area of internal discoloration indicating an event during the growing season may have occurred which set up the process for internal pigmentation.

**Table 5: Tuber Observations by Plant for Internal Pigmentation**

Plant # - Tuber #	Depth of Tuber (cm)	Size of Tuber (oz)	Pink Color Rating (0-5)	Comments
1-1	6	3	0	
2	10	24	3	bud end
2-1	2	4	0	
2	2	1	0	
3	2	3	0	
4	2	3	0	
5	2	3	0	
6	3	5	0	
7	4	2	0	
8	4	1	0	
9	4	3	0	
10	7	4	0	
11	8	1	0	
12	8	10	2	bud end
3-1	2	2	1	mid-central
2	6	6	1	bud end
3	8	8	1	mid-central

4	13	10	1	bud end
4-1	1	4	0	
2	1	6	2	bud end
3	5	8	0	
4	8	2	0	
5	8	6	0	
6	13	3	1	bud end
5-1	3	4	0	
2	4	3	0	
3	8	6	0	
4	8	4	1	throughout tuber
5	9	6	0	
6	12	4	0	
7	12	6	1	bud end
6-1	1	1	5	greenhead
2	1	2	2	greenhead/bud end
3	4	4	0	
4	5	2	0	
5	7	6	0	
6	12	10	4	bud end
7-1	1	1	0	
2	6	12	2	bud end
3	11	24	4	bud end
4	13	12	2	bud end
8-1	1	1	4	greenhead/bud end
2	3	3	1	mid-bud end
3	3	2	0	
4	3	3	0	
5	4	4	1	mid-bud end
6	4	1	0	
7	6	2	1	mid-bud end
8	8	6	1	mid-central
9	13	1	0	
9-1	0	5	2	greenhead
2	3	2	0	
3	3	2	0	

4	4	3	0	
5	6	2	0	
6	7	4	0	
7	8	7	0	
8	9	11	2	throughout tuber
9	10	9	0	
10	10	4	1	throughout tuber
11	11	6	0	
12	13	6	2	throughout tuber
<b>10-1</b>	1	4	0	
2	1	3	0	
3	1	4	0	
4	2	2	0	
5	3	3	0	
6	5	3	0	
7	7	1	0	
8	11	5	0	
<b>11-1</b>	0	8	1	greenhead/bud end
2	0	1	4	greenhead
3	1	2	0	
4	3	4	1	throughout tuber
5	3	3	0	
6	4	1	0	
7	4	9	1	long stolon
8	5	2	0	
9	7	4	1	throughout tuber
10	7	2	0	
11	8	4	0	

Rating scale for internal pigmentation - 0 = none observed, 3 = light pink color fairly evenly spaced throughout the vascular tissue, and 5 = strong pink color throughout the vascular tissue.

**Table 5. 1999 Clonal Disease Evaluation**

Clone				% Grade Loss
	<i>Erwinia</i>	<i>Fusarium</i>	<i>Alternaria</i>	<i>Alternaria</i>
AC87079-3*	3.2	3.2	0.1	0
AC87138-4*	1.7	2.8	0.1	0
AC87340-2*	2.7	2.7	0.1	0
CO89036-10*	2.1	3.5	0.5	0
AC89653-3	3.5	3.1	0.7	0
AC89536-5	3.7	4.0	0.3	0
CO89097-2*	1.7	4.5	0.3	0
NDC4655-1	2.2	3.5	0.1	0
AC90017-2	2.3	3.3	0.1	0
Chipeta*	1.6	2.8	0.3	0
Russet Burbank*	2.9	3.6	0.7	0
Russet Nugget*	2.3	4.5	0.1	0
Sangre*	2.9	4.1	0	0
Ranger Russet	1.7	3.1	0.7	7

\*Clones or cultivars tested for more than one year. Results listed are the mean readings of three replications of five tubers/replication.

Rating scale for each pathogen; *Erwinia* = 1-5, *Fusarium* = 1-5 and *Alternaria* = 0-5 with 0 or 1 being no symptoms and 5 being 100% damage.

Grade loss due to *Erwinia* = 3+, *Fusarium* = 3+ and *Alternaria* = 4+.

0 or 1 = Resistant

2 = Moderately resistant

3 = Moderately susceptible

4 = Susceptible

5 = Very susceptible

**Table 6. 1998/99 Clonal Disease Evaluation (Two year Average)**

Clone	Mean Ratings per Tuber (3 reps x 5 tubers)			% Grade Loss
	<i>Erwinia</i>	<i>Fusarium</i>	<i>Alternaria</i>	<i>Alternaria</i>
AC87079-3	4.1	3.1	0.2	4
AC87138-4	1.9	2.8	0.1	0
AC87340-2	3.1	3.3	0.1	0
CO89036-10	2.0	3.4	0.5	0
CO89097-2	1.9	4.4	0.3	0
Chipeta	1.9	2.8	0.2	0
Russet Burbank	2.7	3.5	0.5	0
Russet Nugget	2.3	4.2	0.2	0
Sangre	3.5	3.3	0	0

Rating scale for each pathogen; *Erwinia* = 1-5, *Fusarium* = 1-5 and *Alternaria* = 0-5  
with 0 or 1 being no symptoms and 5 being 100% damage.

Grade loss due to *Erwinia* = 3+, *Fusarium* = 3+ and *Alternaria* = 4+.

0 or 1 = Resistant

2 = Moderately resistant

3 = Moderately susceptible

4 = Susceptible

5 = Very susceptible

**Table 6. 1997/98 Clonal Disease Evaluation (Two year Average)**

Clone	Mean Ratings per Tuber (3 reps x 5 tubers)			% Grade Loss
	<i>Erwinia</i>	<i>Fusarium</i>	<i>Alternaria</i>	<i>Alternaria</i>
AC87084-3	1.8	4.0	1.5	27
AC88042-1	3.8	3.9	0.4	4
AC88165-3	1.7	4.3	2.0	40
BC0894-2	2.2	3.7	0.4	4
CO86218-2	2.2	3.0	0.9	10
Chipeta	1.7	3.4	0.1	0
Russet Burbank	1.8	4.1	0.7	7
Russet Nugget	3.4	4.5	0.2	0
Sangre	3.2	2.7	0.4	0

Rating scale for each pathogen; *Erwinia* = 1-5, *Fusarium* = 1-5 and *Alternaria* = 0-5 with 0 or 1 being no symptoms and 5 being 100% damage.

Grade loss due to *Erwinia* = 3+, *Fusarium* = 3+ and *Alternaria* = 4+.