

## Research Progress Report for 1994

Submitted to:

SLV Research Center Committee  
and  
Colorado Potato Administrative Committee (Area II)

**TITLE:** Evaluation of the Cardy Ion Meter for nitrogen management among potato varieties grown in the San Luis Valley.

**PROJECT LEADER:** Richard T. Zink, Extension Potato Specialist

**PROJECT JUSTIFICATION:** Second to irrigation scheduling, nitrogen management is the most critical factor in optimum potato production. Accurate nitrogen management starts with soil and water analysis and is followed by petiole testing as the crop develops. Petiole analysis for nitrates is accurate. However, it is costly, time consuming, and associated with several days delay between when samples are taken and results are in hand. An alternative to laboratory analysis that is less expensive and gives on-site results has been available for the past few years. The technology involves a hand-held nitrate meter (Cardy Ion Meter) that is used in the field to obtain a direct reading from plant sap. These meters are being used in potato production in other areas of the country to maximize production, avoid over-fertilization, and reduce nitrate contamination of ground water. Several growers have inquired about using the Cardy meter, and all data indicates that it would be a valuable tool for our industry. Before the Cardy meter can be used with confidence in the San Luis Valley a comparative study across several potato varieties should be conducted.

**PROJECT STATUS:** Ongoing, final year.

### SIGNIFICANT ACCOMPLISHMENTS FOR 1994

**Objective 1).** Determine correlation between the Cardy meter and petiole analysis for plant levels of N. Comparative analysis were run on potato petiole tissue on four dates during the 1994 growing season. Analyses were done by Servi-Tech Laboratory and at the Research Center using the Cardy nitrate meter. In general there was a high degree of correlation between the two methods. There was, however, considerable variation between the methods on some test dates. This was likely an artifact of sampling and was mostly eliminated by increasing the number of sample replications.

**Objective 2).** Determine if nitrate readings made by the Cardy meter are consistent among potato varieties. Nitrate readings were made on four varieties, Russet Norkotah, Sangre, Centennial Russet, and Russet Nugget. Readings between the Cardy meter and laboratory analysis correlated the highest for the varieties Russet Nugget and Russet Norkotah and lowest for the variety Sangre. Varietal variation with the Cardy meter is not uncommon and has been reported by other researchers.

**Objective 3).** Develop reference charts for using the Cardy meter with major potato varieties grown in the San Luis Valley. The first year of field data was collected for developing conversion charts to go from the Cardy meter to plant N levels determined by laboratory analysis. A second data set will be generated in 1995.

**Objectives for 1995:**

Finish evaluation of the Cardy Ion Meter and develop guidelines for its direct use in the field.

**Funding Request:**

1994 Allocation	\$3,800
1995 Request	1,550

**Budget Summary:**

Second Cardy Ion Meter	350
Laboratory Petiole Analysis	400
Labor	<u>800</u>
	\$1,550

## Research Progress Report for 1994

Submitted to:

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Colorado Potato Administrative Committee (Area II)

**Title:** Utilization of green manure crops in continuous potato production to suppress soil-borne diseases and recycle nitrates.

**Project Leaders:** Richard T. Zink and Merlin Dillon

**Project Justification:** For various economic reasons some potato growers in the San Luis Valley are moving away from the traditional grain-potato-grain rotation. Despite that this is not a recommended practice, much of the increase in potato acreage in recent years has been at the expense of crop rotation. Continual potato production will deplete soil organic matter, foster soil-borne diseases and stockpile nitrates. A deep-rooted green manure crop can salvage nitrates and, upon decomposition, kill soil fungi and nematodes. Given the direction in which our potato industry is developing the consequences of less-than-ideal cropping practices need to be examined. Green manure crops could be valuable in the San Luis Valley. However, several economic and biological questions need to be answered.

**Project Status:** Ongoing

### Significant Accomplishments for 1994:

**Objective 1)** Establish a long-term study site at the SLVRC for evaluating green manure crops in potato production. A site for the study was established in 1994 on the northwest corner of the Research Center farm. An area 120' x 220' containing 12 plots 40' x 40' was laid out under a solid-set sprinkler system. Before planting each plot was soil sampled to 24 inches for nitrates and soil type. Soils and nitrates were uniform across the site. The 1994 planting consisted of nine plots of Centennial Russet, two plots of barley, and one plot of a green manure crop. In early August, the green manure plot was tilled under and the barley plots combined. Following harvest of the potato plots soil samples for Verticillium analysis were collected from each plot. Results of the Verticillium assays showed that the average count (microsclerotia/g of soil) for potato plots was 26, barley plots 25, and the green manure plot 3. One of the plots on which potato had been grown was fumigated on October 18 by sprinkler application of Busan.

**Objective 2)** Evaluate crops for use as green manure. Three varieties of sudan grass and three varieties of corn were tested as sources of green manure. For agronomic reasons and ease of tillage the sudan grass variety Trudan 8 was selected for long-term use in the study.

**Objectives for 1995:**

1. Run a second growing season of crop rotation sequences.
2. Collect data on soil nitrates, Verticillium levels in soil and in plant tissue and yields of potato and barley.
3. Collect data on nematode populations.
4. Optimize fumigation procedure.
5. Optimize green manure production and tillage.

**Funding Request:** 1994 allocation \$3,500

1995 request \$3,000

**Budget Summary for 1995:**

Soil fumigation equipment	\$ 500
Soil analysis	200
Supplies	300
Labor	<u>2,000</u>
Total	\$3,000

## Research Proposal for 1995

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

**Title:** Development of management strategies for nematodes detrimental to potato production in the San Luis Valley.

**Project Leader:** Richard T. Zink

### **Project Justification:**

The most serious soil-borne pests that can threaten potato production in western states are the root-knot nematode and stubby root nematode. Historically, the San Luis Valley has not had significant problems with nematodes like Idaho, Oregon and Washington. The reasons for this and how long the current situation will persist are unclear. Limited soil sampling has confirmed that the root-knot nematode and stubby root nematode are present in many fields and in some occur in high numbers. In addition, each fall tuber samples showing nematode damage are brought to the Research Center for diagnosis. These facts raise several important questions.

- Are nematode populations in the San Luis Valley stable or increasing incrementally with each potato crop?
- Do particular varieties of potato or crop rotations favor nematode population growth?
- How are nematode populations affected by soil temperatures during the growing season and over winter?
- Which soils and areas of the San Luis Valley are most problematic for nematodes?
- What are the initial and residual effects of soil fumigation on nematode populations?
- Can root-knot nematode tuber damage be predicted based on fall populations and likely weather conditions over the winter and following growing season?

Answers to these critical questions can only be obtained by undertaking a long-term ecological study of the root-knot nematode and stubby root nematode in the San Luis Valley. Information from this research would provide the basis for developing management strategies to suppress nematodes.

**Project Status:** This is a new project.

### Objectives for 1995:

1. Locate sites with cooperating potato growers that have significant populations of root-knot nematode and stubby root nematode.
2. At each site establish plots with sampling grids for long-term monitoring.
3. Fully characterize the nematode populations at each site before and after each growing season.
4. At sites where it is possible, establish paired plots to assess the effects of soil fumigation.
5. Complete a nematology short course at Clemson University.
6. Collect data at each site on soil populations of Verticillium dahliae.

This is a long-term project. Sampling sites established at the onset will be monitored intensely for five years. Depending on results, some sites may be monitored for longer at a lower intensity.

**Funding Request:** 1995 request \$9,300

### Budget Summary:

Nematology short course	\$2,500
Soil sample analysis	2,800
Supplies	500
Labor (field and laboratory)	3,000
Local mileage	<u>500</u>
Total	\$9,300

**RESEARCH PROPOSAL FOR 1995**  
Submitted to: SLV Research Center Committee  
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**Title:** Control Strategies for Early Blight Tuber Decay

**Project Leaders:** R. T. Zink and R. D. Davidson, SLV Research Center

**Project Justification:**

Tuber damage caused by *Alternaria solani* is likely the most troublesome and unpredictable post harvest disease facing potato growers in the San Luis Valley. The loss of Captan as a post harvest tuber treatment and the introduction of highly susceptible cultivars has greatly exacerbated the problem. Grade and quality economic losses due this disease are currently in the hundreds of thousands if not millions of dollars. Since chemical control strategies are becoming less available, more emphasis must now be placed on cultural practices to reduce the impact of early blight on stored potatoes. To this end, a comprehensive research effort will be initiated at the San Luis Valley Research Center. Some of the components of this program are in progress, while others will be started this year.

**Project Status:** New

**Objectives:**

The following areas will be investigated as to their effect on the incidence of tuber infection by *A. solani*:

- 1) The effect of vine kill methods on spore levels at harvest and their impact on incidence of tuber blight. This will include establishment of the actual amount of inoculum necessary, under SLV conditions, for tuber infection.
- 2) The role of N level in the plant at time of vine kill as it relates to tuber maturity and potential for disease.
- 3) The virulence of SLV isolates of the fungus.
- 4) The role of initial storage temperature and humidity on the healing process, infection and lesion development.
- 5) Existing and potential chemicals for their effectiveness in controlling tuber blight.

**Funding Request:**

Labor	\$4500
Materials/Supplies	\$1000