

**Agricultural Experiment Station
San Luis Valley Research Center
2007 - Proposal for Potato Research Funded by CPAC**

Title: Potato Disease Management

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Nature and Objectives:

This is the annual general request for funds to support approximately 50% of the cost of a range of research projects related to control and management of potato diseases specific to the San Luis Valley. For the most part, these are long term projects designed to address evolving chronic disease problems which limit potato production. Funds being requested are for fixed expenses: primarily labor (full time and hourly) and land rent. Each year the scope of work accomplished within this project expands, however, the base level funding request has remained relatively flat.

The potato industry in the San Luis Valley continues to be faced with serious disease management challenges. These challenges have been made more difficult recently because of the continuing poor water situation. Seed borne diseases such as powdery scab, pink rot, and silver scurf require increasingly sophisticated management schemes. While growers seem to have a handle on control of the foliar phase of early blight, the tuber phase continues to be damaging and difficult to control. Potato leafroll and potato virus Y are now epidemic in major cultivars, particularly Russet Norkotah. Although cultivar resistance will be of great value, these diseases for now will be controlled to a large extent by utilizing clean seed, good management techniques, and judicious use of chemistries.

Efficacy trials are a permanent component of this overall research effort at the SLV Research Center. These trials generate the basic information required by product manufacturers, the EPA and State Department of Agriculture for labeling and registration. Ongoing evaluation of products is essential to maintaining current labels as well as justifying Section 18, LSN24C, and Section 3 registrations for new products or established products with label variations. Availability of new crop care products to potato growers in Colorado is contingent upon scientifically valid data developed within the University on a regional basis. Resistance management among fungicides, both foliar and soil applied, is becoming even more critical as many new products have similar modes of action. Therefore, development of comprehensive season-long fungicide programs for potato will require more attention than in the past.

Evaluation of advanced clones from the CSU Cultivar Development program for reaction to several critical diseases is also a permanent component of this research effort. The increasing threat of major diseases and the advent of Plant Variety Protection for new cultivars make this work central to protecting grower and University interests. In addition, these evaluations provide valuable information to the producer of new cultivars so that the threat from many diseases is mitigated.

Methods, Procedures and Facilities:

The research to be conducted under this proposal will occur at several locations. Fungicide efficacy trials for early blight, pink rot, silver scurf, and seed piece decay will be conducted on station under solid set irrigation with at least one off-station site on a grower cooperator's land.

Evaluation of advanced selections from the CSU Cultivar Development program for reactions to PLRV and PVY will be conducted on an isolated corner site at the station while reactions to ring rot will be

conducted off-station with a cooperating grower. Evaluation for early blight tuber rot, dry rot, and soft rot will be conducted in the SLVRC Processing building.

Evaluation of advanced selections for powdery scab as well as chemical and cultural control studies will be conducted off-station on a grower cooperator's land known to have a high incidence of disease. Additional work at this site will focus on better understanding of the various environmental and production practices that influence amount of scab in the crop. Screening compounds for activity against *Spongospora subterranea* and large scale screening of new potato clones early in the selection process for resistance to powdery scab and potato virus Y will be conducted at the station in the isolation greenhouses. There will be continued development of the appropriate delivery system for placement of Omega fungicide (fluazinam) on grower cooperator's land.

Biological agents and fungicides for control of pink rot will be conducted both on station and off-station on a cooperating grower's land. New clones and existing cultivars will be screened for susceptibility.

Evaluation and comparison of two drip irrigation systems against standard overhead irrigation will be continued on station in the southeast corner and on a grower cooperator's farm.

Evaluation of biological agents, compost teas, and products to increase plant defense systems and corresponding yield and quality will be evaluated on station.

All resources necessary to conduct these projects are currently available or will be purchased.

Relationship of Proposed Research to Overall Problem:

The proposed research is driven by the compliment of disease problems that limit potato production and quality of the crop in the San Luis Valley. The specific components of this research effort have been identified and ranked by SLV potato growers through annual surveys and direct contacts.

Potential for Leveraging Outside Funding:

Historically, funds granted by the CPAC to the Potato Disease Management research project have been used to leverage outside funds from agricultural chemical companies, Colorado Certified Potato Growers' Association, CSU, AES, and USDA CSREES. In general terms, for each dollar of base level funding from the CPAC, there have been two to three dollars leveraged from outside, non-Colorado potato industry, sources. It is, however, only by virtue of consistent base level funding that assures the presence of the project Research Associate, Andrew Houser, that these outside sources of funding can be secured.

Time line for Proposed Research:

These are continuing projects. For efficacy trials, data are generated each year and used in registration and labeling of new products and local use recommendations for existing and new products. Data from cultivar evaluation studies is accumulated from year-to-year and used by the CSU Cultivar Development program and states in the Western Regional Cultivar Development Program in the long term assessment of new releases. Research on powdery scab was formally started in 2001 and is expected to continue for the coming two to three years. This is base level applied research on the biology and control of the disease in the San Luis Valley. It is difficult to know where this work will lead, only that as many approaches to control and management of this disease are being pursued as possible. Studies on the control and biology of the pink rot fungus will continue for two to three years. The drip vs. overhead irrigation studies are scheduled to last two to three years. The study of biologicals and compost teas will last from two to three years.

Progress in 2006:

Powdery scab and pink rot

- ▶ Evaluated 47 different potato cultivars for susceptibility to powdery scab tuber lesion and root gall development.

- ▶ Evaluated 12 fungicide programs for control of powdery scab and 14 treatments for control of pink rot. Working with ISK for LSN24C label for Ranman (cyazofamid) fungicide in Colorado for the 2007 growing season.
- ▶ Continued to show that Omega (fluazinam) reduces powdery scab severity and incidence when used in-furrow at planting. Should have a LSN24C label for this product and application methods for the SLV in 2007 with support from ISK, Syngenta and the local potato producers. Working toward developing an appropriate delivery system for in-furrow applications over the seed piece and in the surrounding soil.
- ▶ Evaluated russet cultivars and the same cultivars with skin mutations (i.e., lacking a russet skin) for powdery scab lesion development. Determined that development of a russet skin provides resistance to lesion development; presumably due to either impeding infection or the actual russet development. Working with Dr. Jayanty to identify the components of resistance in the russet cultivars. Evaluating best greenhouse conditions for symptom development for powdery scab which matches field data.
- ▶ Recorded soil temperature and soil moisture readings at three soil depths (6, 8, and 10"). Working to develop a better understanding of how these parameters affect both infection and disease development under SLV conditions.
- ▶ Evaluated individual potato hills of the clone Cherry Red (DT6063-1R; highly susceptible to powdery scab) by examining disease development based upon tuber depth in the hill, location in relation to the outer surface of the hill, size of the tubers, and location of the infection on each tuber. Developed a model of how and where powdery scab is most severe in the hill in an effort to direct better placement of effective chemistries and to help in managing irrigation water to minimize infection and subsequent lesion development.
- ▶ Evaluated NuEarth biological and Beyond as biological control agents for powdery scab and pink rot at two locations.

Early blight, late blight, degree day models, growth regulators

- ▶ Evaluated 25 fungicide programs for control of foliar early blight using different cultivars and fungicide rates, number of applications, and proper timing of applications.
- ▶ Demonstrated that fungicide programs involving two to three applications, with one of the applications being a strobilurin class fungicide, reduced disease to acceptable levels when applied at proper intervals. Also demonstrated that applying two to three fungicides later season was as effective as applying fungicides when timed with the early blight degree day model (650 DD) for disease control. Effect of these application intervals will be correlated with early blight tuber decay.
- ▶ Recorded late blight severity units at three valley locations (Blanca, Hooper, and Sargent), calculated and reported on the SLVRC web page and on phone message (at SLVRC) the early blight and nematode degree days throughout 2006 season to assist in timely, effective application of fungicides and/or insecticides.

Cultivar disease assessments

- ▶ Evaluated 53 cultivars for timing and expression of bacterial ring rot symptoms. These represented advanced clones from both the CSU Cultivar Development program and the Western Regional breeding programs.
- ▶ Evaluated 28 advanced clones from the CSU Cultivar Development program for timing and expression of PLRV and potato virus Y symptoms, tuber dry rot and soft rot. Assisted in development of cultivar management profiles for each of the clones released for grower testing by CSU.
- ▶ Cooperated with and assisted the CCPGA as owners in pursuing Federal plant variety protection for two cultivars released by CSU; Rio Colorado and Canela Russet.

Milestones in 2006:

- ▶ Confirmed the cost effectiveness and the ability to control foliar early blight disease when applying three fungicides at the proper time.
- ▶ Confirmed the effectiveness of Omega in controlling powdery scab when applied in-furrow at planting.

Confirmed that use of two nozzles during application of in-furrow Omega (seed piece and surrounding soil) was more effective than use of only one nozzle spraying over the seed piece. Should have LSN24C label for commercial use of Omega on potatoes for the 2007 season.

- ▶ Confirmed that resistance to PVY, *Fusarium* and *Erwinia* in several advanced clones is real. These clones are being moved into advanced trials for eventual release to growers.

Objectives and Expected Accomplishments for 2007:

- ▶ Supply comprehensive data package on the disease reactions of all new potato clones released from CSU. Reduce potential for the release of problematic cultivars. Conduct earlier screening of new germplasm for resistance to powdery scab and potato virus Y in the greenhouse.
- ▶ Work toward the development of a long term management strategy of pink rot in the San Luis Valley (in cooperation with Agro Engineering) using existing research information and supplementing with very focused research under SLV conditions.
- ▶ Develop a multi-component management regime for powdery scab for use where a determined degree of control is economically justified. Continue work with the fungicide Omega; in-furrow placement in the hill, levels of control based upon soil potential, etc. Included in this effort is the development of long term management strategies to reduce potential build up of powdery scab in SLV soils.
- ▶ Generate information for potato growers, through efficacy trials, that can be used to reduce expenditures on pesticides based on specific data for crop care products addressing rates, combinations, sequences, rotations, season long programs, application timing, and less costly generic alternatives.
- ▶ Finish two year project with drip tape in southeast corner of station and on a grower cooperator's farm.
- ▶ Evaluate biologicals, compost teas, and other products to increase plant defense systems and corresponding yield and quality.

Funding History: 2000, \$21,000; '01, \$18,000; '02, \$27,000; '03, \$25,000; '04, \$29,000; '05, \$20,000; '06, 25,000

Budget for 2007: \$25,000

Labor: Full time (50% Research Associate) + part time plot labor	\$20,000
Land rent (\$2,500) + supplies (\$2,500)	\$ 5,000