

**2009 PROPOSAL FOR THE SLV RESEARCH CENTER COMMITTEE AND
THE COLORADO POTATO ADMINISTRATIVE COMMITTEE (AREA II)**

TITLE: Management of Nematodes on Potato in the San Luis Valley, Colorado

PROJECT LEADERS:

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NATURE, SCOPE AND OBJECTIVES OF PROPOSED RESEARCH

The Columbia root-knot nematode (*Meloidogyne chitwoodi*, CRKN) has become a threat to quality potato production in the San Luis Valley (SLV) of Colorado. CRKN infects tubers and causes galling (small bumps) on the surface and small brown spots surrounding the adult females inside the tuber. Both symptoms are considered quality defects. Domestic fresh and processing markets have low tolerance for tubers expressing symptoms of root-knot infection, but seed and many export markets have no tolerance for root-knot infection in tubers. Corky ringspot (CRS) disease has also become a growing concern in the SLV. CRS is caused by tobacco rattle virus (TRV), which is vectored by stubby-root nematodes (*Paratrichodorus allius*, SRN). Symptoms of CRS in tubers include necrotic arcs, rings or spots throughout the tuber that can also be seen on the unpeeled surface of light-skinned varieties. Symptoms of CRS are also considered quality defects and even a small percentage of tubers with excessive symptom severity can result in crop rejection. Potential control measures for CRKN and SRN/CRS include fumigation with Telone, Vydate C-LV or, potentially green manure cover crops, perhaps in combination with Vydate C-LV. Separate management strategies may need to be developed for CRKN and SRN/CRS and for crops destined for domestic, seed or export markets. This research program proposes to continue development of sound management strategies for controlling these nematode-mediated tuber defects.

OBJECTIVES

1. Screen potato cultivars for resistance to corky ringspot and root-knot nematode.
2. Evaluate green manure cover crops for suppression of stubby-root-nematodes, corky ringspot disease and root-knot nematodes.

JUSTIFICATION, METHODS, PROCEDURES AND FACILITIES (BY OBJECTIVE)

Objective 1: Screen potato cultivars for resistance to corky ringspot and root-knot nematode.

Justification: Different varieties of potato may express symptoms differently when infected with TRV. Symptoms may also vary with different strains of TRV. For example, Russet Norkotah has expressed extensive symptoms of CRS when grown in areas of the Columbia Basin, but was symptom-free when grown in areas of the Klamath Basin. Yukon Gold grown adjacent to the Norkotah in the Klamath Basin had extensive symptoms of CRS which confirmed the presence of TRV. Work by this research program in the SLV during 2008 documented that Canela Russet, Rio Grande Russet and Yukon Gold were highly susceptible to TRV and expressed extensive symptoms of CRS, whereas Russet Norkotah, Russet Nugget and Centennial expressed very few tuber symptoms. If more varieties suitable to the SLV can be determined to express few or no symptoms of CRS, it would represent a management option for growers with fields that are known or suspected to be infested with TRV. Similarly, identification of highly susceptible varieties would provide growers information on varieties to avoid in TRV-infested fields. Identification of resistance in clones from breeding lines would also be valuable to the variety development program. Since reaction of varieties to TRV can vary by region it is important to do this testing in the SLV.

While no commercial variety is resistant to CRKN, there may be less susceptibility in some varieties than in others. Research in the SLV in 2008 observed that populations of CRKN at harvest under Centennial were less than half that under Russet Norkotah and the percentage of culled Centennial tubers was less than half that of Russet Norkotah. More promise for resistance to CRKN exists in the development of new varieties. Chuck Brown, a USDA-ARS potato breeder at Prosser, WA has several selections that have resistance to CRKN, some of which also express little to no symptoms of CRS.

Procedures: Selected potato varieties or clones will be planted in a field with a recent history of CRS. The proposed list below is based on discussions with Jeannine Willett at Agro Engineering and Chuck Brown at USDA-ARS, Prosser WA. Steve James at Oregon State University was also consulted in regard to seed availability and to reserve seed for clones from the Tri-State Variety Development Program. This list may be modified depending on the desires of growers and potato breeders.

Canela - highly susceptible to CRS, used as a control to confirm presence of TRV

Chipeta – Highly resistant to CRS

Classic Russet - reaction to CRS in SLV unknown

Blazer - reaction to CRS in SLV unknown

Highly CRS resistant clones

A00286-3Y

ATTX961014-1R/Y

CO97087-2RU

PA99N2-1

PA9982-4

PA00N14-2

Each cultivar will be replicated five times in a randomized block design. All plots will be tarped during Vydate applications made to the field by the grower. Nematode samples will be taken at planting and at harvest. Tuber samples will be collected, sliced and scored for symptom expression of CRS as acceptable damage, serious damage, or culls. If CRKN is present in this field, tubers will be evaluated for CRKN symptoms as well.

Objective 2: Evaluate green manure cover crops for suppression of stubby-root-nematodes, corky ringspot disease and root-knot nematode.

Justification: Sudangrass green manure crops have been successful at suppressing population densities of CRKN in the San Luis Valley and are being grown extensively. Recently, however, it has been documented that sudangrass can increase stubby-root nematodes and potentially increase the severity of CRS if TRV is present in that field. Use of green manure crops is highly desirable for improving soil health, however, and should not be abandoned for suppression of CRKN. What is needed are cultivars or cultivar mixtures that may suppress CRKN and SRN, or at least not increase SRN, for use in fields with both CRKN and CRS.

Research in Oregon during 2001 demonstrated that radish cv Colonel was very effective at suppressing densities of SRN and CRKN. However, since mustard green manure crops suppressed CRKN for a longer period than radish, research on radish was not continued. Research on radish for suppression of SRN and CRS was reinitiated in Oregon during 2007 as new cultivars have become available for screening. Average SRN populations at time of green manure incorporation in radish cvs Terranova and Dublet plots were 7% and 2%, respectively, of densities in sudangrass cv Sordan 79 plots.

Procedures: In 2008, the following green manure crops were planted in a SLV field with CRKN, SRN and a history of CRS. This trial was in cooperation with Merlin Dillon, who was planting another green manure trial in the same field, to conserve resources. Funds are requested in this proposal to monitor nematode populations and tuber damage from CRKN and CRS in the plots that had been planted to the different green manure crops. Nematodes will be sampled from each plot at planting and harvest of potatoes. At harvest, 25 4-12 oz tubers will be collected from each plot. Each tuber will be rated for external damage from CRKN, peeled and the number of internal CRKN infection sites counted. Tubers will be rated as not infected, infected (1 or more infection sites), or culls (6 or more infection sites). Tubers will then be, sliced and scored for symptom expression of CRS as acceptable damage, serious damage, or culls.

1. Sudangrass cv Sordan 79
2. Radish cv Adios
3. Radish cv Dublet
4. Radish cv Terranova
5. Mustard cv Caliente 61
6. Sudangrass cv Sordan 79 plus Radish cv Dublet
7. Wheat

RELATIONSHIP OF PROPOSED RESEARCH TO OVERALL PROBLEM

A considerable percentage of potato acreage in the western United States is infested with root-knot nematodes. Even minimal damage to tubers from root-knot nematodes can result in substantial decrease in crop value. Fields with a history of damage from CRS are less frequent but can be a major concern to growers who are at risk from this disease. The number of areas and fields where CRS has been reported appears to be increasing. Control measures for CRKN and CRS utilized in other regions have been effective but are too expensive for the narrow profit margins from production in the SLV. Nematode management guidelines and treatment options must be developed specifically for the unique growing conditions in the San Luis Valley. Research in the SLV is complemented by biological and treatment schedule research in other production areas in an attempt to develop a comprehensive management plan for nematode control that can be applied to all production areas.

POTENTIAL OF PROPOSED RESEARCH RESULTS TO OBTAIN OTHER FUNDING

Dow and DuPont have contributed substantially to funding, labor and product for various objectives completed by this project in the past. However, as project objectives move away from the use of nematicides, additional support from chemical companies with established products is less likely. On the other hand, companies with new products may see opportunities for their materials in the SLV as more is learned about the nematode situation. Research dollars for trials from these sources in the future are conceivable. Previous CPAC funded research on green manure crops in cooperation with Merlin Dillon and others contributed to the successful funding of a grant submitted to EPA in 2007. Results from this research project may also provide necessary data for preparation of a Western Region IPM proposal, which would provide funding for CRKN nematode research in the San Luis Valley.

TIMELINE AND OUTCOMES

All fieldwork associated with these trials will be completed by fall of 2009 and all data gathering and analyses should be finished by January 2010. Outcomes from the research will have immediate results in the ability to make recommendations of the relative merit of growing various green manure crops for suppression of CRKN and CRS, and in which potato varieties should be recommended or avoided in fields suspected of being infested with TRV. Longer term benefits may come from establishing the presence of CRKN and/or CRS resistance in the clones from the potato breeding lines. This may result in development of new, resistant varieties that will lead to reduction in nematicide use. The two trials may complement each other in that if only partial resistance is found in a potato variety, that may be sufficient if that variety is planted after a nematode suppressive green manure crop.

FUNDING REQUEST:

2008 Allocation: \$16,600

2009 Request:

Nematode Processing of Soil and Tuber Samples	\$ 8,925
Travel	4,200
Labor	2,000
Shipping Samples to Oregon	1,575
Misc services and supplies	2,000
Total Cost of Project	\$18,700

Total CPAC Request **\$18,700**