

## 2008 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. Impact of CRS may also potentially be minimized by careful cultivar selection. 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 and begin work on a best management practices document for potato nematodes in the SLV.

### **OBJECTIVES**

1. Evaluate sudangrass cultivars for suppression of CRKN.
2. Determine the optimum time of Vydate C-LV applications for control of corky ringspot.
3. Screen potato cultivars to sensitivity of symptom expression to corky ringspot.
4. Evaluate green manure cover crops for suppression of stubby-root-nematodes.
5. Summarize current best nematode management practices for the SLV.

## **JUSTIFICATION, METHODS, PROCEDURES AND FACILITIES (BY OBJECTIVE)**

### **Objective 1: Evaluate sudangrass cultivars for suppression of CRKN.**

*Justification:* Trials have documented that sorghum-sudan cv Sordan 79 is effective at suppressing populations of CRKN in the SLV. Honey sweet, another sorghum-sudan hybrid available in the SLV, has not been as effective at suppressing CRKN populations. However, symptoms of CRKN in tubers grown after both cultivars were acceptable for domestic markets when tubers were evaluated at harvest. When tubers were incubated to reveal late season infection, damage was higher in tubers grown in Honey sweet plots than after Sordan 79. Variation in the suppressiveness of different cultivars of sudan and sorghum-sudan hybrids has also been observed in the Pacific Northwest. It is important to know the reaction of CRKN to different sudan or sorghum-sudan cultivars to determine if a variety exists that is more suppressive than Sordan 79 or if there are cultivars that may actually increase CRKN and thus should be avoided in potato rotations. Furthermore, cultivars that are equal or superior to Sordan 79 need to be identified should Sordan 79 be discontinued. Very little screening of sudan cultivars has been completed, however.

*Procedures:* In 2007, five sudangrass varieties and a wet fallow control were established in a field with CRKN. This field will be planted to potato in 2008. Soil samples for nematode analyses will be taken at planting and at harvest. Tuber samples will be collected and examined for symptoms of CRKN infection at harvest and after a warm storage period (incubation).

### **Objective 2: Determine the optimum time of Vydate C-LV applications for control of corky ringspot disease.**

*Justification:* Research in Oregon determined that Vydate could control corky ringspot (CRS) if applications began early, particularly in-furrow at planting. However, all successful treatment programs included 4-6 applications. Similarly, six Vydate applications controlled CRS during 2007 in a mildly infested site in the SLV. However, many SLV growers are reluctant to apply Vydate in-furrow or to use six applications. It is likely that CRS can be controlled in the SLV with fewer applications but timing is likely to be critical.

*Procedures:* This project will test 1, 2 and 3 applications applied through the pivot after planting in a field with a recent history of CRS. The cooperating grower will make the applications and plots not to receive treatment at particular times will be covered with a tarp during that application. The exact timing of application will depend on the grower's program but will be similar to the following set of treatments.

1. Untreated control
2. 21 days after planting
3. 42 days after planting
4. 21 and 42 days after planting
5. 21, 42 and 63 days after planting

Each treatment will be replicated five times in a randomized block design. Nematode samples will be taken at planting and at harvest. Tuber samples will be collected, sliced and scored for symptom expression of CRS. If CRKN is present in this field, tubers will be evaluated for CRKN symptoms as well.

**Objective 3: Screen potato cultivars to sensitivity of symptom expression to corky ringspot.**

*Justification:* Different cultivars 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 had extensive symptoms of CRS which confirmed the presence of TRV. If some cultivars suitable to the SLV can be determined to express symptoms less than others it would represent a management option for growers that have fields that are known or suspected to be infested with TRV. This would also provide growers information on particular cultivars to avoid in TRV-infested fields.

*Procedures:* The following cultivars will be planted in a field with a recent history of CRS.

Russet Norkotah

Russet Nugget

Rio Grande

Centennial

Canela

Yukon Gold

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

**Objective 4: Evaluate green manure cover crops for suppression of stubby-root-nematodes.**

*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. 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. No CRKN were present in this study.

*Procedures:* In this trial the following green manure crop cultivars will be planted in a field with a recent history of CRS. Suitable areas of the field will be grid sampled and plots will be planted in the area with the highest population of SRN.

1. Sudangrass cv Sordan 79

2. Radish cv Arena

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

These treatments will be planted in a randomized block design with five replications. Soil samples for nematode analyses will be taken before planting and after incorporation of the green manure crops. In 2009 funds will be requested to evaluate the tubers in each plot for CRS. If CRKN is present in the plots it will be evaluated as well.

**Objective 5: Summarize current best nematode management practices for the SLV.**

*Justification:* Since this project began in 2001, several successful trials have generated valuable information on nematode management in the SLV. Some of these results have been published in the annual Proceedings of the Southern Rocky Mountain Agricultural Conference and Trade Fair and some have been published in issues of Pomme de Terre, but there is no single place where growers can access the collective information from this program.

*Procedures:* Research results will be summarized by topic and the current best management practices for nematode control will be discussed on a web site that growers can link to for research results and recommendations in the SLV.

**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. 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. Support from DuPont for 2008 is unknown at this time but DOW has expressed interest in contributing to another Telone rate trial in fall of 2008 if a suitable site and cooperating grower can be located. Work 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 2008 except for the green manure variety trial which will continue through the potato year in 2009. We intend to establish another Telone II rate trial in fall of 2008 to collect supporting data to pursue a reduced rate label for the SLV. Funds for that trial, including work that will occur in 2008 will be requested from CPAC and Dow AgroSciences in our proposal for 2009.

Short-term outcomes will include recommendations of the most effective and/or economical use of Vydate for control of CRS in the SLV. This project will also contribute to developing guidelines for using green manure crops for management of CRS that will compliment those being develop for management of CRKN. This project also will provide the first information on control of CRS in the SLV with Vydate programs applied at different timings. Major milestones and accomplishments expected include better understanding of the relationship between CRKN, SRN, CRS and potato, and the establishment of the most reliable and economical methods for SLV growers to protect potato crops from losses due to nematode damage.

## FUNDING REQUEST:

2007 Allocation: \$25,000

### 2008 Request:

Nematode Processing of Soil and Tuber Samples	\$13,300
Travel	5,000
Labor	7,000
Shipping Samples to Oregon	2,500
Misc services and supplies	3,800
Total Cost of Project	\$31,600

**Total CPAC Request** **\$31,600**

This budget includes work for all the objectives as described including \$1,000 for Merl Dillon to plant and maintain the green manure trial (objective 4). However, there is some flexibility in the budget by reducing the effort under some objectives and/or eliminating other objectives to meet the needed support for the research if this is necessary due to CPAC budget constraints.