

**2006 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. In addition to the fresh market, which has low tolerance for tubers expressing symptoms of root-knot infection, the SLV also produces potato for seed and export markets, which have no tolerance for root-knot infection in tubers. Separate management strategies may need to be developed for crops destined for these different markets. Nematode management for fresh market may be based on fumigation with Telone, Vydate C-LV or, potentially green manure cover crops, perhaps in combination with Vydate C-LV. Various aspects of these different management strategies are addressed in this proposal.

This research program has developed an economical management program using Vydate C-LV in which performance is enhanced by an in-furrow application at planting. However, while some growers have adopted the use of Vydate C-LV in-furrow, other growers are reluctant to make in-furrow applications. Work proposed for 2006 will attempt to determine if a Vydate program can provide adequate control without the use of an in-furrow application. While Telone II is recommended for control of CRKN in seed, growers are interested if a full season Vydate program would be sufficient in fields with low CRKN densities. In another objective, the potential for Telone II to suppress CRKN for a second fresh market potato crop will be investigated. Corky ringspot (CRS) disease occurs sporadically in the SLV but can be a major production concern where it does occur. This research program will initiate reliable and economical approaches to control this virus disease that is vectored by stubby-root nematodes. Cultural practices such as planting green manure crops or small grains that support low or no CRKN reproduction may become important nematode management strategies in the future and work on each of these approaches is proposed. Accumulated degree-days during the growing season will be monitored at several locations in the SLV.

OBJECTIVES

1. Determine if post-plant Vydate chemigations, prior to the hatch of overwintering CRKN, increase the efficacy of a standard Vydate program.
2. Determine if a full season Vydate program can adequately control CRKN in seed potato fields with low CRKN densities.
3. Determine the optimum times for Vydate applications to control corky ringspot disease.
4. Determine the effect of various green manure cover crops on potato tuber damage caused by CRKN.
5. Determine the duration of CRKN suppression by different rates of Telone II two years after application.
6. Determine the relative host status of different varieties of small grain crops to evaluate their roles in CRKN management by rotation.

JUSTIFICATION, METHODS, PROCEDURES AND FACILITIES (BY OBJECTIVE)

Objective 1. Management of Columbia root-knot nematode (CRKN) with Vydate C-LV is most effective when applications begin early in the season. One of the most effective ways of applying Vydate is an in-furrow application at planting, followed by chemigation applications beginning 800DD_{5c} after planting and continuing on two week intervals until harvest. However, many growers are reluctant to apply Vydate in-furrow due to the inconvenience of having one more thing to do during the busy planting period and due to concerns about worker exposure.

In an attempt to find a time for an early-season Vydate application that would be an alternative to in-furrow at planting, we examined early season population dynamics in the SLV. What we observed was a rise in population CRKN density at 400 (2002) or 600 (2003) DD_{5c}, presumably due to the recovery of newly hatched CRKN from over-wintering eggs. Therefore, an early Vydate C-LV application at 400-600 DD_{5c} may be effective at reducing the number of over-wintering CRKN that infect roots in the SLV, which would reduce the number of CRKN hatching out of roots to infect tubers later in the season. We tested this concept in 2005 where we evaluated the benefit of adding an application at 400 DD_{5c} to applications at 790 and 980 DD_{5c} in a field with CRKN near 1,000/250-g soil. While both treatments controlled external symptoms, only the treatment with the additional application at 400 DD_{5c} adequately controlled internal symptoms. In 2006 we would like to monitor this treatment regime in two different fields to examine the effectiveness of this treatment timing under different field conditions.

Three treatments will be established in two growers' fields in a randomized block design.

1. A chemigation application of Vydate C-LV at 2.1 pt/a at 400-600 DD_{5c} followed by a standard program of Vydate C-LV at 2.1 pt/a applied through chemigation in ½ in. water beginning at 800 DD_{5c} followed by applications 2 and 4(?) weeks later. (We will follow growers normal program).

2. The standard program of Vydate C-LV at 2.1 pt/a applied through chemigation in ½ in. water beginning at 800 DD_{5C} followed by applications 2 and 4(?) weeks later.
3. A nontreated control in which tarps will be placed over plots for all Vydate applications.

Each treatment will be replicated five times in a randomized block design. Nematode samples will be taken from each plot at planting and at harvest and tubers will be evaluated for external and internal symptoms.

Objective 2. The best control for CRKN in potato seed is Telone II, but many seed growers are reluctant to spend the money for Telone if they only have low densities of CRKN in their field. A full season Vydate program may control CRKN in under low nematode densities but has not been tested.

Plots will be established in a grower's field that is to receive a full season program of Vydate C-LV beginning at 800 DD_{5C} and every two weeks until vine kill. Additional early applications will be recommended but we will follow whatever the grower decides his program will be. No untreated checks will be included. Several plots will be sampled initially and only those with CRKN will be resampled for CRKN at harvest. Tuber samples will be taken to examine for the visible presence of CRKN at harvest, after incubation, and after storage in the grower's cellar.

Objective 3. Corky ringspot (CRS) occurs occasionally in the SLV and can devastate the quality of a sensitive potato cultivar. Vydate C-LV can provide effective control of CRS but timing of early applications is critical and no research has been conducted in SLV. The following treatments will be tested for control of CRS in a field that had symptoms of CRS in 2004.

1. Untreated control (tarps will be placed over plots during chemigations).
2. A chemigation application of Vydate C-LV at 2.1 pt/a as soon after planting as possible.
3. A band treatment applied with a dammer-diker at emergence and followed by irrigation.
4. A chemigation application of Vydate C-LV at 2.1 pt/a just after hilling.

All treatments would then receive the remainder of the grower's Vydate program.

Each treatment will be replicated five times in a randomized block design. Nematode samples will be taken from each plot at planting and at harvest and tubers will be evaluated for symptoms of CRS and root-knot nematode if present.

Objective 4. During 2005, Merlin Dillon planted several green manure cover crops on June 15 which were incorporated in the soil on September 1. Each cover crop was replicated five times in a randomized block design and nematode samples were taken on May 18 and October 19. Effects of the cover crops on CRKN are illustrated in figure 1. This field will be planted to potato in 2006 and thus, provides an excellent opportunity to follow the effects of these cover crops on CRKN suppression through the potato crop, as well as examine the amount of

protection these cover crops may provide for suppression of tuber damage by CRKN. Soil will be sampled for nematodes at planting and at harvest, and tubers will be evaluated for symptoms of CRKN infection.

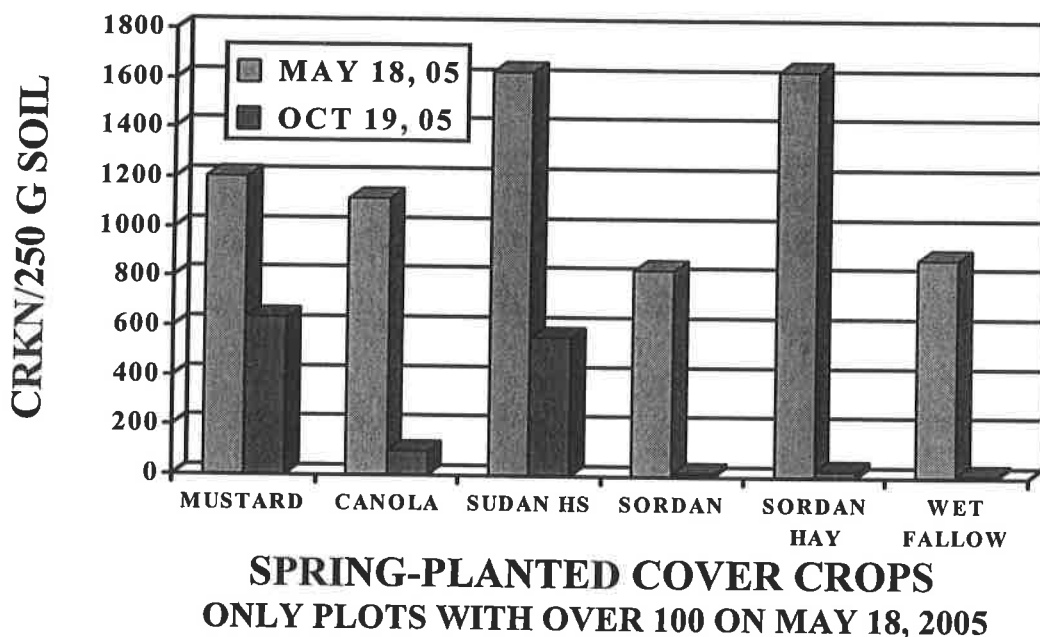


Figure 1. Effects of spring-planted cover crops on populations of Columbia root-knot nematode (*Meloidogyne chitwoodi*) in the San Luis Valley during 2005.

Objective 5. Two trials were initiated in fall of 2004 to examine the effects of Telone II at rates of 12, 15, and 20 gpa on CRKN. All three treatments provided excellent control of CRKN populations and almost no tuber infection was present in the 2005 potato crop in either trial. These plots will be resampled in fall of 2006 to determine if populations have remained suppressed to the extent that chemical control would not be required for the 2007 crop. If two potato crops could be protected with a single Telone application it would make this excellent management procedure more economically attractive for domestic fresh market growers.

Objective 6. Small grains are important crops in potato rotations in the SLV. While most of these crops are considered hosts that increase populations of CRKN, work by Carlson et al. (1988 & 90) indicated irrigated spring barley vars. Klages, Steptoe, and Briggs reduced CRKN levels comparable to oilseed radish, while var. Crystal maintained CRKN levels. Unfortunately no information is available on the relative host status of different small grains under growing conditions in the SLV. If a grower has the choice of growing a variety that is less of a host than another variety he may be able to more successfully manage CRKN, particularly if that crop is followed by a green manure crop the next year. This strategy may permit domestic fresh market growers to manage CRKN populations without nematicides.

A site in a barley field confirmed to have CRKN will be planted to different small grains in a randomized block design with five replications. CRKN population will be sampled at planting and after harvest to determine the amount of population increase under each variety. Potential varieties to be tested include:

- Malt barley
 - C69
 - Scarlet
 - Metcalf
- Feed barley
 - Comarque
 - Steptoe
- Oats
 - Monida

Plots will also be established in a wheat field(s). Wheat can not be planted in the same design with the barley since it has a longer growing season and population assessments made in wheat under a shortened growing season in a barley field would not be representative.

Degree-day monitoring. Data loggers will be installed in all field locations to measure accumulated degree-days during the growing season.

RELATIONSHIP OF PROPOSED RESEARCH TO OVERALL PROBLEM

A considerable percentage of potato acreage in the western United States is infested with root-knot nematodes. Corky ringspot (CRS) occurs less frequently but is a very significant problem in fields where it is present. Even minimal damage to tubers from root-knot nematodes or CRS can result in substantial decrease in crop value. Control measures 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

DuPont will provide \$5,000 towards the cost of this project in 2006 as well as labor assistance and product. \$2,000 has been requested from Dow AgroSciences. 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 2006. We intend to establish another Telone II rate trial in fall of 2006 to collect supporting data to pursue a reduced rate label for the SLV. Funds for that trial, including work that will occur in 2006 will be requested from CPAC and Dow AgroSciences in our proposal for 2007

Short-term outcomes will include recommendations of the most effective an/or economical Vydate treatment schedule for CRKN and CRS. Longer-term outcomes will include better management of CRKN thorough crop rotation and green manure crops. Major milestones and accomplishments expected include better understanding of the relationship between Columbia root-knot nematode 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:

2005 Allocation: \$20,000

2006 Request:

Nematode Processing of Soil and Tuber Samples	\$15,600
Travel	5,000
Labor	5,000
Shipping Samples to Oregon	1,700
Misc services and supplies	4,000
Total Cost of Project	\$31,300
Dupont "Cash" Contribution	5,000
Dow agrochemical "cash" contribution	

DuPont will provide other support
in labor and product

Total CPAC Request

\$26,300

**Note: If the objective on small grain host status is approved, Merlin Dillon will need \$1,000 for his effort in this objective.

This budget includes work for all the objectives as described. However, there is 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. Priority ranking of objectives by the project leaders would be: #4, #1, #5 #2, #3, #6. Other objectives of interest were discussed with growers and consultants but are not being requested for support at this time.

BUDGET JUSTIFICATION

The majority of the budget request is for shipping and processing of soil and tuber samples for nematode evaluation and travel for Russ Ingham and Nick David to visit study sites to set up and harvest plots. Funds requested for labor are for assistance from Agro Engineering personnel, temporary labor during harvest, and for Nick's time associated with this project.

REFERENCES

Carlson, H.L., B.B. Westerdahl, and H. Ferris. 1988. Columbia Root-Knot Nematode Biology and Control. University of California Research Progress Report.
Carlson, H.L., B.B. Westerdahl, and H. Ferris. 1990. Columbia Root-Knot Nematode Biology and Control. University of California Research Progress Report .