

**2005 PROPOSAL FOR THE SLV RESEARCH CENTER COMMITTEE AND THE  
COLORADO POTATO ADMINISTRATIVE COMMITTEE (AREA II)**

**TITLE: Biology and Management of Columbia Root-knot Nematodes (*Meloidogyne chitwoodi*) 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. 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 2005 will attempt to improve the "standard Vydate program" to attain adequate control without the use of an in-furrow application.**

A program based on Vydate as currently used is probably not adequate for seed or export markets, however. Crops intended for these markets should be treated with Telone, perhaps to be followed with a modified Vydate program if live nematodes are detected after fumigation. While growers consider Telone an expensive treatment, it is relatively inexpensive when compared to the cost of crop rejection from these more lucrative markets. Cost of a Telone

program could be lowered by reducing the rate of product applied or by determining if one application at the full labeled rate (20 gpa) provides effective control for two potato crops. While these strategies may be inadvisable for other potato growing areas, the San Luis Valley's unique environment with short, cool growing seasons suggests that this may be achievable. Recent research by this program documented that sites with pretreatment populations of root-knot nematodes as high as 7,000/250 g soil were still zero two years after Telone had been applied. **Proposed work for 2005 will examine reduced rates of Telone at two sites. Some of these plots will be monitored beyond 2005 to observe the rate of nematode recovery after application.** As this project proceeds and encompasses data from several growing seasons, it will determine the management parameters to establish which strategies will provide adequate and reliable control of CRKN at the most economical level.

## OBJECTIVES

1. Determine the relative effectiveness of adding an early season Vydate chemigation application timed with the hatch of over-wintering eggs, to a standard application program that brackets hatch of the second generation, to determine if this treatment would be adequate without an in-furrow application.
2. Determine the effectiveness of Telone at 12, 15 and 20 gpa for control of CRKN over a range of nematode densities and monitor the rate of nematode recovery over time in each rate.
3. Determine the effect of various green manure cover crops on protection of tuber damage from CRKN.

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

**Objective 1.** 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 in comparison to that in the Columbia Basin (Figure 1). The rise in population density at 100 (1984) and 300 (1985) DD<sub>5C</sub> for WA and at 400 (2003) and 600 (2003) DD<sub>5C</sub> for the SLV is presumably due to the recovery of newly hatched CRKN from over-wintering eggs. What is new from our recent research in the SLV is that egg hatch appears to peak later than in the Columbia Basin. Therefore, while an application at planting may be necessary to control CRKN that hatch right after planting in the Columbia Basin, a later application (400-600 DD<sub>5C</sub>) may be effective at reducing the number of over-wintering CRKN that infect roots in the SLV. Reducing root invasion would reduce the number of CRKN hatching out of roots to infect tubers later.

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 500 DD<sub>5C</sub> 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<sub>5C</sub> followed by applications 2 and 4 weeks later.
2. The standard program of Vydate C-LV at 2.1 pt/a applied through chemigation in ½ in. water beginning at 800 DD<sub>5C</sub> followed by applications 2 and 4 weeks later. In this case tarps will be placed over the plots during the 500 DD<sub>5C</sub> application.

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 infection.

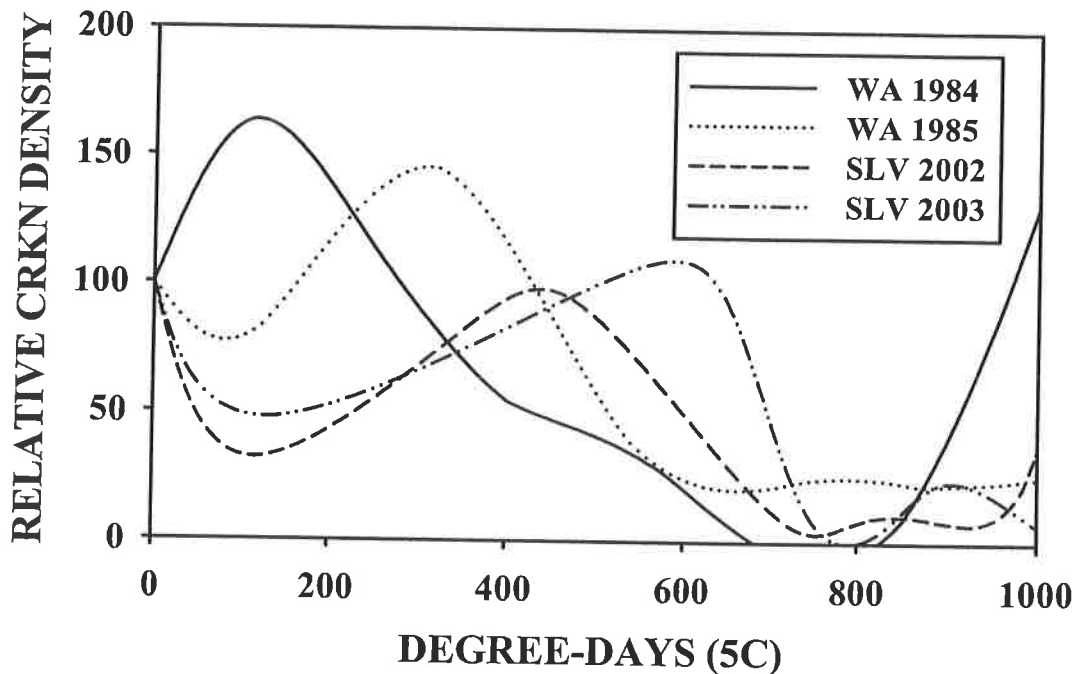


Figure 1. Early season population dynamics of Columbia root-knot nematode (*Meloidogyne chitwoodi*) showing periods of egg hatch that occur in the Columbia Basin (WA) and in the San Luis Valley (SLV).

**Objective 2.** In anticipation of research needs for 2005 two Telone fumigation studies were established in fall of 2004 in different areas of the SLV, on different soils and in fields with different cropping history. In the first study, 20 plots were sampled along each of three transects in an attempt to use the natural variation in population density in fields to establish plots with different nematode densities. Populations over the 60 plots ranged from 0-2,090/250-g soil on September 14, 2004. The transects were then fumigated with Telone at 12, 15 or 20 gpa on September 21. Distances from the pivot road and wheel tracks to each plot were recorded so that the precise location of each plot can be resampled. At least 10 of the plots that represent the range in density for each rate will be sampled at planting (live/dead assays will be done on this date) at harvest in 2005, and at planting and harvest of barley in 2006 to determine if any further treatment would be necessary for 2007.

In the second study, treatments of 0, 12, 15 and 20 gpa were applied to plots in a randomized block design with five replications. Populations over all plots ranged from 25-2,190 and averaged 670/250-g soil on October 1, 2004. Each plot will be resampled at planting (live/dead assays will be done on this date) and at harvest.

**Objective 3.** During 2004, Merlin Dillon planted several cover crops on June 10 which were incorporated in the soil on August 30. Each cover crop was replicated five times in a randomized block design and nematode samples were taken on May 14 and October 26. Effects of the cover crops on CRKN are illustrated in figure 2. This field will be planted to potato in 2005 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, midseason, and at harvest, and tubers will be evaluated for CRKN infection.

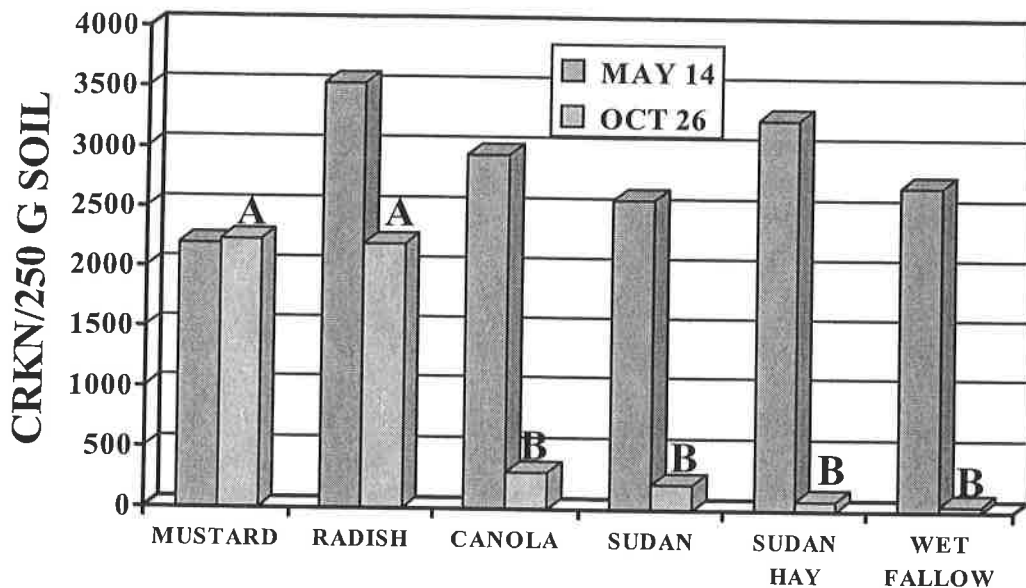


Figure 2. Effects do spring-planted cover crops on populations of Columbia root-knot nematode (*Meloidogyne chitwoodi*) in the San Luis Valley during 2004.

### Tuber evaluations

In each study above, plots will be harvested and two samples of 25 tubers each will be taken from each plot. One sample will be evaluated immediately after harvest and the other will be incubated for maximum symptom expression. Each tuber will be examined for external symptoms and then peeled to count the number of internal infection sites.

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 and even minimal damage to tubers from nematodes 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 2005 as well as labor assistance and product. Objectives on effectiveness of Telone II are of interest to Dow Agrochemical Co., which has provided \$5,000 towards the cost of the rate trials in 2005 and labor assistance is expected as well. 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 2005. The only data collection that will extend beyond 2005 will be the periodic sampling of plots in one of the Telone trials to follow the recovery of CRKN populations after fumigation with Telone at the different rates. Funding for these samples will be requested in future proposals.

Short-term outcomes will include recommendations of the most effective an/or economical Vydate treatment schedule and Telone II rates for management of root-knot nematodes and potentially the range in nematode density in which particular treatment schedules may be effective. Longer-term outcomes will follow as Telone fumigated plots are evaluated in subsequent years, and as untreated plots. 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.

Information transfer of results to the industry will include oral presentations at the annual SLV Potato Grain Conference and articles in Pomme de terre.

**FUNDING REQUEST:**

2004 Allocation: \$20,000

2005 Request:

Nematode Processing of Soil and Tuber Samples	\$15,100
Travel	6,800
Labor	7,720
Shipping Samples to Oregon	2,000
Digger Rent and misc supplies	2,600
Total Cost of Project	\$34,220
Dupont "cash" contribution	5,000
Dow agrochemical "cash" contribution	5,000

Both companies will provide other support  
in labor and product

**Total CPAC Request**

**\$24,220**

**BUDGET JUSTIFICATION**

The majority of the budget request is for shipping and processing of soil and tuber samples for nematode evaluation, 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.