

**2004 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. Recent research from this program has documented the variability of nematode population distribution within a field, determined that CRKN population dynamics in the San Luis Valley are similar to other areas in the western United States, and developed an economical management program using Vydate C-LV in which performance is enhanced by early season Vydate applications. Proposed research aims to further understand the host-parasite relationship between potato and CRKN, while answering specific management questions that are relative to the San Luis Valley's unique growing conditions. As this project proceeds and encompasses data from several growing seasons, it will determine the management parameters to establish when treatment is necessary and which strategies will provide adequate and reliable control of CRKN at the most economical level.

**OBJECTIVES**

- 1. Determine if chemigating Vydate at planting, at crop emergence, or band applying Vydate with fertilizer is as effective as applying Vydate in-furrow at planting.**
- 2. Determine if reduced rates of Telone II are effective in controlling Columbia root-knot nematode in the San Luis Valley.**
- 3. Determine if there are levels of Columbia root-knot nematode that do not need to be treated in the San Luis Valley.**
- 4. Determine the longevity of CRKN control from 20 gpa of Telone II.**

## **JUSTIFICATION:**

### **Objective 1: Determine if chemigating Vydate at planting, at crop emergence, or band applying Vydate with fertilizer is as effective as applying Vydate in-furrow at planting.**

Research from this program has demonstrated that the standard Vydate program of chemigation applications of 2.1 pt/a at 850 degree-days (base 5C) plus two and four weeks later, is consistently improved with an in-furrow application of Vydate at planting. Tuber infection (one or more CRKN/tuber) was reduced from 23% to 7% and from 80% to 30% in 2002 and 2003 respectively when in-furrow Vydate was added to the standard program. Despite its superiority, concerns about worker safety at planting have resulted in slow acceptance of applying Vydate in-furrow at planting. If other application methods at planting or other early season timings are found to be as effective as in furrow, growers will be able to confidently use the method that best fits their individual program.

### **Objective 2: Determine if reduced rates of Telone II are effective in controlling Columbia root-knot nematode in the San Luis Valley.**

Trials in the Pacific Northwest have demonstrated that Telone II is effective in controlling CRKN on potato. However, the labeled rate of Telone for control of CRKN is 20 gpa prior to every potato crop regardless of nematode pressure or season length. In the SLV this would generally mean applying Telone every other year at an estimated cost of \$200 per acre. Even though 20 gpa of Telone may be necessary in the Columbia basin of Oregon and Washington where long, hot growing conditions result in high nematode pressure, reduced rates of Telone may be adequate in the relatively cool and short growing season of the San Luis Valley. Determining if rates below 20 gpa adequately control CRKN could reduce chemical costs associated with Telone and provide potato growers with another economical tool to combat CRKN.

### **Objective 3. Determine if there are levels of Columbia root-knot nematode that do not need to be treated in the San Luis Valley.**

While research in the Pacific Northwest has clearly shown that levels as low as 1 CRKN nematode/250 g of soil will cause significant tuber damage if left untreated, the threshold for CRKN in the San Luis Valley is neither clear nor well understood. This program has been monitoring damage in untreated plots in the San Luis Valley for the past three years and has observed 8%, 27%, and 2.5% internal culls from CRKN in 2001, 2002, and 2003 respectively. The range in culled tubers from year to year indicates that both initial nematode density and accumulated degree-days (2001 and 2002 were warmer than 2003) are important factors affecting CRKN tuber infection in the San Luis Valley. Continued observation of CRKN infection in potatoes from untreated areas over the course of several growing seasons representing both cool and hot years, will enable us to better predict levels of CRKN which need to be treated and levels which can be safely left untreated.

### **Objective 4. . Determine the longevity of CRKN control from 20 gpa of Telone II.**

The cost of Telone II at 20 gpa (approximately \$200) is significantly more than using Vydate C-LV (3-4 applications at \$25 or less) to control CRKN in the San Luis Valley. In the fall of 2002, a barley field with high nematode densities was soil sampled on 3-acre grids and each plot was georeferenced with a GPS unit. CRKN reduction from the fumigation was quite impressive and was published in the January 2004 issue of Pomme de terre. Determining if these population

reductions persist and if more than 1 potato crop can be safely grown after a Telone application would allow the fumigation cost to be spread out over two or more potato crops, thus reducing the cost/crop.

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

### **OBJECTIVE 1. Determine if chemigating Vydate at planting, at crop emergence, or band applying Vydate with fertilizer is as effective as applying Vydate in-furrow at planting.**

Several fields will be sampled this spring to locate areas within four Russet Nugget or late-harvested Russet Norkotah fields that have adequate populations of Columbia root-knot nematode. The following early season Vydate C-LV treatments will be evaluated to determine how well they increase control of CRKN when added to the standard Vydate program (2.1pts/a. chemigated at 850 DD<sub>5C</sub> + 2 and 4 weeks later).

1. 2.1 pts/a. in-Furrow at planting + standard program.
2. 2.1 pts/a. chemigated at planting + standard program.
3. 2.1 pts/a. chemigated at crop emergence + standard program.
4. 2.1 pts/a. mixed with fertilizer and band applied either at planting or at sidedress.

Each field used in this experiment will receive the standard Vydate program and the standard program plus one of the early season programs (either in-furrow at planting, chemigated at planting, chemigated at crop emergence, or banded with fertilizer). Prior to planting, transects for both the standard program and the early season + standard program will be established in each field. Transects will consist of fifteen 20-ft long plots that represent a range of starting nematode densities. The cooperating grower(s) will be asked to apply the early season and standard program treatments at the appropriate times.

Nematode samples will be taken from each plot at planting and at harvest. The 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 placed in the grower's storage and evaluated in the spring of 2005. Each tuber will be examined for external symptoms and then peeled to count the number of internal infection sites.

### **OBJECTIVE 2. Determine if reduced rates of Telone II are effective in controlling Columbia root-knot nematode in the San Luis Valley.**

Several areas next to the pivot road in a barley field were sampled on August 27, 2003 to find an area with populations of Columbia root-knot nematode (CRKN). A site with a population of 335 CRKN/250 g soil was selected as a research location. Plots to evaluate the treatments listed below were laid out and sampled for CRKN on September 12. Each treatment was replicated 10 times to ensure having plots with acceptable CRKN levels in each treatment. Corners of the plot were referenced with GPS so plots could be reestablished in the same locations in the spring. Telone was applied on October 1, 2003.

Untreated Control #1  
Untreated Control #2  
Telone at 10 gpa  
Telone at 12 gpa  
Telone at 15 gpa  
Telone at 20 gpa

In spring of 2004, five plots in each treatment will be selected based on CRKN populations determined in the fall. Soil samples will be taken at 0-12 and 12-24 in. as soon after planting (Russet Norkotah) as possible. At harvest, tubers will be dug from 20 linear feet of row, graded by size and weighed to determine yield. A sample of 25 4-12 oz tubers will be collected for evaluation of nematode damage. Since the GPS coordinates of the plot corners have been established these plots could be relocated in the future to monitor the long-term effects of these treatments on CRKN populations.

**OBJECTIVE 3. Determine if there are levels of Columbia root-knot nematode that do not need to be treated in the San Luis Valley.**

Extra untreated control plots were established in the field used for the Telone fumigation trial in 2004. Soil samples will be taken at planting and harvest and potatoes will be inspected for CRKN infection. If possible, additional untreated plots will be established in fields that are not going to be treated in 2004 or in Vydate treated fields where the grower is willing to leave a portion untreated. Understanding the logistical problems with leaving an area untreated for multiple Vydate applications, untreated plots (for 2005) will be established in the fall of 2004 in Telone treated fields. Cooperating grower's and Stone's Farm Supply will be asked to leave "untreated strips" in several fields. This will allow us to set up untreated plots in fields with "high" nematode counts without requiring a lot of work from the cooperators and leaving large untreated areas in the field. Data from these experiments will be added to the information already gained over the previous three years and will aid our understanding of when potato fields need to be treated for CRKN and what population levels can be safely left untreated.

**OBJECTIVE 4. Determine the longevity of CRKN control from 20 gpa of Telone II.**

The 43 plots that were established prior to fumigation in 2002 will be soil sampled after barley harvest in 2004. The results from these soil samples will indicate the longevity of CRKN control from 20 gpa of Telone II in the San Luis Valley.

**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 2004 as well as labor assistance and product. Objectives on effectiveness of Telone II are of interest to Dow Agrochemical Co., which has provided \$7,000 towards the cost of the rate trial in 2004 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

With the exception of objective 4, all field research will be completed by fall of 2004. Data collection will be completed when tubers in storage are evaluated in spring of 2005. 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 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 are monitored over several years to encompass as wide a range of environmental factors as possible. 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:

2001 Allocation: \$18,000

2002 Allocation: \$20,000

2003 Allocation: \$20,000

2004 Request:

Nematode Processing of Soil and Tuber Samples	\$23,800
Travel	4,200
Labor	7,440
Shipping Samples to Oregon	1,500
<b>Total Cost of Project</b>	<b>\$36,940</b>
Dupont "Cash" Contribution	5,000
Dow agrochemical "cash" contribution	7,000

Both companies will provide other support  
in labor and product

**Total CPAC Request**

**\$24,940**

## 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.