

**2003 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*) of Potato in the San Luis Valley, Colorado**

**PROJECT LEADERS:**

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**NATURE, SCOPE AND OBJECTIVES OF PROPOSED RESEARCH**

Nematodes have become a serious threat to potato production in the San Luis Valley in recent years. Recommendations from other areas with nematode problems, such as the Pacific Northwest, would suggest that all fields with nematodes should be treated with metam sodium and/or Telone each year potatoes are grown at costs that may exceed \$240/acre. However, because the SLV has a short, cool growing season, not all nematode densities in commercial fields may need to be treated, and less expensive nematicides, like Vydate (as inexpensive as \$65/acre) may be sufficient for densities that do require control. Furthermore, if fumigants, like Telone, are used, they may reduce nematode densities to levels that may be sufficient to provide protection for more than one crop, thus reducing the long-term costs of this procedure. As this project proceeds, it will determine the management parameters to establish when treatment is necessary and the management strategies that will provide adequate control of root-knot nematode and corky ringspot at minimal cost.

**OBJECTIVES**

- 1. Determine the optimum schedule for Vydate applications to control Columbia root-knot nematode in the San Luis Valley.**
- 2. Observe effects of Vydate treatments on population dynamics of Columbia root-knot nematode in the San Luis Valley in relation to accumulated soil degree-days.**
- 3. Determine initial density of Columbia root-knot nematode that causes damage in Russet Norkotah when treated with two applications of Vydate C-LV at 2.1 pts/a.**
- 4. Determine the longevity of control from a soil fumigation treatment with Telone II.**

## **JUSTIFICATION:**

**Objective 1:** Vydate is a non-fumigant liquid nematicide/nematostat whose use on potato has been rapidly increasing since it secured a chemigation label. Although Vydate can kill nematodes on contact as a nematicide, it also controls root-knot nematodes by nematostatic action. As a nematostat, Vydate disorients nematodes and prevents feeding and penetration of roots and tubers. However, once the concentration of Vydate falls below a critical concentration in the soil solution, believed to be 1 ppm, nematodes recover and are once again able to infect roots and tubers. Thus, multiple applications are necessary. Although Vydate is being widely used in potato, there is still little information on the number and timing of applications required to achieve adequate control at minimal cost. Our research in the SLV during 2002 demonstrated that several treatment schedules of 3, 4 or 5 applications were sufficient to achieve acceptable control. Several of these schedules had applications between planting and hatch of the second generation (900 degree-days, base 5 C), which appeared to be of little benefit. This suggests that control may be achieved with fewer applications and treatments in 2003 will examine schedules with 1, 2 and 3 applications. Treatments with and without in furrow applications will be compared to determine the effectiveness and/or necessity of in furrow applications.

**Objective 2:** Following the effects of Vydate applications at different times on nematode population dynamics can help determine when a nematode population is most vulnerable to a nematicide application, as well as when a nematicide treatment may have little effect. It also helps for making recommendations on when to take nematode samples.

**Objective 3:** It is important to determine if there is an initial population level of Columbia root-knot nematode that will cause tuber damage when the crop is treated with Vydate. If an upper threshold for Vydate exists, growers will know when to implement other control measures, such as soil fumigation. However, if an upper threshold for Vydate does not exist for densities commonly found in the SLV, growers will be confident that Vydate will offer adequate protection at any population level.

**Objective 4:** Soil fumigation is a very effective treatment for control of tuber damage from Columbia root-knot nematodes in potato but it is very expensive at the labeled rate of 20 gpa. However, the overall cost could be reduced if protection from fumigation would persist through more than one potato crop. Evaluation of Telone in comparison to Vydate will also be important in making recommendations to seed growers who may suspect that they may have nematodes in fields planned for seed production.

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

### **OBJECTIVE 1: Determine the optimum schedule for Vydate applications to control Columbia root-knot nematode in the San Luis Valley.**

Several areas within a field known to have Columbia root-knot nematode will be grid-sampled to find the area with the highest nematode population in which to put this trial. The following Vydate C-LV treatment schedules will be evaluated in a Russet Nugget or late-harvested Russet Norkotah crop so treatments are subjected to high nematode pressure.

1. Untreated control
2. In furrow at 1 lb a.i. (2.1 pints)/a + chemigation of 2.1 pts/a at 900 DD<sub>5C</sub>
3. In furrow at 1 lb a.i. (2.1 pints)/a + chemigation of 2.1 pts/a at 900 DD<sub>5C</sub> and 2 weeks later
4. In furrow at 1 lb a.i. (2.1 pints)/a + chemigation of 2.1 pts/a at 900 DD<sub>5C</sub> + 2 & 4 weeks later
5. Chemigation of 2.1 pts/a at 900 DD<sub>5C</sub>
6. Chemigation of 2.1 pts/a at 900 DD<sub>5C</sub> and 2 weeks later
7. Chemigation of 2.1 pts/a at 900 DD<sub>5C</sub> + 2 & 4 weeks later

Potatoes will be planted in 6-row blocks with 0 or 2.1 pts/a Vydate C-LV applied in furrow. Prior to treatment, several 20-ft long plots will be sampled along each in furrow treatment to find areas with comparable nematode densities in which to establish plots for data collection. Each treatment will be replicated 5 times. The entire study area will receive chemigation applications of Vydate C-LV at 2.1 pts/a in ½ in. water at 900 DD<sub>5C</sub> and at 2 weeks and 4 weeks later. Tarps suspended over PVC frames will prevent Vydate from being applied to plots on dates when no Vydate is scheduled for that treatment. The cooperating grower will be asked to put up and take down tarps on the first two chemigation dates, but we will put up and dismantle tarps and frames on the last application.

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. One will be allowed to reach maximum symptom expression by storing at room temperature for an additional 800 DD<sub>5C</sub> after harvest (incubation sample) and the other will be placed in the grower's storage and evaluated in the spring of 2004 (storage sample). Each tuber will be examined for external symptoms and then peeled to count the number of internal infection sites. The incubation sample will provide the most sensitive evaluation of treatment performance and permit results to be obtained for presentation at the 2004 meetings. However, the storage sample is the more "real world" evaluation, representing the amount of damage present when the crop is marketed. Nematode damage in incubation and storage samples will be compared to see if a grower could take sub samples for incubation to give him an early estimate of nematode damage that a crop may have coming out of storage. Early recognition of potential damage may permit a grower to sell that crop before symptoms develop in storage.

**OBJECTIVE 2: Observe effects of Vydate treatments on population dynamics of Columbia root-knot nematode in the San Luis Valley in relation to accumulated soil degree-days.**

Agro Engineering will be asked to sample treatments 1, 2, 4, and 6 in objective 1 every other week until 800 DD<sub>5C</sub> and then on a weekly basis until harvest. The soil samples will be shipped to OSU where they will be extracted and counted.

Data loggers will be installed in the plot that Agro Engineering will be asked to download each week. Data will be sent to the project leaders at OSU who will compile the data send it to Research Center Personnel who will post it on the Research Center web site so growers will be able to track degree-day accumulation during the season.

**OBJECTIVE 3: Determine initial density of Columbia root-knot nematode that causes damage in Russet Norkotah when treated with two applications of Vydate C-LV at 2.1 pts/a.**

Nematode counts from fields routinely sampled by Agro Engineering will be examined to find the field with the highest population. That field will then be sampled in 10 areas to find an area with the highest counts. Samples will be taken at or before planting in 40-50 locations to obtain plots with different nematode densities. All plots will receive one application of Vydate C-LV (2.1 pts/a) at 900 and another 2 weeks later. At harvest, 25 of these plots that represent the best range in nematode density will be harvested and tubers will be evaluated for nematode damage as described in Objective 1. Damage level will be compared to the initial nematode population to determine the population level, if any, where that Vydate program no longer provided adequate protection.

**OBJECTIVE 4:** In preparation for this project, 43 plots were marked with GPS for later relocation and sampled for nematodes prior to fumigation of the field with Telone II at 20 gpa. Plots (15-20) which represent a range in nematode density will be resampled at planting in spring of 2003 and at harvest to determine if nematode populations have recovered.

It is intended for nematode populations to be monitored from these same plots at planting and harvest of future grain and potato crops until it has been determined that the effects from fumigation are no longer evident. This budget request will only include work intended for 2003. Funds for subsequent years will be modest and will be requested in future proposals.

#### **RELATIONSHIP OF PROPOSED RESEARCH TO OVERALL PROBLEM**

A considerable percentage of potato acreage in the west is infested with root-knot nematodes and even minimal damage to tubers from nematodes can result in substantial decrease in crop value. Control measures in other regions have been effective but are too expensive for the narrow profit margins from production in the SLV. Nematode management with Vydate appears to be a more economical alternative for this cool, short season region, but since Vydate generally does not kill all nematodes outright, more information on nematode biology is required to predict the relative effectiveness of different application times. 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.

Cooperative research between this project and research conducted by Merlin Dillon also evaluates cultural methods for nematode control that may be less chemical intensive and more economical.

#### **POTENTIAL OF PROPOSED RESEARCH RESULTS TO OBTAIN OUTSIDE FUNDING**

Previous research on this project has been appreciated by DuPont, which will provide \$5,000 towards to cost of this project in 2003 as well as labor assistance and product. Objectives on effectiveness of Telone II should be of interest to Dow Agrochemical Co., which may provide

partial funding in future projects. Results from this research project may also provide necessary data for preparation of a Western Region IPM proposal.

### TIMELINE AND OUTCOMES

With the exception of objective 4, all field research will be completed by fall of 2003. Data collection will be completed when tubers in storage are evaluated in spring of 2004. Short-term outcomes will include recommendations of the most effective an/or economical Vydate treatment schedule for management of root-knot nematodes and the range in nematode density in which particular treatment schedules may be effective. Initial evaluation of Telone fumigation will also be available by the end of 2003. Preliminary results on these outcomes will be available for presentation at the 2004 SLV Potato and Grain Conference. Longer term outcomes will follow as Telone fumigated plots are evaluated in subsequent years. Major milestones and accomplishments expected include better understanding of the differences in nematode population biology between the SLV and other production areas, 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 Request:

Nematode Processing of Soil and Tuber Samples	\$16,950
Travel	5,500
Supplies	1,000
Agro Engineering Subcontract	4,000
Shipping Samples to Oregon	2,000

*to go through OSU?*

<b>Total Cost of Project</b>	<b>\$29,450</b>
Dupont "Cash" Contribution	5,000
Dupont will provide other support in labor and product	

<b><u>Total CPAC Request</u></b>	<b><u>\$24,450</u></b>
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### 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. Additional funds are requested for Agro Engineering, which will provide labor for data collection during the season. A minimal amount is needed for perishable supplies and for construction and purchase or additional tarps and frames.