

RESERCH PROPOSAL FOR 2003

Submitted to:

**SLV Research Center Committee
and the Colorado Potato Administrative Committee (Area II)**

TITLE: Vertical Distribution of Eptam, Dual Magnum, Outlook, Sencor, Matrix, and Spartan in Soil Based on the Amount of Water Used for Incorporation.

INVESTIGATOR: Dr. Scott Nissen, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins.

NATURE, SCOPE, OBJECTIVES:

The San Luis Valley is truly a unique and wonderful environment; however, intense production agriculture has the potential to significantly impact water quality in the Rio Grande Watershed and the San Luis Closed Basin. Three of the eight most common pesticides found in the San Luis Valley ground water are herbicides used in potato production. These include Dual, Sencor and Eptam. Levels of these contaminants are not high, but their presence illustrates that the shallow ground water of the San Luis Valley is vulnerable to contamination. This research project will help to define best management practices to reduce the potential environmental impacts of herbicides used in potato production. The safe and environmentally responsible use of pesticide (in this case herbicides) requires that producers understand how to reduce movement below the potato root zone.

We have demonstrated that soil moisture levels at the time of chemigation can significantly influence the vertical distribution of herbicides in the soil profile under laboratory conditions. In soils columns with several inches of dry soil at the surface, movement out to weed seed germination zone (upper inch) was minimal for all herbicides evaluated. Simulated chemigation to soil at or near field capacity resulted in significant herbicide movement to a depth of 6 inches. The application of laboratory results to field situations is not always possible; therefore, this project seeks to test the validity of our laboratory results under field conditions in the San Luis Valley. In addition, **Spartan** will have a Section 18 label for weed control in potatoes for the 2003 growing season; however, very little information is available on Best Management practices to minimized movement of this new herbicide.

OBJECTIVES:

This is an ongoing project and some very interesting information was generated during the 2002 field season.

- **Evaluate the vertical distribution of Eptam, Dual Magnum, Outlook, Sencor, Matrix and Spartan under three different scenarios.**
 - Application to dry soil with 0.5 inches of water for incorporation.
 - Application to dry soil with 1.0 inches of water for incorporation.
 - Application to wet soil with 0.5 inches of water for incorporation.

- **Evaluate the effects of application volume on weed control.**
 - Under field conditions this would be very difficult to evaluate; however, under greenhouse conditions with soil collected from the SLV this could be evaluated.

METHODS AND MATERIALS:

Field Experiment: The experimental will be conducted at the San Luis Valley Research Center in Center, CO. An experimental area 40 ft wide by 130 ft long will be left fallow and maintained weed free by cultivation. Experimental plots will be 10 ft wide and 30 ft long and each treatment will be replicated 4 times. Herbicides will applied with a small plot, CO₂ backpack sprayer at an application volume of 20 gal/ac. The herbicides were applied as different rates depending on the relative sensitivity for analysis; however, all herbicides were applied at the same time.

-The soil will be watered several days before application to make sure that the lower part of the soil profile is moist, but the soil surface is dry.

-The herbicide mixture will be applied to half the plots and sprinkler irrigation will used to apply 0.5 inches of water immediately after application.

-After application treated plots will be sampled to a depth of 6 inches and samples will be divided into increments of 0-1, 1-2, 2-3, and 3-6 inches. Each plot was sub-sampled four times, sub-samples will be mixed in stainless steel buckets and transferred to glass vials with Teflon liners.

-The same herbicide mixture will then applied to the other plots that will now be wet to the soil surface and an additional 0.5 inches of water applied for incorporation.

-All plots will be sampled as previously described so there will be three treatments 1) application to dry soil with 0.5 inches of water for incorporation 2) application to dry soil with 1 inch of incorporation and 3) application to wet soil with 0.5 inches of incorporation.

Samples will be kept cold with dry ice, transport to CSU and stored at -20C until they could be analyzed by GC-MS.

This experiment will require minimal resources from the SLV Research Center Staff. The main duties that will be requested will be maintaining a weed free plot area and assisting with the irrigation.

Greenhouse Experiment: Soil will be collected from the SLV Research Center and transported to the Weed Research Lab at Colorado State University. Greenhouse flats will be filled with greenhouse soil and hairy nightshade will be seeded at a depth of 1 inch. Herbicides will be applied at labeled rates and incorporated with several different amounts of water using the rainfall simulation capability of our new spray chamber. This will provide information on the amount of water necessary for activation and the appropriate amount of water for incorporation.

In a second set of experiments, herbicides will actually be chemigated on to the flats using rainfall simulation and an Agri-Inject system designed to operate with standard garden hose.

RELATIONSHIP OF RESEARCH TO OVERALL PROBLEM:

The water quality of the San Luis Closed Basin and the Rio Grande Watershed depends on the success of producers in the valley at keeping pesticides and fertilizers from moving below the crop root zones. Herbicides used in potato production represent a third of the contaminants commonly found in well samples; therefore, research results that provide producers with information about herbicide movement can serve at the basis for Best Management Practices to

minimize environmental impacts of potato production. As new herbicides become available, we need to provide growers with as much information as possible about the benefits and risks of any new pest management option.

POTENTIAL FOR LEVERAGING:

I submitted a proposal dealing with a more detail study of Spartan's potential movement in the coarse, low organic matter soils of the San Luis Valley to Region 8 EPA in April of 2002. That proposal was not funded. In December, I submitted a version of that proposal to the Region 8 Consolidated Funding Process under the Water Quality Cooperative Grants program. A response to the proposal will be issued around March 1. I believe there is potential to leverage funds provided by the San Luis Valley CPAC Area II into competitive grant funds available from EPA.

TIMELINE:

TASK	April-May-June 2003	July-Aug-Sept 2003	Oct-Nov-Dec 2003	Jan-Feb-March 2004
Conduct field experiment, collect soil samples				
Collect soils for greenhouse experiments				
Analyze soils samples from field experiments				
Conduct spray chamber and greenhouse experiments				
Data analysis and report writing.				
Use data for to develop grants for external funding sources.				

A major short-term outcome will be the initial steps in developing a data-base on the relative mobility of common potato herbicides under field conditions in the SLV. This data-base will be expanded to include newer potato herbicides like Spartan and Outlook. A second short-term objective will be to use this information as preliminary data to develop grant proposals for external funding sources.

The development of research based BMPs for herbicide use in the San Luis Valley will be a major long-term goal of this research project. The environmental quality of the SLV is still very high and information derived from this research will help to maintain this quality.

Annual Budget:

2003 Request: \$14,000

Item	Cost
Support staff-Research Associate -establishment of field experiment -soil sampling -collection of soil for greenhouse experiments -conducting greenhouse studies	\$3,000
Support staff-Lab Manager -extracting soil samples -GC-MS and HPLC analyses of six different herbicides -data analysis	8,000
Travel	500
Supplies for GC-MS	2,000
Miscellaneous Supplies	500
Total	\$14,000

Budget Justification: The PI is seeking funds to support the major components of the proposed research. The majority of funds will provide salary support and benefits for field and laboratory personnel. These are soft money positions totally dependent on funding from non-university sources. This type of research is not possible without skilled technical support. GC-MS supplies are expensive and repairs are need on a regular basis so we have budget funds for supplies and equipment maintenance. Travel funds will provide for several overnight trips to the valley during the growing season.