Summary Research Progress Report for 1997

And Research Proposal for 1998

Submitted to:
SLV Research Center Committee
And the
Colorado Potato Administrative Committee (Area II)

Title: Potential Losses of Eptam During Sprinkler Application and the Influence of Soil Moisture Levels at Time of Application on Efficacy

Project Leaders: Dr. Scott Nissen, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins and Dr. Susie Thompson-Johns, SLV Agricultural Experiment Station, Center, CO.

Project Justification: Eptam is used extensively in the San Luis Valley for the control of annual grasses, volunteer barley and several broadleaf weeds. Eptam has low water solubility and a higher vapor pressure then many other herbicides. The result of these two characteristics is a tendency for Eptam to volatilize as air temperatures increase. Herbicide losses due to volatility can be substantial and can result in application rates that are too low for control of pigweed and nightshade.

Research conducted at Washington State University suggests that temperature, relative humidity and wind can have a significant impact on Eptam losses during application by overhead sprinkler systems. Depending on conditions these losses can be as high as 30%. Additional research has shown that applying Eptam to wet soils can result in reduced efficacy because the herbicide is lost due to a process called *codistillation*. Codistillation occurs when there is free water at the soil surface that reduces Eptam/soil interactions. Results of this research project will be very useful to the potato industry in the San Luis Valley because it will help to determine the most efficient methods for Eptam use. This research will also indicate if any steps should be taken to reduce potential environmental impacts and if frequent Eptam use in the San Luis Valley is selecting for soil bacteria that can rapidly degrade Eptam, significantly reducing residual weed control.

Project Status: Project is on going.

Significant Accomplishments for 1997: For the past three years, a field study has been conducted in the San Luis Valley to determine Eptam losses during chemigation and to determine the relative rates of soil degradation. In 1997, a portable chemigation system was developed to determine the influence of temperature on Eptam volatility under more controlled, reproducible conditions.

The three year field study consisted of four treatments: 1) an untreated control plot 2) chemigation to dry soil 3) chemigation soil that was wet before chemigation and 4) ground application followed by sprinkler incorporation. To conduct this study under field conditions the untreated and ground application plots were covered by plastic tarps before the entire field was chemigated. Volatility losses during chemigation were determined by collecting water samples

near the nozzles and at the soil surface. These were immediately analyzed for Eptam concentration. Rate of soil degradation was determined by collecting soil samples to a depth of 6 inches and analyzing for the amount of intact Eptam. Soil samples were collected at 0, 1, 15 and 38 days after application in 1995 and 0, 1, 3, 7, 10, 15, and 38 days after application in 1996 and 1997. This study was conducted at a field site just north of Monta Vista.

Eptam losses during chemigation were 10, 28, and 15% in 1995, 1996 and 1997, respectively. Air temperatures varied from year to year and that resulted in different amounts of herbicide being lost due to volatility. Increasing the number of soil samples collected in 1996 and 1997 provided a more detailed picture of Eptam degradation. The amount of herbicide remaining in the soil 15 days after treatment (DAT) was approximately 25% of the initial concentration in 1995 and 1996, but only 10% in 1997. The amount of Eptam in the soil decreased immediately and did not show the classical "lag phase" response that would normally be expected. The term lag phase means the herbicide concentration remains relatively constant for a time before rapid degradation occurs. This is considered the normal pattern of herbicide degradation because soil microorganisms that can use the herbicide as a food source need time to increase before significant degradation can occur. Plots that were wet at chemigation showed even more rapid losses of Eptam. This loss is the result of codistillation. Eptam did not have sufficient time to interact with the soil because of excessive soil moisture and was lost from the soil surface due to secondary volatility.

Using a portable chemigation unit, simulated chemigation applications were made at 6 am, 10:30 am and 2:30 pm on three consecutive days in early September 1997. Air temperatures ranged from 55F to 90F during the application period and nozzles were approximately 6 ft from the soil surface. Eptam losses ranged from 15% at 55F to 45% at 90F and the effect of temperature on volatility was relatively linear over that temperature range.

Summary of Significant Accomplishments

- Documented Eptam losses during chemigation ranging for 10 to 28% from field scale equipment, these losses occurred under moderate air temperatures.
- Demonstrate very high losses of Eptam if soil is wet before application.
- Determined the half-life of Eptam under SLV conditions could range from 1 to 7 days.
- Showed the amount of Eptam remaining fifteen days after application was only 10 to 25% of the initial concentration.
- Demonstrated the inherent biological activity of Eptam on important weed species using soil from the San Luis Valley and showed the relative sensitivity to be as follows (ranking most to least sensitive): wild oat, volunteer barley, pigweed and nightshade.
- Conducted preliminary experiment to determine the influence of air temperature on Eptam volatility during chemigation process, study indicated that losses could be as high as 45% with 90F air temperatures and that even moderate air temperature of 70F to 75F could result in Eptam losses of 30%.

Objectives for 1998: Field research results have provided valuable insights into Eptam behavior in the San Luis Valley; however, more controlled studies would help to explain some of the variability in research results. Research objectives for 1998 are designed to answer the remaining questions about Eptam behavior and demonstrate this information to growers.

Objective 1: Determine the best method for reducing Eptam losses during chemigation.

A small preliminary study demonstrated that Eptam losses during chemigation increased with increasing air temperatures. No attempt was made to determine if Eptam losses could be minimized by reducing nozzle height or changing nozzle type. If these parameters have no affect on Eptam losses growers could be advised that the most efficient time to chemigate Eptam would be between 8pm and 8am (for example).

Objective 2: Determine the half-life of Eptam in common SLV soils with and without a history of Eptam.

Field studies conducted in 1995 and 1996 showed similar rates for Eptam degradation under field conditions, while 1997 results indicated more rapid degradation. While this kind of variability is not uncommon with large field experiments, it makes it difficult to definitively answer the basic research question. This type of experiment would involve collecting a large quantity of soil from the SLV with a known history of Eptam use. The biological activity of the soil would be maintained by keeping the soil near field capacity and at a temperature of 75F. Part of the soil would be pretreated with Eptam once a month for three months to simulate multiple year applications, while the remainder would be untreated. A final application of Eptam would be made to both soils and degradation would be monitored over a 30 day period. This information would confirm the general degradation pattern of Eptam under more controlled conditions and provide evidence for the influence of multiple applications on degradation rates.

Objective 3: Determine the maximum amount of time between broadcast applications of Eptam and sprinkler incorporation.

A small preliminary study was conducted at the San Luis Valley Research Station in 1997 to determine how long Eptam could remain on the soil surface before it was incorporated by sprinkler irrigation. Barley was planted as an indicator species and Eptam was applied at a rate of 3 pints per acre and incorporated immediately, 12 hours, 24 hours and 48 hours after application with 0.50-0.75 inches of overhead irrigation. Barley biomass was significantly reduced even when incorporation was delayed 48 hours. If these results can be reproduced consistently, it provides growers with another option to efficiently use Eptam.

Objective 4: Demonstrate the attributes of Eptam, Dual, Frontier, Prowl, Matrix and Sencor/Lexone for the 1998 Field Tour at the San Luis Valley Research Station.

The Research Station at Center will have a field tour in 1998. Based on the response of a twilight tour in 1997, I would like the opportunity to have some demonstration plots on station for the 1998 tour. The primary focus would be for producers to see first hand the weed spectrum and rate response of various potato herbicides.

Funding Request:

Item	Cost
Field Research	
Travel	$1,000
Salaries (student hourly)	$4,000
Miscellaneous supplies	$500
Vehicle Rental	$600
Subtotal	$6,100
Laboratory Analysis	
Salaries (lab supervisor + student hourly)	$5,000
Supplies to process soil and water samples	$1,500
GC/MS analyses (column, pure gases supplies and maintenance)	$2,500
Subtotal	$9,000
Grand Total	**$15,100**