SUMMARY RESEARCH PROGRESS REPORT FOR 2000
AND RESERCH PROPOSAL FOR 2001

Submitted to:

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

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

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

PROJECT JUSTIFICATION: The influence of water volume on herbicide distribution has been determined for Eptam in a common San Luis Valley soil. For this study, soil profiles were reconstructed from soil collected from a potato field near Monte Vista. Profiles were reconstructed in a PVC pipe made up of five sections. The sections were 0-1, 1-2, 2-3, 3-6, 7-12 inches. Eptam was incorporated with 0, ¼ , ½ and 1 inch of water followed by analysis of each section for Eptam content. Eptam remained primarily in the top one inch of soil regardless of the amount of water used for incorporation. Research results clearly indicated that using less water (¼ inch) caused more problems than using too much water, with the greatest amount of Eptam present in the soil column when ½ inch of water was used for incorporation.

Common potato herbicides differ significantly in water solubility and in another common physical parameter called the octanol/water partitioning coefficient or K_{ow} (Table 1). Octanol will not dissolve in water and so when mixed together they separate like oil and water; however, in this case the octanol floats on the water. K_{ow} is simply the ratio of herbicide dissolved in octanol (an organic solvent) divided by the amount of herbicide dissolved in water. A large number indicates that a much greater proportion of the herbicide is soluble in organic solvent than in water. In general, this indicates that the herbicide should bind readily to soil organic matter and clay. Since most agricultural soils in the SLV are low in both organic matter and clay, the vertical distribution of common potato herbicides in soil could be significantly different than in other areas.

Table 1. Water solubility and K_{ow} values for common potato herbicides.

Herbicide	Water Solubility (ppm)	K_{ow}
Eptam	370	130,000
Prowl	0.3	152,000
Dual Magnum	488	794
Sencor (metribuzin)	1100	45
**Outlook	1174	141
Matrix	7,300	0.034

****Outlook** is new product from BASF that is being registered for use in potatoes and should be available in 2002 or 2003.

While these herbicides are familiar to all potato growers there is very little information available about how herbicide movement might be affected by the volume of water used for incorporation. Sencor and Outlook are similar in water solubility and yet the K_{ow} values differ by a factor of three. Dual Magnum has about half the water solubility of Sencor but has a K_{ow} 17 times higher, while Matrix is highly water soluble and has a very low K_{ow}. Research funded by the CPAC (Area II) found that water volume may not be a significant factor in Eptam performance as long as a minimum amount is applied; therefore, water volume could be more critical with other common potato herbicides. This is especially true as water solubility increases and K_{ow} decreases.

PROJECT STATUS: New

SIGNIFICANT ACCOMPLISHMETNS FOR 2000:

OBJECTIVES FOR 2001:

Using similar procedures to previous research with Eptam, determine the influence of water volume used for incorporation on the vertical movement of Dual Magnum, Sencor, Outlook, and Matrix in soil. The soil columns will be reconstructed from the San Luis Valley soil used in the Eptam study and 0, ¼ , ½, and 1 inch of water will be used for incorporation. Each soil section will be analyzed for herbicide concentration using GC-MS and bromide will be used to determine water movement.

FUNDING REQUEST:

2000 Allocation: NONE

2001 Request:

Item	Cost
Support staff-Lab manager -building columns -herbicide applications -extracting soil sample -GC-MS analysis -bromide analysis -data analysis	$6,000
Supplies for GC-MS	1,500
Miscellaneous Supplies	500
Total	**$8,000**

SUMMARY RESEARCH PROGRESS REPORT FOR 2000 AND RESERCH PROPOSAL FOR 2001

Submitted to:

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

TITLE: Continued Evaluations of New Herbicides for Weed Control in Potatoes

PROJECT LEADERS: Dr. Scott Nissen, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, and Dr. Susie Thompson, Department of Horticulture and SLV Agricultural Experiment Station, Center, CO.

PROJECT JUSTIFICATION: Matrix was the first new herbicide labeled for use in potatoes in more than twenty years. The wide spread occurrence of ALS resistant kochia and carryover problems to sugar beets have producers and weed scientists concerned. Evaluating new products for weed control in potatoes has been a major focus of my research effort for the past 4 years. This work has been conducted primarily along the Front Range, but with the identification of two very promising herbicides the research needs to expand to the SLV for evaluate weed spectrum and variety tolerance issues.

Consolidation in the agricultural chemical industry and significant cut backs in funding for applied research make support from commodity groups more important then ever. Commodity support can help with initial screening studies and to develop the type of data necessary to convince a chemical company that a product fits a market that could potentially be profitable. Based on research that was largely self-funded or funded with support from Area III growers, two exciting new compounds have been identified. Spartan was discovered and is marketed by FMC and has excellent broadleaf weed control including all nightshade species, redstem filaree, pigweed, lambsquarters and common mallow. Field tests indicate that applications of Spartan at rates as low as 0.125 lb ai/ac in combination with Dual will provide season long weed control with no measurable crop response. Valor is marketed by Valent and is currently being used in the fruit tree and vine crop market. Valor also has an excellent spectrum for broadleaf weed control in potatoes because of its activity on all nightshade species. Valor is non-mobile in the soil and so would fit well in areas where herbicide movement to ground-water is an issue. These products would be applied as PRE/drag-off type treatments and so would be compatible with current weed management practices.

PROJECT STATUS: Continuing

SIGNIFICANT ACCOMPLISHMENTS FOR 2000:

- Spartan and Valor were applied at several rates to four potato varieties and evaluated for crop response under environmental conditions and management practices in the San Luis Valley. Four potato varieties evaluated were: Nugget,

Norkotah, Chipeta, and Sangre. Spartan was applied at 0, 0.1, 0.125, 0.187 and 0.25 lb active ingredient/ac, while Valor was applied at 0.032, 0.047, 0.062 and 0.125 lb active ingredient/ac. Valor was safe at all rates evaluated and on all varieties tested. Based on weed control, a rate of 0.032 lb ai/ac would be sufficient when tank mixed with Dual Magnum. At this rate, Valor has more than a 3x safety factor. Spartan is not as safe on all varieties as Valor; however, at rates adequate for good nightshade control Spartan applications resulted in minimal crop response.

- A replicated field study evaluating Spartan and Valor applied alone and tank mixed with Dual and Prowl was conducted in the area used of the disease nursery. Due to some communication problems a substantial percentage of the potatoes had emerged before herbicide application were made. We decided to apply treatments in order to evaluate the injury potential caused by a misapplication of Spartan and Valor. Both herbicides have significant foliar activity and so we knew that crop response would be significant. We had no idea if the potatoes could recover from the injury or how yield would be affected.

- Initial crop injury was significant with all Valor and Spartan treatments. In general, visual injury ratings ranged from 7 to 35%. Pigweed was the only weed present and all treatments provide 100% control. Yields were more variable than would be expected, but Spartan and Valor treatments produced over 250 cwt and many treatments produced over 300 cwt. Spartan applied at 0.25 lb ai/ac produced over 400 cwt even with an early season injury rating of 29%. These data indicated that while exposed top growth is susceptible to crop injury, neither herbicide moves enough in the plant to kill the tuber.

OBJECTIVES FOR 2001:

Continue evaluations of Spartan and Valor in tank mixes with Dual, Prowl and Outlook to provide grass activity. Compare these treatments to standard treatments that include Matrix, Dual, Sencor, and Eptam. Provide crop response, weed control and yield information to IR-4 in support of future labels for these products on potatoes.

FUNDING REQUEST:

2000 Allocation: $6,000

2001 Request: $4,000

Item	Cost
Field Support Salaries-technical, student hourly -establishing plots -herbicide applications -handweeding of untreated plots -harvest, grading, data analysis	$3,500
Miscellaneous Supplies	500
Total	**$4,000**

SUMMARY RESEARCH PROGRESS REPORT FOR 2000
AND RESERCH PROPOSAL FOR 2001

Submitted to:

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

TITLE: Comparison of Potato Vine Kill with Sulfuric Acid, Diquat, Desicate II, Rely and Gramoxone Extra When Vines Remain Immature from Fungicide Applications (new title).

PROJECT LEADERS: Dr. Scott Nissen, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, and Dr. Susie Thompson, Department of Horticulture and SLV Agricultural Experiment Station, Center, CO.

PROJECT JUSTIFICATION: Potato vine killing before harvest is a common practice that aids in harvest efficiency and weed control. Killing vines several weeks before harvest allows stolons to loosen from tubers, develops tuber maturity and skin set and decreases vine quantity. Potato vine kill can also be an important tool for management of late blight. Vines infected with late blight must be removed from the field or desiccated to point where the vines can no longer support the fungus. Combining fungicides with vine killing materials could be very important for late blight management.

In the SLV, most vines are killed with sulfuric acid, while in other parts of the state, Diquat has become the most common means of potato vine desiccation. Sulfuric acid is very effective and causes the most rapid rate of vine desiccation. Diquat can also be a very effective desiccant if weather conditions cooperate after application. If the weather turns cool or showery after application plants can sprout new shoots from axillary meristems. This can affect bulking and this new tissue can support late blight.

There are other vine desiccation products that could be used for potato vine kill in addition to sulfuric acid and Diquat. Desicate II or endothall is currently labeled for potato vine desiccation in Colorado, but little information is available on how well this product works. Aventis received a label for "Rely" for 2000 as a potato vine desiccant. Rely translocates more readily than Diquat and should not be used on seed potatoes because it tends to inhibit sprouting. Gramoxone Extra was labeled again in 2000 for fresh market potatoes only and was used extensively in some areas because of price.

PROJECT STATUS: Continuing

SIGNIFICANT ACCOMPLISHMENTS FOR 2000:

- Vine kill applications were made on August 28th to standard Norkotah potatoes. All desiccant applications were made in 20 gallons of water with the exception of Rely, which was applied at both 20 and 40 gallons/ac. Weather conditions after desiccant applications were highly conducive to vine kill and all treatments provide similar leaf drop 14 days after application. The percent of green stems was also similar for all treatments 14 days after application, but all treatments were significantly lower than the non-treated check (Table 1).

- Tuber yields, USDA #1 tubers, and skin set were evaluated 14 and 21 days after harvest; however, statistically there was not significant differences between harvest dates so data from the two harvests were combined (Table 1). There were some differences in total yield, but statistically the non-treated plots had a yields equal to the best desiccant treatment. The best overall treatment was Diquat applied at 2pt/ac with NIS.

Desiccant	Green Stem %	Total Yield Cwt/ac	USDA #1 Cwt/ac	Skin Set by Torque Oz/in
Non-treated	40 a	240 abc	156	80
Spotlight + MSO	2.3 c	206 bc	132	82
Spotlight + Freeway	2.0 c	186 cd	104	83
Gramoxone + NIS	1.0 c	257 ab	159	88
Desicate II + LI700 + AMS	1.0 c	206 bc	119	83
Rely + AMS (20 gal/ac)	1.2 c	203 bc	122	86
Rely + AMS (40 gal/ac)	3.7 c	211 bc	113	86
Diquat + NIS (1 pt/ac)	1.0 c	260 ab	161	86
Diquat + NIS (2 pt/ac)	1.3 c	301 a	206	87
			NS	NS

Numbers in columns followed by the same letter are not significantly different.
NS=no significant difference
Freeway is a silicon based surfactant
MSO=methylated seed oil
NIS=Non-ionic surfactant
AMS=ammonium sulfate

- The combination of weather conditions and variability within the plot area did not allow for the types of treatment differences we had hoped. It was interesting to note that bulking did not occur between 14 and 21 days and with no rainfall after vine kill no axillary shoot sprouting occurred. Regrowth from axillary shoot buds was common in some treatments in 1999. One advantage of Rely was that axillary sprouting was greatly reduced compared to other treatments (1999 observation).

OBJECTIVES FOR 2001:

- We would like to redirect research efforts on vine kill to focus on interactions between fungicide applications which prolong the immature nature of vines and vine desiccation with sulfuric acid, Diquat, Desicate II, Rely and Gramoxone under field conditions in the SLV. Plots will be planted with Russet Nuggets, which produce significant vines and have been difficult to kill. Two fungicide treatment levels will be established using 2-3 fungicide applications with 1 or 2 Quadris applications compared to a 7 to 10 day fungicide program alternating Quadris with Bravo or other fungicides. Both programs will begin around July 1 and will be modified if late blight is detected. The two fungicide programs will establish two levels of vine maturity.

- Vine kill treatments will be subplots within the main fungicide programs. Randomization of the sulfuric acid treatments will not be possible and so they will have to be placed at one end of the fungicide blocks. All other desiccation treatments will be randomized within fungicide blocks. Treatments will be evaluated for leaf drop, % of green stems, and regrowth 7 and 14 days after treatment. Plots will be harvested 14 and 21 days after vine kill. Yield and grade will be determined and skin set will be evaluated using a torque meter.

FUNDING REQUEST:

2000 Allocation: $4,000

2001 Request: $5,000

Item	Cost
Field Support Salaries-technical, student hourly -establishing plots -fungicide and desiccant applications -harvest, grading, data analysis	$3,000
Travel-vehicle rental, mileage charges, lodging, food, for multiple trips for fungicide, desiccant and yield evaluations	1,500
Miscellaneous Supplies	500
Total	**$5,000**