

SUMMARY: RESEARCH PROGRESS REPORT FOR 1990  
AND RESEARCH PROPOSAL FOR 1991

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

**TITLE:** CSU Cooperative Extension Potato Research (NEW NAME: Potato Diseases Research).

**PROJECT LEADER:** Gary D. Franc, Research and Extension Plant Pathologist, University of Wyoming, Department of Plant, Soil and Insect Sciences, P.O. Box 3354, Laramie, WY 82071-3354.

**PROJECT JUSTIFICATION:** This project addresses work done primarily in the area of plant pathology. Disease causing micro-organisms such as bacteria, fungi and viruses continue to cause loss of tuber yield and quality in the San Luis Valley and other potato production areas.

There is an opportunity to develop special potato research projects at the University of Wyoming. These projects will be done independently and/or in cooperation with faculty at Colorado State University. The experimental approach and objectives for this project were selected so duplication of other research does not occur. Funding from other sources may be pursued to enable broadening project objectives.

**PROJECT STATUS:** This is the fourth reporting year for this project. This is the first year the report and funding request originated from the University of Wyoming.

**SIGNIFICANT ACCOMPLISHMENTS FOR 1990:** Projects related to Potato Virus 'S' and the ring rot clone test, done in cooperation with Rob Davidson, were funded via another proposal and will be reported separately by us. Research reports for projects funded by outside (non-PAC) sources will be attached to the comprehensive research summary and not to this abbreviated report. Attachments will include summaries for work done on seedpiece treatments, early blight control and vine desiccation.

The following summary is for the project funded by the Area II PAC to study (1) the potential of the early blight fungus to develop fungicide resistance and (2) the potential for transmission of the ring rot bacterium via true potato seed.

1. Early Blight Studies: Effect of Fungicide Exposure on *Alternaria solani* Spore Germination in the Laboratory. Crop consultants observed that chlorothalonil-based fungicides failed to protect potato foliage from early blight in some fields near Wiggins (Fort Morgan), and, suggested the fungus was developing resistance. Fungicide resistance, if possible, would first occur in production areas with high disease pressure, especially if disease control depended on the repeated annual use of a single fungicide. This scenario describes the history of the Wiggins production area at the time this observation was made. *Because disease pressure is much greater at Wiggins than in the SLV, learning all we can about early blight strains recovered from the Wiggins area should allow us to predict what could occur in the SLV early blight population. Therefore, a study was established to determine how fungal strains recovered from potato fields near Wiggins reacted when exposed to chlorothalonil and to compare their reaction to strains recovered from the SLV.*

All 1990 studies were done in the laboratory and strains were not allowed to escape to the field. Ten pure cultures of *A. solani* were recovered from infected foliage during the 1990 growing season; 7 strains were recovered from SLV potato fields and 3 strains were from fields near Wiggins. All strains were prepared for long term storage on PDA, an artificial growth medium.

A method to induce sporulation in the laboratory was tested and modified for all strains. This method was needed to insure efficient and predictable spore formation by all strains so comparisons could be made in the laboratory and, eventually, the field (proposed research for 1991). A method to harvest and count spores was also developed. Currently, several practice runs are being done to determine the best fungicide and spore concentrations to use for the remainder of the study. The ability of spores to

germinate and form germ tubes after exposure to fungicide will be compared for the range of isolates recovered from the field. A final report will be submitted.

2. Determining the Presence of *Clavibacter michiganense* subsp. *sepedonicum* (the ring rot bacterium) in True Potato Seed. Research has shown that the ring rot bacterium can be recovered from sugarbeet seed and from true seed harvested from infected tomato plants. The bacterium can also infect potato plants without causing symptoms. Because of the close similarities in the physiology of potato and tomato plants, it is also possible that true seed recovered from potato 'seed balls' carries the bacterium and could present a risk to breeding and certification programs.

True potato seed (TPS) was harvested from inoculated potato plants grown in the field during 1990. The TPS was separated from seed balls and assayed using eggplants to determine if the ring rot bacterium could be recovered. After 40 days incubation (incubation will end during March, 1991), the eggplants will be harvested and tested via the gram stain to determine if the ring rot bacterium was present in the TPS. A final report will be submitted.

#### OBJECTIVES FOR 1991:

1. The comparison of early blight strains in the laboratory needs to be extended to tests done on plants. *Spores produced by A. solani strains (selected during the 1990 laboratory studies) will be applied to fungicide treated plants and the rate of disease development for each strain determined. Measuring disease development will be much more detailed than for previous early blight studies and will include rate of lesion appearance, measurement of lesion size and an estimate of spore production per lesion when exposed to fungicide. The budget reflects the increased need for labor, media, etc. Because some strains could be fungicide resistant, it would not be appropriate to conduct these tests in the SLV.*

There are at least three reasons for completing the second phase of the study funded in 1990. First, a grower survey done in the SLV during 1990 showed that most growers used fungicides for early blight control and ranked early blight as the greatest disease threat to their farming operation if pesticides were no longer available. Second, if early blight strains were found to be developing resistance to certain fungicides, spray programs will need to be modified so that a number of different fungicides are applied during the growing season. The reverse trend is currently occurring since EPA restrictions are giving growers fewer fungicide choices. Third, the disease pressure is greater in the Wiggins area than in the SLV. Therefore, studies using strains from this production area should be predictive in nature, allowing us to make an educated guess about what could happen in the SLV. By carefully developing the materials and methods used for isolation, sporulation and inoculation of plants, future researchers can make comparisons more efficiently. Also, by comparing laboratory results for spore germination (1990 project) to the more difficult plant inoculation study (proposed 1991 project) it may be possible to base future tests on laboratory studies alone.

2. The tuber decay phase of early blight can be particularly severe in the SLV because the short growing season minimizes the time available to growers to insure 'skin set' and abundant spores are available at harvest for tuber infection. Because post-harvest treatments are no longer available to control early blight tuber decay, growers will need to develop alternative (cultural) methods for control. *Goals for 1991 are to measure the early blight decay rate for tubers harvested from SLV potato fields and to compare decay rates with different fertility programs during the growing season. Comparisons will be made at two or more tuber storage temperatures.*

#### FUNDING REQUEST:

1990 Allocation:	\$6,800.00
1991 Budget Request:	
Objective 1.	\$5,200.00
Objective 2.	\$3,700.00
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Total	\$8,900.00

Report to the Area II Potato Administrative Committee:

Early Blight Studies:  
Effect of Fungicide Exposure on *Alternaria solani*  
Spore Germination in the Laboratory

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Introduction

In 1989, it was reported that chlorothalonil-based fungicides failed to control early blight in some potato fields near Wiggins (Fort Morgan), CO. However, 1989 and 1990 fungicide trials in the San Luis Valley showed that this fungicide effectively controlled strains of the early blight fungus infecting potato foliage in the SLV.

Research has shown that repeated exposure of a fungus to fungicides can select for resistant strains. The net result of this selection is that the fungicide fails to control the disease or requires greater concentrations to achieve the same amount of control. This has not been reported in the scientific literature for early blight/chlorothalonil combination. However, if resistant strains of the fungus were to develop, it would occur in an area of high disease pressure and repeated application of the same fungicide. Both conditions occurred near Wiggins, CO.

Work to determine if fungicide resistance has developed is especially important since EBDC fungicide use has been greatly restricted. Because of this restriction, growers have fewer fungicide choices available to them in the SLV and in other production areas. Additionally, the lighter skinned chipping cultivars, which will be grown in the SLV if a processing plant is built, are traditionally more susceptible to early blight infection. Therefore, early blight control will become more critical in the Valley's future for several reasons. If this work shows that resistance is possible and anticipated for the SLV, it may be delayed or prevented by alternating fungicide use patterns, changing fungicide labels or by some other means.

The objective of this study is to determine if resistant strains of *A. solani* were selected in Colorado through the repeated annual use of chlorothalonil. This portion of the study concentrated on characterization of the fungus using laboratory techniques. A study to test strains on plants has been proposed for 1991.

Materials and Methods

Strains of *A. solani* were collected from different potato fields located in the San Luis Valley and near Wiggins. These fields had been treated with different fungicides during the growing season and had a range of cropping histories. The previous history of fields near Wiggins showed repeated annual use of chlorothalonil. The strains of the fungus were all recovered from infected leaf tissue and aseptic techniques were used to get pure cultures. Ten pure cultures (seven strains recovered from SLV potato fields and three strains recovered from potato fields near Wiggins) were used in the following laboratory studies.

The technique of Shahin and Shepard was modified and used to induce sporulation in the recovered strains. Spore production was excellent using this technique, but, additional work to standardize the age of the spores and the spore concentration was also done.



Purified spores for representative strains of the fungus are being compared for their ability to germinate after exposure to various common fungicides. Germination tests are being done on water agar.

### Results

Although some germination tests have been initiated, characterization of the strains has not been completed. Trial runs are being conducted to determine the best combination of spore and fungicide concentration.

### Acknowledgements

This work was done with the assistance of Corbett Henderson, Kelley Darland and Jim Zizz.

