

EVALUATION OF FUNGICIDE APPLICATION METHODS FOR LATE BLIGHT IN THE COLUMBIA BASIN

by

Brad Geary, Dennis A. Johnson, Washington State University; Pullman, WA
Phil Hamm, Oregon State University; Hermiston, OR.

INTRODUCTION

In 1995, 25.3 million dollars were spent on fungicides to control late blight in the Columbia Basin of Washington and Oregon (1). Due to the high costs of fungicides and the expense in applying them, it is important to understand the efficacy and how fungicides are distributed by the different application methods. Fungicides are applied by air, irrigation system, and ground sprayers; the majority of the fungicides are applied by air, the least by ground. Each method of application distributes fungicides differently throughout the potato canopy.

The purpose of this study was to evaluate the distribution of fungicides in the potato canopy when applied by chemigation and air. Chemical residues and disease infection were used to measure the efficacy of fungicide application.

COMPARISON OF CHEMIGATION WATER RATES .06 IN/A VS. .20 IN/A

Previous studies with chemigation water levels using .23 and .11 inches of water indicated that excess water was causing reduced chemical levels in the canopy. The following test was initiated to further test reduced water levels. The fungicide Bravo 720 was applied by a center pivot system to a potato field in the Columbia Basin at .06 in/A and .20 in/A. The trial was designed with three replications. Samples were taken from the area between the outer most wheel tracks at the center of each treated section. Each section had a outer diameter length of 300 feet. Leaf samples, for residue testing and disease evaluation, were taken from three canopy levels top, middle, and lower. For residue tests, five discs 5 mm in diameter, were taken from five leaves (subsamples) placed in small vials, put on ice and sent to a private lab. For disease evaluation tests, four leaves (subsamples) were collected and placed in a cooler and transported to WSU where they were inoculated with the US 8 strain of *Phytophthora infestans*.

No significant differences were found in the levels of fungicide on the tissue according to residue analysis, but the treatment .06 in/A did show a minor but consistent increase in residue levels in all but one sampling period (Fig. 6). There were no significant differences in the disease evaluation tests between the water levels.

This Presentation is part of the 1997 Proceedings of the Washington State Potato Conference & Trade Show.

CONVENTIONAL CENTER PIVOT VS. ATTACHED SPRAY BOOM

Concurrent with the above study, another circle capable of reducing water use during chemigation was also tested. In this test an irrigated center pivot system was fitted with a spray boom (attached boom) in a commercial Russet Burbank potato field in the Columbia Basin. The field was divided into six sections and Bravo 720 was applied to each section alternately by conventional center pivot chemigation or through the attached boom (three reps per treatment). Both treatments delivered 1.5 pints of Bravo 720 per acre, at a rate of 3200 gals. water/A for the conventional method and 72 gals. water/A for the attached boom. An area within each treatment was covered during application to function as a non-treated control. Potato leaf samples from the upper, middle, and lower canopy areas were collected just after and approximately seven days following each fungicide application for a total of six collections (three just after and three, seven days after a fungicide application). Three treated areas and one control were sampled in each rep. Each of the three plots coincided with an area closest to the center stand pipe, in the middle of the section, or near the edge of the field in each rep. Leaf samples from all plots were taken to Pullman WA. and inoculated with a US 1 and US 8 strain of the late blight fungus and rated for disease seven days later. Also, leaf samples were taken from each rep in the field and sent to a private laboratory to determine residue amounts of Bravo 720 fungicide deposited at different canopy levels from each treatment and sample date.

Significantly more disease occurred on leaves from non-treated areas than from those treated with the fungicide regardless of sample time. There were no differences between the two treatments for late blight severity when samples were taken immediately after fungicide application. However, seven days after fungicide application, leaf samples from the attached boom treatment had significantly less disease than the conventional chemigation treatment (Fig. 1). Also overall residues of fungicide on leaf samples were approximately three times higher in the attached boom treatments compared to conventional chemigation.

COMPARISONS OF SECTION 18 FUNGICIDES UNDER CHEMIGATION AND AERIAL APPLICATION

Washington

The fungicides Acrobat MZ, Curzate M-8, Tattoo C, and Polyram+Super Tin applied at label rates were compared for protection against late blight on Russet Burbank potato in the Columbia Basin. These fungicides were applied to two commercial center pivot potato circles; one circle by aerial application and the other circle by chemigation.

In the chemigation trial, each fungicide treatment was applied in two replications on three consecutive intervals of approximately seven to ten days. Leaf samples were collected as in the previous described chemigation trials using Bravo 720, just after and seven days after each treatment application. These samples were taken to Pullman WA for inoculation of late blight fungus and rated for their efficacy in controlling the fungus. Due to unforeseen cultural and scheduling problems all planned collections were not sampled or rated. Significantly better late blight control was achieved through most of the collections with Tattoo C. Polyram+Super Tin and Acrobat MZ were similar in protection, while Curzate M-8 gave the least protection but was not significantly different from Polyram+Super Tin (Fig. 2).

In the aerial application test, three sample collections were rated for fungicide efficacy against late blight. Again, leaf samples were collected as in the previous described trials. The lower canopy had a higher rate of infection than the middle and upper potato canopies but was only significantly higher in one of the three sample times. Overall there was no differences between the effectiveness of the fungicides against late blight when these fungicides were applied by air (Fig. 3).

Oregon

Chemigation and air application trials were set up as in Washington with the section-18 fungicides, except Bravo 720 was used as a standard instead of Polyram+Super Tin.

In the chemigation trial, each fungicide treatment was applied in three replications on three consecutive intervals of approximately seven days. Leaf samples were collected as before and challenged with late blight in the laboratory. Curzate M-8 showed significantly less late blight control on one collection date, but overall there was no significant differences between the effectiveness of the fungicides at the different sample times on canopy levels (Fig. 4).

In the aerial application trial, the upper canopy had significantly less control in two of the four collections, while Curzate M-8 and Acrobat MZ showed significantly less control in one of four collections. Overall there were no differences between the canopy levels or the fungicides (Fig. 5).

COMPARISON OF AERIAL FUNGICIDE WATER RATES 5 g/A VS. 10g/A

The purpose of this trial was to compare two fungicides, Dithane and Bravo, at two different rates of water, 5 g/A and 10 g/A, as applied from the air to a commercial field of potatoes in the Columbia Basin. Each fungicide treatment was applied in four replications on three consecutive intervals of seven days. The trial was designed to collect from different canopy levels samples of leaves just after and seven days following each treatment application. Samples of leaf tissue was collected as before to obtain chlorothalonil levels. For disease evaluation tests four leaves (subsamples) were collected and placed in a cooler and transported to WSU where they were inoculated with the US 8 strain of *Phytophthora infestans*.

Residue analysis, from the Bravo 720 applied areas resulted in no significant differences in deposition between the water rates. Disease tests resulted in no significant differences between fungicide used or water rates. The top portion of the canopy had significantly better late blight control immediately after each application regardless of fungicide, seven days after application there were no differences within the canopy (Fig. 7).

DISCUSSION

Water rates in each chemigation trial showed no significant differences between fungicide residue until rates were dropped to 72 gal/A (.003 in/A). At the lowest water rate (.003 in/A) disease severity was significantly reduced, corresponding to greater fungicide residue levels.

Chemigation did not leave as much fungicide residue on plant foliage as air and ground applicators, but the fungicides were distributed throughout the potato canopy. Fungicides applied by chemigation may also concentrate on leaves and stems where water retention is longest, giving the highest residue levels where infection is the most likely. Residue levels appeared to increase in the lower canopy areas with repeated fungicide applications. Section 18 fungicides may not provide the same control in chemigation, Tattoo was significantly better in one of two trials this summer. Therefore, if a section 18 is applied the form of application and type of material should be considered.

There were no significant differences among fungicides or water rates when fungicides were applied by air. Both Dithane and Bravo in our tests provided comparable control of late blight in laboratory tests. Residue levels were the highest in the top of the canopy the day of application. Redistribution occurred over time but two applications were needed to provide adequate protection to all canopy levels.

After one years testing the data would indicate that 5 gallons of water is adequate to apply fungicides to the canopy. More important is a uniform application to the canopy (no skips) consistent application frequency, exposure, and first application occurring at least one week prior to late blight.

Literature Cited

1-Johnson D.A., T.F. Cummings, P.B. Hamm, R.C. Rowe, J.S. Miller, R.E. Thornton, G.Q. Pelter, and E.J. Sorensen. 1997. Potato Late Blight in the Columbia Basin: An Economic Analysis of the 1995 Epidemic. *Plant Disease* 81: 103-106.

Acknowledgments

Gary Pelter, Arnie Greenwalt, Leonard Line, Quincy Farm Chemicals, Tee Jet spray products, Growers, Oregon State Potato Commission, Washington State Potato Commission, ISK BioSciences, Staff with Phil Hamm at Oregon State University, and Staff with Dennis Johnson at Washington State University.

Fig. 1 Percentage of potato tissue with late blight symptoms in laboratory leaf assays after Bravo 720 was applied to a commercial field of Russet Burbank potatoes. Fungicide applications were made through chemigation (.10 in/A), attached boom (.003 in/A), and controls had no fungicides applied.

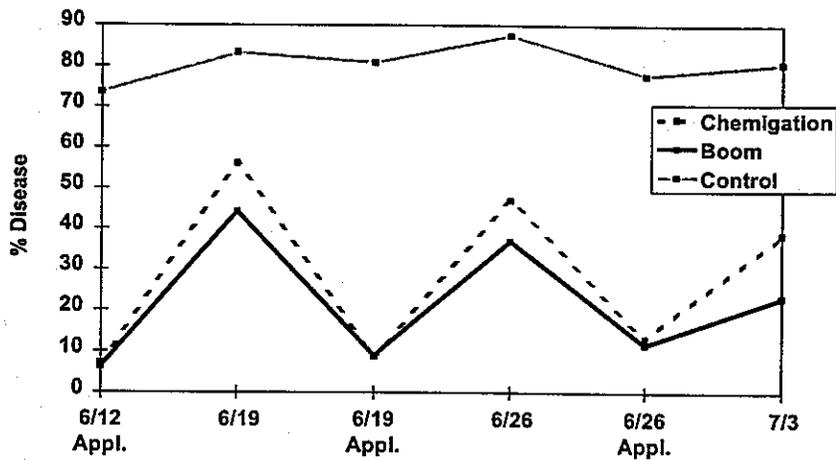


Fig. 2 Percentage of potato tissue with late blight symptoms in laboratory leaf assays after four fungicides were applied by chemigation to a Russet Burbank potatoes near Pasco, WA.



Fig. 3 Percentage of potato tissue with late blight symptoms in laboratory leaf assays after four fungicides were applied by air craft to Russet Burbank potatoes near Pasco, WA.

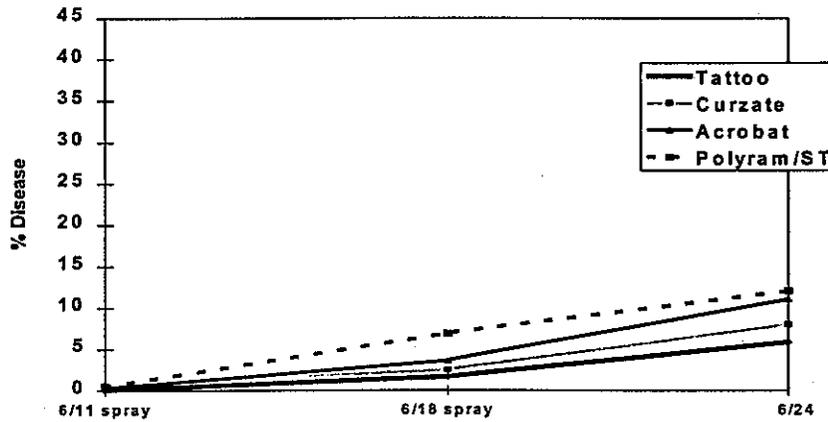


Fig. 4 Percentage of potato tissue with late blight symptoms in laboratory leaf assays after four fungicides were applied by chemigation to Russet Burbank potatoes near Hermiston, OR.

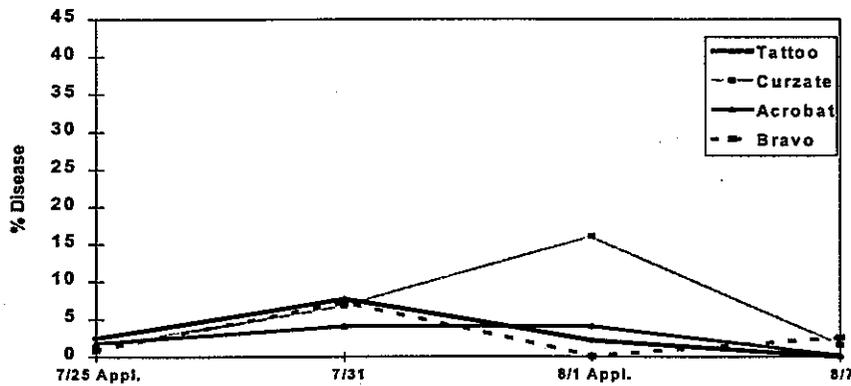


Fig. 5 Percentage of potato tissue with late blight symptoms in laboratory leaf assays after four fungicides were applied by air craft to Russet Burbank potatoes near Hermiston, OR.

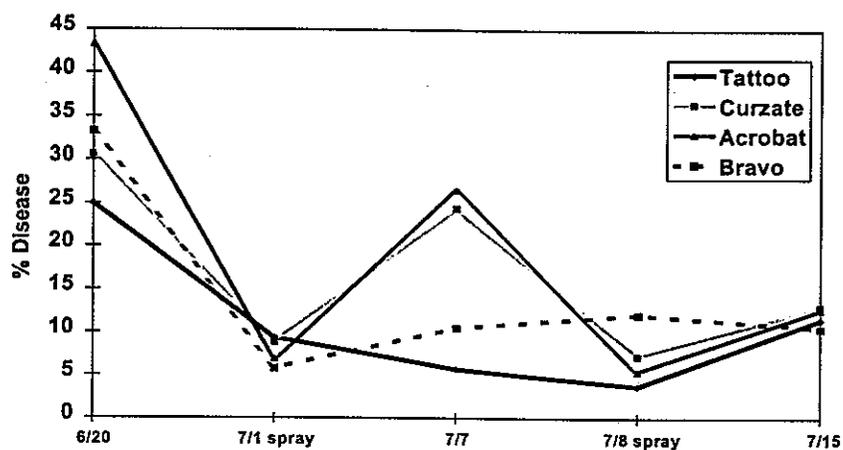


Fig. 6 Chlorothalonil residue on potato tissue after the fungicide was applied through chemigation at two water rates, .06 in/A and .20 in/A.

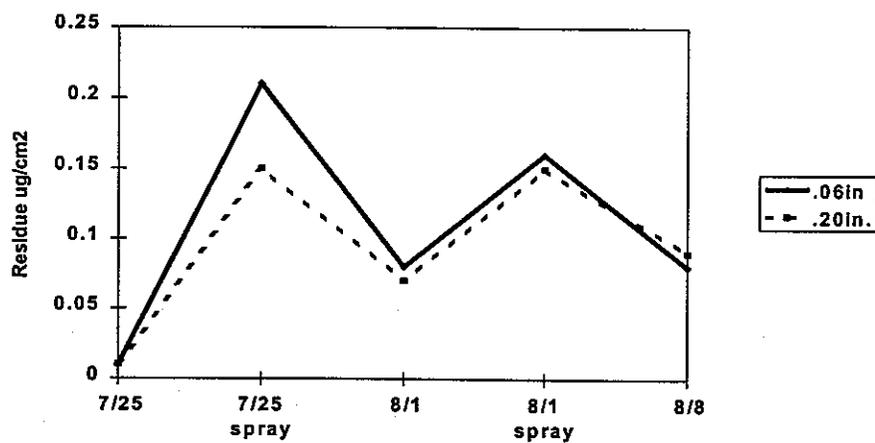


Fig. 7 Percentage of potato tissue with late blight symptoms in laboratory leaf assays after two fungicides were applied at two water rates (5 gal. and 10 gal.) through an airplane to Russet Burbank potatoes near Hermiston, OR.

