# MANAGING LATE BLIGHT WITH FUNGICIDES

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Strict sanitation practices, proper irrigation management, cultural practices, and timely applications of fungicides are needed to manage late blight. Sanitation practices are aimed at reducing potential sources of infection and include (1) planting disease free seed, (2) eliminating culls and refuse potato tubers, and (3) eliminating volunteer potatoes. Over irrigation and irrigation during wet weather will aggravate a late blight situation and make control much more difficult. Disease severities in several fields and sections of fields in the Columbia Basin in past seasons were increased by improper irrigation. Sanitation and proper cultural practices will reduce disease pressure and increase the effectiveness of fungicides.

Deep planting of seed tubers, forming adequate hills, either not planting potatoes near the center of the pivot or not over applying irrigation water in this area, and harvesting only during dry weather will reduce tuber infection. Good air flow throughout the pile in storage and low humidity air will reduce storage losses.

Late blight is a very explosive disease and fungicides are most effective when applications are made before infection or when the disease is in the very early stage of exponential growth. The later use occurs before the visual perception threshold or before most individuals can find late blight in a field. Furthermore, it is paramount to prevent infections from becoming established in sprinkler irrigated fields because the microclimate within the plant canopy is generally favorable for continued disease development whenever the field is irrigated.

Late blight forecasting models are helpful in determining when the first fungicide applications should be applied. The Columbia Basin Late Blight Forecasting System is currently used for central Washington and north central Oregon. Late blight forecasts are made in mid-May and again in mid-July. Weather conditions in April and May are a main component of the late blight forecasts. Short and long term weather forecasts are used in conjunction with the disease forecasting models. Disease forecasts are sent to growers via Spud Topics and are available on toll free information lines (1-800-984-7400 in WA, and 1-800-705-3377 in OR).

Total crop canopy coverage with fungicides is essential for late blight management. Application skips will become infected and will serve as sources of spore production, thus creating a higher risk of infection within the field and adjacent fields. Our research has shown that with air application after row closure, at least two applications are needed before the fungicide is redistributed to the lower crop canopy (Figure 1). Applications are needed weekly to cover new growth.

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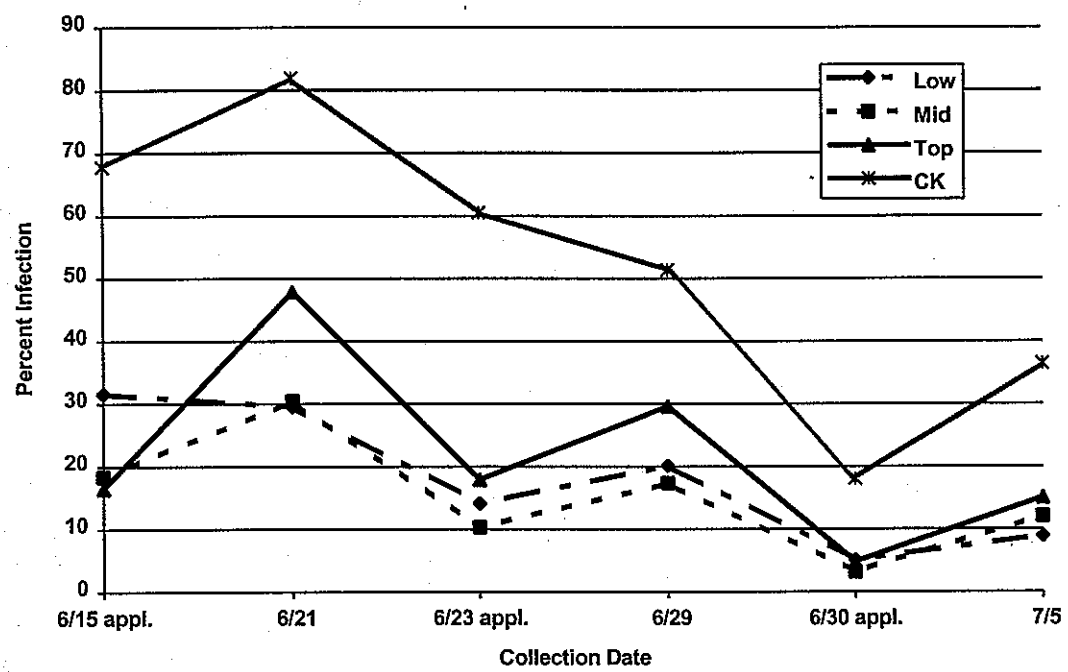


**Figure 1.** Percentage of leaflet tissue at three canopy levels of Russet Burbank potato after two fungicides either with or without two additives applied on three dates. Fungicide treatments were combined by canopy levels.

New strains of the late blight fungus (US-8, US-11) are more difficult to control with fungicides than the older strain (US-1) (Table 1). However, research has shown that the new strains of the late blight fungus can be controlled with chlorothalonil (Bravo, Terranil) metiram (Polyram), mancozeb (Dithane M-45, Manzate 200), and maneb (Maneb), and a mixture of Polyram or mancozeb with super tin. These fungicides must be applied before infection and all foliage must be covered including new growth. This means that EARLY and REPEATED applications at SHORT INTERVALS are needed for control.

**Table 1.** Percentage of leaf area infected when plants in field plots were treated with various fungicides and then leaf samples were inoculated in an assay with two isolate of *P. infestans*.

| Treatment | Strain US 8 | Strain US 1 |
|---|---|---|
| Control | 36.3 a | 16.4 a |
| Curzate M-8 | 12.5 b | 1.5 b c |
| Dithane | 9.8 b c | 1.2 b c |
| Bravo Zn | 3.0 b c | 0.3 c |
| Tattoo C | 2.8 b c | 3.9 b |
| Chlorothalonil | 1.7 c | 1.6 b c |
| Acrobat MZ | 1.3 c | 1.1 c |
| Polyram | 1.1 c | 0.3 c |
| Polyram+super tin | 0.2 c | 0.3 c |

Mean of four replications. Values followed by the same letter are not significantly different at P = 0.05.

Copper based fungicides by themselves are not effective in controlling late blight under disease conditions experienced in the Columbia Basin. Metalaxyl (Ridomil) is also ineffective against the late blight strains in the Pacific Northwest. Ridomil pre-packs that contain chlorothalonil or mancozeb are effective protectants against late blight, but it is the chlorothalonil and mancozeb and not the Ridomil that reduce late blight. Do not use Ridomil-copper for late blight. Ridomil is an effective tool in managing pink rot and pythium leak in storage.

Method of fungicide application is important in how well late blight is controlled. Our research has shown that ground application is the most consistent method for applying the greatest quantity of fungicide throughout the canopy; chemigation applies the least. Air application can be equal to ground application but do not expect good application in situations where trees, power lines, houses or other obstacles prevent the plane from flying consistently close to the canopy. Field research in 1997 in the Columbia Basin showed that air application of fungicide with 10 gal. water/ acre was no better than 5 gal. water / acre. Fungicides should be applied by chemigation with less than 0.2 inches of water / acre. Research in 1996 and 1997 demonstrated that an attached boom was more effective in applying fungicide than chemigation (figures 2,3, and 4). The attached boom is a low water chemical delivery system added to a center pivot irrigation system.

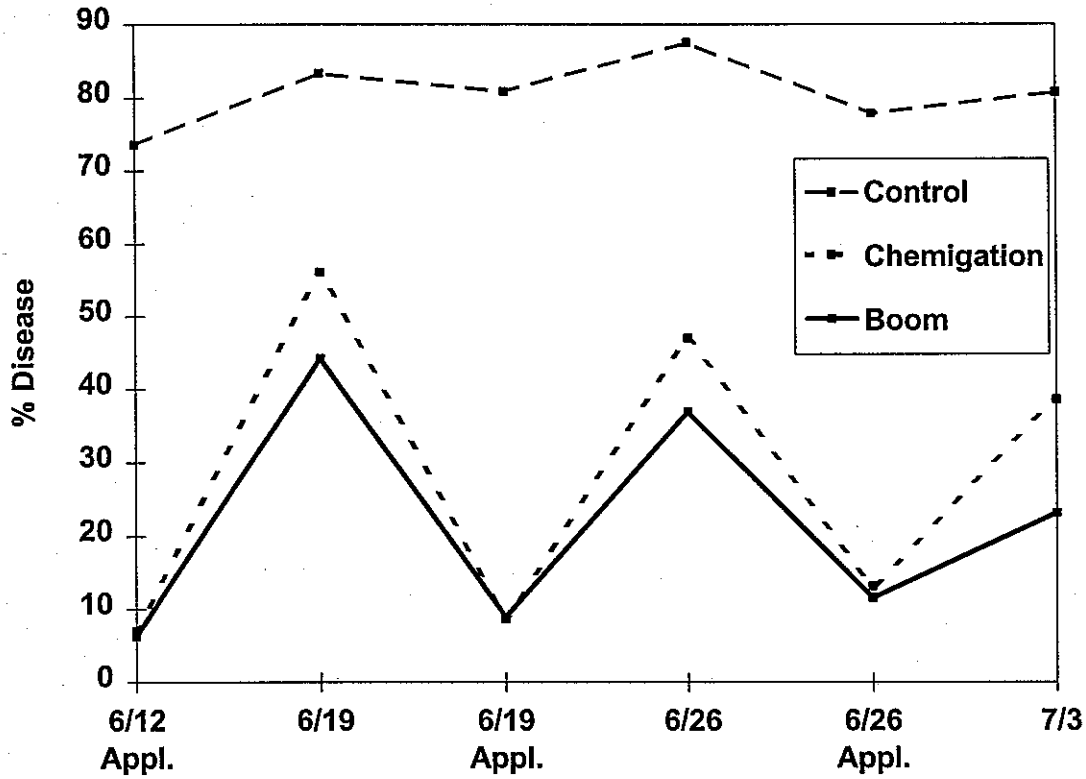


**Figure 2.** Mean percentage of potato leaves with late blight symptoms in laboratory leaf assays after Bravo 720 was applied on three dates to a commercial field of Russet Norkotah potatoes through chemigation (26,200 L / ha), attached boom (675 L / ha), and no chemical control.

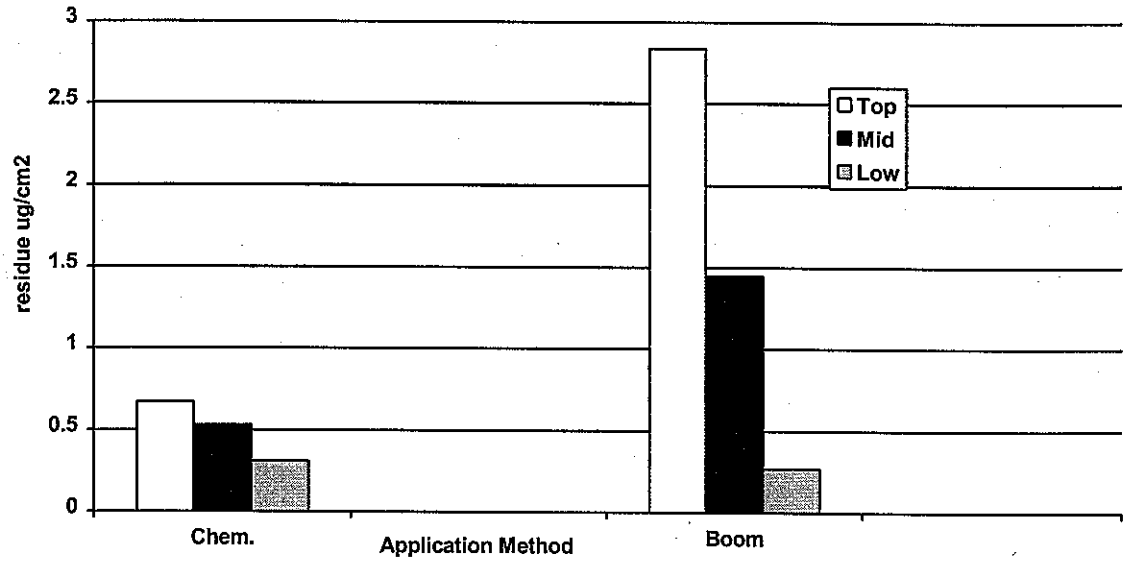


**Figure 3.** Mean quantity of chlorothalonil residue on the top, middle, and lower sections of the plant canopy within 2 hours of each of the three fungicide applications when Bravo 720 was applied to a field of Russet Norkotah potatoes through a center pivot or an attached boom.

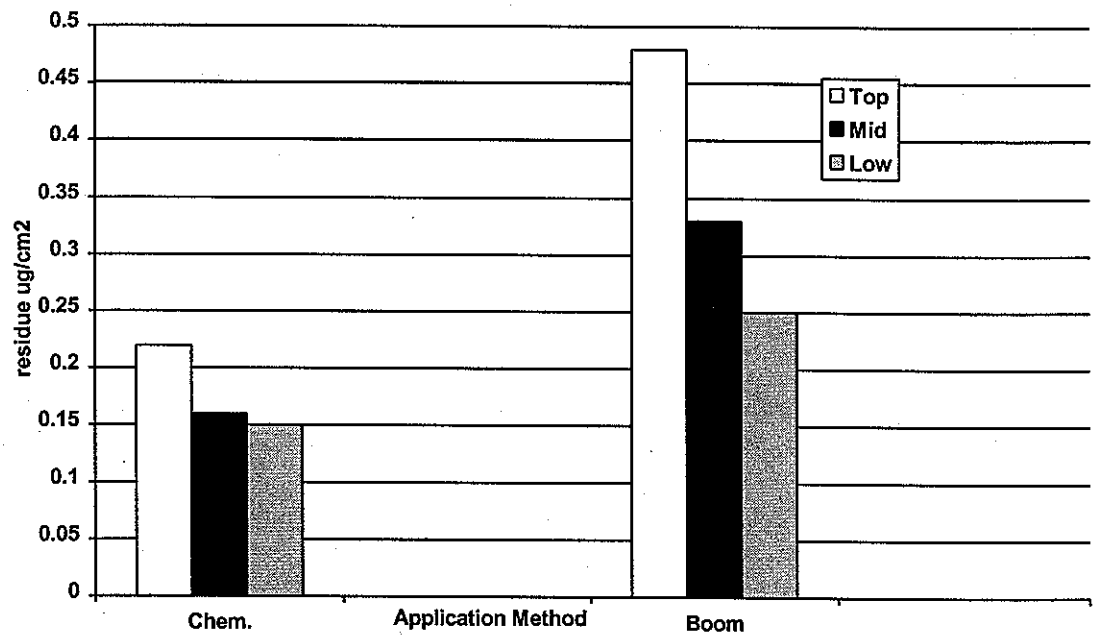


**Figure 4.** Mean quantity of chlorothalonil residue on the top, middle, and lower sections of the plant canopy seven days after each of the three fungicide applications when Bravo 720 was applied to a field of Russet Norkotah potatoes through a center pivot or an attached boom.

Section-18 materials (Tattoo C, Curzate M-8 and Acrobat MZ) and a standard protective fungicide (Bravo 720 was used in Oregon and Polyram plus Super Tin was used in Washington) were applied by air and chemigation to Russet Burbank potatoes in the Columbia Basin of Washington and Oregon. Leaf samples were collected and tested for effectiveness of control at various times after application. The tested fungicides gave equal and good control in the two states when applied by air (Figures 5 and 6). In the chemigation test in Oregon, the Section-18 materials and Bravo 720 gave similar control (Figure 6). However, in the chemigation test in Washington, Tattoo-C was significantly better than the control in two of four collections. Polyram plus Super Tin and Acrobate MZ were the best in one collection; and Tattoo-C, Acrobat MZ, and Polyram plus Super Tin were better than Curzate M-8 in the fourth collection (Figure 7). There were no significant differences between the chemigation applied fungicides in Oregon (Figure 8).

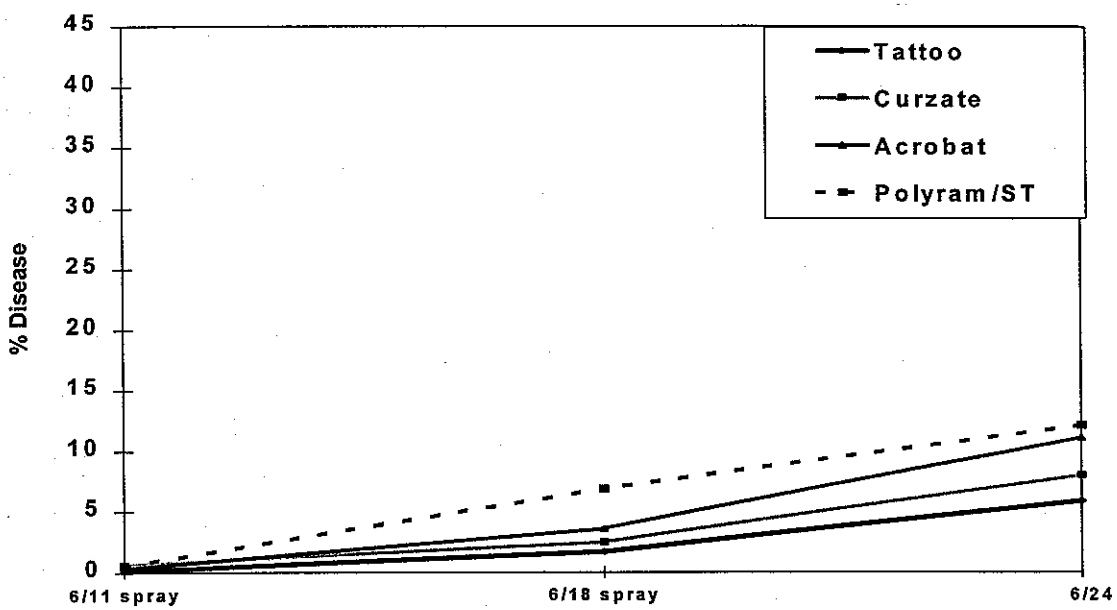


**Figure 5.** Mean percentage of potato leaf tissue with late blight symptoms in laboratory leaf assays after four fungicides were applied two times by air craft to Russet Burbank potatoes near Pasco, WA.

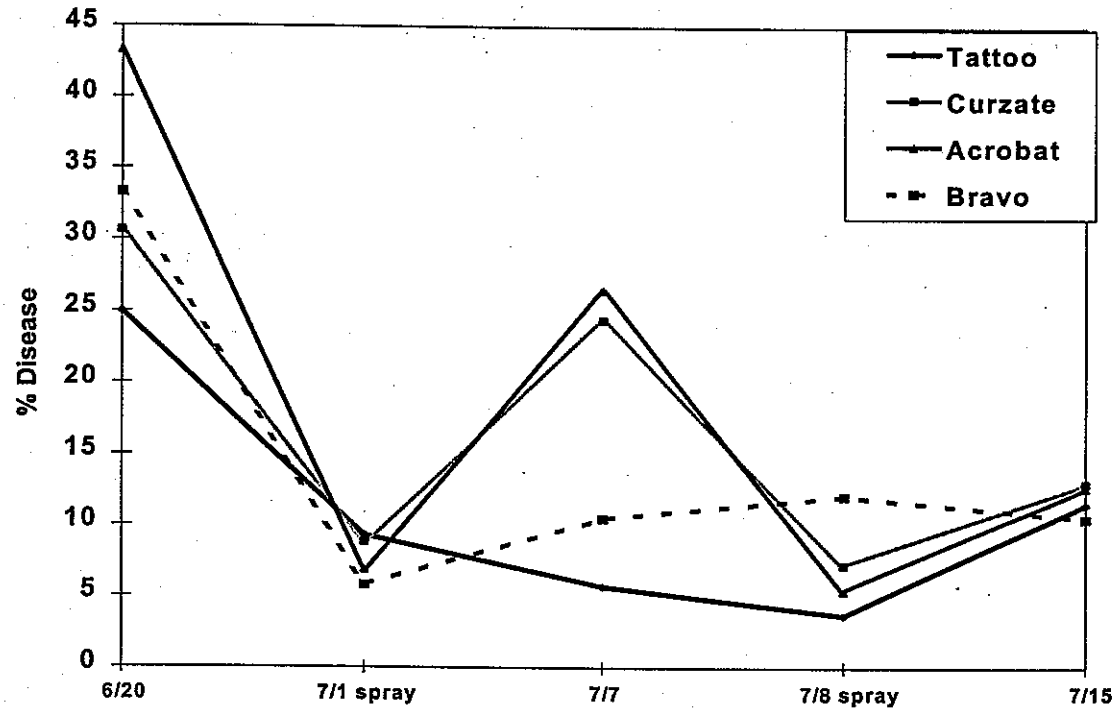


**Figure 6.** Mean percentage of potato leaf tissue with late blight symptoms in laboratory leaf assays after four fungicides were applied two times by air craft to Russet Burbank potatoes near Hermiston, OR.

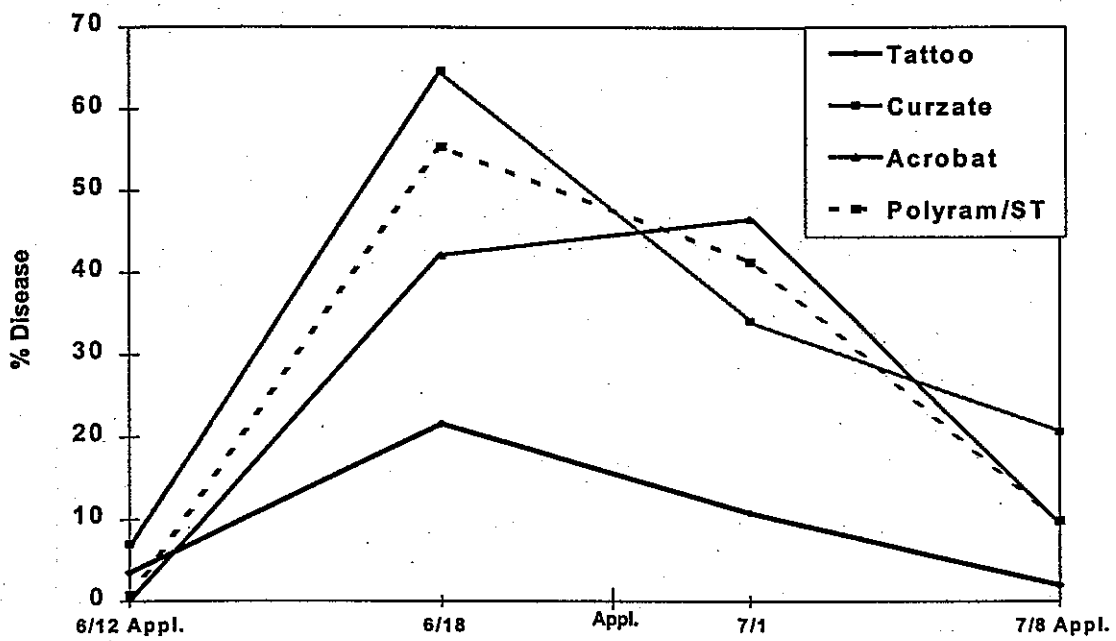


**Figure 7.** Percentage of potato leaf tissue with late blight symptoms in laboratory leaf assays after four fungicides were applied on three dates by chemigation to Russet Burbank potatoes near Pasco, WA.

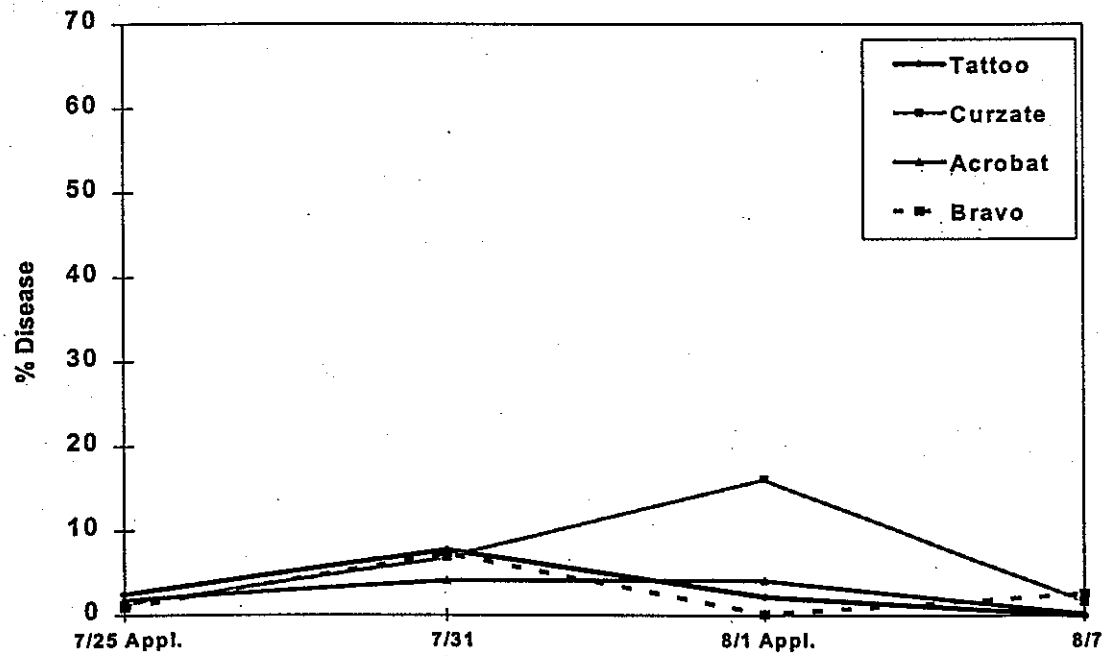


**Figure 8.** Percentage of potato leaf tissue with late bight symptoms in laboratory leaf assays after four fungicides were applied on two dates by chemigation to Russet Burbank potatoes near Hermiston, OR.