EFFECTIVE USE OF LATE BLIGHT CONTROL FUNGICIDES

by
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Ridomil has been an important fungicide in the past for late blight control. However, Ridomil-resistant strains of the late blight fungus have become established in Washington and Ridomil is no longer effective in managing late blight for many areas. We have demonstrated at WSU-Mount Vernon that protectant fungicide spray programs either with or without limited Ridomil prepack applications result in a significant reduction in late blight caused by Ridomil-resistant strains of the late blight fungus, and a significant increase in yield (see Proceedings of the 33rd Washington State Potato Conference and Trade Fair).

Chemical control programs for late blight in commercial potato fields now involve primarily the application of protectant fungicides (see Table 1). These fungicides work by providing a protective layer on the surface of leaves and stems, either killing late blight sporangia or preventing infection. Because protectant fungicides do not stop established infections they must be applied before infections occur **early** in the course of a disease outbreak and reapplied before there are additional wet periods. Growers should begin these fungicide applications when late blight is forecast, when wet weather conditions are anticipated, when plants are 6 to 8 inches tall, or when plants close within the row. Early applications also help to delay the onset of an epidemic, thereby limiting the amount of disease that can potentially develop throughout the entire season.

During the middle of the season protectant fungicide applications should continue on a **regular** basis. New foliage needs constant protection as it expands. Shorter intervals between sprays are needed when disease pressure is high; a 5 - 7 day interval is recommended in many potato areas of the world where weather favors blight and a 10 - 14 day interval otherwise is common. Thorough coverage utilizing high pressure and high volume per acre is important to get the fungicide onto the middle and lower leaves of the canopy. If applications are made by center pivot irrigation, fungicides should be applied with less than 0.2 inch of water.

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[2] Parts of this presentation were excerpts from: *D. A. Inglis and D. A. Johnson. 1996. Controlling late blight in commercial potato fields. Washington State University Cooperative Extension Bulletin (In press); and, D.A. Inglis, L. Johnson, B. Gundersen and N. Callahan. 1996. Evaluation of fungicides for late blight control. Fungicide and Nematicide Tests: Volume 51. The American Phytopathological Society, Minneapolis.*

This Presentation is part of the Proceedings of the 1996 Washington State Potato Conference & Trade Show.

When using fungicides always check the label for correct application rates and intervals, and the preharvest interval. Rotation of products, especially with those having systemic activity (Table 1) can be useful midseason when disease pressure is high. Generally, Ridomil prepacks are incorporated into fungicide rotation programs when tubers are nickel size and again 14 to 22 days later so that the benefit of metalaxyl in controlling storage problems like pink rot and Pythium can be realized.

Once the end of the season arrives, fungicide applications need to **continue** until vines are completely dead because the fungus can sporulate on green vines and wash down into the soil to infect tubers. Copper based fungicides may be useful at this time. Remember also as the season closes to check maximum allowable amounts of the various materials per acre per season as they vary for different fungicides.

Several fungicides for late blight control were tested in 1995 in a field trial near Mount Vernon, Wa. (Table 2). Treatments were compared by the area under the disease progress curve (AUDPC), the incidence of blighted tubers, and total yield. All except Bravo 720 had a significant impact on yield. [The delayed and wider (14-day) spray interval and the lower rate (0.75 pt/a) of the first application is probably the reason Bravo 720 did not perform as well in the 1995 trial as in past years; Bravo Ultrex, however, performed as well as the other materials in spite of the 14-day schedule.] All of the products that received Section 18 emergency exemptions this year controlled late blight. Of note, the Tattoo C and Acrobat treatments averaged less than 1% blighted tubers by weight.

In another 1995 study at WSU-Mount Vernon applications of mancozeb significantly altered the progress of late blight disease, percent (by weight) blighted tubers, specific gravity and total yield for Russet Burbank, Shepody, and Russet Norkotah (Table 3) compared to the non-treated control. The seven day schedule resulted in lower, but not significantly lower, AUDPC values, tuber blight incidence and total yield compared to the fourteen day spray schedule. The weather was not favorable for late blight in Mount Vernon in 1995 until August, however, and that may account for the similarity between the seven and fourteen day schedules. Shepody and Norkotah were extremely susceptible to tuber blight, even with protectant fungicide sprays. This has been reported previously (see Proceedings of the 34th Annual Washington State Potato Conference and Trade Show) and needs to be considered in the overall late blight management of these cultivars. Other fungicide trials in the Pacific Northwest (Table 4) resulted in different levels of disease (as measured by average AUDPC values) depending on the weather and disease pressure in the vicinity of the trials. Only two fungicides (chlorothalonil as Bravo 720 and Bravo Ultrex) were common to all, and both of these significantly reduced the amount of foliage late blight compared to the controls.

The main emphasis in using protectant fungicides is not so much what materials are applied but when they are applied. To quote O. C. Maloy from *Plant Disease Control*, "It probably matters not so much what is splashed on, of the effective fungicides, but when it is splashed on.

Table 1. Some protectant fungicides used for late blight control in commercial potato fields in Washington. Check the label before using them.	
Chemical Name	*Some Trade Names*
mancozeb	Dithane M-45; Dithane F-45; Dithane DF; Manzate 200DF; Penncozeb; Penncozeb DF
maneb	Maneb 75 DF; Maneb 80; Maneb + Zinc; Manex
metiram	Polyram 80DF
anilazine	Dyrene 50% WP
chlorothalonil	Bravo 90DG; Bravo 720; Bravo W-75; Bravo Ultrex; Bravo S; Bravo ZN; Bravo 500; Evade; Echo 500; Echo 720; Terranil 6L; Terranil 90DF
triphenyltin hydroxide	Super Tin 4L and Super Tin 80WP
copper sulfates, copper metallics and copper hydroxides	Kocide 101; Kocide DF; Kocide LF; Champ Formula 2; Tenn-cop 5E; Copper Count N; Basicop; Nordox; Clean Crop C-O-C-S; Tennessee Brand Tri-Basic Copper Sulfate
Fungicides that received Section 18 Emergency Exemptions for use in Washington in 1995.	
cymoxanil*	Curzate M-8; Manex M-8
dimethomorph*	Acrobat
propamocarb hydroxide**	Tattoo C

Note: The above may not include all of the products and Section 18 emergency exemptions that have been cleared for use in Washington and is not an endorsement of any particular product. *Has translaminar (can penetrate the leaf surface) systemic activity. **Has upward systemic activity.

Table 2. Late blight fungicides tested in 1995 at WSU-Mount Vernon			
Treatment and Product/Acre[1]	Area Under Disease Progress Curve	Blighted Tubers (% by weight)	Total Yield (cwt/a)
Nontreated Control	367.63 a	18.11 a	425
Bravo 720 (0.75 pt 1st time then 1.5 pt thereafter)	200.97 b	12.95 ab	399
Curzate M-8 72WP (1.25 lb) + Bond (1 pt) + 0.5 % citric acid	9.54 c	6.05 c	426
Curzate M-8 72WP (1.5 lb) + Bond (1 pt) + 0.5 % citric acid	4.12 c	3.79 c	382
EXP10673A (2.66 pt) + Latron (0.5 pt)	24.08 c	7.14 bc	408
EXP10673A (4 pt) + Latron (0.5 pt)	3.71 c	3.63 c	479
A5504 80WG (0.138 lb) + Bond (0.6 pt) + R11 (1 pt)	35.38 c	6.59 bc	445
A5504 25SC (0.42 pt) + Bond (0.6 pt) + R11 (1 pt)	5.44 c	2.41 c	435
Tattoo C 6.25 (2.3 pt)	4.87 c	0.87 c	453
RH7281 2F (0.5 pt) + Dithane 75DF (1.6 lb) + Latron (0.5 pt)	6.69 c	3.54 c	402
IB11925 (1.75 pt)	6.69 c	1.34 c	426
Bravo Ultrex (1.4 lb)	9.04 c	3.53 c	438
Ridomil MZ72 (2.5 lb) then Dithane DF (2 lb) then MZ72	5.54 c	2.64 c	429
Acrobat MZ 69 WP (2.25 lb) + Latron (0.5 pt)	2.41 c	0.91 c	433
LSD ($P = 0.053$)[2]	139.4	6.51	NS

[1] Treatments applied 13 July, 27 July, 10 August to *White Rose* planted 15 May.
[2] Numbers within a column followed by the same letter are not significantly different.

Table 3. Results of 1995 fungicide timing study at WSU-Mount Vernon.

Treatments	AUDPC	Blighted Tubers % by Weight	Total Yield (cwt/a)	Specific Gravity
Mancozeb Schedules				
Every 7-days	50.9 b	5 b	535 a	1.074 ab
Every 14-days	186.2 b	11 ab	570 a	1.076 a
No spray	834.5 a	16 a	455 b	1.071 b
Cultivars				
R. Burbank	237.83 b	2 b	526	1.077 a
Shepody	359.34 ab	13 a	513	1.071 b
R. Norkotah	474.44 a	17 a	522	1.074 a
LSD (P =.05)	*217.13*	*5.69*	*NS*	*0.0031*

Table 4. 1995 Pacific Northwest Fungicide Trials	
Locale	*AUDPC*
Eastern Oregon I (Hamm)	1665 a
Western Oregon (Powelson)	1409 b
Eastern Oregon II (Hamm)	1340 b
Idaho (Thornton)	1195 bc
Eastern Washington (Johnson)	958 c
Western Washington (Inglis)	193 d
P = .0001	*246.06*
Fungicide Treatments in Common	
Non-treated Control	1739 a
Bravo 720 (1.5 pt)	667 b
Bravo Ultrex	531 b
P = .0001	*147.79*