

## 1996 NATIONAL LATE BLIGHT FUNGICIDE TRIAL

by

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The National Late Blight Fungicide Trial was designed so that defined fungicide spray programs involving Section 18 and/or registered protectant fungicides could be compared against late blight of potato (caused by *Phytophthora infestans*) at numerous locations across the United States. To the best of our knowledge no one has attempted to coordinate the evaluation of a similar program of fungicides against a single disease under a wide range of environments, disease pressure and host susceptibility.

Coordination of the trial was sponsored by a grant from USDA/CSREES (Cooperative State Research and Extension Education Service). Cooperators included Barbara Christ, Pennsylvania State University; William Fry, Cornell University; Philip Hamm, Oregon State University; Willie Kirk, Michigan State University; David Lambert, University of Maine; Krishna Mohan and Phil Nolte, University of Idaho; H. (Bud) W. Platt, Agriculture and Agri-Food Canada Research Center; Randy Rowe, Ohio State University; Gary Secor, North Dakota State University; and, David P. Weingartner, University of Florida.

Altogether, seven chemicals (four registered compounds and three Section 18 compounds) were evaluated for control of late blight at 10 locations: Florida, Maine, Michigan, New York, North Dakota, Oregon, Pennsylvania, Prince Edward Island, northwestern Washington and southwestern Washington. The trial methodology consisted of a randomized complete block design with a minimum of four replications; a susceptible cultivar typical of the location; fungicide applications (in 25-50 gpa water at 35-100 psi using flat fan or hollow cone nozzles) beginning when plants were either 6 to 8 in tall or disease was reported in the area, and at planned weekly intervals until vine kill; reliance on natural infections or plots or spreader rows inoculated with *P. infestans* immediately before or after the first fungicide application; and, disease readings (as percent blighted foliage) a minimum of every 7 days, beginning when late blight first appeared in the non-treated control plots and continuing until vine-kill. See Table 1 and Appendix I and II for fungicide programs included in the study.

The relative area under the disease progress curve (RAUDPC) and tuber yield (as percent of control) were used to compare fungicide program effects within and across locations and fungicide programs. RAUDPC is the AUDPC (area under the disease progress curve) divided by the total time of the epidemic. Time units were degree days after planting and were calculated with a lower threshold of 55 F (12.8 C) and no upper threshold.

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

Within each location, the fungicide programs were ranked low to high for RAUDPC and high to low for tuber yield (as percent of control). Locations were then treated as blocks and ranks for both RAUDPC and tuber yield (as percent of control) were separately analyzed to obtain an overall ranking of the fungicide treatments for these two variables. For the purpose of data presentation, locations were divided into areas of low, medium and high disease pressure (Table 2). This division was somewhat arbitrary based on the level of disease in the nontreated control plots, where RAUDPC > 70 = high; 30 < RAUDPC < 69 = medium; and, RAUDPC < 30 = low disease pressure.

The predominant genotype of *P. infestans* in the trial was US8 (A2, metalaxyl insensitive) (Table 2). US11 (A1, metalaxyl insensitive) occurred only in western Washington. Rate of disease increase in the nontreated control was similar at all locations, regardless of cultivar or pathogen genotype.

All fungicide programs resulted in a reduction in RAUDPC relative to the control (Table 3). Number of fungicide applications at the different sites ranged from six to eight. At the low disease pressure sites (Florida and Northwest Washington) percent disease reduction ranged from 92 to 99%. At the medium disease pressure sites (Maine, Michigan, Oregon, and southwestern Washington) percent disease reduction ranged from 76 to 98%. Percent reduction in disease ranged from 42 to 94% at the high disease pressure sites (North Dakota, New York, Pennsylvania, and Prince Edward Island).

Chlorothalonil, mancozeb and triphenyl-tin/EBDC programs were included at nearly all trial sites whereas not all cooperators included the mancozeb/copper hydroxide program (Table 3), and at some trial sites the timing and number of Section 18 fungicide applications within protectant fungicide programs varied. Typically, the mancozeb/copper hydroxide program was the least effective program in controlling foliar disease symptoms whereas the other fungicide programs, either with or without Section 18 fungicides, were similar in their efficacy. This was true whether RAUDPC values (Table 4) or mean ranks of RAUDPC values (Table 5) were compared.

Percent increase in tuber yield (Table 6) ranged from 14 to 33% at the low disease pressure sites; from 8 to 82% at the medium disease pressure sites; and, from 4 to 110% at the high disease pressure sites. Mean ranks of tuber yield within a location (Table 7) did not differ significantly.

Overall comparison of mean ranks of RAUDPC when locations were treated as blocks (Table 8) showed that fungicide programs with chlorothalonil, chlorothalonil/propamocarb hydrochloride, mancozeb, mancozeb/dimethomorph or triphenyl-tin plus metiram were similarly ranked. The mancozeb/copper hydroxide treatment ranked higher indicating that it was not as effective as the other treatments. The mancozeb/cymoxanil treatment ranked intermediate between these two groups. It is not clear at this time whether this was inherent in the treatment or due to the variation among locations in the timing and intensity of cymoxanil applications. In contrast, overall comparison of mean ranks of tuber yield (as percent of control) when locations were treated as blocks demonstrated that all fungicide programs performed similarly (Table 8).

The following general conclusions can be made from the 1996 study:

- Although no fungicide program achieved 100% control of foliar symptoms of late blight, each consistently reduced the amount of foliar late blight and increased tuber yield compared to the nontreated control.
- Section 18 compounds did not out perform registered fungicides in controlling foliar late blight or increasing tuber yield.
- Across locations the mancozeb/copper program was the least effective treatment in controlling foliar symptoms of late blight.
- Disease suppression was achieved with 6-8 fungicide applications regardless of site or fungicide program.
- When and how protectant fungicides are applied is probably more important than minor differences among effective products for control of late blight.

Plans are now being made to repeat this trial in 1997. Evaluation of the same or similar fungicide programs is anticipated in order to confirm 1996 findings regarding control of foliar symptoms of late blight and treatment effects on tuber yield. However, we expect that the 1997 study will also emphasize efficacy of these fungicide programs in controlling tuber blight. This phase of the disease is of special concern to people who store potatoes, either for processing or as seed. Our long range goal is to develop fungicide-based program(s) for controlling both phases of this destructive disease in order that growers may produce high quality tubers in a profitable way.

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*Acknowledgments: Ted Alby and Jim Vandecoevering, American Cyanamid Co.; John Blair and Walt Slabaugh, ISK BioSciences; Terry Mayberry, AgrEvo USA Company; Norm McKinley, DuPont; and, Tom Neidlinger, Rohm and Haas Co.*

Table 1. Fungicide spray programs in the 1996 National Late Blight Fungicide Trial.

Treatment Programs <sup>1</sup>	
chlorothalonil	weekly application
chlorothalonil/propamocarb hydrochloride	chlorothalonil weekly until late blight was evident in control, then propamocarb and chlorothalonil rotated weekly
mancozeb	weekly application
mancozeb/copper hydroxide	mancozeb weekly all season except for copper hydroxide last 3 weeks
mancozeb/cymoxanil	mancozeb weekly until late blight was evident in control, then cymoxanil 3 weeks, then mancozeb weekly
mancozeb/dimethomorph	mancozeb weekly until blight was evident in control, then dimethomorph rotated weekly
triphenyl-tin tank mixed with metiram	weekly application

<sup>1</sup> Fungicide program and application schedules at some sites varied (see Appendix II).

Table 2. Potato cultivars and *Phytophthora infestans* genotypes at 1996 trial sites, and late blight pressure assignment based on RAUDPC (relative area under disease progress curve) of nontreated control plots.

Location	Cultivar <sup>1</sup>	Genotype	RAUDPC	Disease Pressure
Florida	Red LaSoda	US 8	16.3	Low
Maine	FL-1533	US 8	38.6	Medium
Michigan	Snowden	US 8	32.7	Medium
North Dakota	Snowden	US 8	71.9	High
New York	Norchip	US 8	79.9	High
Oregon	Russet Burbank	US 8	39.5	Medium
Pennsylvania	Atlantic	US 8	72.7	High
Prince Edward Island	Green Mountain	US 8	91.2	High
Northwest Washington	White Rose	US 11	7.1	Low
Southwest Washington	Russet Burbank	US 11	65.2	Medium

<sup>1</sup> *Norchip and Atlantic are generally regarded as very susceptible whereas the other cultivars are susceptible to late blight.*

Table 3. Effect of foliar fungicide programs on percent reduction in RAUDPC (relative area under the disease progress curve) relative to the control at locations having low, medium or high late blight pressure.

Treatment <sup>1</sup>	Percent										
	Low		Medium				High				
	FL	NW WA	ME	MI	OR	SW WA	ND	NY	PA	PEI	
chlorothalonil	-- <sup>2</sup>	99	95	94	94	92	70	94	99	71	
chlorothalonil/propamocarb hydrochloride	92	98	94	93	96	77	70	85	98	74	
mancozeb	99	99	87	87	93	97	71	62	94	74	
mancozeb/ copper hydroxide	96	95	85	80	76	--	--	--	94	78	
mancozeb/cymoxanil	--	99	92	94 <sup>1</sup>	96	90	42	81	93	65 <sup>1</sup>	
mancozeb/dimethomorph	99	99	98	91 <sup>1</sup>	95	97 <sup>1</sup>	62	79 <sup>1</sup>	96	74	
triphenyl-tin/metiram	99	99	92	93	98	97	73	82	93	66	

<sup>1</sup> Fungicide programs varied from experimental protocol (see Appendix II).

<sup>2</sup> Fungicide program not included.

Table 4. Effect of foliar fungicide programs on RAUDPC (relative area under the disease progress curve) across locations having either low, medium, or high late blight pressure.

Treatment <sup>1</sup>	RAUDPC									
	Low		Medium				High			
	FL	NW WA	ME	MI	OR	SW WA	ND	NY	PA	PEI
chlorothalonil	-- <sup>2</sup>	0.1 abc <sup>3</sup>	2 a	2 b	2 b	5 ab	22 ab	5 b	1 b	27 c
chlorothalonil/ propamocarb hydrochloride	1 a	0.2 ab	2 a	2 b	1 b	15 a	22 ab	12 ab	1 b	23 c
mancozeb	0.03 b	0.02 bc	5 a	4 ab	3 b	2 bc	21 b	30 a	5 a	21 c
mancozeb/ copper hydroxide	1 a	0.4 a	6 a	7 a	9 a	--	--	--	5 a	50 ab
mancozeb/ cymoxanil	--	0.02 b	3 a	2 b <sup>1</sup>	2 b	6 a	42 a	15 ab	5 a	32 bc
mancozeb/ dimethomorph	0.03 b	0.03 bc	1 a	3 b <sup>1</sup>	2 b	2 c <sup>1</sup>	27 ab	17 ab <sup>1</sup>	3 a	23 c
triphenyl-tin/ metiram	0.05 b	0.02 c	3 a	2 b	1 b	2 bc	19 b	14 ab	5 a	31 bc

<sup>1</sup> Fungicide programs varied from experimental protocol (see Appendix II).

<sup>2</sup> Fungicide program not included.

<sup>3</sup> Means followed by the same letter within a column are not significantly different ( $P \leq 0.05$ ) according to Ryan-Einot-Gabriel-Welsch F test.

Table 5. Effect of foliar fungicide programs on mean rank of RAUDPC (relative area under the disease progress curve) at locations having low, medium, or high late blight pressure.

Treatment <sup>2</sup>	Rank <sup>1</sup>									
	Low		Medium				High			
	FL	NW WA	ME	MI	OR	SW WA	ND	NY	PA	PEI
chlorothalonil	-- <sup>3</sup>	4.6 abc <sup>4</sup>	3.0 b	3.1 ab	3.8 ab	4.0 b	2.2 a	1.3 c	1.3 c	4.0 b
chlorothalonil/ propamocarb hydrochloride	4.0 ab	5.6 ab	2.9 b	2.8 ab	3.0 b	6.0 a	3.5 a	3.0 bc	1.8 bc	2.8 b
mancozeb	2.1 b	2.4 c	5.9 a	5.2 ab	5.3 ab	2.4 c	2.7 a	5.8 a	4.5 a	2.0 b
mancozeb/ copper hydroxide	4.3 a	6.2 a	6.2 a	6.5 a	4.0 a	--	--	--	5.3 a	7.0 a
mancozeb/ cymoxanil	--	2.8 bc	4.9 ab	2.5 b <sup>2</sup>	3.8 b	4.8 ab	5.0 a	4.0 ab	5.6 a	4.3 b <sup>2</sup>
mancozeb/ dimethomorph	2.3 b	3.8 abc	2.1 b	4.2 ab <sup>2</sup>	3.0 b	2.0 c <sup>2</sup>	4.3 a	3.0 bc <sup>2</sup>	4.0 ab	3.0 b
triphenyl-tin/ metiram	2.4 ab	2.6 c	3.1 b	3.5 ab	2.3 b	1.8 c	2.7 a	4.0 ab	5.6 a	5.0 ab

<sup>1</sup> 1 = lowest RAUDPC value.

<sup>2</sup> Fungicide programs varied from experimental protocol (see Appendix II).

<sup>3</sup> Fungicide program not included.

<sup>4</sup> Means followed by the same letter within a column are not significantly different ( $P \leq 0.05$ ) according to Ryan-Einot-Gabriel-Welsch *F* test.

Table 6. Effect of foliar fungicide programs on percent increase in potato tuber yield relative to the control at locations having low, medium or high late blight pressure.

Treatment <sup>1</sup>	Percent									
	Low		Medium				High			
	FL	NW WA	ME	MI	Or	SW WA	ND	NY	PA	PEI
chlorothalonil	-- <sup>2</sup>	33	69	24	54	40	42	13	--	82
chlorothalonil/ propamocarb hydrochloride	14	30	63	34	54	36	32	17	--	92
mancozeb	20	14	62	23	46	70	28	10	--	99
mancozeb/ copper hydroxide	33	19	64	8	45	--	--	--	--	77
mancozeb/ cymoxanil	--	26	52	30 <sup>1</sup>	68	39	19	2	--	86 <sup>1</sup>
mancozeb/ dimethomorph	14	31	73	17 <sup>1</sup>	59	82 <sup>1</sup>	24	4 <sup>1</sup>	--	110
triphenyl- tin/metiram	25	33	59	18	69	79	31	11	--	88

<sup>1</sup> Fungicide program varied from experimental protocol (see Appendix II).

<sup>2</sup> Fungicide program not included

Table 7. Effect of foliar fungicides on mean rank of potato tuber yield (percent of control) at locations having low, medium or high late blight pressure.

Treatment <sup>2</sup>	Rank <sup>1</sup>									
	Low		Medium				High			
	FL	NW WA	ME <sup>3</sup>	MI	OR	SW WA	ND	NY	PA <sup>3</sup>	PEI
chlorothalonil	-- <sup>4</sup>	4.2	--	3.5	4.5	4.5	1.5	3.5	--	4.8
chlorothalonil/ propamocarb hydrochloride	3.5	3.2	--	1.5	4.4	5.0	2.5	2.0	--	3.8
mancozeb	2.5	5.4	--	4.5	5.4	2.5	4.2	2.8	--	3.3
mancozeb/ copper hydroxide	2.5	5.2	--	5.3	5.8	--	--	--	--	5.5
mancozeb/ cymoxanil	--	3.8	--	3.3 <sup>2</sup>	2.3	5.0	4.5	4.8	--	4.3 <sup>2</sup>
mancozeb/ dimethomorph	3.8	3.2	--	5.3 <sup>2</sup>	3.0	2.3 <sup>2</sup>	4.3	4.0 <sup>2</sup>	--	2.5
triphenyl-tin/metiram	2.8	3.0	--	4.8	2.8	1.8	3.6	3.8	--	4.5

<sup>1</sup> 1=highest tuber yield.

<sup>2</sup> Fungicide program varied from experimental protocol (see Appendix II).

<sup>3</sup> Fungicide program not included.

<sup>4</sup> Data not available.

Table 8. Effect of foliar fungicide programs on overall ranks of both RAUDPC (relative area under disease progress curve for late blight of potato) and potato tuber yield (as percent of control) across locations.

Treatment	RAUDPC <sup>1</sup>	Tuber Yield <sup>1</sup>
chlorothalonil	3.0	3.8
chlorothalonil/propamocarb hydrochloride	3.5	3.2
mancozeb	3.8	3.8
mancozeb/copper hydroxide	6.1	4.8
mancozeb/cymoxanil	4.2	3.9
mancozeb/dimethomorph	3.2	3.5
triphenyl-tin/metiram	3.2	3.4
<i>P Value (X<sup>2</sup>)<sup>2</sup></i>	<i>0.05 ≤ P ≤ 0.10</i>	<i>0.10 ≤ P ≤ 0.25</i>

<sup>1</sup> 1=lowest RAUDPC value and highest tuber yield value.

<sup>2</sup> Mean ranks did not differ significantly at  $P \leq 0.05$  according to Friedman's test.

Appendix I.

Program Fungicide Programs

- 1 No fungicide
- 2 Chlorothalonil (weekly application)
- 3 Mancozeb (weekly application)
- 4 Triphenyl-tin tank mixed with EBDC (weekly application)
- 5 Mancozeb/dimethomorph (mancozeb weekly until blight is evident in control, then dimethomorph rotated weekly)
- 6 Mancozeb/cymoxanil (mancozeb weekly until blight is evident in control, then cymoxanil for 3 weeks, then mancozeb weekly)
- 7 Chlorothalonil/propamocarb hydrochloride(chlorothalonil weekly until blight is evident in control, then propamocarb and chlorothalonil rotated weekly)
- 8 Mancozeb weekly all season except for copper hydroxide last 3 weeks

Appendix II.

Florida:

Red LaSoda planted 13 Feb

Program	Products (s) Used	Estimated Average Product Price	Application Dates and Product Rates (Product/Acre)						
			Apr 11 Apr 12	Apr 17 Apr 18	Apr 24 Apr 25	May 1 May 2	May 8 May 9	May 15 May 16	May 22 May 23
2	Bravo 720	\$51.50/gal	--	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt
3	Dithane M-45	\$3.10-\$3.50/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb
4	SuperTin 80 WP Polyram 80 DF	\$29.00-\$31.00/lb \$3.27/lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb
5	Dithane M-45 Acrobat MZ	\$3.10-\$3.50/lb \$10.22 to \$11.56/lb	2 lb --	-- 2.25 lb	-- 2.25 lb	-- 2.25 lb	-- 2.25 lb	2 lb --	2 lb --
7	Bravo 720 Tattoo C	\$51.50/gal \$111.28/gal	-- --	-- 2.3 pt	-- 2.3 pt	-- 2.3 pt	-- 2.3 pt	1.5 pt --	1.5 pt --
8	Dithane M-45 Champ Formula 2	\$3.10-\$3.50/lb \$32.00/gal	2 lb --	2 lb --	2 lb --	2 lb --	2 lb --	-- 2.2 pt	-- 2.2 pt

## Maine:

FL 1533 planted 3 June

Program	Products (s) Used	Estimated Average Product Price	Application Dates and Product Rates (Product/Acre)							
			Jul 17	Jul 23	Jul 30	Aug 6	Aug 13	Aug 20	Aug 27	
2	Bravo Weather Stik 6F	\$51.50/gal	0.75 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	
3	Penncozeb	\$3.50-\$4.00/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	
4	SuperTin 80 WP	\$29.00-\$31.00/lb	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz	
	Polyram 80 DF	\$3.27/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	
5	Penncozeb	\$3.50-\$4.00/lb	2 lb	2 lb	2 lb	2 lb	--	--	--	
	Acrobat MZ	\$10.22 to \$11.56/lb	--	--	--	--	2.25 lb	2.25 lb	2.25 lb	
6	Penncozeb	\$3.50-\$4.00/lb	2 lb	2 lb	2 lb	2 lb	--	--	--	
	Curzate M-8	\$12.20/lb	--	--	--	--	1.5 lb	1.5 lb	1.5 lb	
7	Bravo Weather Stik 6F	\$51.50/gal	0.75 pt	1.5 pt	1.5 pt	1.5 pt	--	1.5 pt	--	
	Tattoo C	\$111.28/gal	--	--	--	--	2.3 pt	--	2.3 pt	
8	Dithane M-45	\$3.10-\$3.50/lb	2 lb	2 lb	2 lb	2 lb	--	--	--	
	Champ Formula 2	\$32.00/gal	--	--	--	--	2.2 pt	2.2 pt	2.2 pt	

## Michigan:

Snowden planted 30 May

Program	Products (s) Used	Estimated Average Product Price	Application Dates and Product Rates (Product/Acre)							
			Jul 10	Jul 17	Jul 24	Jul 31	Aug 7	Aug 14	Aug 21	
2	Bravo Weather Stik 6F	\$51.50/gal	0.75 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	
3	Penncozeb 75DF	\$3.50-\$4.00/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	
4	SuperTin 80 WP	\$29.00-\$31.00/lb	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz		
	Polyram 80 DF	\$3.27/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	
5	Bravo Weather Stik 6F	\$51.50/gal	1.5 pt	1.5 pt	1.5 pt	1.5 pt	--	--	--	
	Acrobat MZ	\$10.22 to \$11.56/lb	--	--	--	--	2.25 lb	2.25 lb	2.25 lb	
6	Bravo Weather Stik 6F	\$51.50/gal	1.5 pt	1.5 pt	1.5 pt	--	--	--	--	
	Manzate 75WP	\$4.00/lb	--	--	--	.75 lb	.75 lb	.75 lb	.75 lb	
	Curzate M-8	\$12.20/lb	--	--	--	1.5 lb	1.5 lb	1.5 lb	1.5 lb	
7	Bravo Weather Stik 6F	\$51.50/gal	1.5 pt	1.5 pt	1.5 pt	1.5 pt	--	--	--	
	Tattoo C	\$111.28/gal	--	--	--	--	2.3 pt	2.3 pt	2.3 pt	
8	Penncozeb 75DF	\$3.50-\$4.00/lb	1.5 lb	1.5 lb	2 lb	2 lb	--	--	--	
	Champ Formula 2	\$32.00/gal	--	--	--	--	2.2 pt	2.2 pt	2.67 pt	

## New York:

Norchip planted 20 June

Program	Products (s) Used	Estimated Average Product Price	Application Dates and Product Rates (Product/Acre)					
			Aug 7	Aug 14	Aug 21	Aug 28	Sept 4	Sept 11
2	Bravo Weather Stik 6F	\$51.50/gal	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt
3	Manzate 200	\$4.00/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb
4	SuperTin 80 WP Polyram 80 DF	\$29.00-\$31.00/lb \$3.27/lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb
5	Acrobat MZ	\$10.22 to \$11.56/lb	2.25 lb	2.25 lb	2.25 lb	2.25 lb	2.25 lb	2.25 lb
6	Manzate 200 Curzate M-8	\$4.00/lb \$12.20/lb	0.65 lb 1.5 lb	0.65 lb 1.5 lb	0.65 lb 1.5 lb	0.65 lb 1.5 lb	0.65 lb 1.5 lb	0.65 lb 1.5 lb
7	Bravo Weather Stik 6F Tattoo C	\$51.50/gal \$111.28/gal	1.5 pt --	-- 2.3 pt	1.5 pt --	-- 2.3 pt	1.5 pt --	-- 2.3 pt

## North Dakota:

Snowden planted 29 May

Program	Products (s) Used	Estimated Average Product Price	Application Dates and Product Rates (Product/Acre)						
			Jun 16	Jul 23	Jul 30	Aug 5	Aug 12	Aug 20	Aug 26
2	Bravo Weather Stik 6F	\$51.50/gal	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt
3	Dithane M-45	\$3.10-\$3.50/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb
4	SuperTin 80 WP Polyram 80 DF	\$29.00-\$31.00/lb \$3.27/lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb
5	Acrobat MZ	\$10.22 to \$11.56/lb	2.25 lb	2.25 lb	2.25 lb	2.25 lb	2.25 lb	2.25 lb	2.25 lb
6	Curzate M-8	\$12.20/lb	1.5 lb	1.5 lb	1.5 lb	1.5 lb	1.5 lb	1.5 lb	1.5 lb
7	Bravo Weather Stik 6F Tattoo C	\$51.50/gal \$111.28/gal	1.5 pt --	-- 2.3 pt	1.5 pt --	-- 2.3 pt	1.5 pt --	-- 2.3 pt	1.5 pt --

## Western Oregon:

Russet Burbank planted 12 June

Program	Products (s) Used	Estimated Average Product Price	Application Dates and Product Rates (Product/Acre)					
			Jul 30	Aug 14	Aug 21	Aug 28	Sept 4	Sept 11
2	Bravo Weather Stik 6F	\$51.50/gal	0.75 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt
3	Dithane M-45	\$3.10-\$3.50/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb
4	SuperTin 80 WP Polyram 80 DF	\$29.00-\$31.00/lb \$3.27/lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb
5	Dithane M-45 Acrobat MZ	\$3.10-\$3.50/lb \$10.22 to \$11.56/lb	2 lb --	2 lb --	-- 2.25 lb	2 lb --	-- 2.25 lb	2 lb --
6	Dithane M-45 Curzate M-8	\$3.10-\$3.50/lb \$12.20/lb	2 lb --	2 lb --	-- 1.5 lb	-- 1.5 lb	-- 1.5 lb	-- 1.5 lb
7	Bravo Weather Stik 6F Tattoo C	\$51.50/gal \$111.28/gal	0.75 pt --	1.5 pt --	-- 2.3 pt	1.5 pt --	-- 2.3 pt	1.5 pt --
8	Dithane M-45 Champ Formula 2	\$3.10-\$3.50/lb \$32.00/gal	2 lb --	2 lb --	2 lb --	-- 2.2 pt	-- 2.2 pt	-- 2.2 pt

## Pennsylvania:

Atlantic planted 4 June

Program	Products (s) Used	Estimated Average Product Price	Application Dates and Product Rates (Product/Acre)							
			Jul 9	Jul 16	Jul 23	Aug 6	Aug 13	Aug 20	Aug 27	Sept 3
2	Bravo Weather Stik 6F	\$51.50/gal	0.75 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt
3	Dithane M-45	\$3.10-\$3.50/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb
4	SuperTin 80 WP Polyram 80 DF	\$29.00-\$31.00/lb \$3.27/lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb	2.5 oz 2 lb
5	Dithane M-45 Acrobat MZ	\$3.10-\$3.50/lb \$10.22 to \$11.56/lb	2 lb --	2 lb --	2 lb --	2 lb --	2 lb --	-- 2.25 lb	2 lb --	-- 2.25 lb
6	Dithane M-45 Curzate M-8	\$3.10-\$3.50/lb \$12.20/lb	2 lb --	2 lb --	2 lb --	2 lb --	2 lb --	-- 1.5 lb	2 lb --	-- 1.5 lb
7	Bravo Weather Stik 6F Tattoo C	\$51.50/gal \$111.28/gal	0.75 pt --	1.5 pt --	1.5 pt --	1.5 pt --	1.5 pt --	-- 2.3 pt	1.5 pt --	-- 2.3 pt
8	Dithane M-45 Champ Formula 2	\$3.10-\$3.50/lb \$32.00/gal	2 lb --	2 lb --	2 lb --	2 lb --	2 lb --	2 lb --	-- 2.2 pt	-- 2.2 pt

Northwestern Washington:

White Rose planted 28 May

Program	Products (s) Used	Estimated Average Product Price	Application Dates and Product Rates (Product/Acre)							
			Jul 10	Jul 17	Jul 24	Jul 31	Aug 7	Aug 14	Aug 21	Aug 28
2	Bravo Weather Stik 6F	\$51.50/gal	0.75 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	1.5 pt	--
3	Dithane DF	\$3.10-\$3.50/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	--
4	SuperTin 80 WP	\$29.00-\$31.00/lb	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz	--
	Polyram 80 DF	\$3.27/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb	--
5	Dithane DF	\$3.10-\$3.50/lb	2 lb	2 lb	2 lb	--	2 lb	--	2 lb	--
	Acrobat MZ	\$10.22 to \$11.56/lb	--	--	--	2.25 lb	--	2.25 lb	--	--
6	Dithane DF	\$3.10-\$3.50/lb	2 lb	2 lb	2 lb	--	--	--	--	--
	Curzate M-8	\$12.20/lb	--	--	--	1.5 lb	1.5 lb	1.5 lb	1.5 lb	--
7	Bravo Weather Stik 6F	\$51.50/gal	0.75 pt	1.5 pt	1.5 pt	--	1.5 pt	--	1.5 pt	--
	Tattoo C	\$111.28/gal	--	--	--	2.3 pt	--	2.3 pt	--	--
8	Dithane DF	\$3.10-\$3.50/lb	2 lb	2 lb	2 lb	2 lb	2 lb	--	--	--
	Champ Formula 2	\$32.00/gal	--	--	--	--	--	2.2 pt	2.2 pt	2.2 pt

Southwestern Washington:

Russet Burbank planted 27 June

Program	Products (s) Used	Estimated Average Product Price	Application Dates and Product Rates (Product/Acre)					
			Aug 8	Aug 15	Aug 22	Aug 29	Sept 5	Sept 12
2	Bravo 720	\$51.50/gal	0.55 lb	1.125 lb	1.125 lb	1.125 lb	1.125 lb	1.125 lb
3	Dithane DF	\$3.10-\$3.50/lb	2 lb	2 lb	2 lb	2 lb	2 lb	2 lb
4	SuperTin 80 WP	\$29.00-\$31.00/lb	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz
	Polyram 80 DF	\$3.27/lb	2.5 lb	2.5 lb	2.5 lb	2.5 lb	2.5 lb	2.5 lb
5	Acrobat MZ	\$10.22 to \$11.56/lb	2.25 lb	2.25 lb	2.25 lb	2.25 lb	2.25 lb	2.25 lb
6	Manzate 75DF	\$6.20-\$7.00/lb	.5 lb	.5 lb	.5 lb	.5 lb	.5 lb	.5 lb
	Curzate M-8	\$12.20/lb	1.25 lb	1.25 lb	1.25 lb	1.25 lb	1.25 lb	1.25 lb
7	Bravo Weather Stik 6F	\$51.50/gal	1.5 pt	--	1.5 pt	--	1.5 pt	--
	Tattoo C	\$111.28/gal	--	2.3 pt	--	2.3 pt	--	2.3 pt