2003 Plant Pathology Research and Demonstration Progress Reports

Compiled by G.D. Franc and W.L. Stump

University of Wyoming Department of Plant Sciences

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Research Project	**Micro-rate Herbicide/Amistar Interactions on Sugar Beet, 2003**
Research Team Tel: 307-766-2397 FAX: 307-766-5549 francg@uwyo.edu	G.D. Franc and W.L. Stump University of Wyoming College of Agriculture- Plant Sciences Dept 3354, 1000 E. University Ave. Laramie, WY 82071-3354
Field Plot Location	Torrington Research & Extension Center @ Torrington, WY. 4104 ft MSL; sandy loam soil; overhead irrigation
Plot Design	RCBD with 4 replications; plots were 4 rows (30-in row centers) X 20 ft; 5 ft in-row buffer. Chemical treatments were made to, and all data were collected from, the center two rows of each plot.
Plot Management	**Planting Date**: 21 May (via a replanting) **Variety**: Roundup-ready **Fertilizer**: 180 lb N + 50 lb P_2O_5 **Herbicide**: Roundup Ultra Max (26 fl oz product) on 16 and 30 June.
Treatment Applications	Herbicides and fungicide were applied with the aid of a portable (CO_2) sprayer in a total volume of 21 gal/A at 30 psi boom pressure (four #8002 flat fan nozzles spaced at 20 inches). The micro-rate program consisted of a tank mix (product amount per acre) of Progress 1.8EC (0.36 pt) + Stinger 3SL (0.08 pt) + Upbeet 50DF (0.125 oz). The MSO adjuvant used was Destiny (1.5% v/v) and the basic blend adjuvant used was Quad 7 (1.0% v/v). Fungicide rate used was Amistar 80WG at 2.38 oz of product/A. Timings are indicated in the Tables.
Injury Ratings	Stand counts (2 x 20 row feet) were made on 10 and 23 June, both early and late in the treatment timings respectively. Plant vigor (as a percentage of nearby untreated plants size) and overall plant necrosis was evaluated on 23, 26 June, 3, 8, and 16 July.
Harvest	One 20-ft row of the two treated rows was harvested 19 September and the total root yield was determined. The percentage of total sucrose was determined by Western Sugar's laboratory.
Statistical Analysis	ANOVA with four replications. Mean separations were done using Fisher's protected LSD ($\underline{P} \leq 0.05$). Linear contrasts were made to compare surfactant effects on stand ($\underline{P} \leq 0.05$).

Results and Discussion

Treatments that had been applied up to the 10 June date had no significant effect on beet stand (Table 1, $\underline{P}$=0.05). However by 23 June, treatments had a significant effect on stands ($\underline{P} \leq 0.05$).

Treatments with the additive Destiny resulted in stands that were 20% less than the average stand for treatments with the additive Quad 7 (linear contrast, $\underline{P} \leq 0.05$).

Treatment effects on beet vigor (as a % of size of the untreated buffer row plants) and necrosis are shown in Tables 2 and 3. The greatest phytotoxic response of reduced vigor and increased necrosis occurred when Amistar was co-applied with the micro-rate program plus the additive Destiny ($\underline{P} \leq 0.05$). The stunting of plants in this treatment was still visible by 16 July compared to other treatments ($\underline{P} \leq 0.05$). Co-application of Amistar with the micro-rate program plus the additive Quad 7 also caused significant injury compared most other timings but less than the comparable treatment with Destiny ($\underline{P} \leq 0.05$).

Treatments had no significant effect on yield and quality (Table 4, $\underline{P}=0.05$). Low sugar yields are most likely due to the later planting date (21 May) and the relatively short growing season (early harvest).

There is potential for crop injury when Amistar is used with a micro-rate herbicide program. Injury occurs when Amistar is co-applied with micro-rate herbicides resulting in stunting and necrosis. Injury can be avoided by applying Amistar separately or at least reduced by using a basic blend adjuvant as opposed to a MSO.

Table 1. Effects of Amistar in a program with micro-herbicides and adjuvants on beet stands (G.D. Franc and W.L. Stump, University of Wyoming; 2003).

Treatment and rate (product/A) [1]	Timing [2]	Beet Stage	Stand count (20 row ft)	
			10 June	23 June
1. Untreated check			26.25 a [3]	27.25 f
2. Micro-rate program + Destiny	14 day	4-6 leaves	30.50 a	32.50 def
3. Micro-rate program + Destiny + Amistar 80WG	14 day	4-6 leaves	26.75 a	29.75 ef
4. Micro-rate program + Destiny	11 day	4 leaves		
4. Amistar 80WG	14 day	4-6 leaves	25.75 a	29.75 ef
5. Micro-rate program + Destiny	7 day	2 leaves	26.00 a	31.00 ef
5. Amistar 80WG	14 day	4-6 leaves		
6. Micro-rate program + Destiny	0 day	cotyledon	34.00 a	40.00 a-d
6. Amistar 80WG	14 day	4-6 leaves		
7. Amistar 80WG + Destiny	14 day	4-6 leaves	30.75 a	37.75 b-e
8. Amistar 80WG	14 day	4-6 leaves	33.25 a	41.25 abc
8. Micro-rate program + Destiny	17 day	6-8 leaves		
9. Amistar 80WG	14 day	4-6 leaves	26.25 a	35.25 c-f
9. Micro-rate program + Destiny	21 day	8 leaf		
10. Amistar 80WG	14 day	4-6 leaves	28.00 a	38.00 b-e
10. Micro-rate program + Destiny	28 day	8-10 leaves		
11. Micro-rate program + Quad 7	14 day	4-6 leaves	29.25 a	40.25 a-d
12. Micro-rate program + Quad 7 + Amistar 80 WG	14 day	4-6 leaves	27.75 a	39.75 a-d
13. Micro-rate program + Quad 7	11 day	4 leaves	28.00 a	41.00 abc
13. Amistar 80 WG	14 day	4-6 leaves		
14. Micro-rate program + Quad 7	7 day	2 leaves	29.75 a	43.75 ab
14. Amistar 80 WG	14 day	4-6 leaves		
15. Micro-rate program + Quad 7	0 day	cotyledon	31.50 a	46.50 a
15. Amistar 80 WG	14 day	4-6 leaves		
16. Amistar 80 WG + Quad 7	14 day	4-6 leaves	30.75 a	46.75 a
17. Amistar 80 WG	14 day	4-6 leaves	28.50 a	45.50 ab
17. Micro-rate program + Quad 7	17 day	6-8 leaves		
18. Amistar 80 WG	14 day	4-6 leaves	25.75 a	43.75 ab
18. Micro-rate program + Quad 7	21 day	8 leaf		
19. Amistar 80 WG	14 day	4-6 leaves	28.00 a	47.00 a
19. Micro-rate program + Quad 7	28 day	8-10 leaves		

[1] Micro-rate program consisted of a tank mix (product amount per acre) of Progress 1.8EC (0.36 pt) + Stinger 3SL (0.08 pt) + Upbeet 50DF (0.125 oz). The adjuvants Destiny was used at 1.5% v/v and Quad 7 at 1.0% v/v. Amistar was applied at 2.38 oz product/A.

[2] Treatment timing corresponded to days after initial application made at cotyledon stage (0 day, 3 June).

[3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, P=0.05).

Table 2. Effects of Amistar in a program with micro-herbicides and adjuvants on beet vigor (G.D. Franc and W.L. Stump, University of Wyoming; 2003).

Treatment and rate (product/A) [1]	Timing [2]	Beet Stage	Vigor (% of check)				
			23 June	26 June	3 July	8 July	16 July
1. Untreated check			100.0 a [3]	100.0 a	100.0 a	100.0 a	100.0 a
2. Micro-rate program + Destiny	14 day	4-6 leaves	95.0 ab	95.0 a	97.5 a	98.8 ab	100.0 a
3. Micro-rate program + Destiny + Amistar 80WG	14 day	4-6 leaves	62.5 e	65.0 c	66.3 d	71.3 e	81.3 b
4. Micro-rate program + Destiny 4. Amistar 80WG	11 day 14 day	4 leaves 4-6 leaves	97.5 ab	97.5 a	97.5 a	98.8 ab	100.0 a
5. Micro-rate program + Destiny 5. Amistar 80WG	7 day 14 day	2 leaves 4-6 leaves	97.5 ab	100.0 a	100.0 a	100.0 a	97.5 a
6. Micro-rate program + Destiny 6. Amistar 80WG	0 day 14 day	cotyledon 4-6 leaves	100.0 a	100.0 a	100.0 a	100.0 a	100.0 a
7. Amistar 80WG + Destiny	14 day	4-6 leaves	85.0 d	87.5 b	88.8 c	90.0 d	97.5 a
8. Amistar 80WG 8. Micro-rate program + Destiny	14 day 17 day	4-6 leaves 6-8 leaves	100.0 a	100.0 a	100.0 a	100.0 a	100.0 a
9. Amistar 80WG 9. Micro-rate program + Destiny	14 day 21 day	4-6 leaves 8 leaf	100.0 a	100.0 a	98.8 a	98.8 ab	100.0 a
10. Amistar 80WG 10. Micro-rate program + Destiny	14 day 28 day	4-6 leaves 8-10 leaves	97.5 ab	97.5 a	97.5 a	97.5 abc	98.8 a
11. Micro-rate program + Quad 7	14 day	4-6 leaves	87.5 cd	87.5 b	87.5 c	91.3 cd	97.5 a
12. Micro-rate program + Quad 7 + Amistar 80 WG	14 day	4-6 leaves	87.5 cd	87.5 b	91.3 bc	93.8 a-d	97.5 a
13. Micro-rate program + Quad 7 13. Amistar 80 WG	11 day 14 day	4 leaves 4-6 leaves	92.5 bc	95.0 a	96.3 ab	96.3 a-d	100.0 a
14. Micro-rate program + Quad 7 14. Amistar 80 WG	7 day 14 day	2 leaves 4-6 leaves	100.0 a	100.0 a	100.0 a	100.0 a	97.5 a
15. Micro-rate program + Quad 7 15. Amistar 80 WG	0 day 14 day	cotyledon 4-6 leaves	100.0 a	97.5 a	98.8 a	95.0 a-d	97.5 a
16. Amistar 80 WG + Quad 7	14 day	4-6 leaves	97.5 ab	97.5 a	100.0 a	100.0 a	97.5 a

Treatment and rate (product/A) [1]	Timing [2]	Beet Stage	Vigor (% of check)				
			23 June	26 June	3 July	8 July	16 July
17. Amistar 80 WG . . . . 17. Micro-rate program + Quad 7	14 day 17 day	4-6 leaves 6-8 leaves	100.0 a	100.0 a	100.0 a	100.0 a	100.0 a
18. Amistar 80 WG . . . . 18. Micro-rate program + Quad 7	14 day 21 day	4-6 leaves 8 leaf	97.5 ab	95.0 a	95.0 ab	92.5 bcd	96.3 a
19. Amistar 80 WG . . . . 19. Micro-rate program + Quad 7	14 day 28 day	4-6 leaves 8-10 leaves	100.0 a	100.0 a	100.0 a	96.3 a-d	96.3 a

[1] Micro-rate program consisted of a tank mix (product amount per acre) of Progress 1.8EC (0.36 pt) + Stinger 3SL (0.08 pt) + Upbeet 50DF (0.125 oz). The adjuvants Destiny was used at 1.5% v/v and Quad 7 at 1.0% v/v. Amistar was applied at 2.38 oz product/A.

[2] Treatment timing corresponded to days after initial application made at cotyledon stage (0 day, 3 June).

[3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, P=0.05).

Table 3. Effects of Amistar in a program with micro-herbicides and adjuvants on beet necrosis (G.D. Franc and W.L. Stump, University of Wyoming; 2003).

Treatment and rate (product/A) [1]	Timing [2]	Beet Stage	% Necrosis				
			23 June	26 June	3 July	8 July	16 July
1. Untreated check			0.0 d [3]	0.0 d	0.0 c	0.0 d	0.0 b
2. Micro-rate program + Destiny	14 day	4-6 leaves	1.0 cd	1.0 d	0.5 c	0.0 d	0.0 b
3. Micro-rate program + Destiny + Amistar 80WG	14 day	4-6 leaves	20.3 a	27.8 a	8.5 a	2.0 ab	0.0 b
4. Micro-rate program + Destiny 4. Amistar 80WG	11 day 14 day	4 leaves 4-6 leaves	0.0 d	0.0 d	0.0 c	0.0 d	0.0 b
5. Micro-rate program + Destiny 5. Amistar 80WG	7 day 14 day	2 leaves 4-6 leaves	0.0 d	0.0 d	0.5 c	0.0 d	0.0 b
6. Micro-rate program + Destiny 6. Amistar 80WG	0 day 14 day	cotyledon 4-6 leaves	0.0 d	0.0 d	0.0 c	0.0 d	0.0 b
7. Amistar 80WG + Destiny	14 day	4-6 leaves	17.0 a	12.0 b	4.8 b	1.5 bc	0.0 b
8. Amistar 80WG 8. Micro-rate program + Destiny	14 day 17 day	4-6 leaves 6-8 leaves	1.0 cd	1.5 d	0.5 c	0.5 cd	0.0 b
9. Amistar 80WG 9. Micro-rate program + Destiny	14 day 21 day	4-6 leaves 8 leaf	1.0 cd	1.0 d	0.0 c	0.0 d	0.0 b
10. Amistar 80WG 10. Micro-rate program + Destiny	14 day 28 day	4-6 leaves 8-10 leaves	0.5 cd	0.5 d	0.0 c	0.0 d	0.0 b
11. Micro-rate program + Quad 7	14 day	4-6 leaves	1.5 cd	1.5 d	0.5 c	1.5 bc	0.0 b
12. Micro-rate program + Quad 7 + Amistar 80 WG	14 day	4-6 leaves	4.8 b	4.8 d	3.0 b	1.0 bcd	0.0 b
13. Micro-rate program + Quad 7 13. Amistar 80 WG	11 day 14 day	4 leaves 4-6 leaves	1.5 cd	1.5 d	0.5 c	1.5 bc	0.0 b
14. Micro-rate program + Quad 7 14. Amistar 80 WG	7 day 14 day	2 leaves 4-6 leaves	2.0 bc	1.5 d	0.5 c	0.0 d	0.0 b
15. Micro-rate program + Quad 7 15. Amistar 80 WG	0 day 14 day	cotyledon 4-6 leaves	0.0 d	0.5 d	1.0 c	0.5 cd	0.0 b

Treatment and rate (product/A) [1]	Timing [2]	Beet Stage	% Necrosis				
			23 June	26 June	3 July	8 July	16 July
16. Amistar 80 WG + Quad 7	14 day	4-6 leaves	1.5 cd	1.0 d	1.0 c	1.0 bcd	0.0 b
17. Amistar 80 WG	14 day	4-6 leaves	0.5 cd	1.5 d	1.0 c	0.5 cd	0.0 b
17. Micro-rate program + Quad 7	17 day	6-8 leaves					
18. Amistar 80 WG	14 day	4-6 leaves	0.0 d	0.0 d	0.5 c	0.5 cd	0.0 b
18. Micro-rate program + Quad 7	21 day	8 leaf					
19. Amistar 80 WG	14 day	4-6 leaves	1.0 cd	1.5 d	0.0 c	4.0 a	2.0 a
19. Micro-rate program + Quad 7	28 day	8-10 leaves					

[1] Micro-rate program consisted of a tank mix (product amount per acre) of Progress 1.8EC (0.36 pt) + Stinger 3SL (0.08 pt) + Upbeet 50DF (0.125 oz). The adjuvants Destiny was used at 1.5% v/v and Quad 7 at 1.0% v/v. Amistar was applied at 2.38 oz product/A.

[2] Treatment timing corresponded to days after initial application made at cotyledon stage (0 day, 3 June).

[3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, P=0.05).

Table 4. Effects of Amistar in a program with micro-herbicides and adjuvants on beet root yield and quality (G.D. Franc and W.L. Stump, University of Wyoming; 2003).

Treatment and rate (product/A) [1]	Timing [2]	Beet Stage	Beet root yield and quality	
			Beet yield (tons/A)	% total sucrose
1. Untreated check			15.8 a [3]	11.7 a
2. Micro-rate program + Destiny	14 day	4-6 leaves	23.1 a	11.1 a
3. Micro-rate program + Destiny + Amistar 80WG	14 day	4-6 leaves	22.4 a	10.9 a
4. Micro-rate program + Destiny	11 day	4 leaves	22.9 a	11.2 a
4. Amistar 80WG	14 day	4-6 leaves		
5. Micro-rate program + Destiny	7 day	2 leaves	20.6 a	10.8 a
5. Amistar 80WG	14 day	4-6 leaves		
6. Micro-rate program + Destiny	0 day	cotyledon	20.0 a	11.0 a
6. Amistar 80WG	14 day	4-6 leaves		
7. Amistar 80WG + Destiny	14 day	4-6 leaves	20.9 a	10.7 a
8. Amistar 80WG	14 day	4-6 leaves	20.4 a	10.7 a
8. Micro-rate program + Destiny	17 day	6-8 leaves		
9. Amistar 80WG	14 day	4-6 leaves	20.7 a	10.9 a
9. Micro-rate program + Destiny	21 day	8 leaf		
10. Amistar 80WG	14 day	4-6 leaves	16.0 a	10.8 a
10. Micro-rate program + Destiny	28 day	8-10 leaves		
11. Micro-rate program + Quad 7	14 day	4-6 leaves	17.3 a	11.2 a
12. Micro-rate program + Quad 7 + Amistar 80 WG	14 day	4-6 leaves	20.3 a	10.4 a
13. Micro-rate program + Quad 7	11 day	4 leaves	22.0 a	12.8 a
13. Amistar 80 WG	14 day	4-6 leaves		
14. Micro-rate program + Quad 7	7 day	2 leaves	24.5 a	11.0 a
14. Amistar 80 WG	14 day	4-6 leaves		
15. Micro-rate program + Quad 7	0 day	cotyledon	19.8 a	11.2 a
15. Amistar 80 WG	14 day	4-6 leaves		
16. Amistar 80 WG + Quad 7	14 day	4-6 leaves	21.3 a	11.0 a
17. Amistar 80 WG	14 day	4-6 leaves	21.3 a	10.9 a
17. Micro-rate program + Quad 7	17 day	6-8 leaves		
18. Amistar 80 WG	14 day	4-6 leaves	19.1 a	10.6 a
18. Micro-rate program + Quad 7	21 day	8 leaf		
19. Amistar 80 WG	14 day	4-6 leaves	20.1 a	10.2 a
19. Micro-rate program + Quad 7	28 day	8-10 leaves		

[1] Micro-rate program consisted of a tank mix (product amount per acre) of Progress 1.8EC (0.36 pt) + Stinger 3SL (0.08 pt) + Upbeet 50DF (0.125 oz). The adjuvants Destiny was used at 1.5% v/v and Quad 7 at 1.0% v/v. Amistar was applied at 2.38 oz product/A.

[2] Treatment timing corresponded to days after initial application made at cotyledon stage (0 day, 3 June).

[3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, P=0.05).

Research Project	**Rhizoctonia Root and Crown Rot Management with Banded Fungicide Applications to Sugar Beet, 2003**
Research Team Tel: 307-766-2397 FAX: 307-766-5549 francg@uwyo.edu	G.D. Franc and W.L. Stump University of Wyoming College of Agriculture- Plant Sciences Dept 3354, 1000 E. University Ave. Laramie, WY 82071-3354
Field Plot Location	Torrington Research & Extension Center @ Torrington, WY. 4104 ft MSL; sandy loam soil; overhead irrigation.
Plot Design	RCBD with 4 replications; plots were 4 rows (30-in row centers) X 20 ft; 5 ft in-row buffer. Inoculations and fungicide treatments were made to, and all data were collected from, the center two rows of each plot.
Plot Management	**Planting Date**: 17 April **Variety**: Monohikari **Fertilizer**: 180 lb N + 50 lb P_2O_5 **Herbicide**: Post-emergence applications of Betamix + Upbeet (24 fl oz + 0.5 oz product/A) on 14 May and Progress + Stinger (21 fl oz + 2.0 oz product/A) on 23 May.
Disease Development	Immediately following the first fungicide applications on 12 June, inoculum (0.25 tsp = 0.8 g) was applied to the crown of each plant in the two center rows of each plot. Plants were in the 8-14 leaf growth stage when inoculated. Immediately after inoculation, plots were cultivated then watered with 0.67 inch of water and once again on 13 June with 0.67 inch to favor infection. Inoculum used in 2003 was prepared at the USDA lab in Ft. Collins, CO using cultures of *Rhizoctonia solani* AG2-2 grown on grain.
Treatment Applications	Fungicide (7-inch band) applications were made on 12 June (immediately prior to inoculation), and/or on 26 June (2 weeks later), depending on individual treatment protocols. Beets were in the 8-14 leaf-stage on 12 June and the 10-16 leaf-stage on 26 June. Fungicide was applied with the aid of a backpack sprayer in a total spray volume of 1.06 gal/1000 ft at 50 psi boom pressure. The boom was equipped with a single #8002 flat fan nozzle.

Disease Ratings Because beet stands were variable in the plot area, initial stand counts were determined on 10 June. Rhizoctonia crown rot **incidence** was then expressed as a percentage of the initial stand to standardize disease ratings. Rhizoctonia crown rot **incidence** was rated for both center rows (2 x 20 ft) on 23, 26 June, 8, 16, 23, 30 July, and 13 August. Infected beets were those that had rapidly wilting leaves, darkened petioles and/or decayed crowns evident with necrotic leaves present. Because extensive decay of some plants resulted in their disappearance before harvest, only healthy-appearing plants were counted on the last two disease rating dates. This number was subtracted from the 10 June stand counts to determine calculate disease incidence. An Area Under the Disease Progress Curve (AUDPC) was calculated for disease incidence data from 23 June through 13 August. At harvest, a final harvestable beet count was determined. Harvestable beets were those roots with less than 50% volume lost to rot. On harvested roots contributing to total yields, both Rhizoctonia **severity** and **incidence** were rated. Disease severity was determined by visually estimating the surface area of beet root affected by decay while disease incidence was the percentage of roots with any visible amount of decay.

Harvest The two treated rows by 20 ft were hand dug on 3 October and total root yields were determined. The percentage of total sucrose was determined by Western Sugar's laboratory.

Statistical Analysis ANOVA with four replications. Mean separations were done using Fisher's protected LSD ($\underline{P} \leq 0.05$). To compare the effects of Topsin tank mixes linear contrasts were made ($\underline{P} \leq 0.05$). Because of severe disease the untreated check plots had no beets available for disease and sucrose evaluation at harvest. Therefore, the untreated check was removed prior to statistical analysis of disease incidence, disease severity and the percentage of total sucrose at harvest.

Results and Discussion

The 10 June stand counts revealed that treatment plant populations were not significantly different among treatments (Table 1, $\underline{P}=0.05$). Rhizoctonia root and crown rot (RRCR) quickly developed after inoculation and symptoms were visible in the plots by late June. The first RRCR symptoms observed in the plots were rapidly wilting leaves with darkened petioles. Most plants in the untreated inoculated check plots were dead by early July, indicating severe disease development in 2003 and a rigorous test of fungicide efficacy. The untreated noninoculated check (treatment 2) showed high rates of RRCR incidence by late summer, thus, indicating high natural disease pressure later in the season.

Fungicide treatment effects on RRCR incidence during the growing season are summarized in Table 1. By 23 June, all fungicide treatments significantly suppressed RRCR development ($\underline{P} \leq 0.05$). As RRCR development continued, differences among treatments became more evident. Headline treatments generally had greater disease incidence than did Amistar and Quadris treatments. The single half-rate Quadris application at inoculation (treatment 5) was not as effective by 30 July as the Quadris quarter-rate application made at inoculation plus 2 weeks later (treatment 7: $\underline{P} \leq 0.05$). Additionally, AUDPC values reveal treatments with Quadris quarter-rate applications made at inoculation plus 2 weeks later provide season-long disease suppression equivalent to that of either Amistar or Quadris half-rate split application treatments ($\underline{P}$=0.05). The addition of Topsin M reduced disease incidence compared to comparable Quadris alone treatments on 8 and 23 July ratings (linear contrast, $\underline{P} \leq 0.05$). However, later in the season there was no additive effect and the overall AUDPC was not different from the comparable Quadris-alone treatments (linear contrast, $\underline{P}$=0.05)

Final beet root counts, yield and quality are shown in Table 2. Late season RRCR pressure, as illustrated by disease incidence in the untreated noninoculated check, also probably reduced yields in fungicide-treated plots. The Amistar split application resulted in greater beet numbers and beet root yield compared to the comparable Quadris split application treatment ($\underline{P} \leq 0.05$). Headline treatments lost effectiveness by early July and resulted in poor yields not differing from the untreated inoculated check ($\underline{P}$=0.05). Disease incidence and severity was similar for harvested roots, regardless of treatment ($\underline{P}$=0.05). Treatments also had no effect on total sugar ($\underline{P}$=0.05).

Amistar/Quadris applied as a split application at inoculation plus two weeks later provided the most effective early season suppression of RRCR. Quadris efficacy was more dependant on timing than rate, as quarter rate split applications were superior to half rate single applications. Data for Amistar, a new formulation of azoxystrobin, revealed generally improved disease suppression and yields when compared to Quadris. Therefore, based on the conditions encountered during this study, sugarbeet growers can expect the Amistar formulation to perform at least as well, if not better than, the Quadris formulation they used in the past.

Table 1. Effects of banded fungicide applications on Rhizoctonia root and crown rot management (G.D. Franc and W.L. Stump, University of Wyoming; 2003).

Treatment and rate (oz ai per 1000 ft row)	Timing [1]	Beet counts (40 row ft) 10 Jun	Crown rot disease incidence as a percentage of 10 June stand							AUDPC [3]
			23 Jun	26 Jun	8 Jul	16 Jul	23 Jul	30 Jul	13 Aug	
1. Untreated inoculated check	NA	56.0 a	27.5 a [2]	37.4 a	99.6 a	99.6 a	100.0 a	100.0 a	100.0 a	4514.7 a
2. Untreated noninoculated check .	NA	47.0 a	0.6 b	0.6 b	1.6 d	3.6 e	8.3 e	28.0 de	41.1de	709.1 ef
3. Amistar 80WP (0.075)	@ inoculation	53.0 a	0.0 b	0.0 b	0.0 d	2.7 e	6.6 e	8.4 e	25.4 e	332.1 f
3. Amistar 80 WP (0.075)	2 weeks later									
4. Quadris 2.08SC (0.075)	@ inoculation	47.3 a	0.0 b	0.0 b	3.7 cd	7.5 e	18.7 e	26.6 de	37.2 de	763.4 ef
4. Quadris 2.08SC (0.075)	2 weeks later									
5. Quadris 2.08SC (0.075)	@ inoculation	50.8 a	0.0 b	0.5 b	9.3 c	24.6 cd	39.6 cd	54.6 bc	69.1 bc	1615.1 cd
6. Quadris 2.08SC (0.075) + Topsin M 70WP (0.364)	@ inoculation	45.5 a	0.0 b	0.0 b	0.6 d	6.3 e	18.7 e	40.4 cd	53.4 cd	981.8 de
7. Quadris 2.08SC (0.0375)	@ inoculation	46.0 a	0.0 b	0.0 b	6.0 cd	14.0 de	24.5 de	29.0 de	41.1 de	928.3 ef
7. Quadris 2.08SC (0.0375)	2 weeks later									
8. Quadris 2.08SC (0.0375) + Topsin M 70WP (0.182)	@ inoculation	53.0 a	0.0 b	0.0 b	0.0 d	10.8 de	17.7 e	29.6 d	41.9 de	809.3 ef
8. Quadris 2.08SC (0.0375) + Topsin M 70WP (0.182)	2 weeks later									
9. Headline 2.08EC (0.064)	@ inoculation	48.3 a	0.0 b	0.6 b	19.6 b	34.8 bc	45.9 bc	68.4 b	74.6 b	2022.3 bc
9. Headline 2.08EC (0.064)	2 weeks later									
10 Headline 2.08EC (0.086)	@ inoculation	51.5 a	0.0 b	0.5 b	25.0 b	49.9 b	62.9 b	74.3 b	82.3 ab	2424.3 b
10. Headline 2.08EC (0.086)	2 weeks later									

1 All applications were made in a 7-inch banded spray in 1.06 gal/1000ft @ 50 psi boom pressure. Plants in the two center rows of each treatment plot were inoculated with *Rhizoctonia solani* AG2-2 on 12 June, 2003 (8-14 leaf stage) immediately after the first fungicide application. NA= not applicable.

2 Treatment means followed by different letters differ significantly (Fisher's protected LSD, P=0.05).

3 Area under the disease progress curve.

Table 2. Effects of banded fungicide applications for Rhizoctonia root and crown rot management on final beet root numbers, root yield, quality and beet disease present at harvest (G.D. Franc and W.L. Stump, University of Wyoming; 2003).

Treatment and rate (oz ai per 1000 ft row)	Timing [1]	Beet root numbers 3 Oct	Beet root yield and quality		Disease incidence (%) and disease severity at harvest on 3 Oct [2]	
			% total sucrose [2]	Beet yield (tons/A)	Symptomatic beets (%)	Surface area of root decayed (%)
1. Untreated inoculated check	NA	0.0 d	NA	0.0 e	NA	NA
2. Untreated noninoculated check ..	NA	25.8 b	16.6 a	9.9 bcd	1.7 a	1.0 a
3. Amistar 80WP (0.075) .... 3. Amistar 80 WP (0.075)	@ inoculation 2 weeks later	39.3 a	15.6 a	18.4 a	16.4 a	8.5 a
4. Quadris 2.08SC (0.075) .... 4. Quadris 2.08SC (0.075)	@ inoculation 2 weeks later	20.5 bc	15.1 a	11.4 bc	14.6 a	4.0 a
5. Quadris 2.08SC (0.075)	@ inoculation	11.5 cd	15.3 a	5.3 cde	17.5 a	4.7 a
6. Quadris 2.08SC (0.075) + Topsin M 70WP (0.364)	@ inoculation	20.3 bc	14.6 a	10.1 bcd	19.7 a	7.5 a
7. Quadris 2.08SC (0.0375) .... 7. Quadris 2.08SC (0.0375)	@ inoculation 2 weeks later	22.0 bc	15.5 a	14.0 ab	8.2 a	2.0 a
8. Quadris 2.08SC (0.0375) + Topsin M 70WP (0.182) .... 8. Quadris 2.08SC (0.0375) + Topsin M 70WP (0.182)	@ inoculation 2 weeks later	26.3 ab	16.2 a	12.6 ab	13.0 a	4.7 a
9. Headline 2.08EC (0.064) .... 9. Headline 2.08EC (0.064)	@ inoculation 2 weeks later	9.5 cd	16.1 a	4.5 de	18.8 a	7.5 a
10 Headline 2.08EC (0.086) .... 10. Headline 2.08EC (0.086)	@ inoculation 2 weeks later	5.0 d	15.2 a	2.0 e	38.7 a	8.5 a

[1] All applications were made in a 7-inch banded spray in 1.06 gal/1000ft @ 50 psi boom pressure. Plants in the two center rows of each treatment plot were inoculated with *Rhizoctonia solani* AG2-2 on 12 June, 2003 (8-14 leaf stage) immediately after the first fungicide application. NA= not applicable.

[2] Because of severe disease the untreated check plots had no beet roots available for evaluation at harvest. Therefore, the untreated check was not included in statistical analysis. Yield data were analyzed since loss of a replicate due to disease indicated a yield of "0" and, therefore, was not a missing data point. NA= not applicable.

[3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, P=0.05).

Research Project	**Cercospora Leaf Spot Management in Sugar Beet, 2003**
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Field Plot Location	Torrington Research & Extension Center @ Torrington, WY. 4104 ft MSL; sandy loam soil; overhead irrigation
Plot Design	RCBD with 4 replications; plots were 4 rows (30-in row centers) X 20 ft; 5 ft in-row buffer. Fungicide treatments were made to, and all data were collected from, the center two rows of each plot.
Plot Management	**Planting Date**: 16 April, 2003. **Variety**: Beta 4546 **Fertilizer**: 180 lb N + 50 lb P_2O_5 **Herbicide**: Post-emergence applications of Progress + Upbeet (21 fl oz + 0.5 oz product/A) on 7 May, Progress + Stinger (24 fl oz + 2 fl oz product/A) on 14 May, and Progress + Select (24 fl oz + 8 fl oz product/A) on 23 May.
Disease Development	Scattered Cercospora lesions were first noted on 30 July and resulted from natural inoculum. Plot inoculation was not necessary for disease development. Powdery mildew was present near the end of the growing season.
Treatment Applications	Foliar fungicide applications indicated as A, B, and C in the tables were made on 31 July, and 14, 28 August. Fungicides were applied with the aid of a portable (CO_2) sprayer in a total volume of 43 gal/A at 30 psi boom pressure (four #8004 flat fan nozzles spaced at 20 inches). Phytotoxicity was not observed in the plots.
Disease Ratings	**Cercospora leaf spot** severity was determined on 30 July, 5, 13, 20, 27 August, and 4, 11, 18 September. The lesions present on five leaves per plot were counted and the averages calculated.
Harvest	One 20-ft row of the two treated rows was harvested 2 October and the total root yield was determined. The percentage of total sucrose was determined by Western Sugar's laboratory.
Statistical Analysis	ANOVA with four replications. Treatment mean separations were done using Fisher's protected LSD ($\underline{P} \leq 0.05$).

Results and Discussion

Cercospora leaf spot (CLS) development was light to moderate in 2003. Disease development resulted from naturally occurring inoculum. Due to the presence of natural inoculum in the field, additional inoculations were not done. Powdery mildew was not evident in the field plots until September and was found mostly at the edges of the field. Therefore, powdery mildew was not rated and was expected to have no measurable effect on plant performance.

CLS disease severity data collected early in the epidemic, from 5 to 27 August, revealed no significant differences among treatment means compared to the nontreated check (Table 1, P=0.05). By 4 September and throughout the remainder of the growing season, all fungicide programs significantly suppressed CLS lesion development compared to the nontreated check ($P \leq 0.05$). A comparison of AUDPC values revealed that all fungicide programs were statistically equivalent (P=0.05). The AUDPC values for fungicide programs ranged from 23.23 to 95. 36 (average = 51.22) compared to an AUDPC of 555.21 for the nontreated check. Therefore, average season-long CLS development in fungicide treated plots was 9% of the disease that developed in the nontreated check (91% disease suppression via fungicide treatment).

Treatment effects on sugar beet yield were not significant (Table 2, P=0.05). However, trends revealed that all fungicide treatments had greater root yields compared to the nontreated check. There was a significant treatment effect on total sugar ($P \leq 0.05$). However, this effect was not correlated with CLS disease suppression and is unexplained.

Table 1. Cercospora leaf spot (CLS) management with foliar fungicide programs (G.D. Franc and W.L. Stump, University of Wyoming; 2003)

Treatment and application rate (oz a.i./acre)	Application dates [1]	Number of Cercospora lesions per leaf							CLS AUDPC [2]
		5 Aug	13 Aug	20 Aug	27 Aug	4 Sep	11 Sep	18 Sep	
1. Untreated check	NA	0.60 a	2.65 a	1.45 a	1.20 a	21.55 a	37.10 a	25.25 a	555.21 a
2. Gem 25WG (1.6)	A, C	0.60 a	0.80 a	1.35 a	0.55 a	0.45 b	0.75 b	0.70 b	37.13 b
2. Eminent 125SL (1.7)	B								
3. Eminent 125SL (1.7)	A, C	0.45 a	1.35 a	0.50 a	0.45 a	0.25 b	0.60 b	0.45 b	30.08 b
3. Gem 25WG (1.6)	B								
4. Gem 25WG (1.6)	A, C	1.35 a	1.45 a	0.45 a	0.05 a	1.95 b	3.05 b	0.95 b	65.43 b
4. Super Tin 80WP (3.2)	B								
5. Eminent 125SL (1.7)	A, C	0.75 a	1.30 a	1.05 a	3.15 a	0.40 b	5.30 b	2.00 b	95.36 b
5. USF2004 4.17SC (1.6)	B								
6. Headline 2.08EC (2.4)	A	0.80 a	0.95 a	1.15 a	0.80 a	0.60 b	2.80 b	0.85 b	56.13 b
6. Eminent 125SL (1.7)	B								
6. Super Tin 80WP (4.0)	C								
7. Eminent 125SL (1.7)	A	1.00 a	1.10 a	0.35 a	0.25 a	1.00 b	0.60 b	0.60 b	35.66 b
7. Headline 2.08EC (2.4)	B								
7. Super Tin 80WP (4.0)	C								
8. Headline 2.08EC (2.4) + Destiny (0.5 % v/v)	A	0.80 a	0.80 a	0.95 a	0.55 a	0.40 b	0.15 b	0.25 b	29.58 b
8. Eminent 125SL (1.7)	B								
8. Super Tin 80WP (4.0)	C								
9. Super Tin 80WP (4.0)	A-C	1.05 a	0.80 a	0.45 a	0.15 a	0.55 b	1.70 b	0.30 b	36.98 b
10. Topsin M 70WP (5.6) + Penncozeb 75DF (24.0)	A	1.00 a	0.85 a	0.85 a	1.80 a	1.85 b	4.70 b	0.90 b	85.03 b
10. Super Tin 80WP (4.0)	B								
10. Headline 2.08EC (2.4)	C								
11. Topsin M 70WP (4.3) + Super Tin 80WP (3.0)	A	0.30 a	0.60 a	0.35 a	0.30 a	0.40 b	0.35 b	1.20 b	23.23 b
11. Headline 2.08EC (2.4)	B								
11. Eminent 125SL (1.7)	C								
12. Eminent 125SL (1.7)	A, C	1.10 a	1.45 a	1.25 a	0.50 a	3.00 b	1.15 b	1.40 b	68.81 b
12. Headline 2.08EC (2.4)	B								

[1] Application dates: A=30 Jul, B=14 Aug, C=28 Aug. NA= not applicable.

[2] Area under the disease progress curve for lesion count data collected from 30 Jul to 18 Sep.

[3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, P=0.05).

Table 2. The effect of foliar fungicide programs on beet root yield and the percentage of sucrose present in roots (G.D. Franc and W.L. Stump, University of Wyoming; 2003).

Treatment and application rate (a.i./acre)	Application dates [1]	Beet root yield and quality	
		Beet yield (tons/A)	% total sucrose
1. Untreated check	NA	21.5 a [2]	17.73 a
2. Gem 25WG (1.6)	A, C	28.4 a	17.17abc
2. Eminent 125SL (1.7)	B		
3. Eminent 125SL (1.7)	A, C	32.2 a	16.81 abc
3. Gem 25WG (1.6)	B		
4. Gem 25WG (1.6)	A, C	28.3 a	16.55 bcd
4. Super Tin 80WP (3.2)	B		
5. Eminent 125SL (1.7)	A, C	29.4 a	17.20 abc
5. USF2004 4.17SC (1.6)	B		
6. Headline 2.08EC (2.4)	A	30.9 a	17.24 ab
6. Eminent 125SL (1.7)	B		
6. Super Tin 80WP (4.0)	C		
7. Eminent 125SL (1.7)	A	29.1 a	17.17 abc
7. Headline 2.08EC (2.4)	B		
7. Super Tin 80WP (4.0)	C		
8. Headline 2.08EC (2.4) + Destiny (0.5 % v/v)	A	27.3 a	17.07 abc
8. Eminent 125SL (1.7)	B		
8. Super Tin 80WP (4.0)	C		
9. Super Tin 80WP (4.0)	A-C	29.0 a	16.94 abc
10. Topsin M 70WP (5.6) + Penncozeb 75DF (24.0)	A	30.4 a	17.01 abc
10. Super Tin 80WP (4.0)	B		
10. Headline 2.08EC (2.4)	C		
11. Topsin M 70WP (4.3) + Super Tin 80WP (3.0)	A	26.4 a	16.17 cd
11. Headline 2.08EC (2.4)	B		
11. Eminent 125SL (1.7)	C		
12. Eminent 125SL (1.7)	A, C	27.1 a	15.6 d
12. Headline 2.08EC (2.4)	B		

[1] Application dates: A=30 Jul, B=14 Aug, C=28 Aug. NA= not applicable.
[2] Treatment means followed by different letters differ significantly (Fisher's protected LSD, P=0.05).

Research Project	**Interaction of Potato Seed Age and Seed Piece Treatments, 2003**
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Field Plot Location	Torrington Research & Extension Center @ Torrington, WY. 4104 ft MSL; sandy loam soil; overhead irrigation.
Plot Design	RCBD with 4 replications; plots were 4 rows (36-in row centers) X 20 ft; 5 ft in-row buffer. All treatments were made to, and all data were collected from, the center two rows.
Plot Management	**Planting Date**: 27 May **Variety**: Russet Burbank **Fertilizer**: 150 lb N + 50 lb P_2O_5 on 6 May **Herbicide**: Eptam + Prowl (3 pt + 1.5 pt product) PRE on 22 May.
Seed Age Establishment	Seed (cv. Russet Burbank) from one source was taken from storage on 9 April then stored under the following criteria: **Young** seed was stored at 38F° for 6 weeks, **Optimum** seed was stored 3 weeks at 38F° then 3 weeks at 50F°, **Old** seed was stored 6 weeks at 50F°.
Treatment Applications	On 23 May all seed was removed from storage and cut into 1.5-2 oz size. Cut seed was divided into 25 lb lots and placed into plastic bags for each treatment. Treatments were applied in a volume of 113 ml (1% of seed weight) with a hand pump spray bottle. Bags were rolled several times during application to ensure uniform wetting. Tops MZ (treatment 5) was applied after liquid application. Seed was stored at 50F° until planting.
Treatment Ratings	Emergence counts and phytotoxicity evaluations were made on 3, 10, 16, 19, 23, and 26 June, and 3 July for 2 rows by 20 ft. Emergence progress curves were calculated. On 16 July, the number of stems were determined from 5 hills systematically selected from the plots. Plant vigor ratings (directly compared to the optimum seed subplot within the main plot) were made on 16 July and 13 August.
Harvest	Two rows X 10 ft were dug with a one-row mechanical digger on 15 September. Tubers were sorted and weighed to determine yield and quality on 22 September.
Statistical Analysis	ANOVA with four replications. Main effect separations were done using Fisher's protected LSD ($\underline{P} \leq 0.05$), individual means by LS means (shown in appendix 1, $\underline{P} \leq 0.05$).

Results and Discussion

The main effects of seed piece treatments on three physiologically aged lots on emergence are shown in Table 1. Seed piece treatments had no effect on plant emergence for individual dates and for the area under the emergence progress curve (AUEPC). As expected, young seed on average had lower seed emergence on 16 and 19 June, and a lower AUEPC value than the optimum and old aged seed on average ($\underline{P} \leq 0.05$). Young seed should emerge more slowly because it was stored at cold temperatures until shortly before planting. As shown in Table 2, there were significant treatment by seed age interactions for 16 and 19 June emergence ($\underline{P} \leq 0.05$) as well as the overall AUEPC ($\underline{P} \leq 0.10$). Least square mean tables are included in the appendices for individual treatment comparisons of interest.

There were no phytotoxic effects observed in the plants over the course of the experiment (Tables 3, $\underline{P}$=0.05). All plants appeared visually normal during the course of the study.

Main effects of seed piece treatments on stem numbers and vigor for the three physiologically aged lots are shown in Table 4, with individual means shown in Table 5. There were no significant effects on stem number or plant vigor. There was a trend in the data for increased stems as seed age increased. Increased seed age will tend to result in increased stem numbers due to reduced apical dominance.

Treatment effects on tuber yield and quality are shown in Tables 6 and 7. There were both significant treatment and seed age main effects on the yield of grade B tubers ($\underline{P} \leq 0.05$). Younger seed had significantly less B size tubers than other treatments ($\underline{P} \leq 0.05$). The reduced yield of B size tubers and trend towards increased yield of US#1 tubers, is consistent with reduced stem numbers. There were no significant interaction effects (Table 7, $\underline{P}$=0.05).

Table 1. Effects of seed piece treatment on emergence of three physiologically aged seed lots, main effects (G.D. Franc and W.L. Stump, U of WY; 2003).

Seed piece treatment (grams ai/100K seed)	Plant counts per 40 row ft						AUEPC [1]
	10 Jun	16 Jun	19 Jun	23 Jun	26 Jun	3 July	
1. Untreated check	0.2 a [2]	10.9 a	29.0 a	35.3 a	36.3 a	36.6 a	584.2 a
2. Maxim 4 FS (1.25)	0.1 a	12.1 a	31.1 a	36.3 a	36.4 a	35.9 a	598.7 a
3. Maxim 4 FS + Cruiser 5 FS (1.25 + 5.0)	0.1 a	9.4 a	26.8 a	35.8 a	36.3 a	36.1 a	568.9 a
4. Maxim 4 FS + Cruiser 5 FS (1.25 + 4.5)	0.2 a	9.9 a	28.1 a	35.8 a	37.4 a	36.3 a	582.5 a
5. Tops MZ 8.5 DS + Genesis 2 SC (63.7 + 9.4) .	0.0 a	7.8 a	28.8 a	35.9 a	36.6 a	36.8 a	573.3 a
Physiological seed age							
Young	0.1 A [3]	4.6 B	23.7 B	35.0 A	36.2 A	36.3 A	533.7 B
Optimum	0.1 A	13.1 A	31.8 A	36.7 A	37.2 A	36.5 A	612.0 A
Old	0.2 A	12.5 A	30.9 A	35.8 A	36.5 A	36.2 A	598.9 A

[1] Area under the emergence progress curve, both speed and total emergence contribute to the number.

[2, 3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $\underline{P} \leq 0.05$).

Table 2. Effects of seed piece treatment on emergence of three physiologically aged seed lots, individual means (G.D. Franc and W.L. Stump, U of WY; 2003).

Seed piece treatment (grams ai/100K seed)	Physiological seed age	Plant counts per 40 row ft [1]						AUEPC [2]
		10 Jun	16 Jun	19 Jun	23 Jun	26 Jun	3 July	
1. Untreated check	Young	0.0	5.5	24.5	34.3	36.3	36.5	539.4
	Optimum	0.0	15.5	34.8	37.0	37.0	36.3	632.8
	Old	0.5	11.8	27.8	34.5	35.8	37.0	580.5
2. Maxim 4FS (1.25)	Young	0.0	7.8	28.0	35.0	36.5	36.3	564.8
	Optimum	0.0	16.3	32.8	37.3	37.0	36.3	630.0
	Old	0.3	12.3	32.8	36.8	35.8	35.3	601.3
3. Maxim 4FS + Cruiser 5FS (1.25 + 5.0)	Young	0.0	2.5	21.0	34.8	35.5	35.8	509.0
	Optimum	0.3	13.0	31.3	36.3	37.3	36.3	608.6
	Old	0.0	12.8	28.0	36.3	36.0	36.3	589.1
4. Maxim 4FS + Cruiser 5FS (1.25 + 4.5)	Young	0.3	5.3	24.3	36.0	37.0	36.0	546.3
	Optimum	0.0	12.3	29.5	36.3	38.0	37.3	605.6
	Old	0.3	12.3	30.5	35.0	37.3	35.5	595.6
5. Tops MZ 8.5DS + Genesis 2SC (63.7 + 9.4)	Young	0.0	1.8	20.8	34.8	35.5	37.0	509.1
	Optimum	0.0	8.3	30.5	36.8	36.5	36.5	582.8
	Old	0.0	13.3	35.3	36.3	37.8	37.0	628.1
Significance of seed treatment by seed age interaction, *= $P \leq 0.05$, **= $P \leq 0.10$		NS	S*	S*	NS	NS	NS	S**

[1] Individual mean comparisons for significant treatment by age interactions can be made in the least square mean tables found in the appendix 1.

Table 3. Effects of seed piece treatment on phytotoxicity of three physiologically aged seed lots, main effects (G.D. Franc and W.L. Stump, U of WY; 2003).

Seed piece treatment (grams ai/100K seed)	Ave. plant phytotoxicity per 40 row ft, 0= none					
	10 Jun	16 Jun	19 Jun	23 Jun	26 Jun	3 July
1. Untreated check	0 a [1]	0 a	0 a	0 a	0 a	0 a
2. Maxim 4 FS (1.25)	0 a	0 a	0 a	0 a	0 a	0 a
3. Maxim 4 FS + Cruiser 5 FS (1.25 + 5.0)	0 a	0 a	0 a	0 a	0 a	0 a
4. Maxim 4 FS + Cruiser 5 FS (1.25 + 4.5)	0 a	0 a	0 a	0 a	0 a	0 a
5. Tops MZ 8.5 DS + Genesis 2 SC (63.7 + 9.4)	0 a	0 a	0 a	0 a	0 a	0 a
Physiological seed age						
Young	0 A [2]	0 A	0 A	0 A	0 A	0 A
Optimum	0 A	0 A	0 A	0 A	0 A	0 A
Old	0 A	0 A	0 A	0 A	0 A	0 A

[1, 2] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $\underline{P} \leq 0.05$).

Table 4. Effects of seed piece treatment on stem number and vigor of three physiologically aged seed lots, main effects (G.D. Franc and W.L. Stump, U of WY; 2003).

Seed piece treatment (grams ai/100K seed)	Stem number	Plant vigor, optimum seed= 5 [1]	
	16 Jul	16 Jul	13 Aug
1. Untreated check	3.5 a [2]	4.6 a	5.0 a
2. Maxim 4 FS (1.25)	3.8 a	4.8 a	5.2 a
3. Maxim 4 FS + Cruiser 5 FS (1.25 + 5.0)	3.9 a	4.6 a	5.0 a
4. Maxim 4 FS + Cruiser 5 FS (1.25 + 4.5)	3.8 a	5.1 a	5.2 a
5. Tops MZ 8.5 DS + Genesis 2 SC (63.7 + 9.4)	3.5 a	5.0 a	4.8 a
Physiological seed age			
Young	3.5 A [3]	4.4 A	5.2 A
Optimum	3.7 A	5.0 A	5.0 A
Old	3.9 A	5.0 A	4.9 A

[1] Plant vigor rating based on comparison to optimum seed =5, rating takes in consideration plant appearance and size.

[2, 3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $\underline{P} \leq 0.05$).

Table 5. Effects of seed piece treatment on stem number and vigor of three physiologically aged seed lots, individual means (G.D. Franc and W.L. Stump, U of WY; 2003).

Seed piece treatment (grams ai/100K seed)	Physiological seed age	Stem number	Plant vigor, optimum seed= 5 [1]	
		16 Jul	16 Jul	13 Aug
1. Untreated check	Young	3.3 [2]	4.0	5.3
	Optimum	3.5	5.0	5.0
	Old	3.7	4.8	4.8
2. Maxim 4FS (1.25)	Young	3.7	4.3	5.5
	Optimum	3.6	5.0	5.0
	Old	4.2	5.0	5.0
3. Maxim 4FS + Cruiser 5FS (1.25 + 5.0)	Young	4.2	4.0	5.0
	Optimum	3.6	5.0	5.0
	Old	3.9	4.8	5.0
4. Maxim 4FS + Cruiser 5FS (1.25 + 4.5)	Young	3.7	5.0	5.3
	Optimum	3.8	5.0	5.0
	Old	4.0	5.3	5.3
5. Tops MZ 8.5DS + Genesis 2SC (63.7 + 9.4)	Young	3.0	4.8	4.8
	Optimum	4.0	5.0	5.0
	Old	3.6	5.3	4.5
Significance of seed treatment by seed age interaction, *= $P \leq 0.05$, **= $P \leq 0.10$		NS	NS	NS

1 Plant vigor rating based on comparison to optimum seed =5, rating takes in consideration plant appearance and size.

2 Individual mean comparisons for significant treatment by age interactions can be made in the least square mean tables found in appendix 1.

Table 6. Effects of seed piece treatment on yield and quality of three physiologically aged seed lots, main effects (G.D. Franc and W.L. Stump, U of WY; 2003).

Seed piece treatment (grams ai/100K seed)	Yield cwt/A						
	US1>10 oz	US1<10 oz	US1 total	US2	Grade B	Cull	Total
1. Untreated check	0.6 a	155.4 a	156.0 a	7.4 a	39.0 ab	9.7 a	212.0 a
2. Maxim 4 FS (1.25)	1.6 a	163.4 a	165.0 a	5.5 a	43.4 a	9.8 a	223.7 a
3. Maxim 4 FS + Cruiser 5 FS (1.25 + 5.0)	2.7 a	192.3 a	195.0 a	4.4 a	32.9 bc	10.1 a	242.3 a
4. Maxim 4 FS + Cruiser 5 FS (1.25 + 4.5)	2.8 a	203.8 a	206.6 a	8.6 a	36.4 ab	11.7 a	263.3 a
5. Tops MZ 8.5 DS + Genesis 2 SC (63.7 + 9.4)	2.7 a	195.7 a	198.4 a	9.8 a	28.5 c	15.2 a	252.0 a
Physiological seed age							
Young	3.0 A	187.9 A	190.9 A	6.2 A	29.6 B	13.2 A	240.0 A
Optimum	1.6 A	177.3 A	178.9 A	7.0 A	39.7 A	9.8 A	235 5 A
Old	1.6 A	181.1 A	182.7 A	8.1 A	38.8 A	10.8 A	240.5 A

[1, 2] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $\underline{P}\leq 0.05$).

Table 7. Effects of seed piece treatment on yield and quality of three physiologically aged seed lots, individual means (G.D. Franc and W.L. Stump, U of WY; 2003).

Seed piece treatment (grams ai/100K seed)	Physiological seed age	Yield cwt/A [1]						
		US1>10 oz	US1<10 oz	US1 total	US2	Grade B	Cull	Total
1. Untreated check	Young	1.9	183.7	185.6	6.6	30.8	9.3	232.3
	Optimum	0.0	136.3	136.3	5.0	43.4	11.5	196.2
	Old	0.0	146.1	146.1	10.4	42.8	8.2	207.5
2. Maxim 4FS (1.25)	Young	4.7	182.9	187.6	4.2	33.4	13.6	238.8
	Optimum	0.0	159.7	159.7	6.5	45.9	7.3	219.4
	Old	0.0	147.6	147.6	5.7	51.0	8.5	212.8
3. Maxim 4FS + Cruiser 5FS (1.25 + 5.0)	Young	2.3	172.8	175.1	4.4	27.2	10.3	217.0
	Optimum	1.9	201.1	203.0	5.8	34.8	8.4	252.9
	Old	3.9	202.9	206.8	3.1	36.5	11.5	257.9
4. Maxim 4FS + Cruiser 5FS (1.25 + 4.5)	Young	4.1	206.5	210.6	8.5	33.2	7.8	260.2
	Optimum	2.3	204.7	207.0	7.2	43.0	9.3	266.5
	Old	2.0	200.2	202.2	10.1	33.0	17.9	263.2
5. Tops MZ 8.5DS + Genesis 2SC (63.7 + 9.4)	Young	2.0	193.8	195.8	7.4	23.4	25.1	251.7
	Optimum	4.0	184.6	188.6	10.7	31.1	12.6	243.0
	Old	2.2	208.7	210.9	11.3	30.9	8.0	261.1
Significance of seed treatment by seed age interaction, *= $P \leq 0.05$, **= $P \leq 0.10$		NS	NS	NS	NS	NS	NS	NS

[1] Individual mean comparisons for significant treatment by age interactions can be made in the least square mean tables found in appendix 1.

Appendix 1. Effects of seed piece treatment on emergence of three physiologically aged seed lots, LSMeans tables for significant treatment x age interactions (G.D. Franc and W.L. Stump, U of WY; 2003).

For 6/16 emergence The SAS System 14

The GLM Procedure
Least Squares Means

trt	age	ct616 LSMEAN	LSMEAN Number
1	A	5.5000000	1
1	B	15.5000000	2
1	C	11.7500000	3
2	A	7.7500000	4
2	B	16.2500000	5
2	C	12.2500000	6
3	A	2.5000000	7
3	B	13.0000000	8
3	C	12.7500000	9
4	A	5.2500000	10
4	B	12.2500000	11
4	C	12.2500000	12
5	A	1.7500000	13
5	B	8.2500000	14
5	C	13.2500000	15

Least Squares Means for effect trt*age
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: ct616

i/j	1	2	3	4	5	6	7	8
1		<.0001	0.0010	0.1972	<.0001	0.0004	0.0889	0.0001
2	<.0001		0.0358	<.0001	0.6634	0.0664	<.0001	0.1533
3	0.0010	0.0358		0.0259	0.0131	0.7715	<.0001	0.4695
4	0.1972	<.0001	0.0259		<.0001	0.0131	0.0044	0.0044
5	<.0001	0.6634	0.0131	<.0001		0.0259	<.0001	0.0664
6	0.0004	0.0664	0.7715	0.0131	0.0259		<.0001	0.6634
7	0.0889	<.0001	<.0001	0.0044	<.0001	<.0001		<.0001
8	0.0001	0.1533	0.4695	0.0044	0.0664	0.6634	<.0001	
9	0.0002	0.1175	0.5622	0.0064	0.0491	0.7715	<.0001	0.8845
10	0.8845	<.0001	0.0006	0.1533	<.0001	0.0003	0.1175	<.0001
11	0.0004	0.0664	0.7715	0.0131	0.0259	1.0000	<.0001	0.6634
12	0.0004	0.0664	0.7715	0.0131	0.0259	1.0000	<.0001	0.6634
13	0.0358	<.0001	<.0001	0.0014	<.0001	<.0001	0.6634	<.0001
14	0.1175	0.0002	0.0491	0.7715	<.0001	0.0259	0.0021	0.0092
15	<.0001	0.1972	0.3863	0.0030	0.0889	0.5622	<.0001	0.8845

Least Squares Means for effect trt*age
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: ct616

i/j	9	10	11	12	13	14	15
1	0.0002	0.8845	0.0004	0.0004	0.0358	0.1175	<.0001
2	0.1175	<.0001	0.0664	0.0664	<.0001	0.0002	0.1972
3	0.5622	0.0006	0.7715	0.7715	<.0001	0.0491	0.3863
4	0.0064	0.1533	0.0131	0.0131	0.0014	0.7715	0.0030
5	0.0491	<.0001	0.0259	0.0259	<.0001	<.0001	0.0889
6	0.7715	0.0003	1.0000	1.0000	<.0001	0.0259	0.5622
7	<.0001	0.1175	<.0001	<.0001	0.6634	0.0021	<.0001
8	0.8845	<.0001	0.6634	0.6634	<.0001	0.0092	0.8845
9		0.0001	0.7715	0.7715	<.0001	0.0131	0.7715
10	0.0001		0.0003	0.0003	0.0491	0.0889	<.0001
11	0.7715	0.0003		1.0000	<.0001	0.0259	0.5622
12	0.7715	0.0003	1.0000		<.0001	0.0259	0.5622
13	<.0001	0.0491	<.0001	<.0001		0.0006	<.0001
14	0.0131	0.0889	0.0259	0.0259	0.0006		0.0064
15	0.7715	<.0001	0.5622	0.5622	<.0001	0.0064	

For 6/19 emergence

The GLM Procedure
Least Squares Means

trt	age	ct619 LSMEAN	LSMEAN Number
1	A	24.5000000	1
1	B	34.7500000	2
1	C	27.7500000	3
2	A	28.0000000	4
2	B	32.7500000	5
2	C	32.7500000	6
3	A	21.0000000	7
3	B	31.2500000	8
3	C	28.0000000	9
4	A	24.2500000	10
4	B	29.5000000	11
4	C	30.5000000	12
5	A	20.7500000	13
5	B	30.5000000	14
5	C	35.2500000	15

Least Squares Means for effect trt*age

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: ct619

i/j	1	2	3	4	5	6	7	8
1		<.0001	0.1628	0.1338	0.0010	0.0010	0.1338	0.0058
2	<.0001		0.0044	0.0058	0.3855	0.3855	<.0001	0.1338
3	0.1628	0.0044		0.9131	0.0355	0.0355	0.0058	0.1338
4	0.1338	0.0058	0.9131		0.0451	0.0451	0.0044	0.1628
5	0.0010	0.3855	0.0355	0.0451		1.0000	<.0001	0.5140
6	0.0010	0.3855	0.0355	0.0451	1.0000		<.0001	0.5140
7	0.1338	<.0001	0.0058	0.0044	<.0001	<.0001		<.0001
8	0.0058	0.1338	0.1338	0.1628	0.5140	0.5140	<.0001	
9	0.1338	0.0058	0.9131	1.0000	0.0451	0.0451	0.0044	0.1628
10	0.9131	<.0001	0.1338	0.1091	0.0008	0.0008	0.1628	0.0044
11	0.0355	0.0279	0.4470	0.5140	0.1628	0.1628	0.0008	0.4470
12	0.0130	0.0711	0.2354	0.2798	0.3298	0.3298	0.0002	0.7435
13	0.1091	<.0001	0.0044	0.0033	<.0001	<.0001	0.9131	<.0001
14	0.0130	0.0711	0.2354	0.2798	0.3298	0.3298	0.0002	0.7435
15	<.0001	0.8272	0.0025	0.0033	0.2798	0.2798	<.0001	0.0884

Least Squares Means for effect trt*age
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: ct619

i/j	9	10	11	12	13	14	15
1	0.1338	0.9131	0.0355	0.0130	0.1091	0.0130	<.0001
2	0.0058	<.0001	0.0279	0.0711	<.0001	0.0711	0.8272
3	0.9131	0.1338	0.4470	0.2354	0.0044	0.2354	0.0025
4	1.0000	0.1091	0.5140	0.2798	0.0033	0.2798	0.0033
5	0.0451	0.0008	0.1628	0.3298	<.0001	0.3298	0.2798
6	0.0451	0.0008	0.1628	0.3298	<.0001	0.3298	0.2798
7	0.0044	0.1628	0.0008	0.0002	0.9131	0.0002	<.0001
8	0.1628	0.0044	0.4470	0.7435	<.0001	0.7435	0.0884
9		0.1091	0.5140	0.2798	0.0033	0.2798	0.0033
10	0.1091		0.0279	0.0100	0.1338	0.0100	<.0001
11	0.5140	0.0279		0.6629	0.0006	0.6629	0.0168
12	0.2798	0.0100	0.6629		0.0002	1.0000	0.0451
13	0.0033	0.1338	0.0006	0.0002		0.0002	<.0001
14	0.2798	0.0100	0.6629	1.0000	0.0002		0.0451
15	0.0033	<.0001	0.0168	0.0451	<.0001	0.0451	

For AUEPC

The GLM Procedure
Least Squares Means

trt	age	AUEPC LSMEAN	LSMEAN Number
1	A	539.375000	1
1	B	632.750000	2
1	C	580.500000	3
2	A	564.750000	4
2	B	630.000000	5
2	C	601.250000	6
3	A	509.000000	7
3	B	608.625000	8
3	C	589.125000	9
4	A	546.250000	10
4	B	605.625000	11
4	C	595.625000	12
5	A	509.125000	13
5	B	582.750000	14
5	C	628.125000	15

Least Squares Means for effect trt*age
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: AUEPC

i/j	1	2	3	4	5	6	7	8
1		0.0001	0.0596	0.2365	0.0002	0.0062	0.1585	0.0025
2	0.0001		0.0187	0.0029	0.8967	0.1442	<.0001	0.2599
3	0.0596	0.0187		0.4592	0.0252	0.3312	0.0019	0.1907
4	0.2365	0.0029	0.4592		0.0041	0.0925	0.0126	0.0453
5	0.0002	0.8967	0.0252	0.0041		0.1813	<.0001	0.3170
6	0.0062	0.1442	0.3312	0.0925	0.1813		0.0001	0.7280
7	0.1585	<.0001	0.0019	0.0126	<.0001	0.0001		<.0001
8	0.0025	0.2599	0.1907	0.0453	0.3170	0.7280	<.0001	
9	0.0245	0.0465	0.6843	0.2551	0.0611	0.5681	0.0006	0.3607
10	0.7457	0.0003	0.1135	0.3855	0.0004	0.0137	0.0863	0.0058
11	0.0036	0.2065	0.2410	0.0611	0.2551	0.8364	<.0001	0.8874
12	0.0119	0.0873	0.4771	0.1520	0.1122	0.7907	0.0003	0.5407
13	0.1602	<.0001	0.0019	0.0128	<.0001	0.0001	0.9953	<.0001
14	0.0477	0.0239	0.9154	0.3983	0.0320	0.3855	0.0014	0.2276
15	0.0002	0.8272	0.0307	0.0052	0.9295	0.2106	<.0001	0.3607

Least Squares Means for effect trt*age
Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: AUEPC

i/j	9	10	11	12	13	14	15
1	0.0245	0.7457	0.0036	0.0119	0.1602	0.0477	0.0002
2	0.0465	0.0003	0.2065	0.0873	<.0001	0.0239	0.8272
3	0.6843	0.1135	0.2410	0.4771	0.0019	0.9154	0.0307
4	0.2551	0.3855	0.0611	0.1520	0.0128	0.3983	0.0052
5	0.0611	0.0004	0.2551	0.1122	<.0001	0.0320	0.9295
6	0.5681	0.0137	0.8364	0.7907	0.0001	0.3855	0.2106
7	0.0006	0.0863	<.0001	0.0003	0.9953	0.0014	<.0001
8	0.3607	0.0058	0.8874	0.5407	<.0001	0.2276	0.3607
9		0.0501	0.4383	0.7591	0.0006	0.7636	0.0732
10	0.0501		0.0083	0.0255	0.0873	0.0925	0.0005
11	0.4383	0.0083		0.6375	<.0001	0.2848	0.2927
12	0.7591	0.0255	0.6375		0.0003	0.5446	0.1323
13	0.0006	0.0873	<.0001	0.0003		0.0015	<.0001
14	0.7636	0.0925	0.2848	0.5446	0.0015		0.0389
15	0.0732	0.0005	0.2927	0.1323	<.0001	0.0389	

Research Project	**Management of Potato Foliar Diseases with Foliar Fungicide Programs, 2003**
Research Team Tel: 307-766-2397 FAX: 766-5549 francg@uwyo.edu	G.D. Franc and W.L. Stump University of Wyoming College of Agriculture- Plant Sciences Dept 3354, 1000 E. University Ave. Laramie, WY 82071-3354
Field Plot Location	Torrington Research & Extension Center @ Torrington, WY. 4104 ft MSL; sandy loam soil; overhead irrigation.
Plot Design	RCBD with 4 replications; plots were 4 rows (36-in row centers) X 20 ft; 5 ft in-row buffer. All treatments were made to, and all data were collected from, the center two rows.
Plot Management	**Planting Date**: 14 May, 2003. **Variety**: FL1867 **Fertilizer**: 150 lb N + 50 lb P_2O_5 on 6 May. **Herbicide**: Eptam + Prowl (3 pt + 1.5 pt product) PRE on 21 May. **Insecticide**: Asana (8 fl oz product) on 30 June for Colorado potato beetle.
Disease Development	On 16 July, one greenhouse-grown plant infected with local isolates of *Antennaria solani* was transplanted into the buffer row of each treatment plot. The placement of inoculum coincided with early blight development from natural inoculum: typical foliar early blight lesions were first observed on 16 July, 2003. Late blight was not detected during the growing season. All plants in the plot area began a premature decline by 30 July due to various stem and root diseases, predominately Verticillium wilt. Most foliage was dead by mid-August.
Treatment Applications	Treatments for foliar disease management consisted of spray programs initiated on 17 July and application dates are indicated in the Tables. Fungicides were applied with the aid of a portable (CO_2) sprayer in a total volume of 43 gal/A @ 30 psi boom pressure (four #8004 flat fan nozzles spaced @ 20 inches).

Disease and other Treatment Ratings	**Early blight** disease severity was measured by calculating the average number of lesions per leaflet for leaves collected on 16, 23, 30 July, 5, and 11 August. Six leaves were randomly selected from each treatment plot (two leaves each from the top, middle, and bottom third of the canopy) and the number of early blight lesions, on up to seven leaflets from each leaf, was counted. Disease severity data from 16 July to 11 August were used to calculate an area under the disease progress curve (AUDPC) rating for each treatment program. The AUDPC is a measure of season long disease severity for each treatment. Additionally, plots were visually rated using the Horsfall-Barratt scale (0-11) to estimate the percentage of foliar necrosis (combined effects of disease and senescence) on 11 and 20 August. Only the 11 August data is shown in Table 1.
Harvest	Two rows X 10 ft were dug with a one-row mechanical digger on 15 September. Tubers were sorted and weighed to determine yield and grade on 22 September. All yield data are summarized in Table 2.
Statistical Analysis	ANOVA with four replications. Mean separations were done using Fisher's protected LSD ($\underline{P} \leq 0.05$).

Results and Discussion

Early blight disease development was moderate during 2003. However, by early August potato plants were declining rapidly, primarily due to Verticillium wilt. The early death of foliage shortened the growing season by approximately 1 month. Late blight was not detected in the plots and phytotoxicity was not observed for any of the fungicide programs.

By 5 August, all fungicide treatments significantly reduced the average number of lesions per leaflet compared to the two nontreated checks (Table 1, $\underline{P} \leq 0.05$). On 11 August some treatment differentiation was present. All fungicide treatments reduced the AUDPC value compared to the nontreated checks ($\underline{P} \leq 0.05$). No fungicide programs significantly reduced foliar necrosis on 11 August compared to the nontreated checks ($\underline{P} \leq 0.05$), indicating that the necrosis observed was unaffected by fungicide program. This is the expected outcome in the case of Verticillium wilt, when there is little interaction with early blight.

Treatment effects on yield and quality are shown in Table 2. Total yield was not significantly affected by treatment ($\underline{P}=0.05$). Yields and tuber size were reduced approximately 50% due to the shortness of the growing season. For example, none of the treatment plots had tubers in the greater than 10 ounce size category.

Table 1. Effects of foliar fungicide programs on potato foliar disease (G.D. Franc and W.L. Stump, U of WY; 2003).

Treatment and rate (product/A)	Application dates [1]	Early blight lesions per leaflet					AUDPC [2]	% necrosis 11 Aug
		16 July	23 July	30 July	5 Aug	11 Aug		
1. Nontreated check	NA	0.24 a [3]	0.02 a	0.11 a	4.73 a	7.43 a	51.61 a	90.0 a
2. Quadris 2.08 SC (6.2 fl oz)	A, C, E	0.01 a	0.04 a	0.05 a	0.40 b	1.00 g	6.01 d	83.0 a
2. Bravo Weather Stik 6F (1.25 pt)	B, D							
3. Amistar 80WP (2 oz.)	A, C, E	0.01 a	0.01 a	0.08 a	0.89 b	1.28 fg	9.79 cd	80.5 a
3. Bravo Weather Stik 6F (1.25 pt)	B, D							
4. Quadris/Bravo 5.5 SC (1.6 pt)	A, C, E	0.10 a	0.10 a	0.05 a	0.69 b	0.82 g	7.96 d	76.5 a
4. Bravo Weather Stik 6SC (1.25 pt)	B, D							
5. Headline 2.08 EC (6.2 fl oz)	A, C, E	0.04 a	0.02 a	0.05 a	1.80 b	1.84 d-g	16.96 bcd	80.5 a
5. Bravo Weather Stik 6F (1.25 pt)	B, D							
6. KP481 50WG (4 oz) + Manzate 75DF (1.5 lb)	A, C, E	0.01 a	0.05 a	0.07 a	1.67 b	3.29 cd	20.70 bc	86.0 a
6. Manzate 75DF (2.0 lb)	B, D							
7. KP481 50WG (6 oz) + Manzate 75DF (1.5 lb)	A, C, E	0.01 a	0.02 a	0.11 a	0.99 b	3.27 cd	16.60 bcd	83.0 a
7. Manzate 75DF (2.0 lb)	B, D							
8. KP481 50WG (8 oz) + Manzate 75DF (1.5 lb)	A, C, E	0.04 a	0.04 a	0.08 a	1.47 b	2.60 def	17.49 bcd	83.0 a
8. Manzate 75DF (2.0 lb)	B, D							
9. KQ667 68.8WG (1.5 lb)	A, C, E	0.05 a	0.08 a	0.03 a	1.67 b	3.18 cde	20.47 bc	86.0 a
9. Manzate 75DF (2.0 lb)	B, D							
10. Quadris 2.08SC (6.2 fl oz)	A, C, E	0.01 a	0.01 a	0.05 a	0.82 b	1.11 fg	8.72 cd	76.5 a
10. Manzate 75DF (2.0 lb)	B, D							
11. Manzate 75DF (2.0 lb)	A-E	0.06 a	0.04 a	0.04 a	2.04 b	4.30 bc	25.92 b	80.5 a
12. Manzate 75 DF (2.0 lb)	A	0.04 a	0.04 a	0.05 a	1.97 b	4.84 b	27.00 b	80.5 a
12. Manzate 75 DF (2.0 lb)	B							
12. Super Tin 80WP (2.5 oz) + Manzate 75 DF (2.0 lb)	C							
12. Super Tin 80WP (2.5 oz) + Manzate 75 DF (2.0 lb)	D							
12. Manzate 75 DF (2.0 lb) + Headline 2.08EC (6.2 fl oz)	E							

Treatment and rate (product/A)	Application dates [1]	Early blight lesions per leaflet					AUDPC [2]	% necrosis 11 Aug
		16 July	23 July	30 July	5 Aug	11 Aug		
13. BAS 510 70WG (2.5 oz)	A, C, E	0.03 a	0.01 a	0.02 a	1.43 b	1.45 fg	13.18 cd	88.0 a
13. Bravo Weather Stik 6F (1.25 pt)	B, D							
14. Headline 2.08 EC (6.2 fl oz)	A, C, E	0.03 a	0.00 a	0.08 a	0.99 b	1.75 efg	11.82 cd	80.5 a
14. Echo ZN 4.17F (2.0 pt)	B, D							
15. Nontreated check	NA	0.02 a	0.02 a	0.14 a	4.82 a	7.45 a	52.38 a	90.0 a

[1] The planting date was 14 May, 2003 with variety FL1867, and harvest was on 15 September. Fungicide application dates were: A= 17 July, B= 24 July, C= 30 July, D= 7 Aug, E= 14 Aug, NA= not-applicable.

[2] Area under the disease progress curve for data collected from 16 July through 11 August.

[3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $\underline{P} \leq 0.05$).

Table 2. The effects of foliar fungicide programs on potato yield and quality (G.D. Franc and W.L. Stump, U of WY; 2003).

Treatment and rate (product/A)	Application dates [1]	Yield (cwt)						
		US#1			US#2	Grade B	Cull	Total
		>10 oz	<10 oz	total				
1. Nontreated check	NA	0.0 a	125.1 a	125.1 a	0.0 a	33.4 a	4.8 a	163.3 a
2. Quadris 2.08 SC (6.2 fl oz)	A, C, E	0.0 a	102.9 a	102.9 a	0.0 a	33.9 a	6.2 a	143.0 a
2. Bravo Weather Stik 6F (1.25 pt)	B, D							
3. Amistar 80WP (2 oz.)	A, C, E	0.0 a	109.1 a	109.1 a	0.0 a	32.7 a	7.2 a	148.9 a
3. Bravo Weather Stik 6F (1.25 pt)	B, D							
4. Quadris/Bravo 5.5 SC (1.6 pt)	A, C, E	0.0 a	107.3 a	107.3 a	0.0 a	29.9 a	6.3 a	143.5 a
4. Bravo Weather Stik 6SC (1.25 pt)	B, D							
5. Headline 2.08 EC (6.2 fl oz)	A, C, E	0.0 a	113.8 a	113.8 a	0.0 a	33.6 a	7.3 a	154.6 a
5. Bravo Weather Stik 6F (1.25 pt)	B, D							
6. KP481 50WG (4 oz) + Manzate 75DF (1.5 lb)	A, C, E	0.0 a	95.1 a	95.1 a	0.0 a	37.4 a	9.3 a	141.8 a
6. Manzate 75DF (2.0 lb)	B, D							
7. KP481 50WG (6 oz) + Manzate 75DF (1.5 lb)	A, C, E	0.0 a	109.4 a	109.4 a	0.0 a	29.5 a	12.3 a	151.3 a
7. Manzate 75DF (2.0 lb)	B, D							
8. KP481 50WG (8 oz) + Manzate 75DF (1.5 lb)	A, C, E	0.0 a	110.2 a	110.2 a	0.4 a	33.6 a	6.8 a	150.9 a
8. Manzate 75DF (2.0 lb)	B, D							
9. KQ667 68.8WG (1.5 lb)	A, C, E	0.0 a	110.0 a	110.0 a	0.0 a	28.9 a	8.6 a	147.6 a
9. Manzate 75DF (2.0 lb)	B, D							
10. Quadris 2.08SC (6.2 fl oz)	A, C, E	0.0 a	109.6 a	109.6 a	0.0 a	35.2 a	9.6 a	154.5 a
10. Manzate 75DF (2.0 lb)	B, D							
11. Manzate 75DF (2.0 lb)	A-E	0.0 a	110.2 a	110.2 a	0.0 a	35.8 a	5.2 a	151.1 a

Treatment and rate (product/A)	Application dates [1]	Yield (cwt)						
		US#1			US#2	Grade B	Cull	Total
		>10 oz	<10 oz	total				
12. Manzate 75 DF (2.0 lb)	A	0.0 a	127.4 a	127.4 a	0.0 a	31.6 a	8.3 a	167.3 a
12. Manzate 75 DF (2.0 lb)	B							
12. Super Tin 80WP (2.5 oz) + Manzate 75 DF (2.0 lb) ...	C							
12. Super Tin 80WP (2.5 oz) + Manzate 75 DF (2.0 lb) ...	D							
12. Manzate 75 DF (2.0 lb) + Headline 2.08EC (6.2 fl oz)	E							
13. BAS 510 70WG (2.5 oz)	A, C, E	0.0 a	105.5 a	105.5 a	1.0 a	33.2 a	5.8 a	145.5 a
13. Bravo Weather Stik 6F (1.25 pt)	B, D							
14. Headline 2.08 EC (6.2 fl oz)	A, C, E	0.0 a	107.8 a	107.8 a	0.0 a	34.3 a	7.7 a	149.8 a
14. Echo ZN 4.17F (2.0 pt)	B, D							
15. Nontreated check	NA	0.0 a	119.2 a	119.2 a	0.0 a	33.8 a	6.4 a	159.5 a

[1] The planting date was 14 May, 2003 with variety FL1867, and harvest was on 15 September. Fungicide application dates were: A= 17 July, B= 24 July, C= 30 July, D= 7 Aug, E= 14 Aug, NA= not-applicable.

[2] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $\underline{P}\leq 0.05$).

Research Project	**Evaluations of In-Furrow Fungicide Treatments on Potato, 2003**
Research Team Tel: 307-766-2397 FAX: 766-5549 francg@uwyo.edu	G.D. Franc and W.L. Stump University of Wyoming College of Agriculture- Plant Sciences Dept 3354, 1000 E. University Ave. Laramie, WY 82071-3354
Field Plot Location	Torrington Research & Extension Center @ Torrington, WY. 4104 ft MSL; sandy loam soil; overhead irrigation.
Plot Design	RCBD with 4 replications; plots were 4 rows (36-in row centers) X 20 ft; 5 ft in-row buffer. All treatments were made to, and all data were collected from, the center two rows.
Plot Management	**Planting Date**: 15 May. **Variety**: FL1867 **Fertilizer**: 150 lb N + 50 lb P_2O_5 on 6 May. **Herbicide**: Eptam + Prowl (3 pt + 1.5 pt product) PRE on 21 May.
Treatment Applications	**In-furrow** treatments were applied at planting on 15 May. Applications were made in a 7-inch band directed over seed pieces in an open furrow. Immediately following applications, furrows were closed with a tractor-mounted finishing disc. Fungicides were applied with the aid of a portable (CO_2) sprayer with a boom equipped with a single #8002 flat fan nozzle in a total volume of 1.1 gal/1000 row ft @ 50 psi boom pressure.
Treatment Ratings	Emergence counts and phytotoxicity evaluations were made on 3, 10 and 16 June for 2 rows by 20 ft. On 7 July, 5 stems representing 5 hills were removed systematically from each plot and evaluated for rhizoctonia stem canker severity (estimated percentage of the stem surface area symptomatic).
Harvest	Two rows X 10 ft were dug with a one-row mechanical digger, and tubers were weighed to determine total yield on 15 September.
Statistical Analysis	ANOVA with four replications. Mean separations were done using Fisher's protected LSD ($\underline{P} \leq 0.05$).

Results and Discussion

In-furrow fungicide applications had no affect on potato stands (Table1, $\underline{P}$=0.05). Additionally, no phytotoxic effects were observed on plants for all three rating dates ($\underline{P}$=0.05). Treatments had no significant effect on Rhizoctonia stem canker ($\underline{P}$=0.05). Disease pressure was low. Total yield was not affected by treatment ($\underline{P}$=0.05).

Table 1. Evaluation of in-furrow fungicides on potato stands and phytotoxicity (G.D. Franc and W.L. Stump, U of WY; 2003).

Treatment and rate (product/1000 row ft)	Stand count/40 row feet			Phytotoxicity rating (0= no effect)		
	3 June	10 June	16 June	3 June	10 June	16 June
1. Untreated check	16.8 a	28.5 a	32.3 a	0.0 a	0.0 a	0.0 a
2. Quadris 2.08SC (0.4 fl oz)	21.0 a	33.5 a	32.5 a	0.0 a	0.0 a	0.0 a
3. Amistar 80WP (0.125 oz)	13.5 a	25.8 a	29.0 a	0.0 a	0.0 a	0.0 a
4. Moncut 50WP (1.1 oz)	19.0 a	26.0 a	29.0 a	0.0 a	0.0 a	0.0 a
5. Topsin M 70WP (1.65 oz)	19.8 a	29.8 a	30.0 a	0.0 a	0.0 a	0.0 a
6. Ridomil Gold 4EC (0.42 fl oz)	14.5 a	26.0 a	30.3 a	0.0 a	0.0 a	0.0 a
7. Ridomil Gold 4EC (0.84 fl oz)	19.3 a	29.3 a	29.8 a	0.0 a	0.0 a	0.0 a
8. Ridomil Gold 4EC (1.68 fl oz)	16.8 a	26.0 a	29.5 a	0.0 a	0.0 a	0.0 a
9. A13947 4SL (0.42 fl oz)	15.5 a	28.8 a	33.3 a	0.0 a	0.0 a	0.0 a
10. A13947 4SL (0.84 fl oz)	14.5 a	27.8 a	28.0 a	0.0 a	0.0 a	0.0 a
11. A13947 4SL (1.68 fl oz)	20.3 a	30.5 a	31.8 a	0.0 a	0.0 a	0.0 a
12. A9408 4EC (0.42 fl oz)	17.8 a	30.0 a	32.3 a	0.0 a	0.0 a	0.0 a
13. A9408 4EC (0.84 fl oz)	19.5 a	30.8 a	31.5 a	0.0 a	0.0 a	0.0 a
14. A9408 4EC (1.68 fl oz)	17.0 a	29.5 a	31.5 a	0.0 a	0.0 a	0.0 a

[1] In-furrow applications were made at planting over the top of seedpieces in a 7-inch band.

[2] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $\underline{P} \leq 0.05$).

Table 2. Evaluation of in-furrow fungicides on Rhizoctonia management and potato yields (G.D. Franc and W.L. Stump, U of WY; 2003).

Treatment and rate (product/1000 row ft)	Rhizoctonia stem canker 17 July		Total Yield (cwt/A)
	incidence (%)	severity (% of stem surface with canker)	
1. Untreated check	15.0 a	0.3 a	268.2 a
2. Quadris 2.08SC (0.4 fl oz)	10.0 a	0.5 a	289.4 a
3. Amistar 80WP (0.125 oz)	5.0 a	0.1 a	276.8 a
4. Moncut 50WP (1.1 oz)	0.0 a	0.0 a	264.1 a
5. Topsin M 70WP (1.65 oz)	20.0 a	0.6 a	296.8 a
6. Ridomil Gold 4EC (0.42 fl oz)	20.0 a	0.8 a	278.2 a
7. Ridomil Gold 4EC (0.84 fl oz)	5.0 a	0.2 a	287.7 a
8. Ridomil Gold 4EC (1.68 fl oz)	15.0 a	0.6 a	240.0 a
9. A13947 4SL (0.42 fl oz)	15.0 a	0.3 a	286.8 a
10. A13947 4SL (0.84 fl oz)	20.0 a	1.3 a	299.0 a
11. A13947 4SL (1.68 fl oz)	15.0 a	0.5 a	281.8 a
12. A9408 4EC (0.42 fl oz)	20.0 a	0.7 a	266.4 a
13. A9408 4EC (0.84 fl oz)	35.0 a	0.8 a	244.1 a
14. A9408 4EC (1.68 fl oz)	10.0 a	0.3 a	337.1 a

[1] In-furrow applications were made at planting over the seed in a 7-inch band.

[2] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $\underline{P} \leq 0.05$).

Research Project	**Management of Potato Insects with In-furrow and Foliar Broadcast Insecticide Treatments, 2003**
Research Team Tel: 307-766-2397 FAX: 766-5549 francg@uwyo.edu	G.D. Franc and W.L. Stump University of Wyoming College of Agriculture- Plant Sciences Dept 3354, 1000 E. University Ave. Laramie, WY 82071-3354
Field Plot Location	Torrington Research & Extension Center @ Torrington, WY. 4104 ft MSL; sandy loam soil; overhead irrigation.
Plot Design	RCBD with 4 replications; plots were 4 rows (36-in row centers) X 20 ft; 5 ft in-row buffer. All treatments were made to, and all data were collected from, the center two rows.
Plot Management	**Planting Date**: 15 May. **Variety**: FL1867 **Fertilizer**: 150 lb N + 50 lb P_2O_5 on 6 May. **Herbicide**: Eptam + Prowl (3 pt + 1.5 pt product) PRE on 21 May.
Treatment Applications	**In-furrow** treatments were applied at planting on 15 May. Applications were made in a 7-inch band directed over seed pieces in an open furrow. Following applications, furrows were closed with a tractor-mounted finishing disc. Insecticides were applied with the aid of a portable (CO_2) sprayer with a boom equipped with a single #8002 flat fan nozzle in a total volume of 1.1 gal/1000 row ft @ 50 psi boom pressure. **Foliar broadcast** applications were made on 8 August in a total volume of 43 gal/A @ 30psi boom pressure with a boom equipped with 4 #8004 flat fan nozzles spaced @ 20 inches.
Insect Development	All insect development relied on natural infestations. The buffer rows separating treatment plots were left untreated to provide greater pest pressure. Aphid and Colorado potato beetle populations were light. Potato psyllid nymphs were not found in the plots.
Insect Treatment Ratings	Aphid (species not identified), Colorado potato beetle (both adult and larval form), and leaf hopper (species not identified) populations were determined by combining the counts from two beater board samples per plot on 26 June, 8 July, and 5, 7 August. The beater board size was one square foot. Psyllid nymph populations were determined for 5 leaves per plot. Because pest populations never became elevated, foliar applications were made on 5 August and the effects on beneficial insects were determined. In addition to pest populations, beneficial insects were counted on 5 August prior to application and again on 7 August.
Harvest	Two rows X 10 ft were dug with a one-row mechanical digger, and tubers were sorted and weighed to determine yield and grade on 22 September. All yield data are summarized in Table 2.

Statistical Analysis	ANOVA with four replications. Mean separations were done using Fisher's protected LSD ($\underline{P} \leq 0.05$).

Results and Discussion

Pest insect populations were light in the plots for 2003. Leafhoppers, aphids and Colorado potato beetles were detected in low numbers. In the absence of general pest pressure, foliar treatments were applied to test the effect of insecticide on beneficial organisms present in the canopy (spiders, lacewings, nabids, and ladybird beetles), as well as insecticide effects on pest suppression.

Effects of insecticide treatments on aphid populations are shown in Table 1. Despite the low aphid numbers in the plots, all in-furrow treatments resulted in lower aphid numbers compared to the untreated check on 8 July ($\underline{P} \leq 0.05$). By August, aphid populations were variable and no aphids were found on 7 August. Therefore, no conclusions could be made about the effects of post emergence foliar treatment applications on aphid populations.

Effects on Colorado potato beetle (adults and larvae combined) are shown in Table 2. On 8 July, all in-furrow treatments resulted in lower Colorado potato beetle numbers compared to the untreated check ($\underline{P} \leq 0.05$). By 5 August, in-furrow treatments had no effect on beetle populations, except possibly the Platinum 2SC treatment ($\underline{P}=0.05$). On 7 August, most foliar applications reduced beetle numbers compared to the untreated check ($\underline{P} \leq 0.05$). Treatment effects on leaf hopper populations are shown in Table 3. There were no treatment effects on leaf hopper populations from in-furrow and foliar applications of insecticide ($\underline{P}=0.05$).

Effects of post foliar applications on beneficial insect populations are shown in Table 4. In general, the average number of beneficial insects present following foliar applications decreased for most treatments. However, there were no significant differences among treatments that received no foliar application (the untreated check, and treatments 2 and 3) versus any of the treatments that received foliar applications ($\underline{P}=0.05$). Treatment effects on potato yield and quality are shown in Table 5. In the absence of pest pressure, there were no treatment effects on tuber yield or quality ($\underline{P}=0.05$).

Table 1. Effects of insecticide treatments on aphid populations (G.D. Franc and W.L. Stump, U of WY; 2003).

Treatment and rate (ai/A)	Timing [1]	Aphid numbers per 2 beater board samples [2]			
		26 Jun	8 Jul	5 Aug	7 Aug
1. Untreated check	NA	0.25 a [3]	3.50 a	1.75 ab	0.00 a
2. Platinum 2SC (1.63 oz)	In-furrow	0.00 a	0.25 b	0.75 bc	0.00 a
3. Platinum 2SC (2.00 oz)	In-furrow	0.50 a	0.00 b	0.50 c	0.00 a
4. Platinum 2SC (1.63 oz) 4. Fulfill 50WG (1.37 oz) + COC (0.5 %)	In-furrow Foliar	0.00 a	0.50 b	0.25 c	0.00 a
5. Platinum 2SC (2.00 oz) 5. Fulfill 50WG (1.37 oz) + COC (0.5 %)	In-furrow Foliar	0.25 a	0.00 b	0.75 bc	0.00 a
6. Platinum 2SC (1.63 oz) 6. Warrior/Zeon 1SC (0.47 oz)	In-furrow Foliar	0.00 a	0.00 b	0.50 c	0.00 a
7. Platinum 2SC (2.00 oz) 7. Warrior/Zeon 1SC (0.47 oz)	In-furrow Foliar	0.00 a	0.25 b	0.25 c	0.00 a
8. Platinum 2SC (1.63 oz) 8. Agri-Mek 0.15EC (0.16 oz) + X-77 (0.25 %)	In-furrow Foliar	0.25 a	0.00 b	0.25 c	0.00 a
9. Platinum 2SC (2.00 oz) 9. Agri-Mek 0.15EC (0.16 oz) + X-77 (0.25 %)	In-furrow Foliar	0.00 a	0.50 b	0.00 c	0.00 a
10. Platinum 2SC (1.63 oz) 10. Agri-Mek 0.15EC (0.16 oz) + Fulfill 50WG (1.37 oz) + X-77 (0.25 %)	In-furrow Foliar	0.00 a	0.00 b	2.50 a	0.00 a
11. Platinum 2SC (2.00 oz) 11. Agri-Mek 0.15EC (0.16 oz) + Fulfill 50WG (1.37 oz)+ X-77 (0.25 %)	In-furrow Foliar	0.00 a	0.75 b	0.50 c	0.00 a
12. Admire 2SC (0.25 oz.) 12. Monitor 4EC (12 oz.)	In-furrow Foliar	0.00 a	0.00 b	0.00 c	0.00 a

[1] In-furrow applications were made at planting over the seed in a 7-inch band. Post applications were foliar broadcast on 5 August.

[2] Aphid counts were the sum of 2 beater board samples. Beater board was 1 square foot. Aphids were not separated by species.

[3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $P \leq 0.05$).

Table 2. Effects of insecticide treatments on Colorado potato beetle populations (G.D. Franc and W.L. Stump, U of WY; 2003).

Treatment and rate (ai/A)	Timing [1]	Colorado potato beetle numbers per 2 beater board samples [2]			
		26 Jun	8 Jul	5 Aug	7 Aug
1. Untreated check	NA	0.75 a [3]	0.75 a	0.50 a	1.75 a
2. Platinum 2SC (1.63 oz)	In-furrow	0.00 a	0.00 b	1.75 a	1.00 ab
3. Platinum 2SC (2.00 oz)	In-furrow	0.00 a	0.00 b	1.75 a	0.00 c
4. Platinum 2SC (1.63 oz) 4. Fulfill 50WG (1.37 oz) + COC (0.5 %)	In-furrow Foliar	0.25 a	0.00 b	2.00 a	0.75 bc
5. Platinum 2SC (2.00 oz) 5. Fulfill 50WG (1.37 oz) + COC (0.5 %)	In-furrow Foliar	0.00 a	0.00 b	1.25 a	0.00 c
6. Platinum 2SC (1.63 oz) 6. Warrior/Zeon 1SC (0.47 oz)	In-furrow Foliar	0.00 a	0.00 b	2.25 a	0.00 c
7. Platinum 2SC (2.00 oz) 7. Warrior/Zeon 1SC (0.47 oz)	In-furrow Foliar	0.00 a	0.00 b	0.50 a	0.00 c
8. Platinum 2SC (1.63 oz) 8. Agri-Mek 0.15EC (0.16 oz) + X-77 (0.25 %)	In-furrow Foliar	0.00 a	0.00 b	0.50 a	0.00 c
9. Platinum 2SC (2.00 oz) 9. Agri-Mek 0.15EC (0.16 oz) + X-77 (0.25 %)	In-furrow Foliar	0.00 a	0.00 b	0.75 a	0.25 bc
10. Platinum 2SC (1.63 oz) 10. Agri-Mek 0.15EC (0.16 oz) + Fulfill 50WG (1.37 oz) + X-77 (0.25 %)	In-furrow Foliar	0.00 a	0.00 b	1.00 a	0.00 c
11. Platinum 2SC (2.00 oz) 11. Agri-Mek 0.15EC (0.16 oz) + Fulfill 50WG (1.37 oz)+ X-77 (0.25 %)	In-furrow Foliar	0.00 a	0.00 b	1.00 a	0.00 c
12. Admire 2SC (0.25 oz.) 12. Monitor 4EC (12 oz.)	In-furrow Foliar	0.00 a	0.00 b	1.50 a	0.00 c

[1] In-furrow applications were made at planting over the seed in a 7-inch band. Post applications were foliar broadcast on 5 August.

[2] Colorado potato beetle counts (adult and larval combined) were the sum of 2 beater board samples. Beater board was 1 square foot.

[3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $P \leq 0.05$).

Table 3. Effects of insecticide treatments on leaf hopper populations (G.D. Franc and W.L. Stump, U of WY; 2003).

Treatment and rate (ai/A)	Timing [1]	Leaf hopper numbers per 2 beater board samples [2]		
		8 Jul	5 Aug	7 Aug
1. Untreated check	NA	0.25 a [3]	1.00 a	1.00 a
2. Platinum 2SC (1.63 oz)	In-furrow	0.00 a	0.00 a	0.00 a
3. Platinum 2SC (2.00 oz)	In-furrow	0.00 a	0.50 a	0.75 a
4. Platinum 2SC (1.63 oz) . . . . 4. Fulfill 50WG (1.37 oz) + COC (0.5 %)	In-furrow Foliar	0.00 a	0.00 a	0.50 a
5. Platinum 2SC (2.00 oz) . . . . 5. Fulfill 50WG (1.37 oz) + COC (0.5 %)	In-furrow Foliar	0.00 a	0.25 a	0.50 a
6. Platinum 2SC (1.63 oz) . . . . 6. Warrior/Zeon 1SC (0.47 oz)	In-furrow Foliar	0.00 a	0.00 a	0.00 a
7. Platinum 2SC (2.00 oz) . . . . 7. Warrior/Zeon 1SC (0.47 oz)	In-furrow Foliar	0.00 a	0.00 a	0.00 a
8. Platinum 2SC (1.63 oz) . . . . 8. Agri-Mek 0.15EC (0.16 oz) + X-77 (0.25 %) .	In-furrow Foliar	0.25 a	0.25 a	0.25 a
9. Platinum 2SC (2.00 oz) . . . . 9. Agri-Mek 0.15EC (0.16 oz) + X-77 (0.25 %) .	In-furrow Foliar	0.00 a	0.00 a	0.50 a
10. Platinum 2SC (1.63 oz) . . . . 10. Agri-Mek 0.15EC (0.16 oz) + Fulfill 50WG (1.37 oz) + X-77 (0.25 %)	In-furrow Foliar	0.00 a	0.00 a	0.25 a
11. Platinum 2SC (2.00 oz) . . . . 11. Agri-Mek 0.15EC (0.16 oz) + Fulfill 50WG (1.37 oz)+ X-77 (0.25 %)	In-furrow Foliar	0.25 a	0.00 a	1.25 a
12. Admire 2SC (0.25 oz.) . . . . 12. Monitor 4EC (12 oz.)	In-furrow Foliar	0.00 a	0.00 a	0.00 a

1 In-furrow applications were made at planting over the seed in a 7-inch band. Post applications were foliar broadcast on 5 August.

2 Leaf hopper counts were the sum of 2 beater board samples. Beater board was 1 square foot. Leaf hoppers were not separated by species.

3 Treatment means followed by different letters differ significantly (Fisher's protected LSD, $P \leq 0.05$).

Table 4. Effects of insecticide treatments on beneficial insect populations before and after foliar applications (G.D. Franc and W.L. Stump, U of WY; 2003).

Treatment and rate (ai/A)	Timing [1]	Beneficial insect numbers per 2 beater board samples [2]	
		5 Aug (before)	7 Aug (after)
1. Untreated check	NA	1.75 a [3]	1.50 a
2. Platinum 2SC (1.63 oz)	In-furrow	2.75 a	1.50 a
3. Platinum 2SC (2.00 oz)	In-furrow	2.50 a	1.25 a
4. Platinum 2SC (1.63 oz)	In-furrow	1.00 a	1.00 a
4. Fulfill 50WG (1.37 oz) + COC (0.5 %)	Foliar		
5. Platinum 2SC (2.00 oz)	In-furrow	2.75 a	2.00 a
5. Fulfill 50WG (1.37 oz) + COC (0.5 %)	Foliar		
6. Platinum 2SC (1.63 oz)	In-furrow	4.50 a	0.75 a
6. Warrior/Zeon 1SC (0.47 oz)	Foliar		
7. Platinum 2SC (2.00 oz)	In-furrow	1.25 a	1.00 a
7. Warrior/Zeon 1SC (0.47 oz)	Foliar		
8. Platinum 2SC (1.63 oz)	In-furrow	2.25 a	0.50 a
8. Agri-Mek 0.15EC (0.16 oz) + X-77 (0.25 %)	Foliar		
9. Platinum 2SC (2.00 oz)	In-furrow	1.25 a	2.25 a
9. Agri-Mek 0.15EC (0.16 oz) + X-77 (0.25 %)	Foliar		
10. Platinum 2SC (1.63 oz)	In-furrow	2.75 a	2.00 a
10. Agri-Mek 0.15EC (0.16 oz) + Fulfill 50WG (1.37 oz) + X-77 (0.25 %)	Foliar		
11. Platinum 2SC (2.00 oz)	In-furrow	2.25 a	2.75 a
11. Agri-Mek 0.15EC (0.16 oz) + Fulfill 50WG (1.37 oz)+ X-77 (0.25 %)	Foliar		
12. Admire 2SC (0.25 oz.)	In-furrow	1.75 a	1.25 a
12. Monitor 4EC (12 oz.)	Foliar		

[1] In-furrow applications were made at planting over the seed in a 7-inch band. Post applications were foliar broadcast on 5 August.

[2] Beneficial insect counts were the sum of 2 beater board samples. Beater board was 1 square foot. Beneficials included spiders, nabids, lacewing, and ladybug beetle. Counts on 5 August were immediately prior to application.

[3] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $P \leq 0.05$).

Table 5. The effects of insecticide treatments on potato yield and quality (G.D. Franc and W.L. Stump, U of WY; 2003).

Treatment and rate (ai/A)	Application timing [1]	Yield (cwt)						
		US#1			US#2	Grade B	Cull	Total
		>10 oz	<10 oz	total				
1. Untreated check	NA	3.4 a	278.1 a	281.4 a	0.0 a	39.9 a	4.9 a	326.2 a
2. Platinum 2SC (1.63 oz)	In-furrow	0.0 a	244.5 a	244.5 a	0.0 a	38.5 a	6.5 a	289.5 a
3. Platinum 2SC (2.00 oz)	In-furrow	4.3 a	252.3a	256.6 a	0.0 a	27.5 a	6.6 a	290.7 a
4. Platinum 2SC (1.63 oz)	In-furrow	0.0 a	292.9 a	292.9 a	0.0 a	27.0 a	10.0 a	329.9 a
4. Fulfill 50WG (1.37 oz) + COC (0.5 %)	Foliar							
5. Platinum 2SC (2.00 oz)	In-furrow	2.3 a	299.5 a	301.7 a	0.0 a	34.8 a	5.3 a	341.9 a
5. Fulfill 50WG (1.37 oz) + COC (0.5 %)	Foliar							
6. Platinum 2SC (1.63 oz)	In-furrow	2.5 a	271.0 a	273.5 a	0.0 a	37.0 a	4.4 a	314.9 a
6. Warrior/Zeon 1SC (0.47 oz)	Foliar							
7. Platinum 2SC (2.00 oz)	In-furrow	1.8 a	282.1 a	283.9 a	0.0 a	28.5 a	8.3 a	320.7 a
7. Warrior/Zeon 1SC (0.47 oz)	Foliar							
8. Platinum 2SC (1.63 oz)	In-furrow	0.0 a	265.9 a	265.9 a	0.0 a	32.7 a	7.6 a	306.2 a
8. Agri-Mek 0.15EC (0.16 oz) + X-77 (0.25 %)	Foliar							
9. Platinum 2SC (2.00 oz)	In-furrow	2.2 a	280.2 a	282.4 a	0.0 a	31.2 a	6.2 a	319.8 a
9. Agri-Mek 0.15EC (0.16 oz) + X-77 (0.25 %)	Foliar							
10. Platinum 2SC (1.63 oz)	In-furrow	2.2 a	304.0 a	306.2 a	0.0 a	35.2 a	6.9 a	348.3 a
10. Agri-Mek 0.15EC (0.16 oz) + Fulfill 50WG (1.37 oz) + X-77 (0.25 %)	Foliar							
11. Platinum 2SC (2.00 oz)	In-furrow	0.0 a	285.1 a	285.1 a	0.0 a	30.7 a	9.9 a	325.7 a
11. Agri-Mek 0.15EC (0.16 oz) + Fulfill 50WG (1.37 oz)+ X-77 (0.25 %)	Foliar							
12. Admire 2SC (0.25 oz.)	In-furrow	0.0 a	290.4 a	290.4 a	0.0 a	40.8 a	3.8 a	335.0
12. Monitor 4EC (12 oz.)	Foliar							

[1] In-furrow applications were made at planting over the seed in a 7-inch band. Post applications were foliar broadcast on 5 August.
[2] Treatment means followed by different letters differ significantly (Fisher's protected LSD, $\underline{P} \leq 0.05$).

Products Tested in 2003 Research Studies.

Product	Class[1]	Manufacturer	Composition
A13947 4SL	F	Syngenta Crop Protection, Inc. P.O. Box 18300 Greensboro, NC 27419	45.3 % Mefenoxam
A9408 4EC	F	Syngenta Crop Protection, Inc.	46.15 % Mefenoxam
Admire 2F	I	Bayer Corp. Agriculture Division P.O. Box 4913, Hawthorn Rd Kansas City, MO 64120	22 % Imidacloprid
Agri-Mek 0.15EC	I	Syngenta Crop Protection, Inc.	2 % Abamectin
Amistar 80WG	F	Syngenta Crop Protection, Inc.	80% Azoxystrobin
BAS 510 70WG (Endura)	F	BASF Corp. 26 Davis Dr Research Triangle Park, NC 27709	Information not provided
Bravo Weather Stik 6F	F	Syngenta Crop Protection, Inc.	54 % Chlorothalonil
Cruiser 5FS	I	Syngenta Crop Protection, Inc.	47.6 % Thiamethoxam
Destiny	S	Agriliance P.O. Box 64089 St. Paul, MN 55164-0069	Methylated soybean oil (MSO)
Echo ZN 4.17F	F	Sipcam Agro USA, Inc. 70 Mansell Ct., Suite 230 Roswell, GA 30076	38.5 % Chlorothalonil
Eminent 1.04SC	F	Sipcam Agro USA, Inc.	11.6 % Tetraconazole
Fulfill 50WG	I	Syngenta Crop Protection, Inc.	50 % Pymetrozine
Gem 25 WG	F	Bayer Corp.	25 % Trifloxystrobin
Genesis 2SC	I	Bayer Corp.	Imidacloprid
Headline 2.09EC	F	BASF Corp.	22.9 % Pyraclostrobin
KQ667 68.8WG (Equation Contact)	F	Dupont Agricultural Products Wilmington, DE 19880-0402	62.5 % Mancozeb, 6.25 % Famoxate
KP481 50WG (Tanos)	F	Dupont	Information not provided
Manzate 75DF	F	Griffin Corp. P.O. Box 1847, Rocky Ford Rd Valdosta, GA 31603-1847	75 % Mancozeb
Maxim 4FS	F	Syngenta Crop Protection, Inc.	40.3 % Fludioxomil
Moncut 50WP	F	Gowan Co. P.O. Box 5569 Yuma, AZ 85366-5569	50 % Flutolanil

Product	Class[1]	Manufacturer	Composition
Monitor 4EC	I	Bayer Corp.	40 % Methamidophos
Penncozeb 75DF	F	Cerexagri 900 First Ave. King of Prussia, PA 19406	75 % Mancozeb
Platinum 2SC	I	Syngenta Crop Protection, Inc.	21.6 % Thiamethoxam
Progress 1.8EC	H	Bayer Corp.	7 % Phenmedipham + 7 % Desmedipham + 7 % Ethofumesate
Quad 7	S	AGSCO, Inc. P.O. Box 13458 Grand Forks, ND 58208-3458	Basic blend surfactant
Quadris 2.08 SC	F	Syngenta Crop Protection, Inc.	22.9 % Azoxystrobin
Quadris/Bravo 5.5SC	F	Syngenta Crop Protection, Inc.	Premix of azoxystrobin and chlorothalonil
Ridomil Gold 4EC	F	Syngenta Crop Protection, Inc.	47.6 % Mefenoxam
Stinger 3SL	H	DOW AgroScience LLC 9330 Zionsville Rd. Indianapolis, IN 46268	40.9 % Clopyralid
Super Tin 80WP	F	Griffin Corp.	80 % Triphenyltin Hydroxide
Tops MZ 8.5DS	F	Gustafson LLC 1400 Preston Rd, Suite 400 Plano, TX 75093	2.5 % Thiophanate methyl + 6.0 % Mancozeb
Topsin M 70WP	F	Cerexagri	70 % Thiophanate methyl
UpBeet 50DF	H	DuPont	50 % Triflusulfuron
USF2004 4.17SC	F	Bayer Corp.	Trifloxstrobin
Warrior with Zeon	I	Syngenta Crop Protection, Inc.	11.4 % Lambda-cyhalothrin
X-77	S	Loveland Industries, Inc. P.O. Box 1289 Greeley, CO 80632-1289	nonionic surfactant

[1] F= fungicide, I= insecticide, H= herbicide, S= surfactant