A STUDY OF THE CONTROL OF POWDERY MILDEW USING NINE COMMERCIALLY AVAILABLE FUNGICIDES AND THREE EXPERIMENTALS

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Introduction:

Powdery mildew of sugarbeets, caused by *Erysiphe polygoni*, requires treatment to prevent economic loss when average disease exceeds 10% mature leaf area diseased for the season. Most areas of the Treasure Valley of Idaho and eastern Oregon usually require two fungicide treatments to prevent economic loss. The purpose of this study was to test registered and unregistered fungicides for efficacy and economic benefit for sugarbeet powdery mildew control.

Methods:

The study was conducted in 2008 at the Southwest Idaho Research and Extension Center at Parma, Idaho with nine commercial and three experimental fungicides listed below in Table 1.

Table 1. Fungicides, companies and chemistry class for 2008 powdery mildew test.

Fungicide	Trade Name	Formulation	Company	Chemistry
Triazole	Proline	480 SC	Bayer	Prothioconazole
Topguard	Topguard		Cheminova	Flutriafol
Pyraclostrobin	Headline	250 EC	BASF	Strobilurin (QoI)
Caramba	Caramba	90 G/L SL	BASF	Triazole
Sulfur	Microthiol Disperss	80WP	Cerexagri	
Tetraconazole	Eminent	125 SL	Sipcam Agro	Triazole (DMI)
Induce	Induce		Helena	(surfactant)
Trifloxystrobin	Gem	500 SC	Bayer	Strobilurin (QoI)
Inspire XT	Inspire XT		Syngenta	Triazole
Quadris	Quadris SC		Syngenta	Azoxystrobin
Super Tin	Super Tin	80 WP	Dupont	Triphenyltin Hydr.
A7402			Syngenta	
A8122			Syngenta	
A13703			Syngenta	

The field was fall fertilized in 2007 with 80 lb/A N, 130 lb/A P_2O_5, and 75 lb/A K and bedded into 22-inch rows on November 7, 2007.
Variety Beta 4773R was planted in a furrow irrigated field on April 8, 2008 with a 2.6-inch seed drop, and Temik was applied at 18 lb/A at planting. Plants were thinned to approximately 8" spacing at the 2-4 true leaf stage. An additional 80 lb/A N was side-dressed on June 20, 2008.

Weed control was as follows: April 16, Roundup 20 oz/A; April 28, Progress 10 oz/A and Upbeet 1/3 oz/A; May 5, Progress 12 oz/A and Nortron 4 oz/A; May 27, Progress 13 oz/A and Nortron 4 oz/A; May 30, Treflan 16 oz/A and Outlook 21 oz/A. Hand weeding on August 14, 2008.

Experimental design was a randomized complete block with 21 treatments and 6 replications. Individual plots were 6 rows (11 ft.) wide by 30 feet long. Fungicide applications were made to the four center rows of each plot on July 10 and July 31 using a CO_2 backpack sprayer. Applications were applied at 30 psi using XR 1102 nozzles. All applications were applied at 23 GPA.

Disease ratings were taken by plot on July 9 and July 30, with a final disease rating on August 20, 2008. Both sides of recently matured leaves in each plot were rated for percent leaf area infected with powdery mildew using a 0-5 rating scale with the following values: 0 = no disease; 1 = 1-10%; 2 = 11-35%; 3 = 36-65%; 4 = 66-90%; 5 = 91-100%. Percent mature leaf area diseased (%MLAD) was calculated from the average disease rating for each treatment.

The experiment was harvested on October 15, 2008. Roots were topped and the two center rows of each plot (total 50 ft of row) were lifted and weighed using a tractor mounted two-row lifter. Two sugar samples of approximately 8 roots each were taken for each plot and analyzed for sugar content, conductivity and tare at Amalgamated Sugar Company's tare laboratory at Paul, Idaho. Yield data were adjusted by plot based on tare values.

Percent extraction is used to calculate the estimated recoverable sugar (ERS) in lb/ton and lb/A, and is presented in Table 3. The percent extraction is defined as the percentage of sugar that is extractable from roots and can be granulated into finished product. All calculations were done by plot prior to analysis. Percent extraction was first calculated from conductivity and percent sugar using the following formula:

$$\% \text{ Extraction} = 250 + [\{1255.2\ C - 15000\ S - 6185\} \div \{S\ (98.66 - 7.845\ C)\}]$$

Where C = conductivity in millimhos
And S = sugar content as %.

Then: (% extraction ÷ 100)(gross sugar/A) = ERS/A
And: ERS/A ÷ root yield/A = ERS/ton

Results:

The average disease ratings and % MLAD are given in Table 2. There was no disease prior to the first application on July 10, 2008. Disease was first detected in the plots on July 30, 2008. All treatments had lower disease ratings than the untreated check on August 20 with treatments #11, #15, & #16 having the best ratings overall.

The yield, sugar content, gross sugar, conductivity, extraction and recoverable sugar pounds per ton and pound per acre are given on Table 3.

There was nine tons per acre difference between treatment #11 and the untreated check (treatment #1). Root yields ranged between two tons – up to nine tons per acre greater than the untreated check. The only treatment that was slightly above the untreated check was treatment #20, with a yield of 33.39 which was only 0.36 greater than the untreated check. This same treatment also had one of the worst disease ratings.

Table 2.

Average disease rating and percent mature leaf area diseased (%MLAD) in fungicide treatments for Sugarbeet powdery mildew control at the University of Idaho, Parma R&E Center, Parma, Idaho, 2008.

Treatment	Mean Disease Rating* 7/9/2008	% Mature Leaf Area Diseased	Mean Disease Rating* 7/30/2008	% Mature Leaf Area Diseased	Mean Disease Rating* 8/20/2008	% Mature Leaf Area Diseased
1. Untreated Control	0.00	0.00	0.70	17.50	3.72	83.00
2. A. Topguard, 7 fl oz/A+Sulfur 80WP 5 lb/A B. Topguard, 7 fl oz/A+Sulfur 80WP 5 lb/A	0.00	0.00	0.21	5.25	0.75	18.75
3. A. Topguard, 10 fl oz/A+Sulfur 80WP 5 lb/A B. Topguard, 10 fl oz/A+Sulfur 80WP 5 lb/A	0.00	0.00	0.27	6.75	0.39	11.70
4. A. Topguard, 14 fl oz/A+Sulfur 80WP 5 lb/A B. Topguard, 14 fl oz/A+Sulfur 80WP 5 lb/A	0.00	0.00	0.17	4.25	0.17	4.25
5. A. Topguard, 28 fl oz/A+Sulfur 80WP 5 lb/A B. Topguard, 28 fl oz/A+Sulfur 80WP 5 lb/A	0.00	0.00	0.09	0.90	0.10	1.00
6. A. Headline 250EC, 9 fl oz. A +Sulfur 80WP 5.0 lb/A B. Caramba, 9 fl oz. A +Sulfur 80WP 5.0 lb/A	0.01	0.10	0.61	18.30	0.89	22.25
7. A. Headline 250EC, 9 fl oz. A +Sulfur 80WP 5.0 lb/A B. Caramba, 14 fl oz. A +Sulfur 80WP 5.0 lb/A	0.01	0.10	0.68	17.00	1.01	10.10
8. A. Caramba, 9 fl oz. A +Sulfur 80WP 5.0 lb/A B. Headline 250EC, 9 fl oz. A +Sulfur 80WP 5.0 lb/A	0.01	0.10	0.23	5.75	1.81	30.25
9. A. Gem 500SC, 3.5 fl oz/A + Sulfur 80WP 5.0 lb/A B. Proline 480SC, 5 fl oz/A + Sulfur 80WP 5.0 lb/A + Induce 0.125% v/v	0.00	0.00	0.19	4.75	0.24	6.00
10. A. Proline 480SC, 5 fl oz/A + Sulfur 80WP 5.0 lb/A + Induce 0.125% v/v B. Gem 500SC, 3.5 fl oz/A + Sulfur 80WP 5.0 lb/A	0.00	0.00	0.08	0.80	1.00	10.00
11. A. Proline 480SC, 5 fl oz/A + Sulfur 80WP 5.0 lb/A + Induce 0.125% v/v B. Proline 480SC, 5 fl oz/A + Sulfur 80WP 5.0 lb/A + Induce 0.125% v/v	0.01	0.10	0.03	0.30	0.03	0.30
12. A. Gem 500SC, 3.5 fl oz/A + Sulfur 80WP 5.0 lb/A B. Gem 500SC, 3.5 fl oz/A + Sulfur 80WP 5.0 lb/A	0.01	0.10	0.38	11.40	2.14	38.50
13. A. Sulfur 80WP 10.0 lb/A B. Sulfur 80WP 10.0 lb/A	0.01	0.10	0.29	7.25	1.35	18.75
14. A. Gem 500SC, 3.5 fl oz/A B. Gem 500SC, 3.5 fl oz/A	0.00	0.00	0.54	16.20	2.62	50.50
15. A. Proline 480SC, 5 fl oz/A + Induce 0.125% v/v B. Proline 480SC, 5 fl oz/A + Induce 0.125% v/v	0.01	0.10	0.01	0.10	0.04	0.40

16. A. Inspire XT, 6.0 fl oz/A B. Inspire XT, 6.0 fl oz/A	0.01	0.10	0.03	0.30	0.05	0.50
17. A. Inspire XT, 6.0 fl oz/A B. Quadris, 9.0 fl oz/A + Sulfur 80WP 5.0 lb/A	0.01	0.10	0.03	0.30	1.76	29.00
18. A. A7402, 7.0 fl oz/A B. Headline 250EC, 9.0 fl oz. A	0.00	0.00	0.21	5.25	2.73	53.25
19. A. A8122. 7.0 fl oz/A B. Headline 250EC, 9.0 fl oz/A	0.01	0.10	0.05	0.50	1.56	26.80
20. A. A13703, 8.5 fl oz/A B. Super Tin, 5 fl oz. A	0.00	0.00	0.42	12.60	2.66	51.50
21. A. Eminent, 13.0 fl oz/A B. Headline 250EC, 9.0 fl oz/A	0.01	0.10	0.26	6.50	2.93	44.30
LSD (0.05)	0.01		0.28		0.70	
LSD (0.10)	0.01		0.24		0.58	
CV (%)	267.5		94.7		45.8	
Pr>F	0.4585		0.0001		0.0001	

Experimental design was a randomized complete block with 21 treatments and 6 replications.
25 recently mature leaves from each plot were rated for disease on July 9, July 30, and August 20, 2008.
Both sides of each leaf were examined.

* Disease Rating Scale 0 = 0%; 1 = 1-10%; 2 = 11-35%; 3 = 36-65%; 4 = 66-90%; 5 = 91-100%

** A. First Fungicide Application: July 10, 2008
B. Second Fungicide Application: July 31, 2008

*** Sulfur = Microthiol Disperss 80% wet table sulfur

Table 3. Yield Results.

Trt	Root Yield (T/A)	Sugar Content (%)	Gross Sugar (lbs/A)	Conduc -tivity (mmhos)	Extra -ction (%)	Recover -able Sugar (lbs/T)	Recover -able Sugar (lbs/A)
1	33.03	15.84	10459	0.638	86.21	273.1	9015
2	39.39	17.03	13412	0.669	86.05	293.1	11544
3	37.90	16.80	12745	0.669	86.01	288.9	10962
4	39.01	16.70	13038	0.628	86.52	288.9	11280
5	37.88	16.68	12644	0.643	86.32	288.0	10910
6	38.99	16.31	12755	0.689	85.61	279.1	10914
7	38.94	16.40	12748	0.668	85.93	282.0	10953
8	37.60	16.46	12384	0.608	86.72	285.7	10742
9	39.12	16.26	12732	0.647	86.18	280.4	10974
10	36.47	16.39	11949	0.665	85.98	281.8	10270
11	42.34	16.33	13810	0.643	86.25	281.7	11910
12	38.56	15.90	12241	0.655	85.99	273.6	10530
13	35.33	16.38	11585	0.717	85.27	279.3	9876
14	37.32	16.02	11957	0.653	86.05	275.8	10287
15	40.25	16.23	13069	0.643	86.23	280.1	11274
16	38.84	16.44	12769	0.629	86.45	284.3	11036
17	39.39	16.39	12881	0.668	85.94	281.9	11067
18	36.79	15.96	11711	0.749	84.75	270.8	9915
19	37.68	16.11	12074	0.756	84.70	273.0	10237
20	33.39	15.36	10186	0.681	85.50	263.2	8713
21	36.17	16.27	11762	0.671	85.87	279.4	10095

LSD (0.05)	3.90	.77	1314	NS	NS	NS	1164
LSD (0.10)	3.26	.65	1100	0.095	1.32	NS	974
CV (%)	9.0	4.1	9.3	14.9	1.6	5.1	9.6
Pr>F	.0022	.0377	.0001	.6598	.6536	.1126	.0001

Discussion:

We as a company do not recommend using the same family of chemicals more than once in a season in the treatment of powdery mildew. Resistance is always an issue. We add 5# of sulfur to each treatment in an effort to slow resistance build up. Timeliness of application is very important. The commercial fungicides we use control mildew more effectively at the front side of infection.

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