## EFFECT OF FUNGICIDE AND INSECTICIDE SEED TREATMENTS ON SUGARBEET STAND ESTABLISHMENT AND SUGAR YIELD IN MONTANA

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Fungicide seed treatments are used on all sugarbeet seed to control seed decays and pre and post-emergent damping off commonly caused by seedborne *Phoma betae*, and the soilborne fungi; *Rhizoctonia solani* AG 4 and AG 2-2 isp IIIB and IV, *Pythium ultimum*, *Fusarium* sp., and *Aphanomyces cochlioides*. Historically, metalaxyl (Apron) and thiram have been used as seed treatment fungicides. However today, new fungicide active ingredients such as fludioxanil (Maxim), azoxystrobin (Dynasty), hymexazole (Tachigaren), pyraclostrobin (Stamina), trifloxystrobin (Trilex), iproconazole (Vortex) have been registered. Activity of these fungicides and trade names are given in Table 1. These fungicides are typically used in combination to achieve control of the full spectrum of pathogens. In addition, the registration of the systemic neonicotinoid insecticides, clothianidan (Poncho, NipsIT Inside) and thiamethoxam (Crusier) and companion insecticides like betacyfluthrin (Beta) have been a dramatic advance in controlling insects affecting sugarbeet. In areas affected by Beet curey top virus these materials have provided control of the virus vector the bet leaf hopper and have dramatically reduced yield losses due to this virus. In addition to control of the beet leaf hopper, these insecticides also reportedly provide control of springtails, wireworm, cutworm, leaf miner, root aphid, black bean aphid, and flea beetles. Critical to using these new tools and other yet unlabeled fungicides is the determination of compatibility and efficacy when used in combination.

Table 1. Sugarbeet seed treatr		

Active ingredient	Trade name(s) and manufacturer	Pathogens controlled
metalaxyl	Apron XL (Syngenta), Allegiance (Bayer), Acquire (BASF)	Pythium species
Thiram	Thiram (Chemtura, Taminco)	Pythium, Rhizoctonia, Phoma
fludioxanil	Maxim (Syngenta)	Rhizoctonia, Fusarium
azoxystrobin	Dynasty (Syngenta)	Rhizoctonia, Aphanomyces
trifloxystrobin	Trilex (Bayer)	Rhizoctonia, Aphanomyces
pyraclostrobin	Stamina (BASF)	Rhizoctonia, Aphanomyces
hymexazole	Tachigaren (Sankyo Agro)	Pythium, Fusarium, Aphanomyces
iproconazole	Vortex (Bayer)	Rhizoctonia, Fusarium, Phoma??

## **Materials and Methods**

Fungicides and insecticides at rates indicated in Tables 2, 3 and 4 were applied by ASTEC of Sheridan, WY when they made 4M pellets. Field trials were planted using a Milton planter to achieve a planted population of 47,520 seeds per acre in 24 inch rows. The cultivar Beta SB935 was used in insecticide/fungicide combination trials and Beta SB 934 was used in fungicide trials. Plots were planted on 5/5/09 at the Southern Agricultural Research Center at Huntley, MT and 5/6/09 at the Eastern Agricultural Research Center at Sidney, MT. Both sites were under irrigation, fertilized as recommended for a yield objective of 30 ton/A and weed control was done using glyphosate (Round UP Powermax with AMS). Plots were 3 rows 30ft in length and a randomized complete block design with ten replications was used. The plot stands were counted at Huntley on 6/22/09 and at harvest on 10/23/09 and at Sidney on 6/15/09 and at harvest on 9/24/09. Percentage curly top virus infection was determined on 8/26/09. The center row of each plot was harvested, weight recorded and samples were sent to the Western Sugar factory lab in Billings (Huntley) or the Sidney Sugars lab in Sidney (Sidney) for determination of tare, % sugar and sugar loss to molasses. Statistics used were ANOVA and Fischers Least Significant difference at P=0.05.

In addition, seed samples from each field treatment were planted at the MSU Plant Growth Center in Bozeman in MSU mix soil that was pasteurized and inoculated with 12 oospores/gm of soil of Pythium ultimum or

Aphanomyces cochioides, with Rhizoctonia solani AG 2-2 isp IV ground barley inoculums (sufficient to give 70-9 0% damping-off) or not inoculated. Stands for each treatment were determined 14 days after emergence.

## Results.

Results for the Huntley and Sidney insecticide/fungicide trials are given in Table 2 and 3 respectively. Results for the Huntley and Sidney fungicide trial are given in Table 4. Results for the MSU greenhouse trials are given in Tables 5 and 6. No significant differences in stand or yield were found in field trials. Beet curly top virus pressure at Huntley was low and no conclusions regarding control of this virus could be determined. In field trials at both Huntley and Sidney root maggot damage was low to nonexistent. In greenhouse trials, several treatments provided improved pathogen control, particularly Aphanomyces. No phytotoxicity or germination reductions were seen for any treatment except Stamina at the 150 ml/kg rate. It appears that we will have several new seed treatment tools available in the near future.

Table 2. Results of the 2009 Huntley Sugarbeet Insecticide/Fungicide Seed Treatment Trial

Treatment: Planted 5/5- 6/09 @ 47,520 seed/A 24" rows Harvest 10/23/09 Beta SB935- 4M pellet	G ai/kg seed	Early Stand/A 6/22/09	Harvest Stand/A 10/23/09	% curly top infection 8/26/09	% Sugar	Extractable Sugar Ibs/A	Tons/A
1.Apron XL 3 LS Maxim 4 FS 2.5	0.075 0.025	38333	37026	6.3	15.6	11198.8	38.57
2.Untreated		37810	36329	6.7	15.8	10732.5	36.23
3 . Apron XL 3 LS Maxim 4 FS Cruiser 5 FS	0.075 0.025 0.050	39030	36329	3.8	15.7	11005.7	37.57
4. Apron XL Maxim 4 FS Dynasty 100 Cruiser 5 FS	0.075 0.025 0.025	40337	41034	3.5	15.7	10562.9	36.10
5. Apron XL Maxim 4 FS Cruiser 5 FS Force 20 CS A14321	0.075 0.025 0.025 60.0	37897	35458	4.1	15.9	9953.6	33.62
6. Apron XL Maxim 4 FS Dynasty 100 Cruiser 5 FS Force 20 CS A14321	0.075 0.025 0.050 60.0	38332	38159	3.9	15.6	10635.4	36.47
7. Ponch-Beta Thiram Allegience Vortex 5.0g/100k	0.075 0.025 0.025 60.0	37810	37810	3.2	15.7	11133.7	38.04
8. Ponch-Beta Thiram Allegiance Vortex Trilex	50 ml	37549	36852	3.1	15.8	10719.5	36.32
9. V-10240 NiPSIT	50 ml	35284	35545	3.1	15.7	9947.7	33.84
10. V-10240 V-10178 NIPSIT 60	150 ml	28924	28488	3.0	15.4	10457.4	36.36
11. V-10249 NIPSIT 60.0	50 ml 20g	34151	32409	3.3	15.9	11620.4	39.08
12. V-10230 27.7 NIPSIT 60.0	150 ml 20g	32757	31886	3.3	15.8	10996.5	37.28
13. V-10250 NIPSIT 60.0	50 ml 0.07	29011	29098	3.1	15.4	11239.5	39.19
14. V-10256 NIPSIT	150 0.07	37984	37549	3.4	15.9	10295.5	34.88
15. V-10234 NIPSIT		27181	27791	3.3	15.7	10794.4	36.86
16. Thiram Allegiance NIPSIT		39030	35981	3.2	15.9	11256.4	37.78
17. Poncho-Beta453 FS Thiram 42-S Allegiance FL		38943	38246	3.3	15.6	10819.6	37.03
Flsd 0.05		4792	4391	ns	0.52		3.3

Table 3. Results of the 2009 Sidney Sugarbeet Insecticide/Fungicide Seed Treatment Trial

Treatment: Planted 5/6/09 @ 47,520 seed/A 24" rows	G ai/kg seed	Stand Count /A June 15 LSD=3122	Stand Count/A Sept 12 LSD=3049	Tons/Acre	Extractable Sugar lbs/A LSD=1412
Harvest 09/24/09 Beta SB934- 4M pellet-					
1.Apron XL 3 LS Maxim 4 FS 2.5	0.075 0.025	40148	36518	37.5	12723.4
2.Untreated	0.025	34412	31654	35.6	11863.0
3 . Apron XL 3 LS	0.025	41527	37534	37.8	12748.5
Maxim 4 FS	0.025	.1327	3733.	37.0	
Cruiser 5 FS	0.050				
4. Apron XL	0.075	41600	39059	38.9	13075.6
Maxim 4 FS	0.025				
Dynasty 100	0.025				
Cruiser 5 FS					
5. Apron XL	0.075	42326	34558	39.2	12916.3
Maxim 4 FS	0.025				
Cruiser 5 FS	0.025				
Force 20 CS	60.0				
A14321 6. Apron XL	0.075	41092	35647	37.9	12810.1
Maxim 4 FS	0.025				
Dynasty 100	0.050				
Cruiser 5 FS	60.0				
Force 20 CS					
A14321					
7. Ponch-Beta	0.075	43052	37462	36.8	12442.1
Thiram	0.025				
Allegience	0.025				
Vortex 5.0g/100k	60.0				
8. Ponch-Beta	50 ml	42181	37607	37.0	12693.2
Thiram					
Allegiance Vortex					
Trilex					
9. V-10240	50 ml	40003	36373	34.6	11566.7
NiPSIT					
10. V-10240	150 ml	39277	34195	33.3	11329.0
V-10178					
NIPSIT 60					
11. V-10249	50 ml	36808	33614	34.9	11801.2
NIPSIT 60.0	20g				
12. V-10230 27.7	150 ml	40438	35211	36.3	12416.9
NIPSIT 60.0	20g				
13. V-10250	50 ml	38551	33832	36.6	12398.8
NIPSIT 60.0	0.07				
14. V-10256	150	42253	38042	38.5	12973.7
NIPSIT	0.07	42233	30042	36.3	123/3./
15. V-10234 NIPSIT		37970	34558	33.7	11403.4
16. Thiram		43705	39277	40.3	13580.0
Allegiance		43/03	39411	40.5	13300.0
NIPSIT					
17. Poncho-Beta453 FS		43560	37825	37.9	12794.9
Thiram 42-S			7		
Allegiance FL					
Flsd 0.05		3122	3049	4.12	1412

Table 4. Results of 2009 Sugarbeet Fungicide Seed Treatment Trial at Huntley and Sidney, MT

Trt#	Treatment	Rate ai/kg	Early	/ Stand/A	Harvest Stand/A		Extracta	ble Sugar Ibs/A
			Huntley	Sidney	Huntley	Sidney	Huntley	Sidney
			6/22	6/15				
1	untreated	0.075	26048	30492	26310	28096	10564	11417
		0.025						
2	Apron	0.075	23784	27298	22390	26789	9302	11627
	Maxim	0.025						
3	Apron	0.075	27356	29040	27791	27007	9676	11103
	Maxim	0.025						
	A12050	0.025						
4	Apron	0.075	27530	28604	27007	26281	10074	11387
	Maxim	0.025						
	A16148	0.050						
5	Apron	0.075	27181	28532	27878	27225	9780	10970
	Maxim	0.025						
	A16148	0.025						
6	Apron	0.075	24394	28750	24394	26717	9309	11394
	Maxim	0.025						
	A16148	0.025						
	A12050	60.0						
7	Apron	0.075	29621	33832	28837	30202	10215	12346
	Maxim	0.025						
	A16148	0.050						
	Cruiser	60.0						
8	Apron	0.075	27356	37462	27007	32815	9740	12400
	Maxim	0.025						
	A16148	0.025						
	Cruiser	60.0						
9	STP15201	50 ml	26223	35719	27443	31073	10357	12181
10	Stamina	50 ml	26659	35792	25875	32307	10355	12890
11	Stamina	150 ml	23958	33396	24655	28677	9697	11615
12	Stamina	50 ml	28227	33396	26223	27152	10298	11888
	Tachigaren	20g						
13	Stamina	150 ml	26920	30274	26223	27878	9669	11353
	Tachigaren	20g						
14	Stamina	50 ml	27966	27951	27530	27370	10957	11716
	Aquire	0.07						
15	Stamina	150	28575	25991	29098	24757	10556	11632
	Aquire	0.07						
Flsd C		6/00 0 47 530	5467	5082	5162	4356		1386

Planted 5/5,6/09 @ 47,520 seed/A 24" rows Sidney Harvest 09/24/09

Huntley Harvest 10/23/09

Beta SB934- 4M pellet-ASTEC treatments 7-17/Syngenta treatments 1-6

Table 5. Stand Establishment Results of 2009 Sugarbeet Fungicide Inoculated Greenhouse Trials

Untreated   S0   77   7   42	Trt#	Treatment	Rate ai/kg	Pasteurized soil % stand @14 days	Pythium ultimum % stand @ 14 days	Rhizoctonia solani AG2-2 % stand @14 days	Aphanomyces cochioides % stand @14 days
2     Apron Maxim     0.075     87     81     28     40       3     Apron Maxim     0.025     82     80     17     31       4     Apron 0.025     0.025     89     84     61     58       4     Apron 0.075     89     84     61     58       A16148     0.050     89     93     30     52       Apron Maxim     0.025     87     71     47     44       A16148     0.025     87     71     47     44       A16148     0.025     87     71     47     44       Apron Maxim     0.025     82     83     65     65       A16148     0.050     82     83     65     65       Cruiser     60.0     82     83     42     63       Maxim A16148     0.025     73     85     42     63       Apron Maxim A16148     0.025     73     85     42     63       Apron Maxim A16148     0.025     73     85     42     63       Apron Maxim A16148     0.025     79     27     67       Affidal A16148     0.025     79     27     67       Affidal A16148     0.025     79 <td>1</td> <td>untreated</td> <td></td> <td>80</td> <td>77</td> <td></td> <td>·</td>	1	untreated		80	77		·
Maxim			0.075				
Maxim	2	•		07		20	40
A12050	3	Apron	0.075	82	80	17	31
4     Apron Maxim		Maxim	0.025				
Maxim		A12050	0.025				
A16148	4	Apron	0.075	89	84	61	58
5         Apron Maxim		Maxim	0.025				
Maxim		A16148	0.050				
A16148       0.025       87       71       47       44         Apron Maxim A16148 A12050       0.025 A16148 0.025 A16148 0.025 A16148 0.050 Cruiser 60.0       82       83       65       65         Apron Maxim A26148 0.050 Cruiser 60.0       0.0025 A16148 0.025 Cruiser 60.0       73       85       42       63         STP15201 50 ml 75 To ml Stamina 100 stamina 100 ml Stamina 150 ml 75 To To To To Tachigaren 20g       79       27       67         11 Stamina 150 ml 75 To ml 76 To Tachigaren 20g       86       79       35       70         13 Stamina 150 ml 75 Stamina 150 ml 75 To Maxim 7achigaren 20g       86       87       23       62         15 Stamina 150 ml 75 Stamina 7achigaren 20g       86       87       23       63         15 Stamina 150 ml 75 Stamina 7achigaren 20g       86       87       23       63         15 Stamina 7achigaren 20g       86       87       23       62         15 Stamina 7achigaren 20g       86       87       23       62         15 Stamina 7achigaren 20g       86       87       23       63	5	Apron	0.075	89	93	30	52
6       Apron Maxim		Maxim	0.025				
Maxim		A16148	0.025				
A16148 A12050       0.025 60.0       82       83       65       65         7       Apron Maxim Cruiser 60.0       0.025 60.0       82       83       65       65         8       Apron Maxim A16148 Cruiser       0.075 60.0       73       85       42       63         9       STP15201       50 ml       75       76       11       49         10       Stamina Tachigaren       50 ml       97       79       27       67         11       Stamina Tachigaren       50 ml       86       79       35       70         13       Stamina Tachigaren       150 ml       47       80       29       75         14       Stamina Tachigaren       50 ml 20g       86       87       23       62         15       Stamina       150 ml       86       87       23       62         15       Stamina       150       84       90       23       63	6	Apron	0.075	87	71	47	44
A12050       60.0       82       83       65       65         Apron Maxim A16148 0.050 Cruiser 60.0       0.075       73       85       42       63         Maxim A16148 0.025 A16148 0.025 Cruiser 60.0       0.025       461448 0.025       60.0       49       49         9 STP15201 50 ml 50 ml 50 ml 50 ml 50 ml 50 ml 75 76       76       11       49       49         10 Stamina 50 ml 50 ml 75 76       29       62       62         12 Stamina 7 achigaren 20g 75       70       35       70         13 Stamina 7 achigaren 20g 72  75       80       29       75         14 Stamina Aquire 0.07       86       87       23       62         15 Stamina 150 ml Aquire 0.07       86       87       23       63		Maxim	0.025				
7         Apron Maxim		A16148	0.025				
Maxim A16148 Cruiser       0.050 60.0       8       Apron Maxim 0.025 A16148 Cruiser       0.075 0.025 A16148 Cruiser       73 60.0       85 73 73 73 74 75 75 76 76 76 79 79 79 79 79 79 70 7		A12050					
A16148       0.050       60.0	7	•		82	83	65	65
Cruiser         60.0         60.0         63           Apron Maxim A16148 O.025 Cruiser         0.025 60.0         60.0         76         11         49           9 STP15201 S0 ml Stamina S10 ml Stamina S10 ml Stamina Tachigaren Tachigaren Aquire         50 ml S6         79         27         67           11 Stamina Stamina Aquire         150 ml S6         79         35         70         75           14 Stamina Aquire         150 ml S6         86         87         23         62           15 Stamina Aquire         150 ml S6         84         90         23         63							
8       Apron Maxim O.025 A16148 O.025 Gruiser       73       85       42       63         9       STP15201 S0 ml O.025 G0.0       76       11       49         10       Stamina S0 ml O.025 G0.0       77       79       27       67         11       Stamina Stamina S0 ml O.00							
Maxim A16148 Cruiser       0.025 60.0       49         9 STP15201 50 ml       75       76       11       49         10 Stamina 50 ml       97       79       27       67         11 Stamina 150 ml       57       76       29       62         12 Stamina Tachigaren 20g       86       79       35       70         13 Stamina Tachigaren 20g       47       80       29       75         14 Stamina Aquire 0.007       86       87       23       62         15 Stamina 150 ml       84       90       23       63		Cruiser	60.0				
A16148 Cruiser       0.025 60.0       0.0       49         9       STP15201       50 ml       75       76       11       49         10       Stamina       50 ml       97       79       27       67         11       Stamina       150 ml       57       76       29       62         12       Stamina Tachigaren       50 ml 20g       86       79       35       70         13       Stamina Tachigaren       150 ml 20g       47       80       29       75         14       Stamina Aquire       50 ml 0.07       86       87       23       62         15       Stamina       150       84       90       23       63	8	•		73	85	42	63
9     STP15201     50 ml     75     76     11     49       10     Stamina     50 ml     97     79     27     67       11     Stamina     150 ml     57     76     29     62       12     Stamina     50 ml     86     79     35     70       13     Stamina     150 ml     47     80     29     75       14     Stamina     50 ml     86     87     23     62       15     Stamina     150     84     90     23     63		-					
9     STP15201     50 ml     75     76     11     49       10     Stamina     50 ml     97     79     27     67       11     Stamina     150 ml     57     76     29     62       12     Stamina     50 ml     86     79     35     70       Tachigaren     20g     75     75       13     Stamina     150 ml     47     80     29     75       Tachigaren     20g     86     87     23     62       44     Stamina     50 ml     86     87     23     62       15     Stamina     150     84     90     23     63							
10         Stamina         50 ml         97         79         27         67           11         Stamina         150 ml         57         76         29         62           12         Stamina         50 ml         86         79         35         70           Tachigaren         20g         80         29         75           Tachigaren         20g         75         75           14         Stamina         50 ml         86         87         23         62           Aquire         0.07         84         90         23         63		Cruiser	60.0				
11         Stamina         150 ml         57         76         29         62           12         Stamina Tachigaren         50 ml 20g         86         79         35         70           13         Stamina Tachigaren         150 ml 47         80         29         75           14         Stamina Aquire         50 ml 86         87         23         62           15         Stamina         150         84         90         23         63	9	STP15201	50 ml	75	76	11	49
12     Stamina Tachigaren     50 ml 20g     86     79     35     70       13     Stamina Tachigaren     150 ml 47     80     29     75       14     Stamina Aquire     50 ml 86     87     23     62       15     Stamina     150     84     90     23     63	10	Stamina	50 ml				
Tachigaren         20g         80         29         75           13 Stamina Tachigaren         20g         80         29         75           14 Stamina Aquire         50 ml 86 87 23         62           15 Stamina         150 84         90         23         63	11	Stamina	150 ml	57	76	29	62
13         Stamina Tachigaren         150 ml 20g         47         80         29         75           14         Stamina Aquire         50 ml 0.07         86         87         23         62           15         Stamina         150         84         90         23         63	12	Stamina	50 ml	86	79	35	70
Tachigaren         20g         86         87         23         62           14 Stamina Aquire         0.07         90         23         63           15 Stamina         150         84         90         23         63		Tachigaren	20g				
14     Stamina Aquire     50 ml 0.07     86 87 23     62       15     Stamina     150 84 90 23     63	13	Stamina	150 ml	47	80	29	75
14     Stamina Aquire     50 ml 0.07     86 87 23     62       15     Stamina     150 84 90 23     63		Tachigaren	20g				
15 Stamina 150 84 90 23 63	14			86	87	23	62
15 Stamina 150 84 90 23 63		Aquire	0.07				
Aquire 0.07	15	Stamina	150	84	90	23	63
		Aquire	0.07				

Beta SB934- 4M pellet

Greenhouse 70-75F- MSU Mix soil

Pythium: 10 oospores/g soil, Rhizoctonia 1 gram ground barley inoculums/kg soil mix, Aphanomyces 10 oospores/g soil mix

Table 6. Stand Establishment Results of 2009 Sugarbeet Insecticide-Fungicide Inoculated Greenhouse Trials

		% stand establishment @ 14 days after emergence					
Treatment	Rate g ai/kg seed	Pasteurized soil	Rhizoctonia solani	Pythium ultimum	Aphanomyces cochlioides		
1.Apron XL 3 LS	0.075	94	32	94	48		
Maxim 4 FS 2.5	0.025						
2.Untreated		96	12	84	49		
3 . Apron XL 3 LS	0.075	95	54	84	53		
Maxim 4 FS	0.025						
Cruiser 5 FS	0.6	00	22	06	62		
4. Apron XL	0.075	98	33	96	63		
Maxim 4 FS Dynasty 100	0.025 0.025						
Cruiser 5 FS	60.0						
5. Apron XL	0.075	97	43	65	39		
Maxim 4 FS	0.075	97	45	03	39		
Cruiser 5 FS	60.0						
Force 20 CS	0.08						
A14321	0.08						
6. Apron XL	0.075	nd	nd	nd	nd		
Maxim 4 FS	0.025						
Dynasty 100	0.025						
Cruiser 5 FS	60.0						
Force 20 CS	0.08						
A14321	0.02						
7. Ponch-Beta	60.0	98	34	93	38		
Thiram	2.09						
Allegience	0.05						
Vortex 5.0g/100k	0.05						
8. Ponch-Beta	0.6	97	55	93	55		
Thiram	2.09						
Allegiance	0.05						
Vortex	0.05						
Trilex	0.1	97	10	00	0.0		
9. V-10240 NiPSIT	0.28 60.0	97	19	96	86		
10. V-10240	28	96	79	83	84		
V-10178	2.5		'				
NIPSIT 60	60						
11. V-10249	28.2	95	77	92	89		
NIPSIT 60.0	60						
12. V-10230 27.7	27.7	97	90	89	86		
NIPSIT 60.0	60						
13. V-10250	25.2	94	80	90	83		
NIPSIT 60.0	60						
14. V-10256	0.36	100	85	93	71		
NIPSIT	60	1		<u> </u>			
15. V-10234	2.27	96	94	77	81		
NIPSIT	60	05		00	74		
16. Thiram	20.9	95	54	88	74		
Allegiance NIPSIT	0.05 60						
17. Poncho-	60	96	16	81	49		
Beta453 FS	20.9		10		43		
Thiram 42-S	0.075						
Allegiance FL							