WHEAT (*Triticum aestivum* 'Moreland')
Crown rot; *Fusarium* spp.

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Evaluation of Sedaxane seed treatments for testing control of crown and foot rot in winter wheat, 2010-2011.

Two trials were established in the fall of 2010 to test product effectiveness against Fusarium foot rot in two winter wheat fields – one in Bingham county, ID and the other in Bonneville county, ID. The Aberdeen (Bingham county) field was grown under partial irrigation to mimic dryland conditions (<15 inches of precip). The field had been cropped to spring wheat in the preceding year and has soil type Declo loam of 0-2% slope, 1.1% organic matter, and pH 8.4. Seed of Moreland hard red winter wheat was planted at 1,000,000 seeds/A on 18 Oct 10. Experimental plots (5 x 13.3 ft planted, 5 x 9.3 ft harvested) were arranged in a randomized complete block design with 4 replicates. Fungicide seed treatments were applied by Syngenta (see Table 1). Row spacing was set at 7-in. with seven rows per plot, planted using a double disk opener with a Hege 500 series drill. All rows (except the non-inoculated control) were inoculated with sterilized millet seed colonized with twenty different isolates of *Fusarium culmorum* at 5g millet/row-foot directly after planting on 18 Oct. Fall stand (Zadoks GS 10-11) was calculated as the % plot stand on 19 Nov. Fall vigor (1-10 scale 1 = dead and 10 = dark green with vigorous growth) and fall phytotoxicity (1-4 scale 1 = death, 2 = severe burn/phytotoxicity symptoms, 3=some burn/phytotoxicity, 4= no symptoms) were also measured 19 Nov. Snow cover began on 20 Nov eliminating the ability to take second stand ratings and fall biomass samples. Biomass samples were collected on 27 Apr 11. Fresh and dry weights were recorded on five plants per plot. Root disease was also assessed on the collected biomass samples rated on a 0 to 4 scale, where 0 = no, 1 = trace, 2 = slight, 3 = moderate, and 4 = severe discoloration of the roots, crown and lower stem base. At Zadoks GS 21, spring green-up was estimated on a 0-4 scale (0 = dead, 2 = half chlorotic/necrotic, and 4 = vigorous all green plants) on 27 Apr. Weeds were controlled with 1pt/A Maestro MA and 2/3 pt/A Starane applied 25 May. At Zadoks GS 77, the number of heads per foot of row was counted, and the number of whiteheads per plot was recorded. Height data was taken prior to harvest. Plots were harvested 19 Aug with a small plot combine. Yield and test weight were determined with the Harvestmaster system on the combine, but a corrected test weight was calculated after cleaning the grain from each plot. After harvest, ten plant samples per plot were collected and rated for stem discoloration associated with Fusarium infection using the rating scale as dictated above (0 to 4). Data were analyzed using the general linear models procedure (Proc GLM) in SAS. Fisher's protected LSD was used for means comparisons.

The Ririe (Bonneville county) field had been summer fallowed, and was cropped to spring peas the previous year. The soil type was a #42 Ririe silt loam of 4-12% slope, 1.2% organic matter, and pH 7.8 (top 1 ft of soil). Seed was planted at 700,000 seeds/A on 23 Sep 2010. Experimental units (5 ft x 14 ft) were arranged in a randomized complete block design with 4 replicates. Row spacing was 10-in with 6 rows/plot planted using a no-till planter. Fungicide seed treatments were applied by Syngenta. All rows (except the non-inoculated control) were inoculated with sterilized millet seed colonized with twenty different isolates of *Fusarium culmorum* at 5g millet/row-foot after planting on 24 Sep. Weeds were controlled with 16 oz/A Goldsky and 10.4 oz/A Salvo applied 20 May. Samples for biomass determination were collected 5 May. Fresh weight and dry weights were recorded. Spring green-up was recorded on 5 May. Root disease was assessed using the 0 (no) to 4 (severe) discoloration of roots, crowns, and lower stem tissue scale. Height was recorded prior to harvest. Plots were harvested 30 Aug with a small plot combine. Yield and test weight were determined with the Harvestmaster system on the combine, but a corrected test weight was calculated after cleaning the grain from each plot. Data were analyzed using the general linear models procedure (Proc GLM) in SAS. Fisher's protected LSD was used for means comparisons. Unusual spring conditions resulted in very poor plant growth and very poor yields in the variety trials planted at the same location. The average yield of the soft white winter nursery was 9 bu/A, and the hard winter nursery yields average 12 bu/A.

At Aberdeen, there were no phytotoxicity effects on seedling growth, and no significant differences spring biomass, spring foot rot disease, spring green-up, plant height, test weight, yield, disease symptoms at harvest, formation of whiteheads, or grain protein were detected (see Figure 1 and Table 2). Combined data also showed no significant treatment effects on any parameter that was combined for analysis. Significant differences occurred in Aberdeen of plant stand measured in the fall, and number of viable tillers per foot. Treatment number 6 was equal to the non-inoculated control (treatment #10) for percent stand. Treatments 1, 2, 3, 4, 6, 7, 8 were less than but not significantly different than treatment 10 for stand (see Figure 2). Treatments number 5 and 9 were significantly less than the control for percent stand (P=0.10). Significant differences for the number of viable tillers per plant existed (see Figure 3) with the highest number of tillers being measured for treatment #2, and the least from treatment 4. The control treatment #10 was not statistically different from any treatment except significantly lower than treatment # 2.

There were no significant differences between treatments for any of the parameters measured at Ririe (see Table 3). There were no significant differences in biomass, spring foot rot disease, spring green-up, plant height, test weight, yield, or grain protein. Combined data (see Table 4) also showed no significant treatment effects on any parameter measured.

Table 1. Seed treatments and application rates on Moreland hard red winter wheat in Aberdeen, ID.

Trt	inoculation level	Treatment/Product	Form type[z]	Form Conc g A.I. t/L	Converted rate Fl oz pr/cwtseed
1	inoculated	Dividend Xtreme 0.96 FS	FS	115.0	3
1	inoculated	STP19183	FS	452.0	0.051
2	inoculated	Dividend Xtreme 0.96 FS	FS	115.0	3
2	inoculated	Cruiser 5 FS	FS	600.0	0.51
2	inoculated	STP19183	FS	452.0	0.051
3	inoculated	Cruiser Maxx Cereals 0.62 FS	FS	74.0	4.97
3	inoculated	STP19183	FS	452.0	0.051
3	inoculated	Apron XL 3 LS	LS	350.0	0.11
3	inoculated	Cruiser 5 FS	FS	600.0	0.256
4	inoculated	A16874	FS	96.5	2.78
4	inoculated	STP19183	FS	452.0	0.051
4	inoculated	Apron XL 3 LS	LS	350.0	0.066
4	inoculated	Cruiser 5 FS	FS	600.0	0.51
5	inoculated	A16874	FS	96.5	2.78
5	inoculated	STP19183	FS	452.0	0.51
5	inoculated	Maxim 4 FS	FS	480.0	0.08
5	inoculated	Cruiser 5 FS	FS	600.0	0.51
6	inoculated	A17511	FS	85.1	4.93
6	inoculated	STP19183	FS	452.0	0.051
6	inoculated	Apron XL 3 LS	LS	350.0	0.066
7	inoculated	A17511	FS	85.1	4.93
7	inoculated	STP19183	FS	452.0	0.051
7	inoculated	Apron XL 3 LS	LS	350.0	0.066
7	inoculated	Cruiser 5 FS	FS	600.0	2.56
8	inoculated	A17511	FS	85.1	4.93
8	inoculated	Apron XL 3 LS	LS	350.0	0.066
8	inoculated	Maxim 4 FS	FS	480.0	0.08
8	inoculated	Cruiser 5 FS	FS	600.0	0.486
9	inoculated	Proceed MD 0.205 FS	FS	24.6	5
9	inoculated	Gaucho 600 FS	FS	600.0	0.256
10	not inoculated	Dividend Xtreme 0.96 FS	FS	115.0	3
10	not inoculated	STP19183	FS	452.0	0.051

[z]FS=flowable concentrate for seed treatment; LS=solution for seed treatment

Table 2. Agronomic data from Aberdeen of ten various seed treatments (as reported in Table 1). Fall stand, biomass fresh weight, biomass dry weight, spring green-up, and final head count (counted as the number of viable tillers for plants per foot of row) are reported.

Trt #	11/19/11 Fall stand (%)	11/19/11 Fall stand (% of trt 10)		4/27/11 Biomass fresh weight (g)	4/27/11 Biomass dry weight (g)	4/27/11 Spring green-up (0-4 scale)	Final head count (# of viable tillers)	
1	81.3	92.9%	A	6.8	3.8	4.0	30.5	BC
2	75.0	85.7%	AB	10.8	6.8	3.8	40.8	A
3	81.3	92.9%	A	7.7	4.1	3.5	32.5	AB
4	75.0	85.7%	AB	10.7	6.6	3.8	23.8	C
5	62.5	71.4%	B	10.5	6.6	4.0	29.5	BC
6	87.5	100.0%	A	9.4	6.2	3.8	28.8	BC
7	75.0	85.7%	AB	9.9	6.4	4.0	28.5	BC
8	75.0	85.7%	AB	8.5	5.0	3.8	32.8	AB
9	60.0	68.6%	B	9.1	5.5	4.0	30.0	BC
10	87.5	100.0%	A	7.4	4.3	3.8	24.8	BC
average	76.0	86.9%		9.1	5.5	3.8	30.2	
LSD[z]	18.7	21.3%		3.8	3.5	0.6	8.7	
CV[y]	16.9	19.3%		28.9	43.5	10.6	19.8	
P>F[x]	0.0728	0.0728		0.341	0.5033	0.714	0.0322	
				NS	NS	NS		

[z] LSD = Fisher's protected least significant difference at $P < 0.05$. NS = not significantly different.
[y] CV = coefficient of variation for the analysis of variance (ANOVA).
[x] P > F = probability associated with the F value when using the Proc GLM procedure in SAS.

Table 2. (continued) Agronomic data from Aberdeen of ten various seed treatments (as reported in Table 1). Plant height, test weight, yield, plant disease as in the spring on 4/27/11, plant disease as rated at harvest, and grain protein are reported.

Trt #	Plant height at harvest (in)	Test weight (lbs/bu)	Yield (bu/A)	Spring disease (0-4 scale)	Plant disease at harvest (0-4 scale)	Grain protein (%)
1	29.5	63.6	71	1.4	1.4	14.0
2	30.5	63.5	69	1.3	1.6	15.3
3	29.3	62.7	69	1.1	1.9	13.9
4	28.5	63.5	62	1.4	1.5	13.6
5	31.0	63.3	64	1.4	1.4	14.3
6	28.3	63.0	55	1.5	1.4	13.8
7	30.3	63.1	73	1.2	1.5	14.8
8	30.3	63.3	61	1.6	1.7	12.7
9	30.3	63.4	67	1.4	1.6	12.9
10	31.0	63.2	66	1.3	1.6	14.0
average	29.9	63.2	65.7	1.3	1.5	13.9
LSD	2.7	0.6	16.8	0.4	0.5	2.3
CV	6.2	0.7	17.6	22.2	23.5	11.2
P>F	0.3952	0.1858	0.5341	0.5545	0.5984	0.4447
	NS	NS	NS	NS	NS	NS

[z] LSD = Fisher's protected least significant difference at $P < 0.05$. NS = not significantly different.
[y] CV = coefficient of variation for the analysis of variance (ANOVA).
[x] P > F = probability associated with the F value when using the Proc GLM procedure in SAS.

Table 3. Agronomic data from Ririe of ten various seed treatments (as reported in Table 1). Spring green-up, plant disease in the spring at 5/5/11, plant height, yield, biomass fresh and dry weight at 5/5/11, test weight, and grain protein are reported.

Trt #	5/5/11 Spring green-up (0-4 scale)	Spring disease (0-4 scale)	Plant height at harvest (in)	Yield (bu/A)	Biomass fresh weight (g)	Biomass dry weight (g)	Test weight (lbs/bu)	Grain protein (%)
1	4.0	2.0	20.8	21.1	10.7	8.3	60.7	10.1
2	3.8	1.6	21.8	13.1	9.7	8.6	61.5	9.8
3	4.0	1.9	20.3	14.9	12.3	10.8	61.0	9.8
4	4.0	1.6	20.0	14.5	11.7	10.2	61.5	8.8
5	3.8	1.8	19.5	14.2	13.8	11.5	60.0	8.8
6	4.0	1.5	20.0	12.0	14.2	12.3	60.0	8.6
7	3.8	1.6	21.3	14.5	10.5	9.0	60.5	8.4
8	4.0	1.4	19.5	13.8	11.2	9.2	60.5	8.9
9	4.0	2.0	20.3	14.9	9.5	8.4	60.5	8.6
10	4.0	1.7	20.0	15.6	11.3	9.5	61.0	9.9
average	3.9	1.7	20.3	14.8	11.5	9.8	60.7	9.2
LSD[z]	0.4	0.7	2.1	5.6	6.0	5.6	1.7	1.5
CV[y]	7.2	27.9	7.1	26.2	35.8	39.6	1.9	11.2
P>F[x]	0.683	0.7107	0.4431	0.1843	0.7972	0.8601	0.5499	0.1944
	NS	NS	NS	NS	NS	NS	NS	NS

[z] LSD = Fisher's protected least significant difference at $P < 0.05$ and 0.10. NS = not significantly different.
[y] CV = coefficient of variation for the analysis of variance (ANOVA).
[x] $P >$ F = probability associated with the F value when using the Proc GLM procedure in SAS.

Table 4. Agronomic data combined from Aberdeen and Ririe of ten various seed treatments (as reported in Table 1). Spring green-up, plant disease in the spring at 5/5/11, plant height, yield, biomass fresh and dry weight at 5/5/11, test weight, and grain protein are reported.

Trt #	Spring green-up (0-4 scale)	Spring disease (0-4 scale)	Plant height at harvest (in)	Yield (bu/A)	Biomass Fresh weight (g)	Biomass Dry weight (g)	Test weight (lbs/bu)	Grain protein (%)
1	4.0	1.9	25.1	46.0	8.8	6.1	62.3	12.4
2	3.8	1.6	26.1	41.1	10.3	7.7	62.5	12.6
3	3.8	1.6	24.8	42.2	10.0	7.4	61.8	11.9
4	3.9	1.7	24.3	38.3	11.2	8.4	62.5	11.2
5	3.9	1.7	25.3	39.1	12.1	9.1	61.6	11.5
6	3.9	1.7	24.1	33.3	11.8	9.2	61.5	11.2
7	3.9	1.5	25.8	44.0	10.2	7.7	61.8	11.6
8	3.9	1.7	24.9	37.5	9.9	7.1	61.9	10.8
9	4.0	1.8	25.3	40.8	9.3	6.9	61.9	10.7
10	3.9	1.6	25.5	40.6	9.4	6.9	62.1	12.0
average	3.9	1.7	25.1	40.3	10.3	7.6	62.0	11.6
LSD[z]	0.4	0.4	1.7	8.6	3.5	3.2	0.9	1.3
CV[y]	9.1	25.3	6.6	21.4	33.5	42.1	1.4	11.4
P>F[x]	0.9004	0.8418	0.3454	0.2342	0.6018	0.6403	0.3352	0.1644

[z] LSD = Fisher's protected least significant difference at $P < 0.05$. NS = not significantly different.
[y] CV = coefficient of variation for the analysis of variance (ANOVA).
[x] $P >$ F = probability associated with the F value when using the Proc GLM procedure in SAS.

Figure 1. Effects of various seed treatments on yield of plots under high disease pressure from *Fusarium culmorum*, causing crown rot and foot rot of wheat. No statistically significant effects of seed treatment were found on yield.

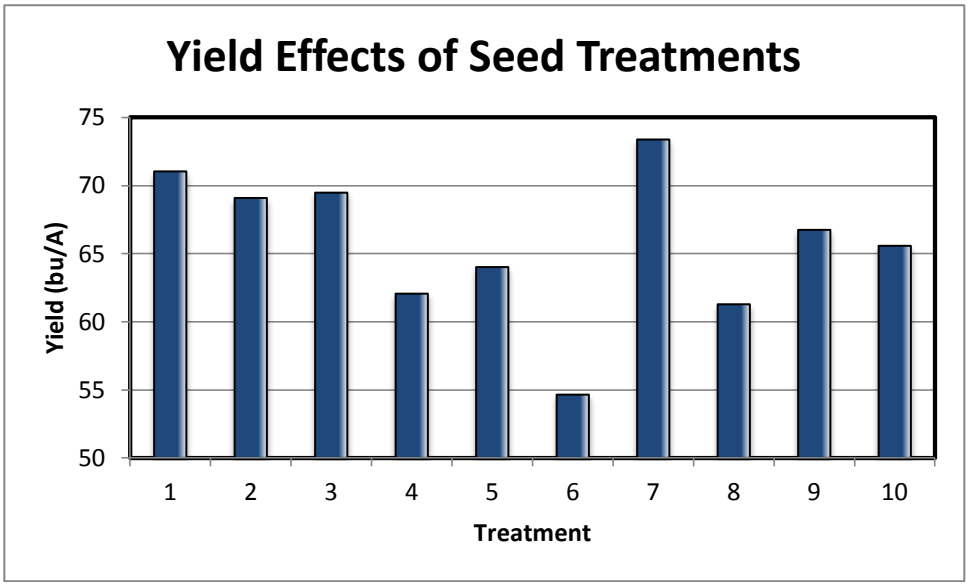

Figure 2. Effects of various seed treatments on plant stand in plots under high disease pressure from *Fusarium culmorum*, causing crown rot and foot rot of wheat. Treatments with a different letter are significantly different at LSD alpha = 0.05.

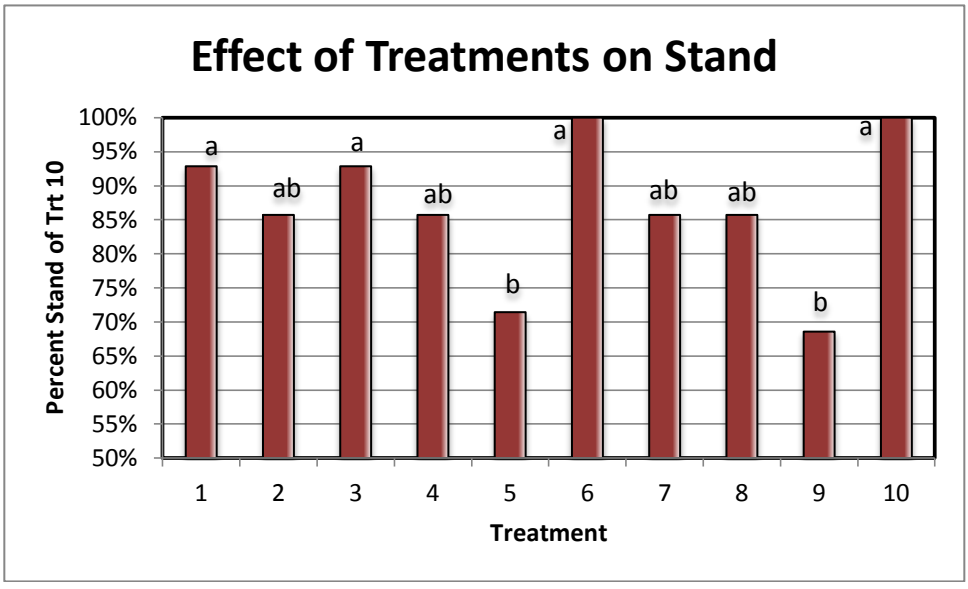

Figure 3. Effects of various seed treatments on number of viable tillers in plots under high disease pressure from *Fusarium culmorum*, causing crown rot and foot rot of wheat. Treatments with a different letter are significantly different at LSD alpha = 0.05.