Managing White Mold Disease in Drybean with Cultivar Architecture, Fungicide and Fungicide Timing

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Materials and Methods

A study was conducted at the Langdon Research Extension Center in 2009 to evaluate plant architecture, fungicide application timing and fungicides as management tools to control white mold disease in dry bean. White mold disease, is caused by the pathogen *Sclerotinia sclerotiorum*. The site had soil type Svea-Barnes complex. The study was arranged in a randomized complete block design with a split split plot arrangement with two replicates. The whole plot was cultivar which included 'Stampede', a new line from North Dakota State University with an upright erect architecture, and Maverick, a vine type with a more horizontal architecture. The subplot included a single fungicide application at early bloom growth stage or sequential fungicide applications at early bloom and 7 days later. The sub subplot included 7 fungicide treatment listed in Table 1. An untreated check of both cultivars was included in the study but not in the statistical analysis as there was no application timing for the control. The treatments included Bayer CropScience experimental fungicide ProPulse applied at 10.3 and 6.84 fl oz/acre + the non-ionic surfactant Induce, Bayer CropScience experimental USF2015A applied at 6.84 and 5.47 fl oz/acre + the non-ionic surfactant Induce, Proline (Bayer CropScience) applied at 5.7 fl oz/acre + the non-ionic surfactant Induce, Prosaro (Bayer CropScience) applied @ 12 fl oz/ acre + the non-ionic surfactant Induce and Headline (BASF) 6 fl oz/ acre + Topsin M (United Phosphorus, Inc.) 1 lb/ acre as a tank mix. The trial was planted on 22 May with a seeding rate of 90,000 seeds per acre with an Almaco double-disc drill in rows spaced 30 inches apart. Planted plot area was two rows 20 feet long. Five foot wide alleys were cut shortening the plot length to 15 feet. An impact sprinkler type irrigation system was installed after post emergence tillage and weed spraying (30 x 40 ft center to center of each sprinkler head). Cultivars, application timings and fungicides included in the study are listed in Table 1. The fungicides were applied with a CO_2 pressurized backpack sprayer equipped with Spraying Systems XR8002 (18.4 GPA) nozzles spaced 20 inches apart and operated at 40 psi. The nozzles were oriented vertically. Treatments were applied as a single application to early flower growth stage dry bean on 29 July at 3:20 p.m. or sequentially on 29 July and 6 Aug at 9:30 p.m. Air temperature was 67º and 60º F and the wind was NW at 5 MPH on 29 July and 6 Aug, respectively. Ascospores were applied at a rate of 5,000 ascospores/ ml in 9.2 GPA water on 3 Aug and 8 Aug with a CO_2 pressurized backpack sprayer equipped with Spraying Systems XR8001 nozzles. Irrigation water was applied periodically beginning at first flower emergence and timed to provide for a wet environment to encourage the development of infection from the broadcast ascospores. North Dakota State University Extension recommended dry bean production practices for Northeast North Dakota were followed. A measuring stick 10 ft long

with 1 ft marked increments was dropped between the rows in each plot and the plants in line with the marks were scored for white mold disease. The plant at each mark was assessed for incidence (presence of white mold disease) and severity (scale of 0-5, 0 = no infection, 1=0-20%, 2=21-40%, 3=41-60%, 4=61-80%, 5=81-100%). A disease index was calculated by multiplying the number of plants in each category times the category number and summing each of the values. Fungicide treated plots were knifed and after drying harvested on October 26 by threshing with a Hege plot combine. Data were analyzed with the general linear model (GLM) in SAS. Least significant differences (LSD) were used to compare means at the 5% probability level using Fischer's protected LSD, Table 2.

Results and Discussion

Due to an inadequate supply of Stampede seed and a late opportunity to plant a decision was made to reduce the number of replicates to two instead of four and plant a second cultivar. No visible phytotoxicity was observed on any observation dates. White mold disease incidence was less when fungicide timing was first bloom and seven days later compared to a single timing, 22.1 vs. 28 percent. White mold disease index was also reduced from 0.78 to 0.56 by the addition of the second fungicide application. No differences in disease severity were measured. Yield was greater in the cultivar Maverick compared to Stampede, 2749.6 vs. 2614.7 hundred weights. The fungicides USF2015A, ProPulse (high rate) and Headline + Topsin had significantly greater yield than USF2015 (high rate), Proline, Prosaro and ProPulse. Pearson correlation coefficients were not significant between yield and disease incidence, severity or index, data not shown. This may indicate that the increase in yield from the fungicide may not be entirely related to a reduction in disease. An interaction was measured for 200 seed weight, Table 3. No specific correlation was apparent for any single fungicide. Some of the differences may be attributed to only two replicates and the long period of the dry beans lay on the wet soil surface before being threshed. 200 seed weight was significantly correlated with white mold incidence, severity and index. Bayer CropScience has indicated that a label is expected for ProPulse in mid 2010 and that the fungicide should be available for the 2011 growing season and will include control of Ascochyta blight for field pea in addition to white mold.

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Table 1. White mold disease incidence, index and severity, yield and 200 seed weight averaged over cultivars, application timings and fungicides, Langdon 2009.

	White Mold				200
	Incidence	Index	Severity	Yield	Seed Weight
	%		%	cwt	g
Maverick	22.9	0.63	0.44	2749.6	78.18
Stampede	27.3	0.72	0.42	2614.7	76.65
First Bloom (FB)	28.0	0.78	0.48	2654.9	77.42
FB and FB + 7 days	22.1	0.56	0.38	2708.4	77.40
USF2015 (High rate)	13.8	0.39	0.31	2558.0 bc	77.09
ProPulse (High rate)	27.5	0.70	0.38	2801.8 ab	79.71
Headline + Topsin	25.0	0.70	0.56	2907.6 a	75.70
Proline	30.0	0.89	0.52	2486.8 c	77.03
Prosaro	41.9	1.13	0.43	2508.3 c	76.91
USF2015A	13.8	0.36	0.37	3014.6 a	78.13
ProPulse	13.8	0.54	0.43	2494.5 c	77.31
$LSD_{(0.05)}$	NS	NS	NS	264.2	
Untreated	32.5	0.78	0.34	2522.2	76.91

Table 2. Source of variation and confidence intervals.

Source	White Mold				200
Of Variation	Incidence	Index	Severity	Yield	Seed Weight
Rep	0.7676	0.7071	0.8855	<0.0001	0.5299
WP	0.6772	0.7276	0.8629	0.0394	0.5014
Rep*WP	0.2332	0.3343	0.1533	0.9045	0.1332
SP	0.0454	0.0328	0.1816	0.7795	0.9892
WP*SP	0.2161	0.2777	0.9330	0.6216	0.3250
Rep*SP(WP)	0.9617	0.9612	0.4750	0.0079	0.1691
SSP	0.3129	0.4341	0.2357	0.0006	0.5133
WP*SSP	0.9509	0.9304	0.3511	0.3496	0.9955
SP*SSP	0.8886	0.7067	0.4682	0.5258	0.0998
WP*SP*SSP	0.9194	0.8947	0.1114	0.0704	0.0286
%C.V.	98.0	114.8	49.2	9.5	4.8

WP (whole plot factor – cultivar) SP (sub plot factor – application timing) SSP (sub sub plot factor – fungicide)

Shaded confidence intervals are significantly different at P= 0.05

Table 3. White mold disease incidence, index and severity, yield and 200 seed weight by cultivar, application timing and fungicide, Langdon 2009.

Cultivar and Timing	Fungicide	White Mold			Yield	200 Seed Weight
		Incidence	Index	Severity		
Maverick		%		%	cwt	g
First Bloom (FB)	USF2015 (high rate)	5	0.15	0.3	2481.3	76.96
	ProPulse (High rate)	32.5	1.08	0.45	2933.0	77.26
	Headline + Topsin	17.5	0.43	0.37	3238.6	81.16
	Proline	35	1.05	0.59	2673.8	81.10
	Prosaro	42.5	1.08	0.51	2615.4	78.08
	USF2015A	15	0.38	0.54	3007.7	78.16
	USF2019A	25	0.80	0.64	2641.4	80.82
FB + FB+7days	USF2015 (high rate)	5	0.10	0.40	2904.6	78.87
	ProPulse (High rate)	20	0.30	0.30	2842.9	83.30
	Headline + Topsin	32.5	0.88	0.56	2924.1	70.29
	Proline	32.5	1.05	0.65	2380.5	74.46
	Prosaro	32.5	0.98	0.42	2594.1	78.29
	USF2015A	0	0	0	2752.7	79.53
	USF2019A	25	0.53	0.41	2689.8	76.23
Stampede						
First Bloom (FB)	USF2015 (high rate)	42.5	1.28	0.43	2572.1	71.96
	ProPulse (High rate)	35	1.03	0.43	2714.5	77.62
	Headline + Topsin	20	0.58	0.76	2705.2	73.60
	Proline	35	1.10	0.65	2545.6	76.11
	Prosaro	40	0.88	0.22	2287.3	78.17
	USF2015A	22.5	0.70	0.53	2709.1	80.65
	USF2019A	25	0.48	0.30	2243.9	72.27
FB + FB+7days	USF2015 (high rate)	2.5	0.03	0.10	2273.8	80.57
	ProPulse (High rate)	22.5	0.40	0.33	2716.7	80.65
	Headline + Topsin	30	0.93	0.57	2962.3	77.73
	Proline	17.5	0.38	0.21	2347.6	76.47
	Prosaro	52.5	1.60	0.59	2536.4	73.12
	USF2015A	17.5	0.35	0.40	3588.9	74.20
	USF2019A	20.0	0.38	0.37	2402.9	79.92

$LSD_{(0.05)}$ for seed weight = 7.5