

Evaluation of Fungicide and Fungicide + Additive to Hard Red Spring Wheat for Control of Head and Foliar Disease, Langdon 2011

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Materials and Methods

A study was conducted in 2011 at the North Dakota State University Langdon Research Extension Center, Langdon North Dakota. The principle objective of the study was to determine the effect of fungicide and fungicide/additive combination for control of foliar and Fusarium head blight (FHB) diseases in hard red spring wheat (HRSW). The evaluated treatments included Caramba (90SL) fungicide BASF Corporation (14 fl. oz./acre) and Caramba fungicide + Preference @ 0.25%v/v + InterLock 3 fl. oz. /acre, Winfield Solutions, LLC. Preference is labeled a nonionic surfactant and antifoaming agent and Interlock a deposition aid, canopy penetrating and drift control agent. The second factor was applications made nozzle that create very coarse, coarse and fine drop size. Prior to the study the sprayer nozzle output was determined by collection of output timed with a stop watch and the pressures adjusted so that nozzle outputs were equal. Nozzle differences were determined by applying the spray solution to water and oil sensitive cards on stands placed in the plots. The cards were obtained from Spraying Systems Co. Wheaton, IL and measured 26 x 76 mm. The study was designed as a randomized complete block in a factorial arrangement with six replicates for the fungicide efficacy part of the study and three replicates for the nozzle comparison. The previous crop was dry bean. The soil type was a Barnes/Svea complex (fine-loamy, mixed superactive Frigid, Calcic Hapludoll/mixed superactive Frigid, Pachic Hapludoll). Vantage, an awned HRSW type, was planted with an Almaco double-disk type plot drill, twenty rows spaced 6-inches on 9 May. Vantage is a high protein cultivar moderately susceptible to FHB. After the application of herbicides to control weeds, the planting block was divided into grids to establish plots by traveling with the sprayer tractor east west and north south directions with use of GPS system. Each plot was 12 x 30 ft. long. Alleys were mowed between the blocks of plots that reduced the length of the plots and provide turning space for the sprayer tractor. Fusarium inoculum was hand-broadcast on 15 June, 27 June, 1 July, and 5 July to encourage development of disease at a rate of 300 grams per plot. Ascospores were also applied by backpack spray system on 26 July at rate of 5000 spores per ml at 9.2 GPA. The backpack sprayer used a similar pressurized distribution system as the tractor sprayer and the solution was delivered through a three nozzle boom operated at 40 psi. Fungicide treatments were applied on 12 Jul at Feekes growth stage (GS) 10.51. At time of fungicide application, 8:30 a.m., wind direction was SE at 3 MPH and air temperature was 63° F. Fungicide treatments are listed in Table 1. The treatments were applied with a tractor sprayer with boom extending to the right of the rear wheel. The spray solution was

distributed to the boom and nozzles with a CO₂-pressurized system instead of a pump. The system was operated at variable pressures delivering 7.4 GPA with the tractor traveling 7.4 MPH. The tractor sprayer was equipped with a four-nozzle boom, nozzles spaced 20 inches on center. The anthesis treatments were made using Spraying Systems AI 11002, AIXR11002 and XR8002 nozzles oriented to spray forward and 30 degrees downward from horizontal. The drop size generated for the aforementioned nozzles are very coarse, coarse and fine. After the fungicide was applied an impact type sprinkler irrigation system was installed (nozzles spaced on 30 x 40 ft. centers) to modify the environment as needed and encourage the development of FHB disease. North Dakota State University Extension recommended production practices for hard red spring wheat in Northeast North Dakota were followed. A visual disease evaluation of disease presence and intensity was made from 10 leaf samples and 20 head samples per plot collected 20 days after the 10.51 GS fungicide applications. The estimate of (FHB) incidence (number of spikes infected) and FHB index (number of infected kernels per head divided by total kernels per individual spike). Head severity is the average severity of infected heads. The leaves were visually evaluated to estimate leaf necrosis and are reported as percent severity. Each plot was harvested on 27 Sept with an Almaco plot combine and the grain sample cleaned and processed for yield and test weight. A sub sample was ground and analyzed for Type B Mycotoxins DON (deoxynivalenol) by North Dakota State University Toxicology Lab. Data was analyzed with the general linear model (GLM) in SAS. Fisher's protected least significant differences (LSD) were used to compare means at the 95% probability level.

Results

The calibrated operating pressures that delivered equal volume of spray solutions for water only, Caramba and Caramba + adjuvant for the XR8002, AI 8002 and AIXR8002 nozzles were 40, 40, 38; 40, 40, 38; and 45, 40, 38 psi, respectively. Foliar disease control was improved by the addition of adjuvant to the Caramba, Table 1. Interactions were measured for yield, test weight and DON, Table 2. A coarse drop increased yield compared to a very coarse drop when adjuvant was included with Caramba. Test weight was also affected when a nozzle that created a very coarse drop was used to spray Caramba + adjuvant reducing test weight compared to all other treatments. Deoxynivalenol accumulation in the seed was greater for the Caramba + adjuvant when a nozzle that created a very coarse drop was used compared to all other treatments. However, when Caramba was applied alone with a nozzle that created a very coarse drop DON was DON decreased compared to a fine drop. This is in contrast to previous studies that found Prosaro fungicide applied with drops in the large fine to small medium drop size category had the smallest DON accumulation.

The performance of the treatments measured on the oil and water sensitive cards differentiated between some spray parameters, Table 3. The VMD (volume median diameter) was smaller with water only compared to Caramba + adjuvant with the forward facing card (F). Statistically the VMD determined from the forward facing card was smaller with the coarse drop than the very coarse drop. The coarse drop was not different from the fine drop. Coverage measured on the F

card was greater when the solutions were applied with fine drop compared to the other drop sizes. Horizontal (H) coverage, coverage most effective for controlling leaf diseases, was greater with Caramba > Caramba + adjuvant > water only. This H coverage was in contrast to the F facing nozzle coverage where the very coarse drop > coarse drop = fine drop size. Some coverage differences were measured for the right and left facing cards but may have been affected by a variable wind. The coverage from the cards measuring the back coverage was insignificant. Two interactions were measured. Applying Caramba + adjuvant with a fine drop produce a VMD of 407 which was significantly smaller than the coarse (561) and very coarse (637) drop. For the water only treatment the coarse drop (446 VMD) was smaller than the fine drop. The spray volume was limited to 7.4 GPA which is approaching the measurement limits of the cards and the cards ability differentiate between two drops deposited side by side and multiple drops collecting on top of each other. The second measured interaction for coverage on the left facing card had similar results.

Table 1. Yield, test weight, Fusarium head blight incidence, severity and index, deoxynivalenol accumulation in the grain and foliar disease by treatment and nozzle type and confidence levels by factor in hard red spring wheat, Langdon, 2011.

	Yield (bu./acre)	Test Weight (lb. /bu.)	Fusarium Head Blight			DON (ppm)	Foliar Disease (%)
			Incidence	Severity (%)	Index		
Non-treated	61.6	62.1	99.2	40.6	40.1	4.1	59.0
<u>Treatment</u>							
Caramba + adjuvant	64.5	62.5	96.9	22.6	21.4	1.63	50.8
Caramba only	64.2	62.6	97.2	22.3	21.1	1.31	64.1
<u>Nozzle</u>							
AI11002	63.5	62.3	96.2	24.0	22.6	1.70	61.3
AIXR11002	65.3	62.7	97.5	23.1	22.0	1.34	55.1
XR11002	64.3	62.6	97.5	20.3	19.1	1.37	56.0
<u>Factor</u>							
Fungicide	0.8062	0.7887	0.7951	0.9082	0.9178	0.1972	0.0146
Nozzle	0.4023	0.1373	0.5824	0.4340	0.4755	0.4305	0.5603
Fungicide*nozzle	0.0198	0.0104	0.4489	0.5639	0.6909	0.0278	0.0933
% C.V.	5.2	0.9	3.5	31.6	34.5	50.5	26.3

Adjuvant = Preference @ 0.25%v/v + InterLock 3 fl. oz. /acre.

Shaded cells = statistically different @ P=0.05

Table 2. Yield, test weight and deoxynivalenol accumulation in the grain by fungicide treatment and nozzle type in hard red spring wheat, Langdon 2011.

Treatment	Nozzle	Yield	Test Weight	DON
		(bu./acre)	(lb. /bu.)	(ppm)
Caramba + adjuvant	AI11002	61.3	61.8	2.37
	AIXR11002	67.1	62.9	1.28
	XR11002	65.1	62.8	1.25
Caramba only	AI11002	65.6	62.7	1.03
	AIXR11002	63.6	62.5	1.40
	XR11002	63.4	62.4	1.48
LSD _(0.05)		4.0	0.7	0.38

Adjuvant =Preference @ 0.25%v/v + InterLock 3 fl. oz. /acre.

Table 3. Volume median diameter drop size and percent coverage determined by deposition on water and oil sensitive cards by fungicide treatment and nozzle type in hard red spring wheat with forward facing nozzles oriented to spray grain spikes and control Fusarium head blight and confidence levels by factor Langdon 2011.

<u>Fungicide</u>	F VMD	F Cov.	B VMD	B Cov.	H VMD	H. Cov.	R VMD	R Cov.	L VMD	L Cov.
Caramba + adj.	535	28.6	176	1.8	437	17.2	325	7.8	489	7.0
Caramba	520	30.3	116	1.0	376	23.0	319	4.1	430	5.9
Water only	495	22.2	146	0.3	378	13.8	257	1.3	461	8.5
LSD _(0.05)	30.8	NS	NS	NS	NS	4.1	NS	4.9	NS	NS
<u>Nozzle</u>										
AI11002	552	24.6	167	0.4	418	23.1	326	1.4	550	8.6
AIXR11002	512	19.6	150	1.9	405	16.5	311	3.7	459	4.6
XR11002	487	36.9	117	0.8	367	14.4	265	8.1	370	8.1
LSD _(0.05)	31	11.0	NS	NS	NS	5.1	NS	NS	62.1	NS
<u>Factor</u>										
Fungicide	0.0426	0.2832	0.2423	0.1905	0.1565	0.0055	0.5560	0.0397	0.1569	0.6710
Nozzle	0.0013	0.0122	0.3195	0.2753	0.3237	0.0063	0.6501	0.0335	<0.0001	0.3287
Fung.*Noz.	<0.0001	0.4181	0.3584	0.4444	0.5817	0.0685	0.5794	0.2840	0.0850	0.0496
% C.V.	6.0	40.7	47.4	164.9	18.2	28.6	48.2	111.7	13.5	84.4

F = forward facing, B = backward facing, H = horizontal, R = right, L = left.

Cov. = % coverage

VMD = Volume Median Diameter

Adjuvant = Preference @ 0.25%v/v + InterLock 3 fl. oz. /acre