

# Evaluation of Biological Alternatives for Single Treatment Fungicide on Hard Red Spring Wheat for Controlling Fusarium Head Blight

## Introduction

A standard treatment for reducing the effects of Fusarium head blight (FHB) on hard red spring wheat (HRSW) has been a fungicide applied to protect the grain head at Feekes growth stage (GS) 10.51 which corresponds to the initiation of anthesis. This treatment, when used with an effective fungicide, can reduce the effects of FHB by nearly 75% when environment conditions are conducive to control and the cultivar is resistant to infection. Biological compounds have been reported to reduce the effects of FHB in greenhouse environments but have not been extensively tested in field situations. Many biological compounds are still in various stages of development and the most effective use has not been defined. This research effort is part of a larger effort supported by the USWBSI known as the uniform biological studies. The Langdon location subset of those studies for 2008 and 2009 is reported along with some additional treatments of interest. The objective of this project was to define the best use of biologicals in relationship to the fungicide standard and an untreated control.

## Materials and Methods

Studies were conducted in 2008 and 2009 at North Dakota State University (NDSU) Langdon Research Extension Center at Langdon, ND. The studies were designed as a randomized complete block with six replicates. The trials were inoculated and supplemental water was applied to encourage the development of FHB. A moderately susceptible cultivar, Howard, to FHB was planted. Howard HRSW was developed by NDSU HRSW breeding program and is a high yield cultivar. Treatments were applied with a CO<sub>2</sub> powered backpack sprayer applying 18.4 GPA and included:

- Control (water and Induce adjuvant only)
- Prosaro fungicide 421 SC from Bayer CropScience and Induce adjuvant applied @ GS 10.51 at 6.5 fl oz/acre
- Biological applied @ GS 10.51
- Biological applied @ GS 10.54
- Biological/Prosaro tank mix applied @ GS 10.51
- Prosaro applied @ GS 10.51 and biological applied @ GS 10.54

The biological treatments included in the studies were:

- 1BA, a *Bacillus* sp provided by B. Bleakley from South Dakota State University, Brookings, SD.
- C3, a *Lysobacter enzymogenes* provided by G. Yuen from University of Nebraska, Lincoln, NE.
- TrigoCor 1448, a *Bacillus subtilis* provided by G. Bergstrom from Cornell University, Ithaca, NY.
- Double yeast, *Cryptococcus flavescens* OH 182.9 (NRRL Y-30216) and *C. aureus* OH 71.4 (NRRL Y-30213) provided by D. Schisler from NCAUR, USDA-ARS, Peoria, IL
- Taegro, *Bacillus subtilis* var. amyloliquefaciens, from Novozyme Biologicals, Inc., Salem, VA, a product that was commercially available in 2008

Not all treatments were included in all studies. 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

- Incidence of biologicals at GS 10.51 and 10.54  $\geq$  untreated  $\geq$  Prosaro and tank mixes  $\geq$  dual timings
- Head severity of untreated  $\geq$  biologicals at GS 10.51 and 10.54  $>$  Prosaro and tank mixes  $>$  dual timings
- DON of biologicals at GS 10.51  $>$  untreated and biologicals at GS 10.54  $>$  dual timings in 2008  $>$  Prosaro and tank mixes  $>$  dual timings in 2009.
- 1000 seed weight of untreated and biologicals at 10.51 and 10.54  $<$  Prosaro and tank mixes  $<$  dual timings
- Yield was inconclusive but generally greater with treatments including fungicide
- Test weight of biologicals at GS 10.51 and 10.54 = untreated  $<$  Prosaro and tank mixes and dual timings.

Table 1. Fusarium Head Blight (FHB) Incidence, Index and Head Severity, Deoxynivalenol (DON), Fusarium Damaged Kernels (FDK), 1000 Seed Weight, Yield and Test Weight by Treatment and Timing on Howard Hard Red Spring Wheat at Langdon, 2008.

Treatment	Feekes Application Timing	FHB		Head Severity (%)	DON (ppm)	FDK (%)	1000 Seed Weight (g)	Yield (bu/a)	Test Weight (lb/bu)	
		Incidence (%)	Index							
untreated (water + Induce)	10.51	88.3	17.2	21.0	4.0	14.8	31.4	72.3	58.8	
Prosaro and Induce	10.51	54.2	3.6	12.2	3.2	3.8	35.0	80.6	59.6	
1BA (Bleakley)	10.51	78.3	13.3	21.3	4.3	6.5	33.1	76.2	59.0	
C3 (Yuen)	10.51	82.5	12.9	18.0	5.2	7.2	31.8	75.1	58.9	
Taegro (Novozyme Biologicals)	10.51	80.8	16.4	22.3	4.3	6.3	32.5	72.0	58.9	
TrigoCor 1448 (Bergstrom)	10.51	82.5	15.1	20.6	4.7	7.3	31.9	75.7	59.0	
<u>Tank mixes</u>										
1BA and Prosaro	10.51	54.2	4.3	13.7	2.5	7.5	34.7	79.8	59.9	
C3 and Prosaro	10.51	55.8	5.2	14.6	2.4	4.0	35.2	78.9	60.2	
Taegro and Prosaro	10.51	55.8	3.9	12.7	3.0	4.0	34.6	74.6	59.7	
TrigoCor 1448 and Prosaro	10.51	41.7	2.2	12.3	2.2	2.5	35.6	80.0	60.2	
Taegro	10.54	81.7	16.6	23.2	3.6	6.7	32.7	75.1	59.2	
TrigoCor 1448	10.51 and 10.54	80.8	14.7	21.3	3.6	8.7	32.2	75.9	59.5	
Prosaro and Taegro	10.51 and 10.54	54.2	3.8	11.9	2.8	4.0	35.6	76.8	60.0	
LSD (P= 0.05)		11.9	6.2	5.8	1.3	3.9	1.5	4.9	0.6	
% C.V.		15.0	53.9	29.1	32.1	52.3	3.8	5.6	0.9	

Table 2. Fusarium Head Blight (FHB) Incidence, Index and Head Severity, Deoxynivalenol (DON), Fusarium Damaged Kernels (FDK), 1000 Seed Weight, Yield and Test Weight by Treatment and Timing on Howard Hard Red Spring Wheat at Langdon, 2009.

Treatment	Feekes Application Timing	FHB		Head Severity (%)	DON (ppm)	FDK (%)	1000 Seed Weight (g)	Yield (bu/a)	Test Weight (lb/bu)	
		Incidence (%)	Index							
untreated (water + Induce)	10.51	77.3	12.6	20.7	1.6	5.1	29.7	74.9	59.1	
Prosaro and Induce	10.51	70.6	7.6	14.1	1.1	1.0	30.8	74.8	59.4	
Taegro	10.51	78.8	13.0	20.2	2.2	4.1	28.7	71.0	58.1	
Double yeast (Schisler)	10.51	83.3	13.9	19.9	1.9	2.8	29.2	71.0	58.5	
TrigoCor 1448	10.51	81.7	13.3	20.3	1.7	3.4	29.7	73.1	59.0	
<u>Tank mixes</u>										
Taegro and Prosaro	10.51	62.5	6.3	14.9	2.3	1.1	31.1	77.2	59.9	
TrigoCor 1448 and Prosaro	10.51	70.0	7.3	13.7	1.9	1.5	30.0	70.1	59.2	
Taegro	10.54	86.5	15.8	21.0	1.0	4.1	30.1	73.6	58.6	
TrigoCor 1448	10.54	89.2	17.8	21.7	1.1	3.9	29.3	73.4	58.8	
Prosaro and Taegro	10.51 and 10.54	54.2	3.3	10.9	0.6	1.1	30.8	76.9	59.5	
Prosaro and double yeast	10.51 and 10.54	62.5	5.1	13.1	0.8	1.7	31.5	78.3	59.6	
Prosaro and TrigoCor 1448	10.51 and 10.54	60.5	3.9	12.2	0.8	1.7	32.0	79.3	60.5	
LSD (P= 0.05)		14.0	4.7	4.9	0.5	1.0	1.5	NS	0.9	
% C.V.		16.7	40.5	25.2	30.8	33.0	4.4	7.4	1.3	

DON analysis provided by North Dakota State University Veterinary Diagnostic Services Department

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