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## Highlights:

- Results are from only one location and year.
- Study was conducted with artificially inoculation and under supplemental overhead irrigation to promote disease development.
- Overall, Headline applied at herbicide timing followed by Caramba at flowering and Proxaro at flowering resulted in lower level of FHB disease than untreated, though in many cases it was not statistically significant.
- Yield and plump kernel percentage was numerically higher in Proxaro at herbicide timing followed by Caramba at flowering and Tilt at herbicide timing followed by Proxaro at flowering compared to that of untreated.
- DON was significantly lower compared to untreated in Tilt at herbicide followed by Proxaro at flowering treatment.

## For further information:

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## OBJECTIVE

Objective of this study was to evaluate sequential fungicide program on controlling Fusarium head blight (FHB) and Deoxynivalenol (DON) contamination in Barley.

## METHODS

**Location:** NDSU Langdon Research Extension Center.

**Experimental Design:** Randomized complete block with six replications.

**Previous crop:** Hard red spring wheat.

**Cultivars:** FHB susceptible cultivar 'Celebration' was used in the study.

**Planting:** 1.2 million pure live seed/A was planted on May 16, 2013. A border plot was planted between treated plots to minimize interference from spray drift.

**Plot size:** Seven rows at six inch spacing. 5 x 20 sq. ft., mowed back to 5 x 15 sq. ft.

**Inoculation:** Plots were inoculated by spreading corn spawn inoculum before boot stage (Feekes 8-9) at the rate of 286 g/plot.

**Disease development:** Supplemental moisture was provided by running overhead irrigation from Feekes 10.5 to 11.25 at the rate of 1 hour per day to create conducive environment for FHB development.

**Fungicide treatments:** Fungicide treatments, their chemistry and application rates and time are listed in Table 1. Fungicides were applied, with CO<sub>2</sub>-pressurized backpack sprayer with three nozzle boom (XR8001), at the water volume of 10 GPA. Herbicide timing fungicide applications (A) were made at Feekes' growth stage 5 on June 12 (wind westerly, speed two MPH, temperature 63 °F at 08:30 AM). Flag leaf timing fungicide application (B) was made at Feekes 9 on June 28 (wind northerly, speed 10.8 MPH, 69 °F at 10:00 AM). Flowering timing fungicide application (C) was made at Feekes 10.5 on July 08 (wind southerly, speed five MPH, 73 °F at 9:00 AM).

**Disease Assessment:** Fusarium head blight (FHB) severity was rated 14, 21 and 28 days after treatments (DAT) of flowering timing (C). Crop response was rated 28 DAT at plot level as either more or less foliar disease and foliage density compared to that of control. For simplicity in data visualization, the following scale was used; 0 = less than untreated, 1 = untreated or similar to untreated, 2 = more than untreated. FHB head severity (SEV) was rated using 0-100% scale on arbitrary 25 heads, excluding two outer rows. FHB incidence (INC) was calculated by counting numbers of heads showing FHB symptoms out of 25 heads that were rated for severity. FHB index (FHBI) was calculated using formula  $FHBI = (SEV * INC) / 100$ .

**Harvest:** Plots were harvested on August 30 (106 days after planting) with a small plot combine and the yield and plump kernel percent determined. Deoxynivalenol (DON) was tested on 50 g sub-sample at Malting Barley Quality Laboratory, NDSU.

**Data Analysis:** Data on 14 and 21 DAT FHB incidence, and 28 DAT FHB index were squared root transformed to achieve homoscedasticity. 14 DAT FHB severity, index and 21 DAT index were log transformed. Data were analyzed using the general linear model (GLM) in SAS. Fisher's least significant difference (LSD) were used to compare means at  $P \leq 0.05$ .

**Table 1. Fungicide treatments, their chemistry and FRAC group, rate, and timing of application.**

TRT #	Treatments	Chemistry (FRAC group)	App. rate
1	Untreated		
2	Caramba (C)	Metconazole (3)	13.5 oz/A
3	Proxaro (C)	Prothiconazole (3) + Tebuconazole (3)	6.5 oz/A
4	Headline (A) Caramba (C)	Pyraclostrobin (11) Metconazole (3)	3 oz/A 13.5 oz/A
5	Prioxar (A) Caramba (C)	Pyraclostrobin (11) + Fluxapyroxad (7) Metconazole (3)	2 oz/A 13.5 oz/A
6	Tilt (A) Proxaro (C)	Propiconazole (3) Prothioconazole (3) + Tebuconazole (3)	2 oz/A 6.5 oz/A
7	Prioxar (A) Twinline (B) Caramba (C)	Pyraclostrobin (11) + Fluxapyroxad (7) Pyraclostrobin (11) + Metconazole (3) Metconazole (3)	2 oz/A 9 oz/A 13.5 oz/A

Notes: A = herbicide timing, B = flag leaf timing, C = flowering timing  
All treatments were applied with NIS @ 0.125% v/v.



**Trial plots at Langdon REC, Langdon, ND**

# Research Report Evaluation of sequential fungicide program in Barley

## 2013

### RESULTS

**Table 2. FHB incidence (%), severity (%) and index rated 14 21 and 28 days after treatment (DAT), crop response (disease) on 28 DAT, yield (bu/A), plump kernel (%) and DON (ppm) in barley.**

Treatments <sup>†</sup>	14 DAT			21 DAT			28 DAT			Crop response disease	Yield (bu/A)	Plump kernel (%)	DON (ppm)
	FHB INC <sup>‡</sup> (%)	FHB SEV <sup>™</sup> (%)	FHB I <sup>†*</sup>	FHB INC <sup>‡</sup> (%)	FHB SEV <sup>™</sup> (%)	FHB I <sup>†*</sup>	FHB INC <sup>‡</sup> (%)	FHB SEV <sup>™</sup> (%)	FHB I <sup>†*</sup>				
Untreated	36.67 a <sup>u</sup>	1.57 a <sup>u</sup>	3.99 a <sup>u</sup>	68.00 a <sup>u</sup>	9.31 a <sup>u</sup>	6.49 a <sup>u</sup>	74.00 a <sup>u</sup>	10.19 ab <sup>u</sup>	7.61 a <sup>u</sup>	1.00	127.26 a <sup>u</sup>	97.73 a <sup>u</sup>	7.78 a <sup>u</sup>
Caramba (C)	20.00 b	0.45 b	2.18 b	53.33 ab	6.25 b	3.91 b	68.67 a	11.65 a	8.16 a	1.17	126.19 a	97.93 a	5.14 ab
Prosaro (C)	18.00 b	0.38 b	1.63 b	52.67 ab	5.92 b	3.28 b	69.78 a	9.11 b	6.41 a	0.67	126.87 a	97.99 a	5.62 ab
Headline (A) Caramba (C)	28.67 ab	0.87 ab	2.47 ab	52.00 b	5.40 b	2.94 b	67.33 a	8.79 b	6.24 a	0.67	125.49 a	97.96 a	6.09 ab
Priaxor (A) Caramba (C)	22.67 b	0.54 b	1.96 b	55.33 ab	6.18 b	3.52 b	68.00 a	8.88 b	6.03 a	0.33	128.67 a	98.02 a	6.48 ab
Tilt (A) Prosaro (C)	18.67 b	0.35 b	1.59 b	58.67 ab	6.33 b	3.97 ab	66.67 a	9.83 ab	6.65 a	1.17	128.24 a	98.31 a	4.40 b
Priaxor (A) Twinline (B) Caramba (C)	22.00 b	0.52 b	1.77 b	51.33 b	6.49 b	3.56 b	72.00 a	9.81 ab	7.20 a	0.33	125.16 a	98.18 a	5.06 ab
% CV	48.66	57.60	105.10	23.62	36.96	61.95	12.97	22.37	31.15		8.85	0.52	42.28
Mean	23.81	0.66	2.23	55.90	6.55	3.95	69.49	9.75	6.90		126.84	98.02	5.79
Max	36.67	1.57	3.99	68.00	9.31	6.49	74.00	11.65	8.16	1.17	128.67	98.31	7.78
Min	18.00	0.35	1.59	51.33	5.40	2.94	66.67	8.79	6.03	0.33	125.16	97.73	4.40

<sup>†</sup> A: Borad leaf timing application, B: Flag leaf timing application, C: Flowering timing application

<sup>u</sup> Means with same letter within individual variable (within column) are not statistically different at P<0.05

<sup>‡</sup> FHB INC: Fusarium head blight Incidence

<sup>™</sup> FHB SEV: Fusarium head blight severity

<sup>†\*</sup> FHB I: Fusarium head blight Index or field severity

Results are shown in Table 2.

**FHB Incidence:** 14 DAT FHB Incidence was significantly lower in all fungicide treated plots compared to untreated except in Headline+Caramba. FHB incidence was significantly lower only in Headline+Caramba in 21 DAT and none of the fungicide treatment differ significantly 28 DAT than untreated.

**FHB Severity:** Similar to FHB incidence, 14 DAT FHB severity was significantly lower than untreated in all treatments except Headline+Caramba. 21 DAT severity was significantly lower in all treatments compared to untreated. 28 DAT FHB severity was significantly lower in Prosaro, Headline+Caramba and Priaxor and Caramba treated plots.

**FHB Index:** All fungicides except Headline+Caramba resulted in statistically lower 14 DAT FHB Index than untreated. In 21 DAT, except Tilt+Prosaro, all treatments had significantly lower FHB Index than untreated. However, none of the fungicide resulted in statistically lower level of FHB Index than untreated on 28 DAT.

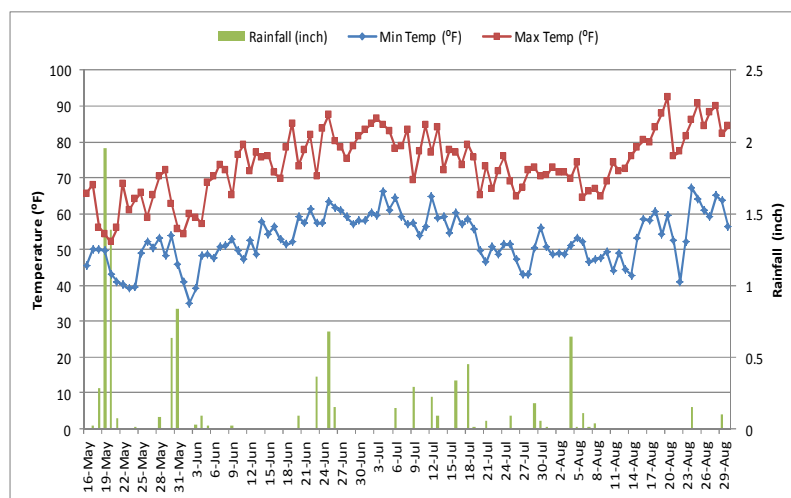
**DON:** Except Tilt+Prosaro, none of the treatments resulted in significant reduction in DON levels compared to untreated. Numerically, all fungicide treatments resulted in lower DON levels than untreated.

**Crop Response:** Crop response as visually evaluated for foliar disease at plot level was generally higher in Caramba and Tilt+Prosaro treated plots compared to untreated. Other fungicide treatments had visually lower levels of foliar diseases than untreated.

**Yield:** None of the fungicide treatments resulted in statistically higher or lower yield than untreated. However, Priaxor+Caramba and Tilt+Prosaro treatments resulted in 1.41 bu/A and 0.98 bu/A higher yield, respectively, than untreated. Rest of the fungicide treatments resulted in numerically 0.39 - 1.59

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**Daily minimum and maximum temperature, and rainfall recorded in Langdon, ND during planting to harvest of barley in this study.**