Barley

Fargo: 2011 Barley Trial Information

Investigator: Marcia McMullen, NDSU Plant Pathology Dept.

Location: ND Ag. Experiment Station Plots, Fargo Campus
Planting Date: May 6, 2011, onto field plots that were drain tiled in fall of 2007

Varieties Planted with Grain Drill:
Barley: Tradition, on bean ground

Post planting herbicides applied on June 3: Axial on Barley

Fungicide applications
Early season fungicide applications, June 6, 85 degrees F
Feekes 9 application, June 20
Feekes 10.3 barley, June 28
Feekes 10.5 barley, July 1
Inoculum: *Fusarium graminearum* inoculum sprayed on FHB study plots on July 5, at 100,000 spores/ml and 30 gal/acre; all other diseases from natural infection

Disease notes, week of July 25; **Harvested** barley Aug. 5

Weather: *Rainfall:* May, 4.28" total , = 2" above 30 year normal; June, 4", = 0.5" above normal; July, 4.1", = 1.2" above normal

Temp: May, 57^0 F avg., 58^0 normal; June, 66^0 F, 66^0 F normal; July, 75^0 F, 71 ^{0}F normal; July had 4 days in 90s; Night time temperatures in July averaged 5 degrees above normal, with some nighttime temperatures not dropping below 73^0 F.

Dew Point: June, avg. 55^{0}F, with 5 days above 60; July, 63^{0}F avg., 6 days averaged above 70^0 F

Summary: 2011 growing season characterized by above normal rainfall and July temperatures and dew points above normal; result was a multitude of diseases in plots. In barley, primary disease was net blotch, but also some barley yellow dwarf virus and bacterial streak occurred, and low FHB. Heat in July also was not favorable for small grain crop development.

North Dakota State University

2011 BayerBarley - 6 row "Tradition"

FP11NARFJK
Location: Fargo

Study Director: Kevin Thorsness
Investigator: Marcia McMullen

Measurement: Parameter measured					Injury %*	F-1 LF SPT %	DON PPM	Twt LB/BU	Yield BU/A
Trt. Nr.	Trt. Name	Form Typ	Rate/Acre	Growth Stage	1	2	3	4	5
1	Untreated				3.25 c	13.13 a	0.23 a	45.83 ab	77.42 b
2	Bay Exp.	SC	1.5 oz/a	FKS 2	19.00 b	10.65 a	0.23 a	45.35 b	79.47 ab
	Wolverine	EC	27.4 oz/a	FKS 2					
3	Bay Exp.	SC	2.0 oz/a	FKS 2	22.50 a	10.33 a	0.20 ab	45.10 b	78.85 ab
	Wolverine	EC	27.4 oz/a	FKS 2					
4	Prosaro	SC	6.5 oz/a	FKS 10.5	4.25 c	1.55 b	0.13 bc	45.53 ab	84.87 a
	NIS	XL	0.125 % v/v	FKS 10.5					
5	Bay Exp.	SC	1.5 oz/a	FKS 2	20.00 ab	1.28 b	0.13 bc	45.78 ab	81.11 ab
	Wolverine	EC	27.4 oz/a	FKS 2					
	Prosaro	SC	6.5 oz/a	FKS 10.5					
	NIS	XL	0.125 % v/v	FKS 10.5					
6	Bay Exp.	SC	2.0 oz/a	FKS 2	22.50 a	1.95 b	0.10 c	46.20 a	81.29 ab
	Wolverine	EC	27.4 oz/a	FKS 2					
	Prosaro	SC	6.5 oz/a	FKS 10.5					
	NIS	XL	0.125 % v/v	FKS 10.5					
LSD (P=.05)					2.658	3.670	0.093	0.789	6.166
Standard Deviation					1.764	2.435	0.061	0.524	4.092
CV					11.57	37.59	36.88	1.15	5.08
Replicate F					2.018	2.856	1.177	9.153	3.703
Replicate Prob(F)					0.1547	0.0722	0.3517	0.0011	0.0356
Treatment F					104.593	19.995	3.353	2.203	1.594
Treatment Prob(F)					0.0001	0.0001	0.0313	0.1083	0.2216

Means followed by same letter do not significantly differ (P=.05, LSD)
Injury ratings Taken on June 10th, four days after Wolverine + Bay Exp. applied on June 6

North Dakota State University

2011 Uniform Trial - Spring Barley "Tradition"

Protocol: USWBSI 2011 Study Director: Carl Bradley, Univ. of Illinois
Location: Fargo Investigator: Marcia McMullen

Measurement Name Measurement Type					DON ppm	Twt lbs/bu	Yield bu/acre
Trt. Nr.	Trt.. Name	Form Typ	Rate/acre	Growth Stage	1	2	3
1	Untreated				0.30 a	46.13 b	65.13 b
2	A9232d	SC	7 fl oz/a	FKS 10.5	0.18 b	46.23 b	71.23 ab
3	Caramba	F	13.5 fl oz/a	FKS 10.5	0.23 ab	46.83 ab	71.85 a
	Induce	XL	0.125 % v/v	FKS 10.5			
4	Prosaro	SC	6.5 fl oz/a	FKS 10.5	0.20 b	46.68 ab	71.13 ab
	Induce	XL	0.125 % v/v	FKS 10.5			
5	Headline	SC	6 fl oz/a	FKS 9	0.23 ab	46.70 ab	66.95 ab
	Induce	XL	0.125 % v/v	FKS 9			
6	Headline	SC	6 fl oz/a	FKS 9	0.18 b	47.23 a	69.48 ab
	Induce	XL	0.125 % v/v	FKS 9			
	Prosaro	SC	6.5 fl oz/a	FKS 10.5			
	Induce	XL	0.125 % v/v	FKS 10.5			
7	Evito	SC	4 fl oz/a	FKS 10.3	0.25 ab	46.88 ab	70.50 ab
	Induce	XL	0.125 % v/v	FKS 10.3			
8	Stratego Yld	SC	4 fl oz/a	FKS 10.3	0.23 ab	46.65 ab	70.10 ab
	Induce	XL	0.125 % v/v	FKS 10.3			
9	Quilt	SC	10.5 fl oz/a	FKS 10.3	0.23 ab	46.08 b	67.63 ab
	Induce	XL	0.125 % v/v	FKS 10.3			
10	Twinline	SC	9 fl oz/a	FKS 10.3	0.30 a	46.15 b	71.90 a
	Induce	XL	0.125 % v/v	FKS 10.3			
LSD (P=.05)					0.088	0.817	6.373
Standard Deviation					0.061	0.563	4.392
CV					26.33	1.21	6.31
Replicate F					3.273	2.155	6.061
Replicate Prob(F)					0.0364	0.1166	0.0027
Treatment F					2.091	1.898	1.091
Treatment Prob(F)					0.0670	0.0957	0.4014

Means followed by same letter do not significantly differ (P=.05, LSD)

Natural inoculum of FHB; no additional spray inoculum;
Some BYDV also present in barley

North Dakota State University

2011 Tessendro K MagThio Barley

Location: FARGO

Study Director: TOM FAIRWEATHER
Investigator: Marcia McMullen

Measurement Name Measurement Type					DON ppm	Twt lbs/bu	Yield bu/acre
Trt. Nr.	Trt. Name	Form Typ	Rate/acre	Growth Stage	1	2	3
1	UNTREATED				0.23 a	45.80 b	78.33 c
2	Proline	SC	5.7 fl oz/a	FK 10.5	0.15 a	46.30 ab	83.15 bc
3	Proline	SC	5.7 fl oz/a	FK 10.5	0.15 a	46.73 a	89.70 a
	MAGTHIO	XL	1 gal/a	FK 10.5			
4	Proline	SC	5.7 fl oz/a	FK 10.5	0.15 a	45.60 b	82.60 bc
	MAGTHIO	XL	2 gal/a	FK 10.5			
5	CARAMBA	F	13.5 fl oz/a	FK 10.5	0.18 a	46.10 ab	82.80 bc
6	CARAMBA	F	13.5 fl oz/a	FK 10.5	0.20 a	46.08 ab	80.03 bc
	MAGTHIO	XL	1 gal/a	FK 10.5			
7	CARAMBA	F	13.5 fl oz/a	FK 10.5	0.20 a	46.10 ab	80.15 bc
	MAGTHIO	XL	2 gal/a	FK 10.5			
8	PROSARO	SC	6.5 fl oz/a	FK 10.5	0.13 a	46.03 ab	85.83 ab
9	PROSARO	SC	6.5 fl oz/a	FK 10.5	0.18 a	46.15 ab	83.28 bc
	MAGTHIO	XL	1 gal/a	FK 10.5			
10	PROSARO	SC	6.5 fl oz/a	FK 10.5	0.23 a	46.25 ab	83.73 bc
	MAGTHIO	XL	2 gal/a	FK 10.5			
LSD (P=.05)					0.104	0.862	5.888
Standard Deviation					0.072	0.594	4.058
CV					40.39	1.29	4.89
Replicate F					0.568	1.078	23.984
Replicate Prob(F)					0.6411	0.3749	0.0001
Treatment F					0.914	1.002	2.497
Treatment Prob(F)					0.5282	0.4620	0.0319

Means followed by same letter do not significantly differ (P=.05, LSD)

MagThio (0-0-0-10S+4Mg) is a neutral to slightly acidic, chlorine free, clear solution, containing 4% magnesium and 10% thiosulfate sulfur. Each gallon of MagThio contains 0.40 pounds of magnesium (Mg) and 1.00 pound of thiosulfate sulfur(S).

2011 Fargo Barley Integrated Cropping System Study for FHB Management

Bob Brueggeman and Pat Gross, NDSU Dept. of Plant Pathology

2011 6-row

Previous ground	FHB Severity%	FHB Incidence%	DON ppm	T.W.lb/A	Yield bu/A*
Wheat	4.2	76.9	0.84b	46.2	43.8b
Soybean	4.3	75.3	0.5a	46.3	49.5a
lsd 0.05	ns	ns	0.15	ns	3.3

* Yield low because of heat stress late in season; also resulted in relatively low FHB

Variety					
Robust	2.8a	64.8a	0.41a	46.2	46.7
Tradition	4.5b	79.0b	0.59a	46.1	47.4
ND 20448	4.7b	73.3b	0.79b	46.4	47.3
Quest	4.8b	87.3c	0.88b	46.3	45.2
lsd 0.05	0.52	7	0.2	ns	ns

Fungicide					
yes	3.3a	71.1a	0.61	46.5	47.1
no	5.1b	81b	0.73	46	46.2
lsd 0.05	0.47	4.4	ns	ns	ns

2011 two row

Previous crop	FHB Severity%	FHB Incidence%	DON	T.W.lb/A	Yield bu/A
Wheat	4.2	54.1	0.39	47.4a	36.8b
Soybean	4	52.9	0.26	46.3b	40.3a
lsd 0.05	ns	ns	ns	0.58	2.9

Variety					
Conlon	6.1d	71.9d	0.14a	48.8a	41.4b
Rawson	4.9c	61.5c	0.5b	46.9b	44.9a
AC Metcalfe	3.7b	48.3b	0.52b	46.3b	33.9c
Scarlet	1.8a	32.3a	0.16a	45.3c	33.9c
lsd 0.05	0.9	6	0.23	0.62	3

Fungicide					
yes	3.5a	48.2a	0.38	47.1a	38.8
no	4.7b	58.8b	0.27	46.6b	38.3
lsd 0.05	0.66	6.1	ns	0.42	ns

Low FHB and some severe BYDV resulted in low yields and no fungicide differences in yield. Fungicide application at early head emergence did result in some FHB reductions.

Barley Uniform Fungicide Study, Langdon 2011

Scott Halley and Amanda Arens, North Dakota State University-Langdon Research Extension Center, Langdon, North Dakota, 58249 Ph.701-256-2582. E-mail Scott.Halley@ndsu.edu

Objectives

The study objectives were to determine if fungicides in the strobilurin fungicide class increase deoxynivalenol accumulation in the seed compared to a non-treated and if a triazole fungicide applied after a strobilurin fungicide could negate or reduce the effect of the strobilurin on DON accumulation.

Materials and Methods

A field experiment was planted on 6 May at the North Dakota State University Langdon Research Extension Center located at Langdon in NE North Dakota. The trial was conducted using best management practices for spring barley including seeding date and rate, fertility, weed control and harvest management. The experiment was a randomized complete block design with four replications. The previous crop was canola. The soil type was Svea-Barnes loam. Celebration spring barley cultivar was seeded at a rate of 1.25 million pure live seeds /acre. Plots seven rows wide by 20 ft. long, 6-in row spacing were planted with an Almaco plot planter equipped with double disk openers and press wheels. A border plot was planted between treated plots to minimize interference from spray drift. Fusarium inoculums consisting of several isolates were hand-broadcast at a rate of 325 grams /plot three and two weeks prior to head emergence and extension to encourage development of Fusarium head blight disease (FHB). After herbicide application was completed an overhead irrigation system was installed to provide supplemental water to wet the inoculum and the grain heads to encourage the development of FHB. Fungicide treatments, rates and application timings are listed in Table 1. The primary active ingredients for the treatments were Cogito-blend of propiconazole and tebuconazole, Caramba-metconazole, Prosaro-blend of tebuconazole and prothioconazole, Headline-pyraclostrobin, Quadris-azoxystrobin, Evito-fluoxastrobin, Stratego YLD-blend of trifloxystrobin and prothioconazole, Quilt-blend of propiconazole and azoxystrobin, Twinline-blend of pyraclostrobin and metconazole. The fungicides were applied with a CO_2–pressurized backpack sprayer operated at 40 psi and delivering 18.4 GPA. The sprayer was equipped with a three-nozzle boom, nozzles spaced 20 inches on center. The foliar treatments were made using Spraying Systems XR8002 nozzles oriented vertically. The flowering treatments were made using Spraying Systems XR8001 nozzles mounted on a double swivel and oriented to spray forward and backward 30 degrees downward from horizontal. The fungicide applications were made at Feekes growth stage 9. 10 or 10.5 on 27 June (wind NW speed 3 MPH, temperature 55° F at 10:15 a.m.), 1 July (no wind, temperature 68° F at 10:30 a.m.) or 6 July (no wind, temperature 66° F at 10:00 a.m.) by maturity. Fusarium head blight (FHB) incidence (I), head severity (HS) and index (FS) were determined from a twenty grain head sample collected at Feekes 11.2 growth stage. Leaf severity was determined from a sample of ten

leaves at the same growth stage. Plots were harvested 10 Aug with an Almaco small plot combine and the yield, test weight, plump and 1000 seed weight determined. Deoxynivalenol accumulation (DON) was determined by the NDSU Toxicology Lab. Data were analyzed with the general linear model (GLM) in SAS. Least significant (LSD) were used to compare means at the $P \leq 0.05$ level.

Results

Yield was positively affected by two fungicide treatments. Caramba applied at GS 10.5 yielded 112.7 bu/ acre which was statistically greater than the non-treated, $P = 0.07$. In addition the treatment that included Headline applied at GS 9 followed by Prosaro applied at GS 10.5 increased yield compared to compared to A9232D (Cogito), the GS 9 application of Headline, Evito and Twinline. No differences in test weight, plump or 1000 seed weight were determined. No differences were determined for visual symptoms of FHB by any parameter or foliar disease.

Although incidence was at very high levels in this study, the severity was in the low category due in part to the environmental climate in the growing season during and after anthesis; i.e. low humidity and very few precipitation events. The DON accumulation was also affected by fungicide treatment despite DON levels of small magnitude. The most effective treatment was the Caramba application which virtually eliminated the presence of DON in the grain sample. Other effective treatments included Prosaro and the Headline + Prosaro treatment although not statistically lower than the non-treated. Also of note were the statistical increases in DON compared to the untreated by Headline (GS9), Quadris, Evito, Stratego YLD, and Twinline fungicides. Quilt was numerically greater than the non-treated but not statistically different. A common thread among this group of treatments is that a component of each treatment includes a fungicide from the strobilurin class. The mode of action of these treatments would be similar and caution should be used in applying them because of this negative affect on DON unless the strobilurin treatment is followed by a fungicide application from the triazole class, i.e. Caramba or Prosaro. More research into the effect of this combination is warranted.

Table 1. Yield, test weight, plump and 1000 seed weight as affected by fungicide treatment to hard red spring wheat, Langdon 2011.

Treatment	Treatment Rate Fl. oz. /acre + %v/v	Feekes Growth Stage	Yield (bu./a)	Test Weight (lb./bu.)	Plump (%)	1000 Seed Weight (g)
Non-treated	NA	NA	94.8	46.9	92.0	35.6
A9232D(Cogito)	7	10.5	92.5	46.4	91.2	35.2
Caramba + Induce	14 + 0.125	10.5	112.7	47.4	93.5	35.9
Prosaro + Induce	6.5 + 0.125	10.5	96.9	47.2	92.9	36.5
Headline SC + Induce	6 + 0.125	9	92.3	47.1	93.1	36.6
Headline SC + Induce and Prosaro + Induce	6 + 0.125 and 6.5 + 0.125	9 and 10.5	109.5	47.0	92.9	35.8
Headline SC + Induce	6 + 0.125	10	99.6	47.2	93.9	36.6
Quadris + Induce	6.2 + 0.125	10	94.4	46.9	92.4	36.1
Evito + Induce	4 + 0.125	10	92.3	46.8	92.7	36.1
Stratego YLD + Induce	4 + 0.125	10	95.1	46.7	92.6	36.5
Quilt + Induce	10.5 + 0.125	10	94.1	46.7	91.5	36.1
TwinLine + Induce	9 + 0.125	10	92.8	47.0	91.7	35.6
LSD (0.05)			16.0[a]	NS	NS	NS
% C.V.			11.5	1.2	1.9	2.8

[a] P = 0.07

Table 2. Fusarium head blight incidence, severity and index, deoxynivalenol accumulation in grain and foliar disease as affected by fungicide treatment to hard red spring wheat, Langdon, 2011.

Treatment	Trt. Rate Fl. oz. /acre + %v/v	Feekes Growth Stage	Fusarium Head Blight Incidence (%)	Severity (%)	Index	DON (ppm)	Foliar Disease (%)
Non-treated	NA	NA	96.3	10.4	9.7	1.2	20.3
A9232D(Cogito)	7	10.5	98.8	11.7	11.5	1.5	16.2
Caramba + Induce	14 + 0.125	10.5	96.3	8.7	8.1	0.1	25.1
Prosaro + Induce	6.5 + 0.125	10.5	97.5	9.2	8.8	0.5	29.5
Headline SC + Induce	6 + 0.125	9	95.0	8.6	7.8	2.2	27.8
Headline SC + Induce and Prosaro + Induce	6 + 0.125 and 6.5 + 0.125	9 and 10.5	91.3	7.6	6.3	0.5	5.1
Headline SC + Induce	6 + 0.125	10	100.0	9.4	9.4	1.9	9.4
Quadris + Induce	6.2 + 0.125	10	96.3	10.2	9.7	2.5	6.4
Evito + Induce	4 + 0.125	10	96.3	8.4	7.8	2.5	21.1
Stratego YLD + Induce	4 + 0.125	10	96.3	10.0	9.5	2.2	11.8
Quilt + Induce	10.5 + 0.125	10	96.3	9.0	8.4	2.0	11.2
TwinLine + Induce	9 + 0.125	10	97.5	9.7	9.3	2.2	8.1
LSD (0.05)			NS	NS	NS	1.0	NS
% C.V.			4.6	27.2	31.4	45.2	92.8

Utilizing and Integrated Management Strategy for Reducing the Negative Effect of Fusarium Head Blight in 6-row Spring Barley.

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Efforts have been initiated and funded by the U.S. Wheat and Barley Scab Initiative to identify management practices that when used together minimize the negative effects caused by Fusarium head blight (FHB) in small grains. Part of this effort has been an ongoing set of trials in different environments evaluating different small grain classes evaluating management options using this integrated approach.

MATERIALS AND METHODS

In 2011 a study was conducted at the North Dakota State University Langdon Research Extension Center. The study was designed as a randomized complete block with a split split plot arrangement and six replicates. The whole plot factor (WP) was previous crop of either canola or hard red spring wheat (HRSW). The split plot factor (SP) was fungicide treatment; Prosaro fungicide or non-treated. The split split factor (SSP) was six-row type spring barley cultivar with differing levels of resistance to FHB. For the 2011 study six barley cultivars were evaluated including Celebration (Bush Agricultural Resources, Inc.), NDSU Experimental a. (NDSU barley breeding program), NDSU Experimental b. (NDSU), Quest (University of Minnesota), Robust (U. of Minnesota) and Tradition (Bush Ag.) NDSU Experimental a. is about 4-5 inches shorter than Tradition, has similar yield potential, would be well suited for irrigation and possible straight combining, has deoxynivalenol accumulation (DON) similar to Stellar-ND and still has not been ruled out by the brewers as suitable for use in their industry. North Dakota Experimental b. has resistance to DON about 50% greater than Robust, is a little taller but has better resistance to lodging, has less stem breakage and similar yield and test weight potential. The cultivars were selected because they were planted on significant acreages of grower's fields in North Dakota or fit a range of susceptibility to FHB. For the split plot factor Prosaro fungicide + Induce adjuvant (6.5 fl. oz. / acre + .0125% v/v) was applied to half the plots and compared to a non-treated. The previous crops for the WP factor were established in 2010 and were canola and HRSW.

The two previous crop treatments were managed by rotary mowing twice (Fall 2010) the canola after pod establishment and HRSW at milk dough growth stage to reduce the amount of viable seed deposited on the ground and minimize contamination by crop class for the 2011 study. The site was tilled with a spring tooth chisel plow with attached harrows once in the fall 2010. In the spring the area was tilled once with a spring tooth cultivator with attached harrows to incorporate the fertilizer and prepare a seed bed. Nitrogen liquid fertilizer, 28-0-0, was fall and spring applied by broadcast method to achieve a target yield goal of 100 bushel /acre. Seed was planted at 1.25 million pure live seeds per acre, determined by blotter paper germination in vitro. The planted plots were seven rows wide six-inch row spacing and measured 20 feet long. An Almaco double-disk drill was used to seed the plots on 19 May. Border plots were planted between treatment rows to

minimize negative effects from spray drift. Prosaro fungicide (421 SC 3.57 lb. /gal. formulation of prothioconazole/tebuconazole, 19% +19% w/w, manufactured by Bayer CropScience)was applied at Feekes growth stage 10.5 (head fully extended), and is recommended to reduce the effects of FHB in small grains. Fungicide treatments were applied with a CO_2-pressurzed backpack sprayer. The boom was equipped with two Spraying Systems Co. TeeJet XR8001 nozzles mounted on a double swivel. The swivels were spaced on 20-inch centers and oriented to spray 30 degrees downward from horizontal and forward and backward. The spray volume was 18.4 GPA obtained by pressurizing the boom at 40 psi. Twenty days after the fungicide application (soft dough growth stage, Feekes 11.2) 20 heads were removed and evaluated to determine FHB incidence (number of spikes infected) and severity of the infected heads (numbers of FHB infected kernels per head divided by total kernels). FHB index is the summation of the individual head incidence times the severity. The plots were harvested with an Almaco plot combine and the sample processed to determine yield, test weight and plump on the barley. Plots were harvested, 24 Aug. A sub sample of the grain was ground and sent to North Dakota State University Barley Quality Lab to determine the presence of the toxin deoxynivalenol (DON). North Dakota State University Extension recommended production practices for barley for Northeast North Dakota were followed. Data were analyzed with the general linear model (GLM) in SAS. Fischer's protected least significant differences (LSD) were used to compare means at the 5% probability level (Table 1).

RESULTS

Previous Crop

The effect of previous crop was measured for Fusarium head blight severity and index and plump. Fusarium severity and index levels were less than 10% and 10 of possible 100, respectively, Table 2. The previous crop HRSW had smaller disease levels than previous crop canola. In previous studies when previous crop canola had greater levels than HRSW we explained differences due to increased density in the canopy including a microclimate more conducive to the development of FHB. In the 2011 trial this was not likely the cause. The site selected for the 2011 trial had a soil profile that was near saturated with water. Since the canola in 2010 matured earlier than the HRSW, the soil had more time to accumulate soil water. The author feels this additional soil water may be partial cause of the small but significant differences in disease levels. A similar advantage was determined for plump although plumps on both previous crops were excellent. An interaction was also determined for DON for previous crop by cultivar, Table 3. The interaction was mostly a magnitude difference with the DON levels for NDSU Experimental line a have greater DON on previous crop canola compared to previous crop HRSW.

Fungicide Treatment

A single application of Prosaro fungicide at early flowering growth stage reduced both head severity and foliar disease levels, Table 2. Deoxynivalenol accumulation was also reduced by 80% with the application. On average yield was increased by 5.2 bu. / acre and test weight increased by 0.7 lb. /bushel. An interaction was also determined for DON for fungicide treatment by cultivar. Most differences by fungicide treatment were magnitude and not significant, Table 3. However, the application of Prosaro to NDSU Experimental a was very effective in reducing DON from 4 ppm on the untreated to 0.6 ppm after fungicide application.

Cultivar

As is often the case differences exist in the cultivar genetics and this study was not different, Table 2. For visual FHB symptoms Quest and Robust had smaller incidence, severity and index. Celebration and NDSU Experimental b had similar FHB severity to Tradition. Foliar disease levels were not high at the growth stage when means were compared. However NDSU Experimental b. had less disease present than Celebration or NDSU Experimental a. Quest and Tradition were statistically significantly different in foliar disease levels from NDSU Experimental a. The ranking of cultivars for DON was as follows NDSU Experimental a > Robust > Tradition = NDSU Experimental b and Quest = Celebration in this study. Yield differences were as follows: Quest = Tradition = Robust and NDSU Experiment b, both of which were equal to Celebration. Differences were also determined for test weight. Robust had greatest test weight followed by Tradition > Celebration which was equal to the other three cultivars. Plump ranking was as follows; NDSU Experimental a > Celebration > Robust and Experimental b both of which were greater than the last two cultivars.

While performance of barley in general was likely affected by site and the microclimate of the season level of performance was very acceptable and comparison among factors should help producers make future decision on strategies for managing FHB.

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Table 1. Confidence intervals for Fusarium head blight incidence, severity, index, foliar disease, deoxynivalenol accumulation in the seed, yield test weight and plump by source of variation, Langdon 2011.

Source of Variation	Fusarium head blight			Foliar Disease	DON	Yield	Test Weight	Plump
	Incidence	Severity	Index					
Rep	0.0221	<0.0001	<0.0001	<0.0001	0.0057	<0.0001	0.0006	0.0609
WP	0.4807	0.0335	0.0381	0.0902	0.0603	0.6038	0.8409	0.0037
Rep*WP	0.0692	0.2484	0.2842	0.0340	0.4825	0.0681	0.0712	0.2581
SP	0.8871	0.0429	0.0634	0.0176	<0.0001	0.0383	<0.0001	0.5534
WP*SP	0.3865	0.3674	0.3659	0.6819	0.0866	0.4345	0.0530	0.4821
Rep*SP(WP)	0.3536	0.0889	0.0529	0.0305	0.1050	<0.0001	0.3011	<0.0001
SSP	<0.0001	<0.0001	<0.0001	0.0448	<0.0001	0.0027	<0.0001	<0.0001
WP*SPP	0.1577	0.9873	0.9534	0.7943	0.0103	0.7606	0.0820	0.2564
SP*SSP	0.1500	0.9663	0.8079	0.9880	<0.0001	0.3030	0.6562	0.2287
WP*SP*SPP	0.6903	0.9576	0.9842	0.9480	0.1120	0.5926	0.2588	0.6387
% C.V.	5.4	18.3	21.0	59.1	47.4	8.6	1.0	0.7

Table 2. Fusarium head blight disease incidence, severity and index, foliar disease, deoxynivalenol accumulation in seed, yield, test weight and plump by previous crop averaged across fungicide treatments and 6-row spring barley cultivars, fungicide treatment averaged across previous crops and 6-row spring barley cultivars and 6-row spring barley cultivars averaged across previous crops and fungicide treatments Langdon, 2011.

	Fusarium head blight			Foliar			Test	
	Incidence	Severity	Index	Disease	DON	Yield	Weight	Plump
	(%)	(%)	(0-100)	(%)	(ppm)	(bu. /acre)	(lb. /bu.)	(%)
Previous Crop								
Canola	97.4	9.8	9.4	23.3	1.0	70.6	46.9	95.9
HRSW	96.4	8.8	8.4	16.7	0.8	71.4	46.8	96.5
LSD $_{(0.05)}$	NS	0.9	0.9	NS	NS	NS	NS	0.3
Fungicide Treatment								
Prosaro	97.0	8.9	8.5	16.0	0.3	73.8	47.2	96.3
Non-treated	96.9	9.7	9.4	24.1	1.5	68.2	46.5	96.1
LSD $_{(0.05)}$	NS	0.8	NS	6.4	0.2	5.2	0.2	NS
Cultivar								
Celebration	98.5	10.1	9.9	24.1	0.4	68.2	46.8	97.1
NDSU Expt. a	98.8	11.1	10.9	25.2	2.3	71.5	46.3	98.1
NDSU Expt. b	98.1	9.7	9.4	16.4	0.6	69.4	46.3	96.2
Quest	93.5	6.9	6.2	18.4	0.6	74.9	46.2	93.3
Robust	92.9	7.3	6.4	18.6	1.0	69.4	48.0	96.2
Tradition	99.8	10.8	10.8	17.4	0.7	72.5	47.4	93.3
LSD $_{(0.05)}$	3.0	1.0	1.1	6.8	0.3	3.5	0.3	0.4

Table 3. Deoxynivalenol accumulation in seed by previous crop and cultivar and fungicide treatment and cultivar, Langdon 2011.

Previous Crop	Cultivar	Deoxynivalenol Accumulation (ppm)	Fungicide Treatment	Cultivar	Deoxynivalenol Accumulation (ppm)
Canola	Celebration	0.4	Prosaro	Celebration	0.2
	NDSU Expt. a	2.7		NDSU Expt. a	0.6
	NDSU Expt. b	0.6		NDSU Expt. b	0.2
	Quest	0.7		Quest	0.2
	Robust	1.0		Robust	0.5
	Tradition	0.6		Tradition	0.3
HRSW	Celebration	0.4	Non-treated	Celebration	0.7
	NDSU Expt. a	1.9		NDSU Expt. a	4.0
	NDSU Expt. b	0.5		NDSU Expt. b	1.0
	Quest	0.6		Quest	1.1
	Robust	0.9		Robust	1.4
	Tradition	0.8		Tradition	1.0
$LSD_{(0.05)}$		0.36 or 0.59			0.36 or 0.39

To compare a_0c_0 vs. a_0c_1 LSD = 0.36 and to compare a_0c_0 vs. a_1c_0 LSD = 0.59 for previous crop by cultivar.

To compare b_0c_0 vs. b_0c_1 LSD = 0.36 and to compare a_0c_0 vs. b_1c_0 for fungicide treatment by cultivar.

Durum

NDSU: Carrington Research Extension Center
2011 - Durum Evaluation
Fungicide Evaluations for Suppression of Fusarium Head Blight (Scab)

ID	Fungicide Treatment	Product Rate/Acre	Application Timing	Treatment Origin	Scab Incid.	Scab Severity	Plot Severity
			Feeke's Stage		%	%	%
1	Untreated control	NA		Core	89.2	42.5	38.2
2	A9232D (Cogito)	7.0 fl oz	Feekes 10.5.1 (early anthesis)	Core	78.3	29.4	23.2
3	Caramba	13.5 fl oz + 0.125% v/v	Feekes 10.5.1 (early anthesis)	Core	85.1	28.6	24.8
4	Prosaro	6.5 fl oz + 0.125% v/v	Feekes 10.5.1 (early anthesis)	Core	68.9	25.7	17.9
5	Headline SC	6.0 fl oz + 0.125% v/v	9.0 (flag leaf fully emerged)	Core	81.4	26.5	21.8
6	Headline SC	6.0 fl oz + 0.125% v/v	9.0 (flag leaf fully emerged)	Core	65.8	22.0	15.5
	Prosaro	6.5 fl oz + 0.125% v/v	Feekes 10.5.1 (early anthesis)				
7	Headline	6.0 fl oz + 0.125% v/v	Feekes 10.5 (~5 days prior to 10.5.1)	Core	76.7	22.1	17.3
8	Quadris	6.2 fl oz + 0.125% v/v	Feekes 10.5 (~5 days prior to 10.5.1)	Core	83.2	35.2	29.7
9	Evito	4.0 fl oz + 0.125% v/v	Feekes 10.5 (~5 days prior to 10.5.1)	Core	87.4	32.5	28.6
10	Stratego YLD	4.0 fl oz + 0.125% v/v	Feekes 10.5 (~5 days prior to 10.5.1)	Core	73.3	22.8	16.7
11	Quilt	10.5 fl oz + 0.125% v/v	Feekes 10.5 (~5 days prior to 10.5.1)	Core	93.1	38.1	35.6
12	TwinLine	9.0 fl oz + 0.125% v/v	Feekes 10.5 (~5 days prior to 10.5.1)	Core	82.3	20.5	16.8
13	Prosaro	6.5 fl oz + 0.125% v/v	* 5 days post-anthesis	CREC	90.8	37.4	34.3
14	Caramba	13.5 fl oz + 0.125% v/v	* 5 days post-anthesis	CREC	86.4	44.1	38.4
15	Folicur	4.0 fl oz + 0.125% v/v	Feekes 10.5.1 (early anthesis)	CREC	76.4	27.3	22.1
16	Proline	5.0 fl oz + 0.125% v/v	Feekes 10.5.1 (early anthesis)	CREC	70.0	24.1	16.8
				MEAN	80.5	29.9	24.9
				C.V.%	9.5	27.2	34.3
				LSD.05	10.9	11.6	12.2
				LSD.01	14.5	15.5	16.2
				Pr > F	<0.0001	0.0007	0.0003
				#REPS	4	4	4

** Treatments 1 through 12 are part of Uniform Scab Fungicide Evaluation program.

** Durum Cultivar = Lebsock;

** Planting Rate = 1.6 million PLS

** Study area inoculated and watered via center pivot.

** This trial was severely damaged by a hail storm on July 24. Only data secured before storm was that related to scab incidence and severity.

** Planting Date = May 6 ; Harvest Date = NA, trial destroyed by hail storm ; Previous Crop = Soybean.

** Treatments applied with 17.0 gallons of water per acre at 35 psi pressure using 8002 Twinjet tips.

** **'Induce'** was the NIS product utilized for all fungicide treatments, except trmt.#2, and was applied at 0.125 % v/v.

Durum Uniform Fungicide Study, Langdon 2011

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Objectives

The study objectives were to determine if fungicides in the strobilurin fungicide class increase deoxynivalenol concentration in the seed compared to an untreated and if a triazole fungicide applied after a strobilurin fungicide could negate or reduce the effect of the strobilurin on DON accumulation.

Materials and Methods

A field experiment was planted on 4 May at the North Dakota State University Langdon Research Extension Center located at Langdon in NE North Dakota. The trial was conducted using best management practices for hard red spring wheat including seeding date and rate, fertility, weed control and harvest management. The experiment was a randomized complete block design with four replications. The previous crop was small grains. The soil type was Svea-Barnes loam. Divide durum wheat cultivar was seeded at a rate of 1.5 million pure live seeds /acre. Plots seven rows wide by 20 ft. long, 6-in row spacing were planted with an Almaco plot planter equipped with double disk openers and press wheels. A border plot was planted between treated plots to minimize interference from spray drift. Fusarium inoculums consisting of several isolates were hand-broadcast at a rate of 150 grams /plot three and two weeks prior to flowering to encourage development of Fusarium head blight disease (FHB). After herbicide application was completed an overhead irrigation system was installed to provide supplemental water to wet the inoculum and the grain heads to encourage the development of FHB. Fungicide treatments, rates and application timings are listed in Table 1. The primary active ingredients for the treatments were Cogito-blend of propiconazole and tebuconazole, Caramba-metconazole, Prosaro-blend of tebuconazole and prothioconazole, Headline-pyraclostrobin, Quadris-azoxystrobin, Evito-fluoxastrobin, Stratego YLD-blend of trifloxystrobin and prothioconazole, Quilt-blend of propiconazole and azoxystrobin, Twinline-blend of pyraclostrobin and metconazole. The fungicides were applied with a CO_2–pressurized backpack sprayer operated at 40 psi and delivering 18.4 GPA. The sprayer was equipped with a three-nozzle boom, nozzles spaced 20 inches on center. The foliar treatments were made using Spraying Systems XR8002 nozzles oriented vertically. The flowering treatments were made using Spraying Systems XR8001 nozzles mounted on a double swivel and oriented to spray forward and backward 30 degrees downward from horizontal. The fungicide applications were made at Feekes growth stage 9. 10.5 or 10.51 on 27 June (wind NW speed 3 MPH, temperature 55° F at 10:15 a.m.), 8 July (wind SE speed 3 MPH, temperature 70° F at 8:00 a.m.) or 11 July (wind West speed 3 MPH, temperature 66° F at 10:30 a.m.) by maturity. Fusarium head blight (FHB) incidence (I), head severity (HS) and index (FS) were determined from a twenty grain head sample collected at Feekes 11.2 growth stage. Leaf severity was determined from a sample of five leaves at the same growth stage. Plots were

harvested 22 Aug with a small plot combine and the yield and test weight determined. Deoxynivalenol accumulation (DON) was determined by the NDSU Toxicology Lab. Data were analyzed with the general linear model (GLM) in SAS. Least significant (LSD) were used to compare means at the $P \leq 0.05$ level.

Results

Strobilurin fungicides are recommended by extension pathologists for control of foliar diseases in small grains. Some researchers have reported elevated DON levels when strobilurin fungicides have been applied for foliar disease control. Divide durum is one of the most resistant durum cultivars to FHB. Durum as a class is possibly the most susceptible wheat to FHB. Fungicide treatments that included a triazole fungicide increased yield compared to the untreated with the exception of Stratego YLD, Table 1. Treatments that were applied at Feekes' growth stage (GS) 10.51 increased test weight and 1000 seed weight. In addition, Headline applied at GS 10.5 increased seed weight. Fusarium head blight incidence was reduced by treatments applied at GS 10.51. The sequential treatment (Headline followed by Prosaro) was more effective than all other treatments in reducing FHB incidence. Fusarium head blight index and head severity were both reduced by the treatments applied at GS 10.51. No differences in leaf diseases were determined. Leaf disease severity was low. Only the Cogito treatment reduced the Fusarium damaged kernels (FDK) in the grain sample. However, there appeared to be a trend toward elevated FDK and DON levels compared to the untreated by many of the strobilurin treatments. Four treatments, Cogito, Caramba, Prosaro and Headline followed by Prosaro were very effective in reducing DON compared to the untreated and all other treatments.

Table 1. Yield, test weight and 1000 seed weight by treatment, fungicide rate and timing on Divide durum, Langdon 2011.

Treatment [a]	Fungicide Rate	Application Timing	Yield	Test Weight	1000 Seed Weight
	Fl. oz. /acre + %v/v	Feekes GS	Bu./acre	Lb./bu.	g
Untreated	Na	Na	37.1	56.8	35.3
Cogito	7	10.5.1	53.6	59.6	39.9
Caramba	14 + 0.125	10.5.1	62.7	60.1	39.8
Prosaro	6.5 + 0.125	10.5.1	57.5	60.1	40.7
Headline	6 + 0.125	9	38.2	56.0	34.9
Headline and Prosaro	6 + 0.125 and 6.5 + 0.125	9 and 10.5.1	64.2	59.9	39.5
Headline	6 + 0.125	10.5	52.2	57.8	37.3
Quadris	6.2 + 0.125	10.5	39.9	56.8	34.5
Evito	4 + 0.125	10.5	38.2	55.9	34.5
Stratego YLD	4 + 0.125	10.5	39.9	56.7	35.7
Quilt	10.5 + 0.125	10.5	42.6	57.1	33.9
TwinLine	9 + 0.125	10.5	48.3	57.8	37.1
LSD (0.05)			9.2	1.1	2.0
Pr>F			<0.0001	<0.0001	<0.0001
% C.V.			13.3	1.3	3.7

[a] Induce adjuvant added to all fungicides except Cogito. GS = growth stage.

Table 2. Fusarium head blight disease incidence, index and head severity, leaf disease, Fusarium damaged kernels and deoxynivalenol accumulation by treatment, fungicide rate and timing on Divide durum, Langdon, 2011

			FHB					
Treatment [a]	Fungicide Rate Fl. oz. /acre + %v/v	Application Timing Feekes GS	Incidence %	Index %	Severity %	Leaf Disease %	FDK %	DON PPM
Untreated	Na	Na	98.8	40.7	42.6	42.4	7.0	12.9
Cogito	7	10.5.1	86.3	16.6	22.1	34.3	1.8	4.4
Caramba	14 + 0.125	10.5.1	82.5	10.8	15.3	39.6	2.6	2.1
Prosaro	6.5 + 0.125	10.5.1	81.3	11.9	17.0	42.5	2.8	1.8
Headline	6 + 0.125	9	96.3	51.4	54.2	38.3	7.7	14.8
Headline and Prosaro	6 + 0.125 and 6.5 + 0.125	9 and 10.5.1	65.0	5.7	12.2	30.6	3.0	2.7
Headline	6 + 0.125	10.5	91.3	24.9	29.9	30.7	6.8	11.8
Quadris	6.2 + 0.125	10.5	97.5	38.4	40.0	32.1	10.9	15.1
Evito	4 + 0.125	10.5	96.3	48.3	49.6	34.9	11.6	13.2
Stratego YLD	4 + 0.125	10.5	95.0	31.5	34.9	54.8	9.7	12.0
Quilt	10.5 + 0.125	10.5	96.3	42.9	45.0	39.4	10.1	12.4
TwinLine	9 + 0.125	10.5	92.5	25.7	29.4	37.7	8.9	11.8
$LSD_{(0.05)}$			10.5	18.7	18.6	NS	4.7	3.4
Pr>F			<0.0001	<0.0001	0.0003	0.3689	0.0003	<0.0001
% C.V.			8.1	44.7	39.5	33.0	47.6	24.6

[a] Induce adjuvant added to all fungicides except Cogito. GS = growth stage. FDK = Fusarium damaged kernels. DON = deoxynivalenol accumulation in the seed.

2011 Evaluation of Diseases on Durum Wheat Varieties at Hettinger

Evaluations by Brandi Herauf, IPM Crops Scout, Dickinson Res. Ext. Center

	Tan Spot		Septoria		Untreated		---- Treated** ----	
Variety	Inc*	Sev*	Inc	Sev	Test wt.	Yield	Test wt.	Yield
	%	%	%	%	lbs/bu	bu/A	lbs/bu	bu/A
Maier	100	3	80	40	55.9	31.3	54.1	35.4
Mountrail	80	2	100	30	56.1	32.4	53.8	35.2
Divide	100	2	100	20	55.8	28.1	55.1	31.4
Alkabo	90	5	100	30	57.1	32.4	55.0	35.6
Grenora	40	1	100	5	53.8	29.2	53.2	36.4
Tioga	50	1	90	10	55.4	25.8	54.0	28.9
Lebsock	20	1	100	40	57.5	33.2	55.4	33.9
Pierce	30	1	100	70	57.4	34.2	56.5	36.4
DG Max	70	1	100	50	57.4	33.4	56.6	40.9
Westhope	40	2	100	40	57.2	38.6	55.2	44.6
Alzada	0	0	100	80	53.2	26.6	51.4	29.7
Strongfield	40	2	90	70	54.0	27.5	52.8	28.2
AC Commander	20	1	100	40	54.0	29.1	54.0	35.0
AC Navigator	30	1	100	40	55.7	26.5	53.8	26.4
WB-Belfield	0	0	100	95	53.3	30.0	52.5	33.6
Wales	0	0	100	40	55.2	30.4	56.0	41.9
CDC Verona	10	10	100	40	53.4	34.5	52.7	35.5
Grande D'oro	50	3	100	20	55.3	33.9	56.3	37.0
DG Star	30	1	90	20	54.1	31.7	53.5	33.2
Rugby	20	1	100	60	54.5	36.2	55.4	41.4
Ben	40	1	100	30	54.8	34.3	56.2	38.1
Dilse	60	1	60	30	53.0	30.1	53.5	36.2
	Trial Mean				55.8	34.8	55.3	38.7

*Incidence = percentage of plants with disease.

*Severity = percentage of flag leaf surface with disease.

**Fungicide Treatments: 8 oz/A Pyraclostrobin (Headline) on June 7 (3 leaf) & 4 oz/A Tebuconazole (Onset) on July 6 (heading).

Date of Observation: July 28
Planting Date: May 2
Previous Crop: HRSW

Crop Rotation, Prosaro Fungicide and Cultivar as Management Tools to Control Disease on Durum Wheat, Langdon, 2011

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Efforts have been initiated and funded by the U.S. Wheat and Barley Scab Initiative to communicate some of the research progress made in developing and identifying strategies that will reduce or minimize the negative effect on small grains from the disease Fusarium head blight (FHB) or head scab. One of these efforts is reported here that compares using crop rotation, a foliar fungicide treatment and durum cultivar resistance or tolerance to FHB. The study utilized a common regional crop rotation, durum after canola, as a comparison to a small grain rotation, durum after hard red spring wheat. The theory behind this is that the quantity of inoculum would be reduced when the previous crop was not susceptible to FHB. The second strategy researched was an application of Prosaro fungicide timed at Feekes growth stage 10.51 (anthesis) to minimize the effects of FHB. The third strategy researched was the selection of a durum cultivar with less susceptibility to FHB.

MATERIALS AND METHODS

These studies were initiated in 2010 by planting randomized strips of hard red spring wheat (HRSW) and canola in six replicates and data collected in 2011 at the North Dakota State University Langdon Research Extension Center. The trial design was a randomized complete block with a split split plot arrangement. Whole plot factor (WP) was previous crop of canola or HRSW, split plot factor (SP) was Prosaro fungicide applied at anthesis or non-treated and split split plot factor was one of six durum cultivars with different levels of resistance to FHB. In 2011 six durum cultivars, DG Star, Dilse, Divide, Grenora, Lebsock and Monroe, were planted at seeding rate of 1.5 million pls acre^{-1} determined by blotter paper germination in vitro. Durum is very susceptible to FHB. The cultivar Divide would have slightly greater tolerance than the other cultivars. All the cultivars are from the North Dakota State University durum breeding program except DG Star which is from the Dakota Growers Pasta breeding program. The cultivars were selected because they were planted on significant acreages of grower's fields in North Dakota or fit a range of susceptibility to FHB, respectively, not enough data, moderately susceptible (MS), moderately resistant, MS, MS and very susceptible. The two previous crop treatments were managed by rotary mowing twice; (Fall 2010) the canola after pod establishment and HRSW at milk dough growth stage to reduce the amount of viable seed deposited on the ground and minimize contamination by crop class for the 2011 study. Liquid nitrogen fertilizer (28-0-0) was fall applied by broadcast method at rate to achieve a yield goal of 60 bu./acre.

The site was tilled with a spring tooth chisel plow with attached harrows once in the fall 2010. In the spring the area was tilled once with a spring tooth cultivator with attached harrows to prepare a seed bed. An Almaco double-disk drill was used to seed the plots on 19 May. The plots were seven rows wide six-inch row spacing and measured 20 feet long. A border plot was seeded between each block to minimize the negative effects of spray drift. A solution of Prosaro fungicide and Induce adjuvant (Helena Chemical Co.) was applied at rate of 6.5 fl. oz. /acre and 0.125%v/v. Prosaro fungicide (421 SC 3.57 lb./gal. formulation of prothioconazole/tebuconazole, 19% +19% w/w, manufactured by Bayer CropScience), applied at Feekes growth stage 10.51, is recommended to reduce the effects of FHB in small grains. Fungicide treatments were applied 18 July at 8:15 a.m. with a CO_2-pressurized backpack sprayer (no wind and air temperature 75°F). The boom was equipped with two Spraying Systems Co. TeeJet XR8001 nozzles mounted on a double swivel. The swivels were spaced on 20-inch centers on a six-nozzle boom and oriented to spray 30 degrees downward from horizontal and forward and backward. The spray volume was 18.4 GPA obtained by pressurizing the boom at 40 psi. Twenty days after the fungicide application (soft dough growth stage, Feekes 11.2) 20 heads were removed and evaluated to determine FHB incidence (number of spikes infected) and severity of the infected heads(number of FHB infected kernels per head divided by total kernels). FHB index is the summation of the incidence times the severity. Ten leaves were also sampled at this time and the necrotic area on the leaf determined visually. The plots were harvested with an Almaco plot combine, 24 Aug and the sample processed to determine yield and test weight. A sub sample of the grain was ground and sent to North Dakota State University NDSU Veterinary Diagnostic lab to determine the accumulation of the toxin deoxynivalenol (DON) in the seed. North Dakota State University Extension recommended production practices for durum wheat for Northeast North Dakota were followed. After the plots were harvested. 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 5% probability level (Table 1).

RESULTS

Previous Crop

The only differences determined for previous crop was an increase in yield and seed weight for durum planted on HRSW previous crop, Table 2. An interaction for previous crop by cultivar for yield was also determined, Table 4. Yield of DG Star increased almost 11 bu. when planting on HRSW previous crop. Only Grenora yield was not increased by planting on HRSW previous crop. Test weight also had interaction for previous crop by cultivar with cultivar Dilse's test weight negatively affected by planting into previous crop HRSW. These results contrast reports from previous similar studies conducted at Langdon where planting on canola previous crop had a positive effect. The site selected for the 2011 trial had a soil profile that was near saturated with water. Since the canola in 2010 matured earlier than the HRSW,

the soil had more time to accumulate soil water. The author feels this additional soil water may be partial cause of the significant differences in yield and seed weights between the two previous crop systems.

Fungicide Treatment

The application of Prosaro fungicide positively affected all the measured parameters except for Fusarium damaged kernels (FDK), Table 2. As one would expect, fungicide treatment provided measurable control of FHB and reduced incidence, severity and index. Foliar disease was also reduced by fungicide treatment and overall deoxynivalenol accumulation in the seed (DON) was reduced by two-thirds. An interaction was determined for DON for fungicide treatment by cultivar, Table 3. All cultivars not treated with fungicide had greater DON. The most severely affected cultivars were Monroe > Lebsock = Grenora = Dilse > DG Star and Divide. This may be one of the first reported comparisons indicating DG Star = to Divide in DON accumulation. Yield was increased by almost eight bushels and both test weight and seed weight significantly increased, Table 2. Perhaps the only disappointment by the fungicide treatment is that the DON levels were still great enough that a price discount may still be applied by the grain buyer.

Cultivar

Differences were determined among cultivars for all parameter except FHB incidence, Table 2. As previously reported Monroe was the most susceptible cultivar and the same as DG Star for FHB severity. All other cultivars had less FHB severity than Monroe. Monroe had slightly greater FHB index than all other cultivars. Dilse had less susceptibility than DG Star determined by FHB index. In contrast Grenora had greatest FDK compared to all other cultivars except Dilse. Divide had less FDK than all cultivars except DG Star. Grenora was the least effected cultivar when measuring foliar disease severity. The DON levels were smallest in DG Star and Divide and greatest in Monroe followed by Dilse. DG Star cultivar yield the greatest and Dilse the least. Test weight was greatest on Lebsock > Monroe and DG Star > Divide > Grenora > Dilse. DG Star and Monroe seed weight > Grenora = Lebsock > Dilse = Divide. A three way interaction occurred for seed weight (previous crop * fungicide treatment * cultivar), Table 4. Seed weight for DG Star, Grenora, Lebsock and Monroe were the same when treated with fungicide and planted on previous crop canola. When no fungicide was applied to previous crop canola all cultivars except DG Star had reduced seed weight. DG Star and Monroe had greater seed weight when treated with Prosaro and planted on previous crop HRSW compared to previous crop canola. In contrast Grenora, Dilse, Divide and Lebsock were not different compared to the previous crop canola Prosaro treated. Divide cultivar had smaller seed weight when not treated with fungicide and planted on previous crop HRSW.

Table 1. Confidence intervals for Fusarium head blight incidence, severity, index and Fusarium damaged kernels (FDK), foliar disease, deoxynivalenol accumulation in the seed (DON), yield, test weight and seed weight by source of variation, Langdon 2011.

Source of Variation	Fusarium head blight				Foliar			Test	Seed
	Incidence	Severity	Index	FDK	Disease	DON	Yield	Weight	Weight
Rep	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0148	<0.0001	<0.0001	0.0283
WP	0.4515	0.2027	0.2571	0.3742	0.1918	0.6311	0.0004	0.2417	0.0030
Rep*WP	0.0322	0.0014	<0.0001	0.8515	0.0004	0.0261	0.5484	0.0201	0.2207
SP	0.0013	<0.0001	<0.0001	0.1552	0.0140	<0.0001	0.0003	0.0012	<0.0001
WP*SP	0.7199	0.9243	0.7690	0.6437	0.3385	0.8262	0.6094	0.9074	0.5823
Rep*SP(WP)	0.0051	0.3780	0.1142	0.6355	<0.0001	0.0046	0.0003	<0.0001	0.1770
SSP	0.1899	0.0003	0.0003	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
WP*SPP	0.3094	0.0817	0.0627	0.5023	0.6140	0.2495	0.0220	0.0428	0.3662
SP*SSP	0.2461	0.1231	0.1375	0.2951	0.3819	<0.0001	0.5469	0.1078	0.2294
WP*SP*SPP	0.8545	0.3708	0.5148	0.5968	0.1802	0.2647	0.8410	0.3552	0.0071
% C.V.	11.3	26.6	38.0	63.3	33.7	34.9	10.7	0.9	3.2

Table 2. Fusarium head blight disease incidence, severity, index and Fusarium damaged kernels (FDK), foliar disease, deoxynivalenol accumulation in seed (DON), yield, test weight and seed weight by previous crop averaged across fungicide trts. and durum cultivars, fungicide trts. averaged across previous crops and cultivars, and cultivars averaged across previous crops and fungicide trts., Langdon, 2011.

	Fusarium head blight				Foliar			Test	Seed
	Incidence	Severity	Index	FDK	Disease	DON	Yield	Weight	Weight
	(%)	(%)	(0-100)	(g/100)	(%)	(ppm)	(bu. /acre)	(lb. /bu.)	(g/1000)
Previous Crop									
Canola	86.8	17.9	14.8	3.6	39.3	1.9	39.6	61.2	42.0
HRSW	84.7	15.7	12.1	3.3	32.5	2.0	45.2	61.0	43.5
$LSD_{(0.05)}$	NS	NS	NS	NS	NS	NS	1.8	NS	0.7
Fungicide Trt.									
Prosaro	79.8	13.8	9.6	3.2	29.3	1.0	46.3	61.6	43.9
Non-treated	91.7	19.8	17.2	3.7	42.4	3.0	38.4	60.5	41.6
$LSD_{(0.05)}$	5.9	1.7	2.4	NS	9.8	0.4	3.2	0.6	0.6
Cultivar									
DG Star	85.9	17.5	14.1	2.5	39.7	1.1	46.2	61.6	44.7
Dilse	82.1	14.7	10.9	3.8	35.3	2.5	38.1	59.8	41.0
Divide	85.7	15.4	12.1	2.2	37.8	1.1	41.2	60.7	40.9
Grenora	85.6	16.6	13.2	5.0	23.3	2.1	43.0	60.3	43.2
Lebsock	85.4	16.1	12.8	3.7	39.1	1.9	42.3	62.3	42.6
Monroe	89.7	20.6	17.7	3.6	40.2	3.2	43.4	61.7	44.3
$LSD_{(0.05)}$	NS	2.6	2.9	1.3	6.9	0.4	2.6	0.3	0.8

Table 3. Deoxynivalenol accumulation in seed by previous crop and cultivar and fungicide treatment and cultivar, Langdon 2011.

Previous Crop	Cultivar	Yield	Test Weight	Fungicide Treatment	Cultivar	Deoxynivalenol Accumulation (ppm)
Canola	DG Star	40.8	61.6	Prosaro	DG Star	0.5
	Dilse	35.4	60.2		Dilse	1.6
	Divide	38.9	60.8		Divide	0.5
	Grenora	42.4	60.5		Grenora	1.0
	Lebsock	39.2	62.3		Lebsock	0.8
	Monroe	40.6	61.7		Monroe	1.5
HRSW	DG Star	51.6	61.6	Non-treated	DG Star	1.7
	Dilse	40.8	59.4		Dilse	3.5
	Divide	43.6	60.7		Divide	1.6
	Grenora	43.6	60.1		Grenora	3.2
	Lebsock	45.4	62.3		Lebsock	3.0
	Monroe	46.2	61.7		Monroe	4.9
$LSD_{(0.05)}$		3.7 or 3.8	0.5 or 0.6			0.6 or 0.7

To compare a_0c_0 vs. a_0c_1 LSD = 3.69 and to compare a_0c_0 vs. a_1c_0 LSD = 3.78 for previous crop by cultivar for yield.
To compare a_0c_0 vs. a_0c_1 LSD = 0.45 and to compare a_0c_0 vs. a_1c_0 LSD = 0.57 for previous crop by cultivar for test weight.
To compare b_0c_0 vs. b_0c_1 LSD = 0.56 and to compare a_0c_0 vs. b_1c_0 LSD = 0.66 for fungicide treatment by cultivar for deoxynivalenol accumulation.

Table 4. Durum seed weight by previous crop, fungicide treatment and cultivar, Langdon 2011

Previous Crop	Fungicide Treatment	Cultivar	Seed Weight (g/1000)
Canola	Prosaro	DG Star	44.5
		Dilse	41.1
		Divide	41.5
		Grenora	44.1
		Lebsock	43.4
		Monroe	44.1
	Non-treated	DG Star	43.0
		Dilse	38.7
		Divide	39.6
		Grenora	41.4
		Lebsock	40.5
		Monroe	42.7
HRSW	Prosaro	DG Star	47.4
		Dilse	42.0
		Divide	42.4
		Grenora	44.8
		Lebsock	44.4
		Monroe	47.3
	Non-treated	DG Star	43.6
		Dilse	42.2
		Divide	40.0
		Grenora	42.7
		Lebsock	42.1
		Monroe	42.9
$LSD_{(0.05)}$			1.6 , 1.7 or 1.3

To compare $a_0b_0c_0$ vs. $a_0b_0c_2$ LSD = 1.6; to compare $a_0b_0c_0$ vs. $a_0b_1c_0$ LSD = 1.7; and to compare $a_0b_0c_0$ vs. $a_1b_0c_1$ LSD = 1.3.

NDSU North Central Research Extension

2011 BASF Durum Fungicide

Trial ID: 11BASFDurumFung
Protocol ID: 11BASFDurumFung
Location: Ray
Study Director: Kent
Project ID:
Investigator: Jeremy Pederson
Sponsor Contact:

Description			Leaf Disease	Leaf Disease	Leaf Disease	Test Weight	Plot Weight
Part Rated			Plot -	Plot -	Plot -	Plot -	Plot -
Rating Date			7-9-2011	7-17-2011	7-27-2011	9-26-2011	9-26-2011
Rating Type			Visual	Visual	Visual	Weight	YIELD
Rating Unit			%	%	%	lb/bu	BU
Number of Subsamples			1	1	1	1	1
Days After First/Last Applic.			6 6	14 14	24 10	85 61	85 61
Trt-Eval Interval			6 DA-A	14 DA-A	24 DA-A		
Trt No.	Treatment Name	Rate Rate Unit					
1	Untreated		23.8a	28.8a	42.5a	56.5c-f	25.6d
	Wolverine	27.4OZ/A					
2	Twinline	7OZ/A	12.5c	12.5ef	30.0cd	55.9ef	25.5d
	Wolverine	27.4OZ/A					
3	Headline	3OZ/A	11.9c	13.1de	27.5cde	56.4c-f	27.9cd
	Wolverine	27.4OZ/A					
4	Headline AMP	5.03OZ/A	12.5c	14.4cde	31.3c	56.7c-f	26.6d
	Wolverine	27.4OZ/A					
5	Priaxor	2OZ/A	13.1c	13.1de	25.0e	55.5f	25.5d
	Wolverine	27.4OZ/A					
6	Priaxor	4OZ/A	10.6c	10.6f	23.8e	57.5bc	27.8cd
	Wolverine	27.4OZ/A					
7	Tilt	2OZ/A	18.1b	20.6b	36.3b	56.2def	25.5d
	Wolverine	27.4OZ/A					
8	Quilt Xcel	5OZ/A	13.8c	16.3c	31.3c	57.0b-e	28.3bcd
	Wolverine	27.4OZ/A					
9	Evito	2OZ/A	12.5c	15.0cd	26.3de	57.2bcd	26.0d
	Wolverine	27.4OZ/A					
10	Headline	3OZ/A	13.8c	15.0cd	15.0f	58.0b	31.3bc
	Headline	6OZ/A					
	Wolverine	27.4OZ/A					
11	Headline	3OZ/A	13.1c	14.4cde	26.3de	59.2a	32.2b
	Caramba	13.5OZ/A					
	Wolverine	27.4OZ/A					
12	Headline	6OZ/A	12.5c	13.8de	13.8f	59.4a	39.9a
	Headline	3OZ/A					
	Caramba	13.5OZ/A					
	Wolverine	27.4OZ/A					
LSD (P=.05)			4.02	2.29	4.82	1.19	4.23
Standard Deviation			2.78	1.59	3.34	0.82	2.93
CV			19.85	10.17	12.18	1.44	10.27
Grand Mean			14.01	15.63	27.4	57.1	28.51

Means followed by same letter do not significantly differ (P=.05, LSD)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.