# Barley 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 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.

Yield, test weight, plump and 1000 seed weight by fungicide treatment to hard red spring wheat, fungicide rate and Feekes' growth stage, 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 by fungicide treatment to hard red spring wheat, treatment rate and Feekes' growth stage Langdon, 2011.

| Treatment | Treatment Rate Fl. oz. /acre + %v/v | Feekes Growth Stage | Fusarium Head Blight Incidence (%) | Fusarium Head Blight Severity (%) | Fusarium Head Blight 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 |