

BARLEY (*Hordeum vulgare*, 'Endeavor', 'KWS Scala', 'SY Tepee', 'Wintmalt')  
Fusarium head blight (scab); *Fusarium graminearum*  
Spot blotch; *Bipolaris sorokiniana*  
Net blotch; *Pyrenophora teres*  
Scald; *Rhynchosporium commune*

J.A. Cummings, K.L. Myers, G.C. Bergstrom, Plant Pathology and Plant-Microbe Section, School of Integrative Plant Science, and P.J. Stachowski, Cornell Agricultural Experiment Station, Cornell University, Ithaca, NY 14853

### Evaluation of integrated methods for management of Fusarium head blight and foliar diseases of winter malting barley in New York, 2017.

The trial was conducted at the Musgrave Research Farm in Aurora, NY in a Lima silt loam soil planted with four 2-row winter malting barley varieties, 'Endeavor', 'KWS Scala', 'SY Tepee', and 'Wintmalt' on 13 Sep 2016. The experiment was set up as a completely randomized block design with a split-plot arrangement, with cultivar as the main plot and the fungicide treatments as subplots, randomized in five replicated blocks. Main plots were sown at 100 lb/A with a commercial grain no-till drill into a terminated hay field. Subplots were 20 × 10 ft including 15 rows with 7.5-in. row spacing. The plots were fertilized at planting (200 lb/A of 10-20-20) and topdressed on 12 Apr (60 lb/A of urea, providing an additional 27.6 lb/A of nitrogen). The Wintmalt barley heads emerged three days later than the barley heads of the other three varieties, and therefore the first fungicide application and inoculation for Wintmalt occurred three days after that of the other varieties, and the second Wintmalt applications occurred when the second round of applications occurred for the other three varieties. Fungicides were applied to Endeavor, KWS Scala and SY Tepee plots at head emergence (Feekes growth stage, FGS 10.5) on 20 May and 27 May, and to Wintmalt plots on 23 May and 27 May. Fungicide applications included the surfactant Induce at 0.125% v/v. After the fungicides had dried, plots were spray-inoculated with a conidial suspension of *F. graminearum* (40,000 conidia/ml) to augment the development of Fusarium head blight (FHB). Fungicide treatments and *F. graminearum* inoculum were applied by a tractor-mounted sprayer with TJ-AI3070 nozzles, 18-in. apart, pressurized at 32 psi, and calibrated to deliver 20 gal/A. Incidence and severity (percent of symptomatic spikelets on symptomatic heads) of FHB in each plot were rated on 7 Jun and used to calculate FHB Index, where FHB index = (FHB severity \* FHB incidence)/100. Primarily spot blotch, caused by *Bipolaris sorokiniana*, and some net blotch, caused by *Pyrenophora teres*, were rated collectively as 'leaf blights' on 7 Jun as percent disease severity on flag leaves and one leaf below the flag leaf (average rating for whole plot). Scald, caused by *Rhynchosporium commune*, was similarly rated on 7 Jun. Grain was harvested from a 20 × 5 ft area in each subplot using an Almaco plot combine on 11 Jul. Grain moisture, plot yield, and test weight was recorded from all plots. Yield and test weight were adjusted to bu/A and lb/bu, respectively, at 14.5% moisture. Deoxynivalenol (DON) concentration (ppm) in grain was analyzed at the Mycotoxin Analysis Laboratory at the University of Minnesota, St. Paul, MN. Treatment means were calculated, subjected to analysis of variance, and separated by Tukey-Kramer HSD test ( $P = 0.05$ ).

The 2017 growing season resulted in moderately low levels of foliar diseases, and moderate concentrations of DON. When the results of all cultivars were combined, all fungicide treatments significantly reduced leaf blights, but only Prosaro significantly reduced scald, as compared with the non-treated control. Prosaro resulted in the greatest test weight, but none of the treatments had any effect on yield. Prosaro was also the only treatment that resulted in significantly lower visual FHB index ratings than all other treatments, but all fungicide treatments significantly reduced DON as compared to the non-treated control. When the results of all treatments were combined, Endeavor had the most severe leaf blights, but the least severe scald. Wintmalt and KWS Scala both had significantly greater levels of scald compared to Endeavor and SY Tepee. SY Tepee had the greatest test weight and yield compared to all other cultivars. According to visual ratings, SY Tepee had the greatest FHB index, but Wintmalt had significantly greater DON than all other varieties. However, when the cultivars were analyzed separately, the FHB index was only differentiated by treatment for SY Tepee, with the Prosaro treatment resulting in significantly lower FHB index than the other treatments. DON was consistently greatest in the non-treated control for each of the individual cultivars. Yield was not affected by any of the treatments for each cultivar. Although there was no differentiation of visual FHB index for Endeavor, KWS Scala or Wintmalt, the DON was greatest for the non-treated control for each of those cultivars. The FHB index did not correlate well with DON for any of the cultivars. This may indicate that visual ratings of FHB incidence and severity for malting barley may not be adequate predictors of DON in the final grain. Overall, these results indicate that all of these fungicide treatments can significantly reduce leaf blights and DON, and that the Prosaro and/or Caramba treatments can reduce DON below the acceptable 1 ppm threshold for Endeavor, KWS Scala, and SY Tepee under moderately-low FHB pressure. These results also indicate that all of these varieties are at least moderately susceptible to FHB, but that Wintmalt is significantly more susceptible to FHB and accumulation of DON than the other varieties.

Cultivar, treatment, and amount/A	Leaf blights (%) <sup>z</sup>	Scald (%)	FHB Index	DON (ppm)	Test weight (lb/bu)	Yield (bu/A)
<b>Endeavor</b>						
Non-sprayed, inoculated control	7.2	2.4	0.6	2.2 a	49.3 b	58.2
Prosaro 421SC (8.2 fl oz) and inoculated FGS 10.5	2.8	1.6	0.3	1.2 b	51.2 a	82.6
Caramba 0.75EC (17.0 fl oz) and inoculated FGS 10.5	2.8	0.7	0.1	0.7 b	50.2 a	93.4
Inoculated at FGS 10.5, followed by Caramba 0.75EC (17.0 fl oz) and inoculated 7 days later						
HSD ( <i>P</i> =0.05)	NS	NS	NS	0.72	1.53	NS
CV (%)	76.6	102.7	119.2	62.8	2.2	28.9
<b>KWS Scala</b>						
Non-sprayed, inoculated control	3.6	15.6 ab	1.1	2.1 a	48.3	85.0
Prosaro 421SC (8.2 fl oz) and inoculated FGS 10.5	2.1	1.2 b	0.4	0.8 b	48.8	86.7
Caramba 0.75EC (17.0 fl oz) and inoculated FGS 10.5	3.0	14.8 ab	0.5	0.7 b	48.5	79.8
Inoculated at FGS 10.5, followed by Caramba 0.75EC (17.0 fl oz) and inoculated 7 days later						
HSD ( <i>P</i> =0.05)	NS	19.55	NS	1.14	NS	NS
CV (%)	33.1	86.8	68.5	77.9	1.9	16.3
<b>SY Tepee</b>						
Non-sprayed, inoculated control	2.6	3.6	2.2 a	2.6 a	50.1	98.1
Prosaro 421SC (8.2 fl oz) and inoculated FGS 10.5	1.2	0.8	0.7 b	0.7 b	50.5	97.4
Caramba 0.75EC (17.0 fl oz) and inoculated FGS 10.5	1.4	0.5	1.6 ab	0.6 b	50.4	93.2
Inoculated at FGS 10.5, followed by Caramba 0.75EC (17.0 fl oz) and inoculated 7 days later						
HSD ( <i>P</i> =0.05)	NS	NS	1.23	0.83	NS	NS
CV (%)	63.6	204.5	60.3	77.3	1.1	17.6
<b>Wintmalt</b>						
Non-sprayed, inoculated control	2.8 a	22.6 a	0.1	4.1 a	48.5 b	59.7
Prosaro 421SC (8.2 fl oz) and inoculated FGS 10.5	1.0 b	6.7 b	0.1	2.3 ab	50.7 a	80.1
Caramba 0.75EC (17.0 fl oz) and inoculated FGS 10.5	1.8 ab	11.0 ab	0.1	2.0 b	49.6 ab	79.7
Inoculated at FGS 10.5, followed by Caramba 0.75EC (17.0 fl oz) and inoculated 7 days later						
HSD ( <i>P</i> =0.05)	1.36	14.2	NS	1.89	1.41	NS
CV (%)	50.0	62.0	69.4	64.1	2.1	21.9
<b>Cultivar mean</b>						
Endeavor	4.1 a	1.4 b	0.3 bc	1.2 b	50.2 ab	80.2 b
KWS Scala	2.8 ab	14.6 a	0.7 b	1.1 b	48.6 c	82.1 ab
SY Tepee	1.7 b	1.6 b	1.4 a	1.2 b	50.4 a	96.4 a
Wintmalt	1.9 b	15.2 a	0.1 c	2.4 a	49.5 b	71.0 b
HSD ( <i>P</i> =0.05)	1.46	6.78	0.44	0.90	0.79	14.67
CV (%)	75.5	127.5	113.9	80.0	2.4	23.6
<b>Treatment mean</b>						
Non-sprayed, inoculated control	4.1 a	11.1 a	1.0 a	2.7 a	49.1 b	77.1
Prosaro 421SC (8.2 fl oz) and inoculated FGS 10.5	1.8 b	2.6 b	0.4 b	1.2 b	50.3 a	86.7
Caramba 0.75EC (17.0 fl oz) and inoculated FGS 10.5	2.3 b	6.8 ab	0.6 ab	1.0 b	49.7 ab	87.3
Inoculated at FGS 10.5, followed by Caramba 0.75EC (17.0 fl oz) and inoculated 7 days later						
HSD ( <i>P</i> =0.05)	1.50	8.33	0.59	0.77	0.93	NS
CV (%)	75.5	127.5	113.9	80.0	2.4	23.6

<sup>z</sup> Column numbers followed by different letters are significantly different at *P*=0.05 as determined by Tukey-Kramer HSD.