

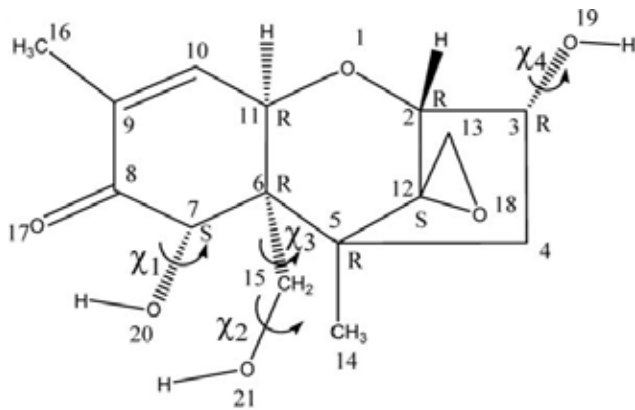
Developing transgenic wheat and barley  
that exhibit resistance to *Fusarium  
graminearum* via glucoside conjugation of  
trichothecene mycotoxins

Gary J. Muehlbauer  
University of Minnesota



# Trichothecenes are virulence factors on wheat

Deoxynivalenol (DON)

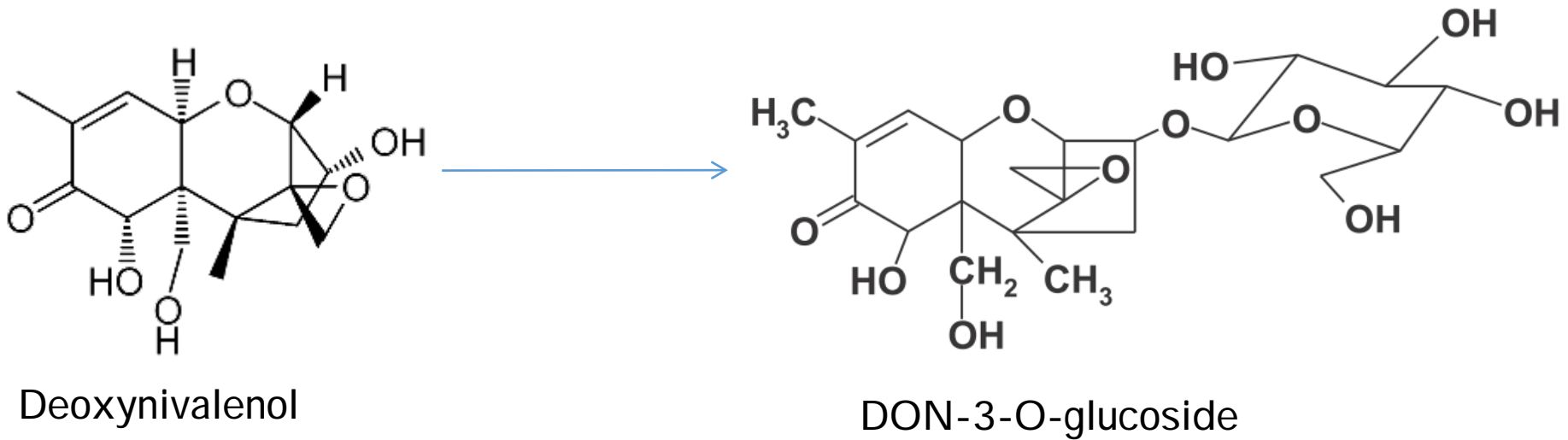


*Tri5* mutant - knockout in trichodiene synthase resulting in trichothecene nonproducing Fusarium



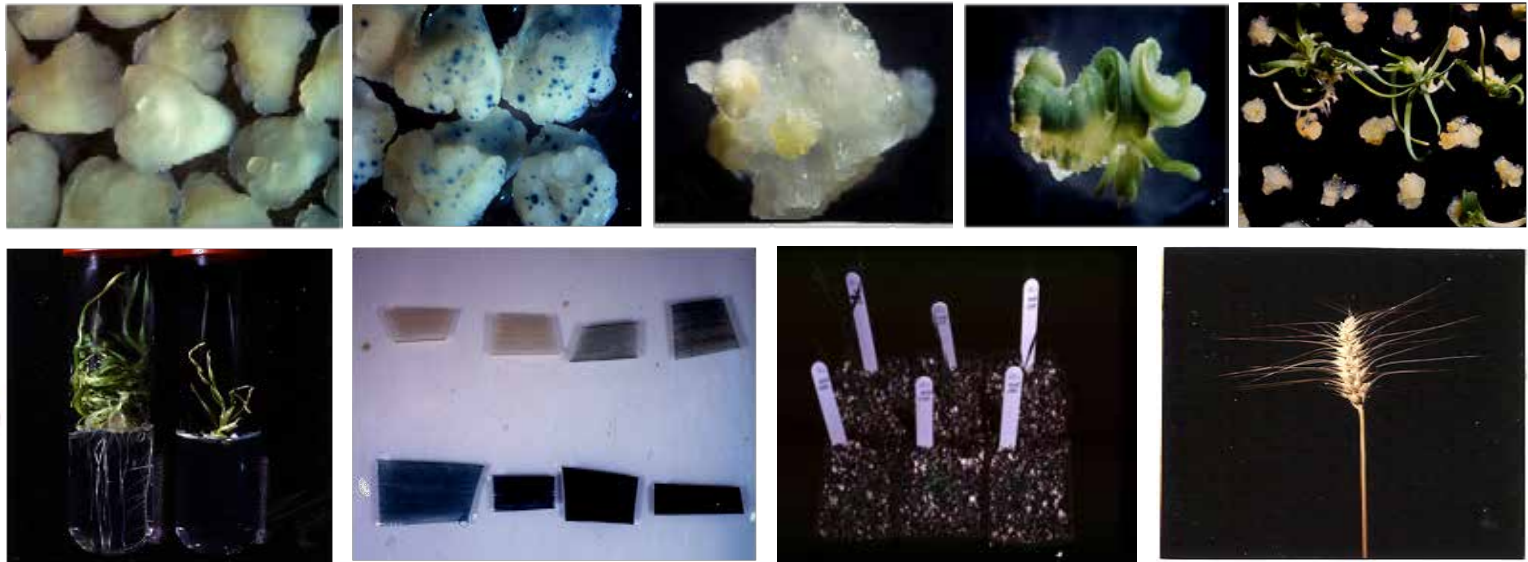
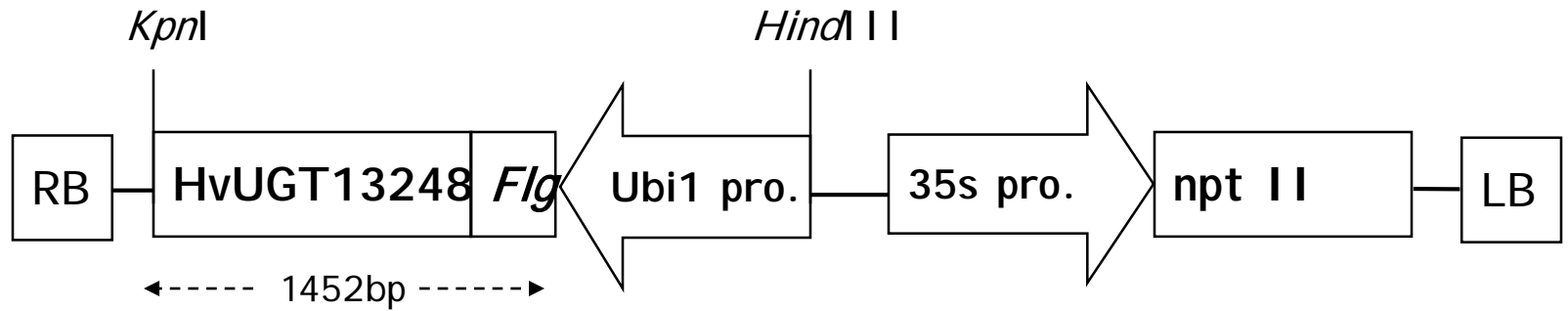
Proctor et al., 1995

# UDP glucosyltransferase activity converts DON to DON-3-glucoside



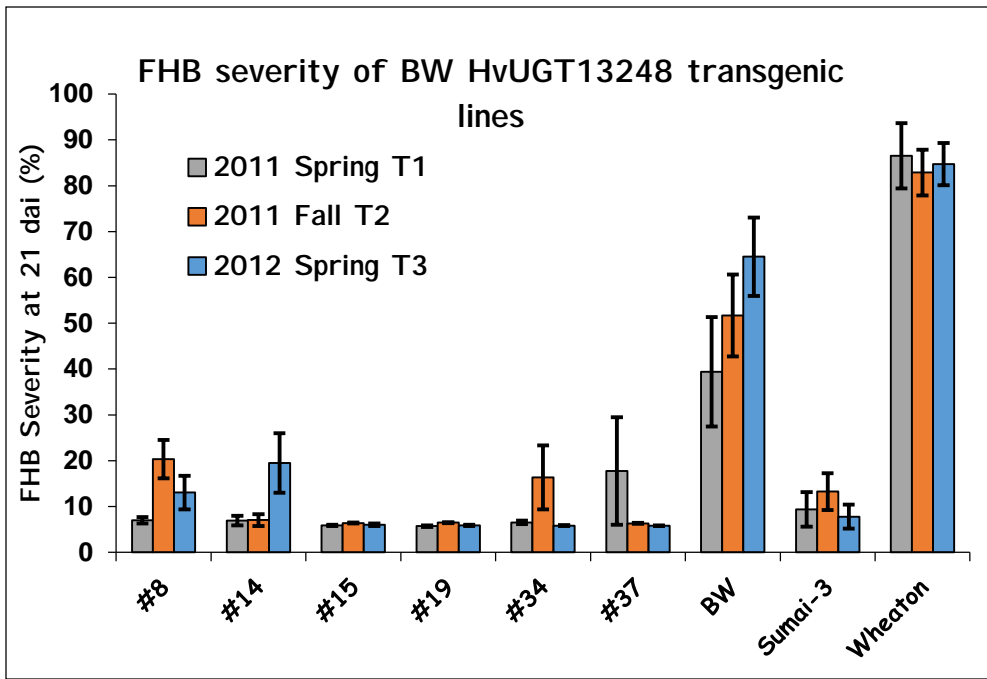
- HvUGT13248* encodes a barley UDP glucosyltransferase
- Confers resistance in yeast and Arabidopsis to DON
  - Catalyzes the conjugation of DON to D3G
  - Schweiger et al., 2010; Shin et al., 2012

# Wheat transformation



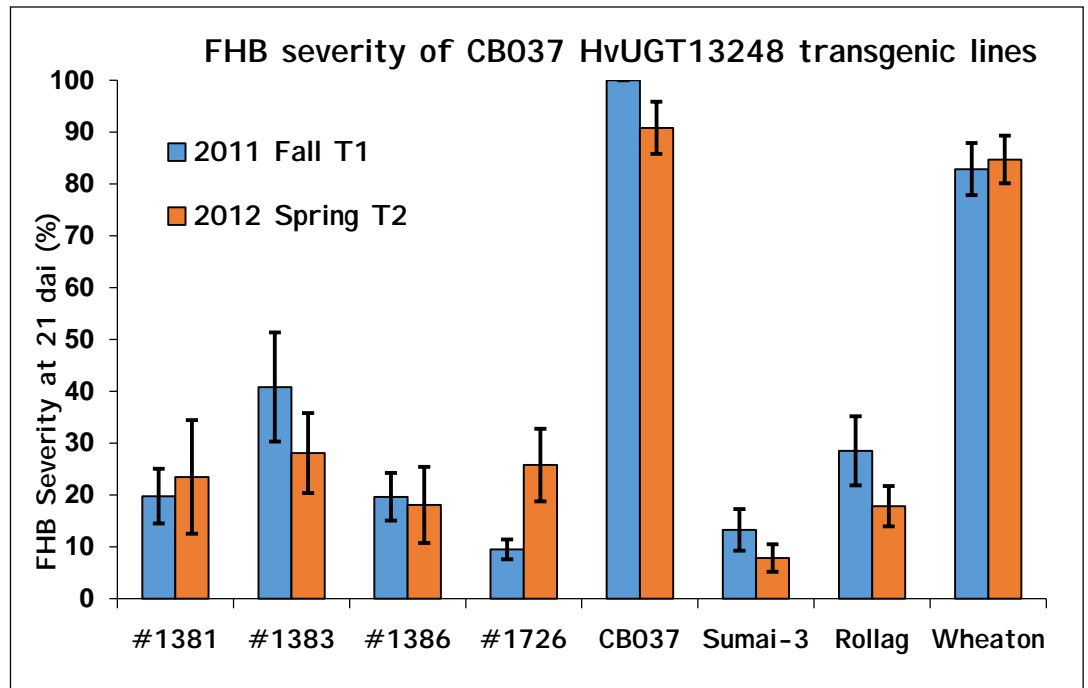
Clemente collaboration

# Transgenic wheat carrying *HvUGT13248* confer type II resistance

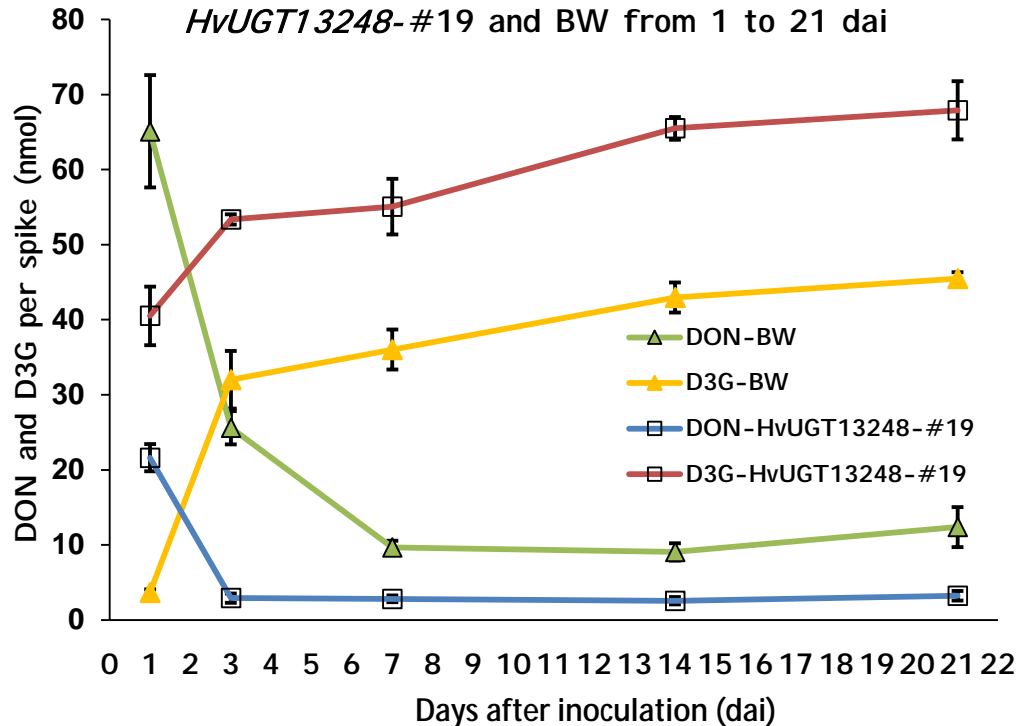


HvUGT13248

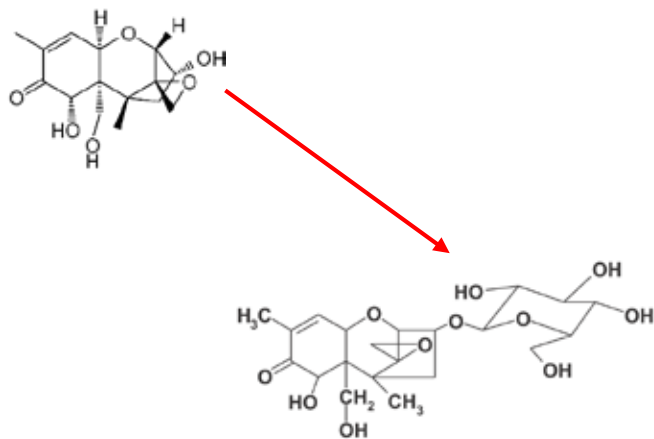
BW



DON and D3G concentration changes in  
*HvUGT13248*-#19 and BW from 1 to 21 dai

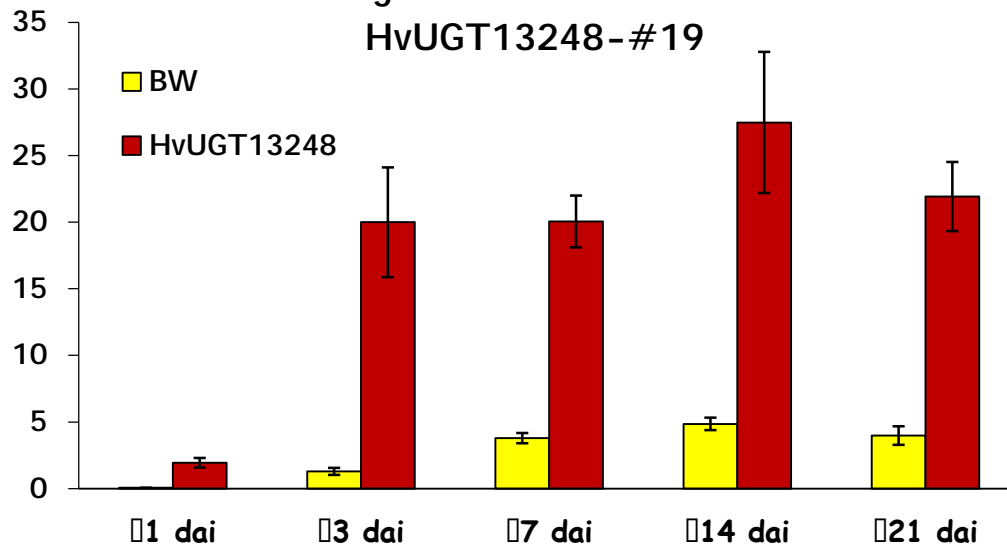


*HvUGT13248*  
rapidly catalyzes  
DON to D3G *in*  
*planta*

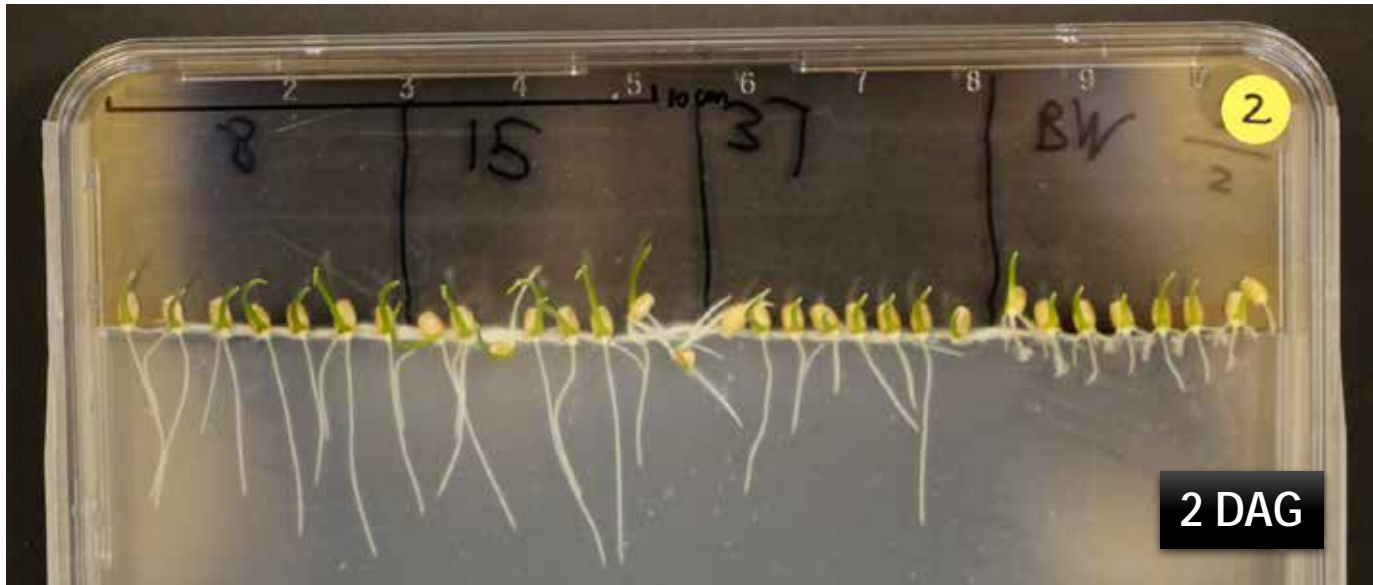


F. Berthiller collaboration

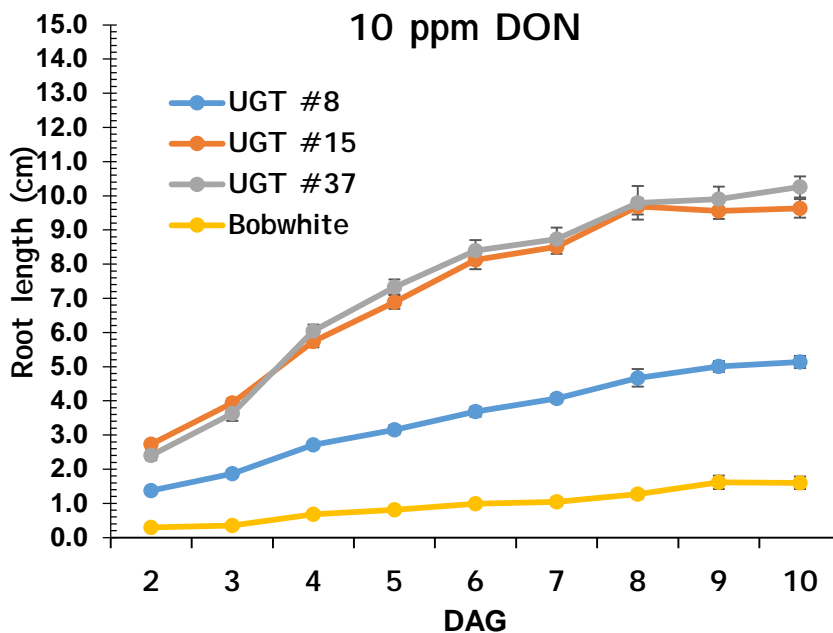
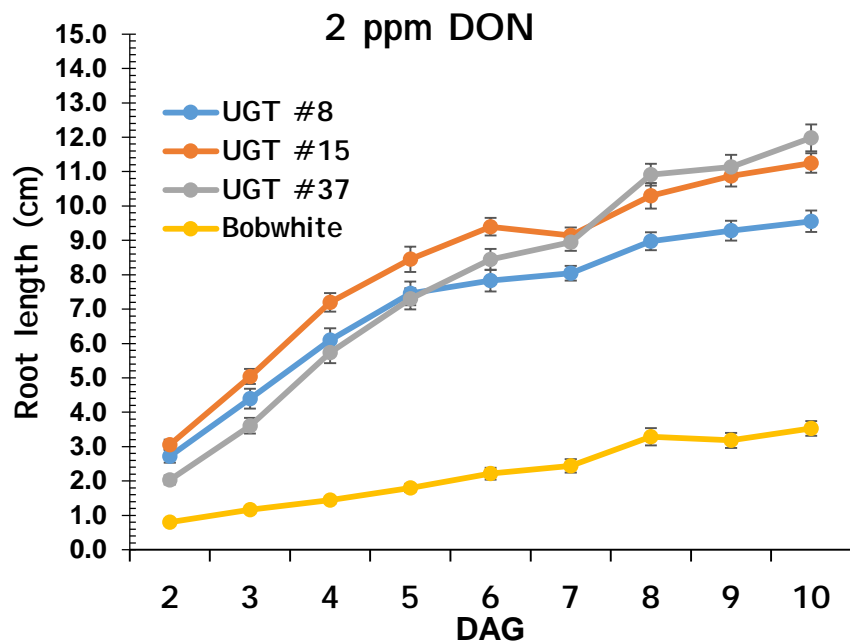
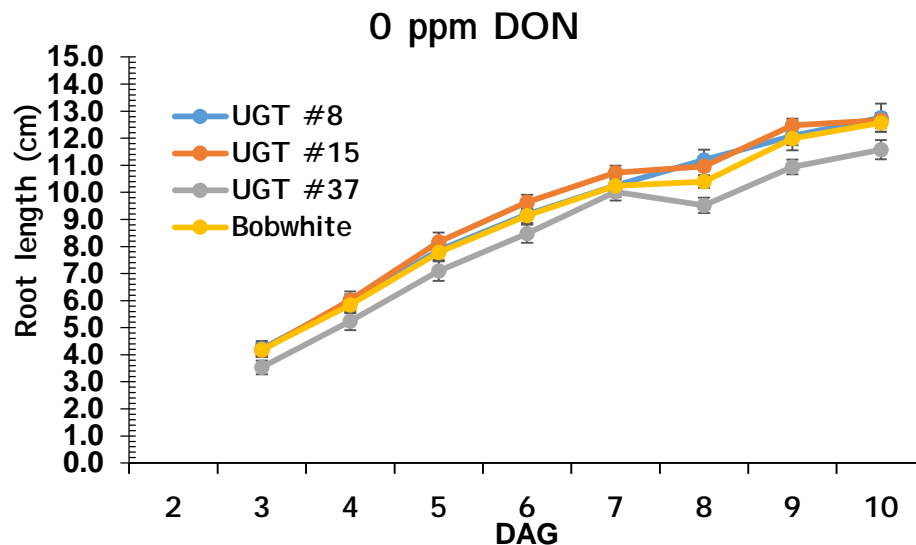
Fold change of D3G/DON in BW and  
*HvUGT13248*-#19



# Transgenic wheat carrying *HvUGT13248* provide resistance to DON

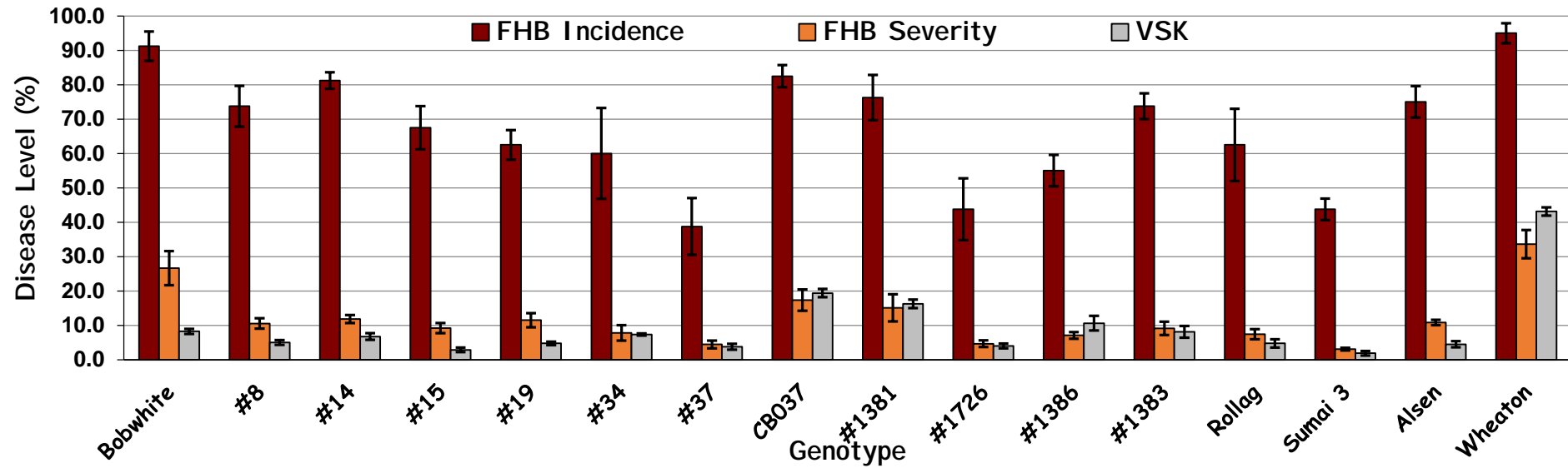


# Transgenic wheat carrying *HvUGT13248* provide resistance to DON

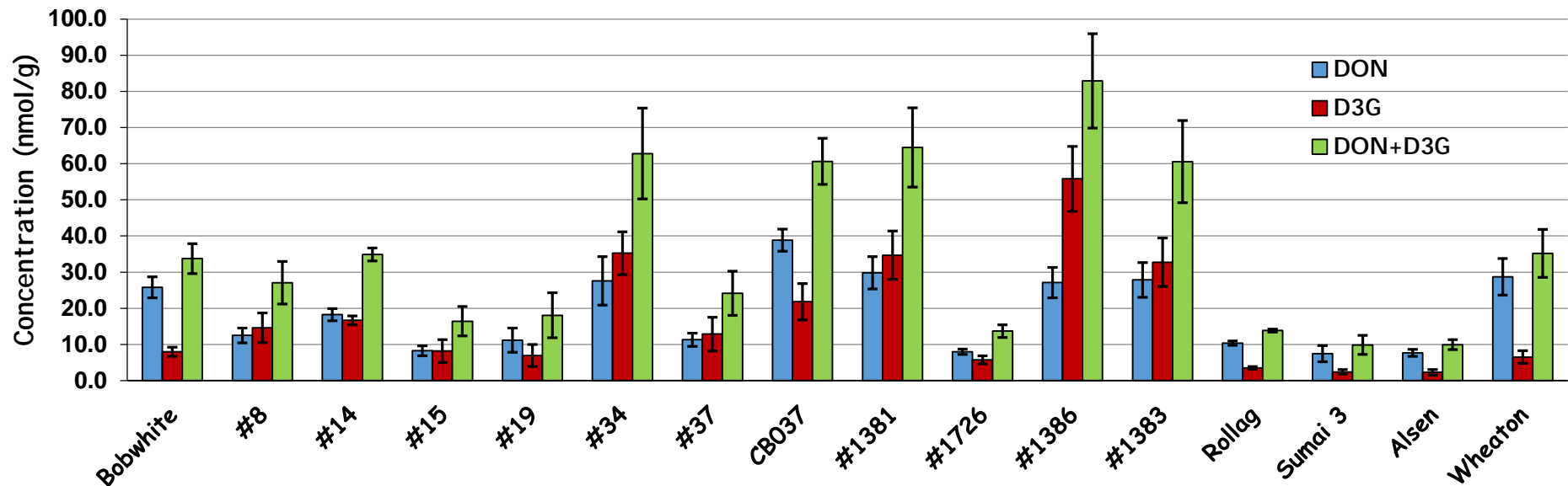




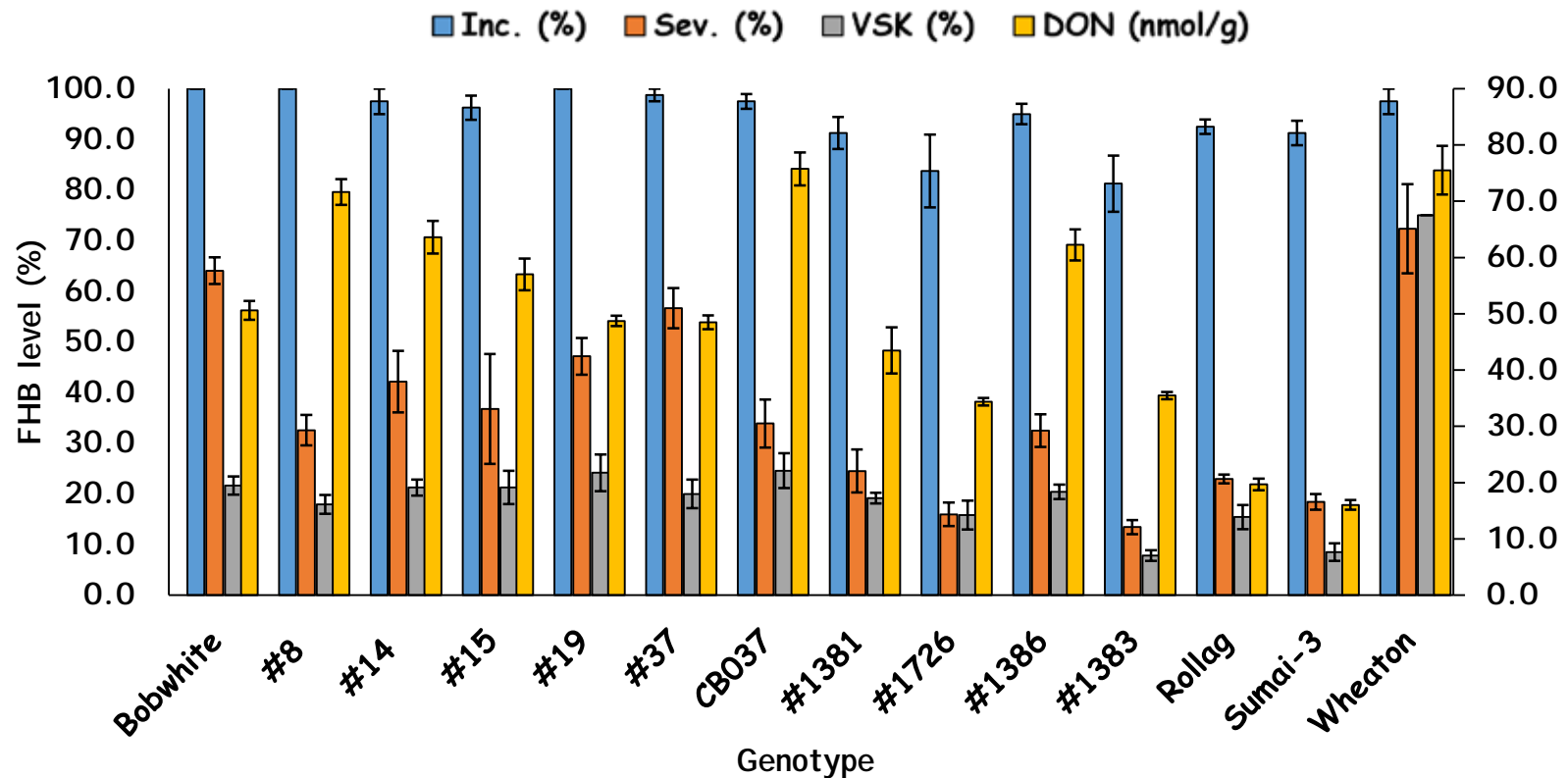
# FHB disease phenotypes in field grown transgenic wheat (2013)



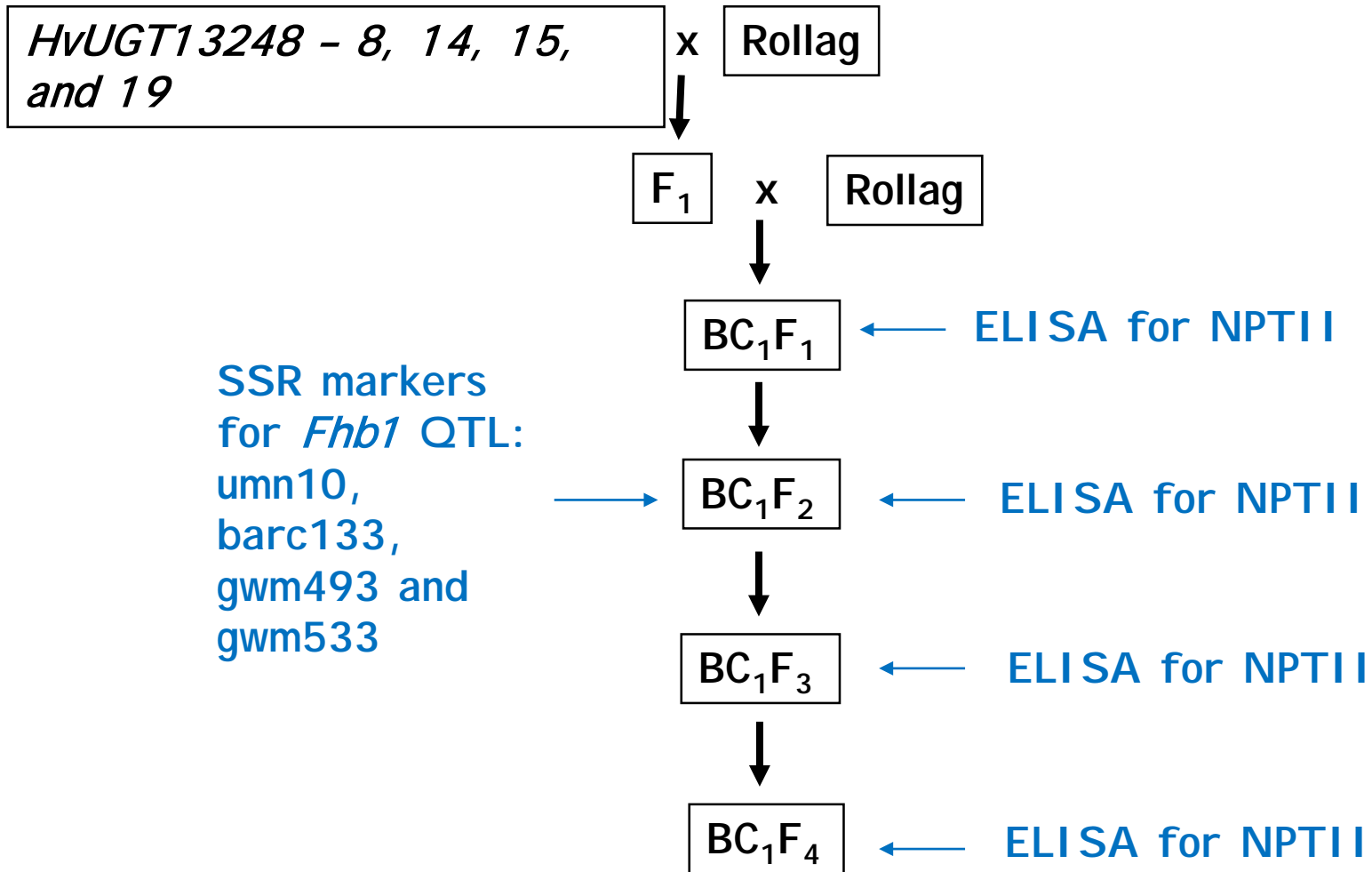
# DON and D3G concentration in field grown transgenic wheat (2013)



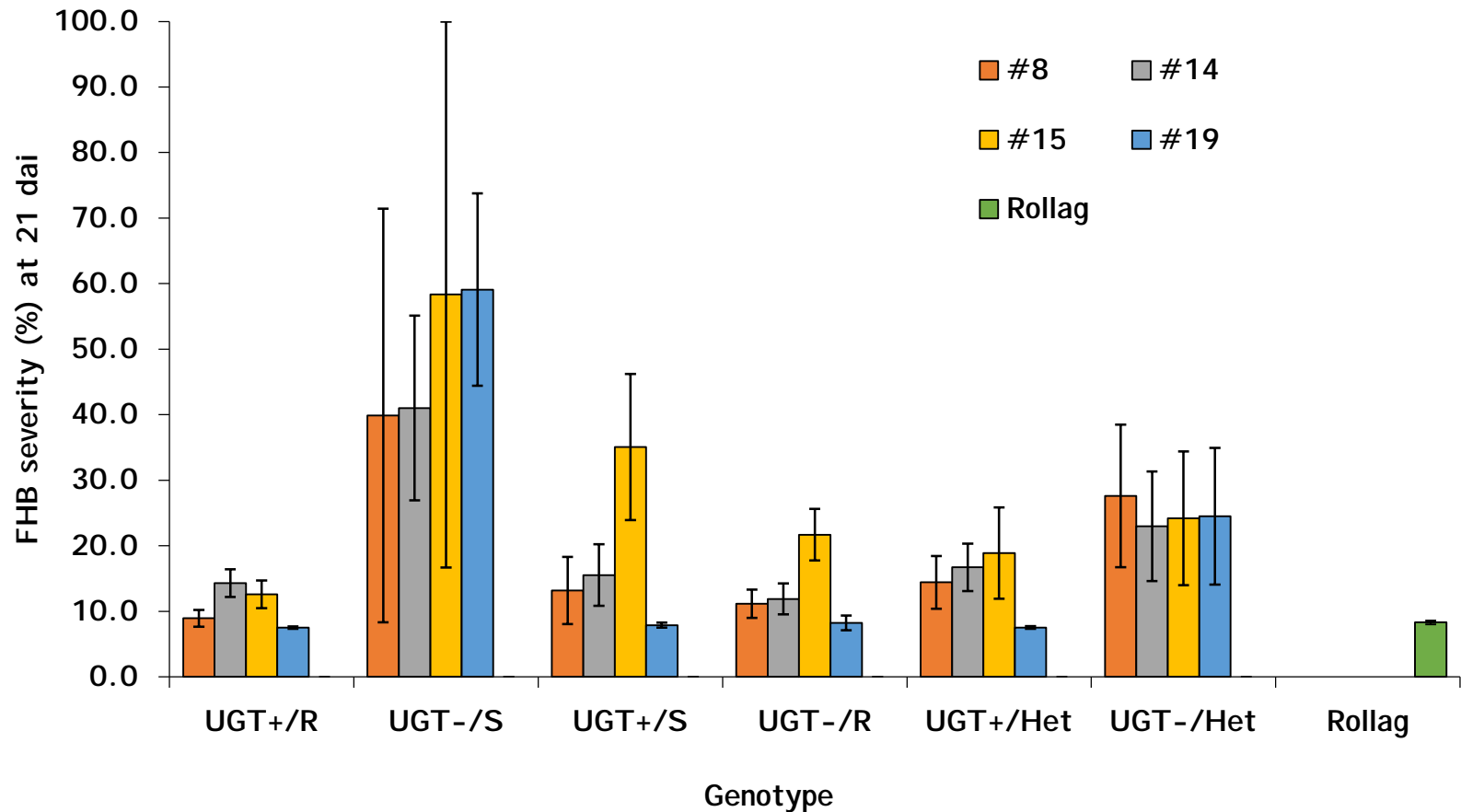
# Transgenic wheat carrying *HvUGT13248* confer FHB resistance (2014)



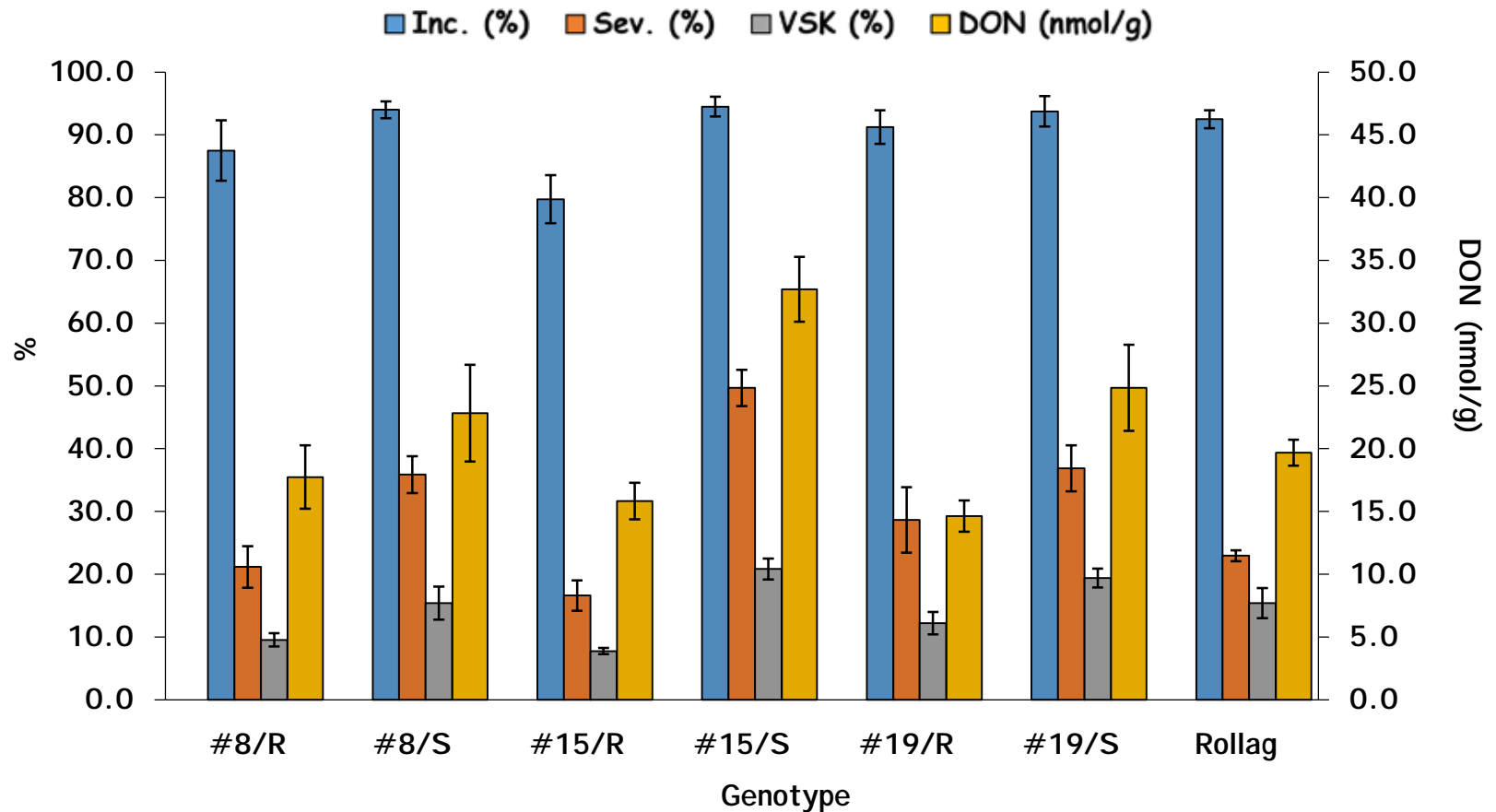
# Introgression of HvUGT13248 into Rollag



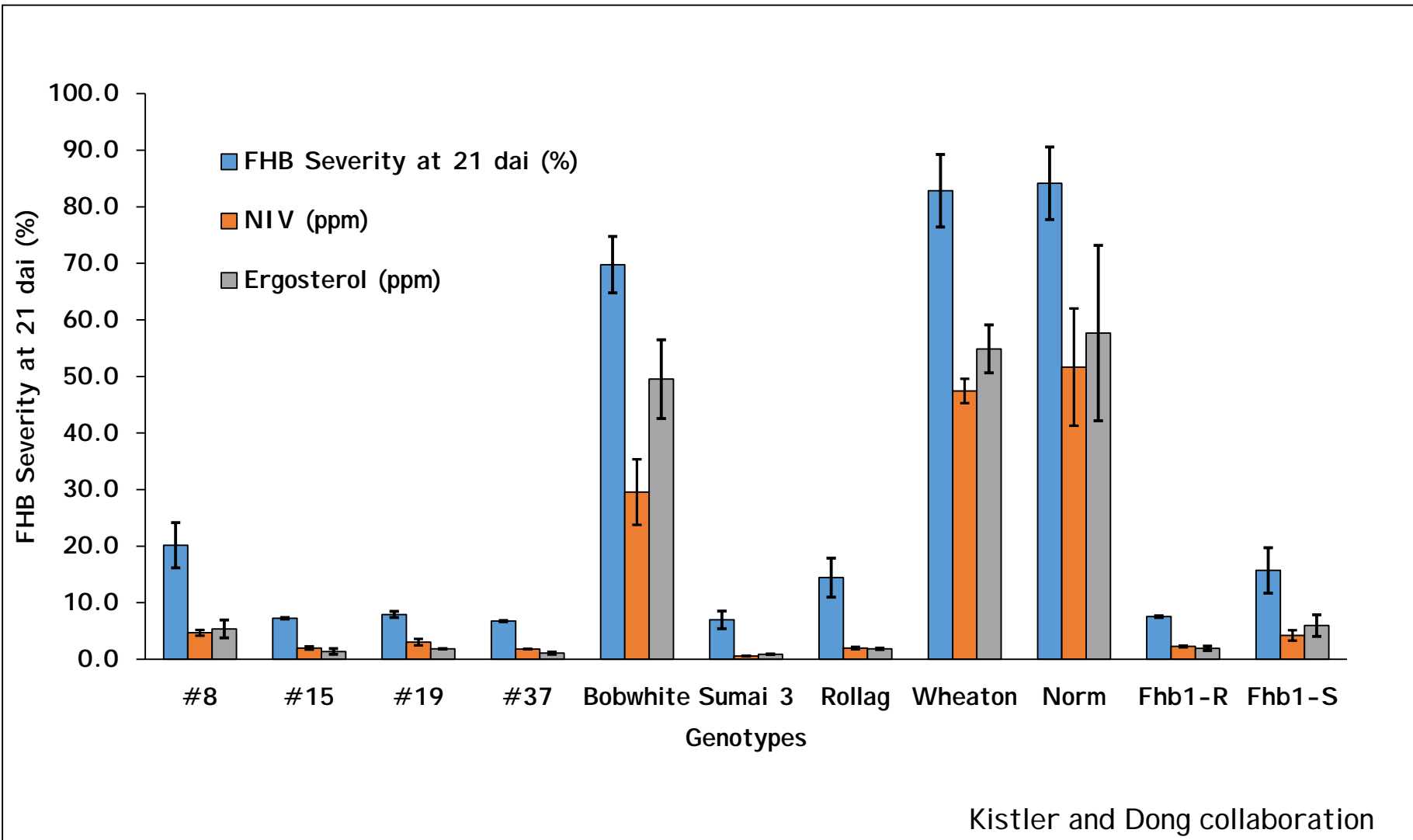
# UGT x Rollag BC<sub>1</sub>F<sub>2</sub> lines point inoculation in the greenhouse



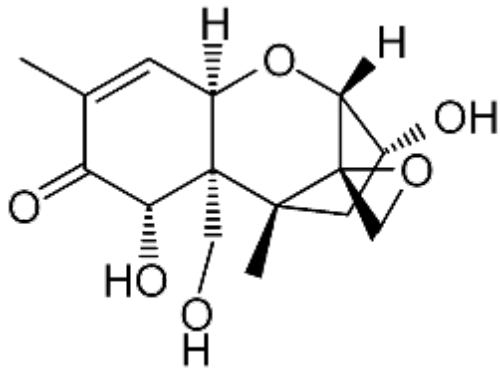
# UGT x Rollag BC<sub>1</sub>F<sub>4</sub> lines spray inoculated in the field



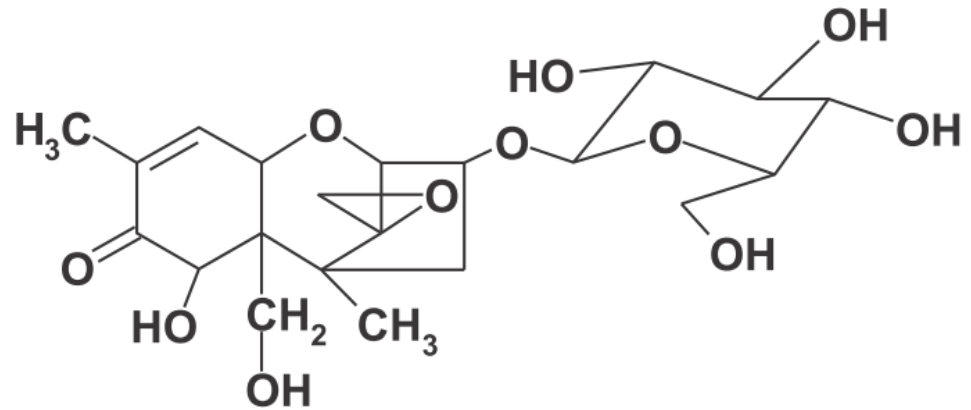
# Transgenic wheat carrying *HvUGT13248* exhibit type II resistance to a NIV-producing *Fg* strain



# UDP glucosyltransferase activity converts DON to DON-3-glucoside



Deoxynivalenol

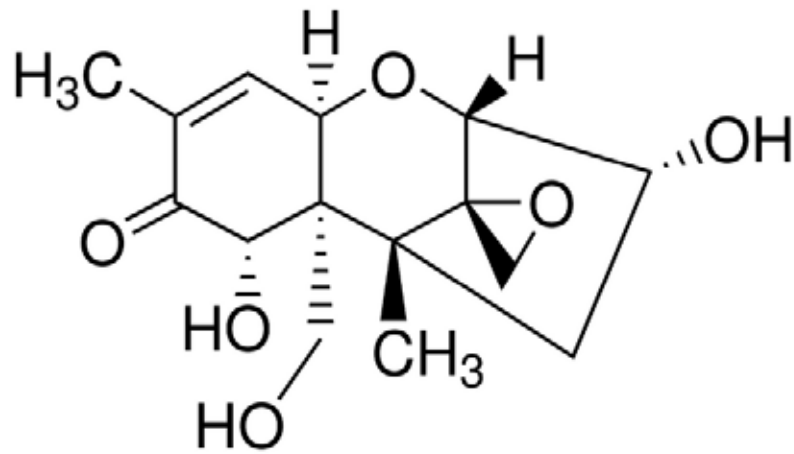


DON-3-O-glucoside

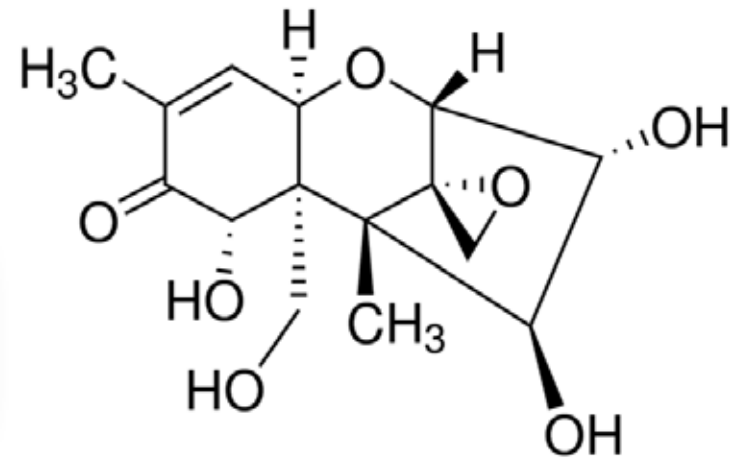


# *HvUGT13248* detoxifies DON and NIV

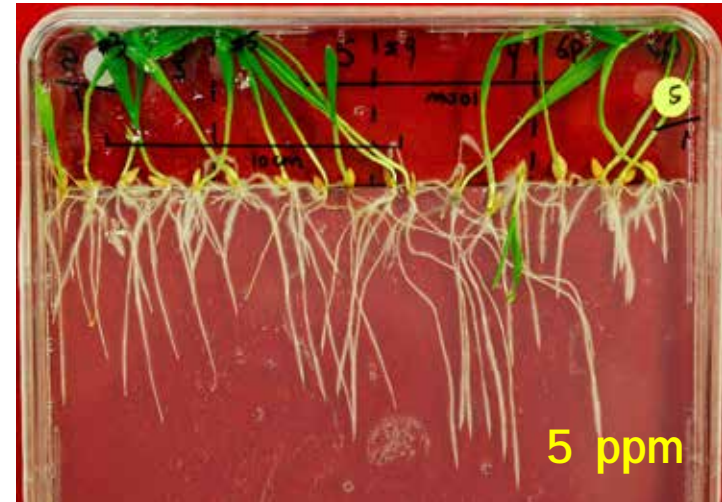
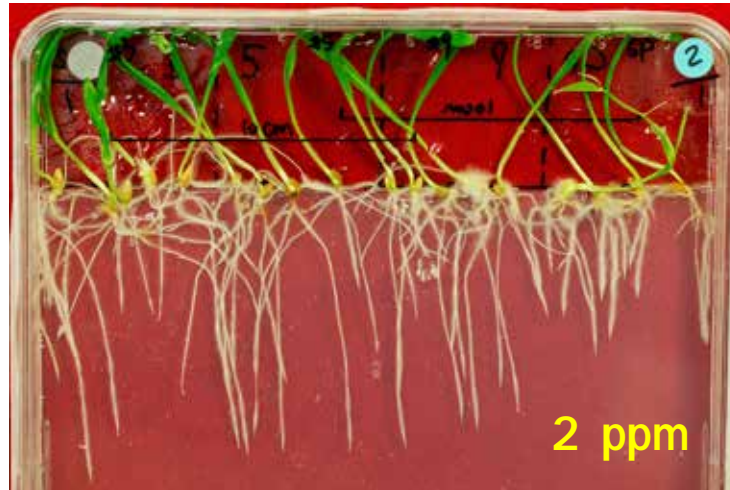
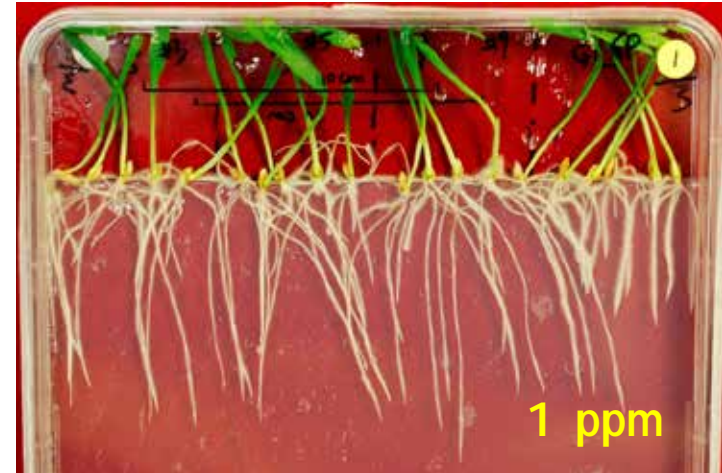
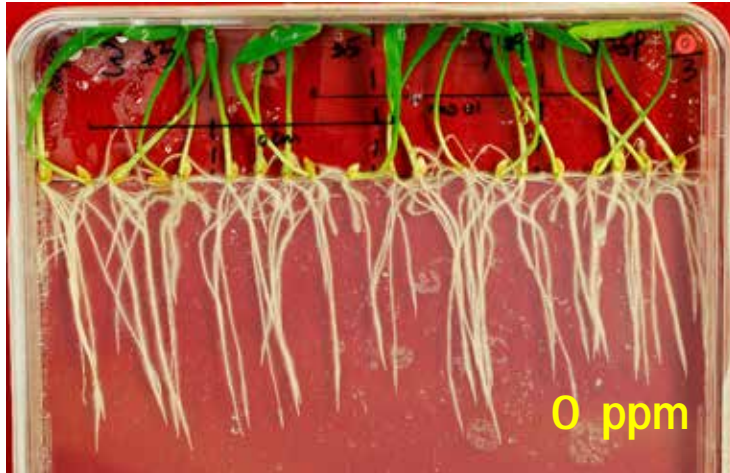
DON



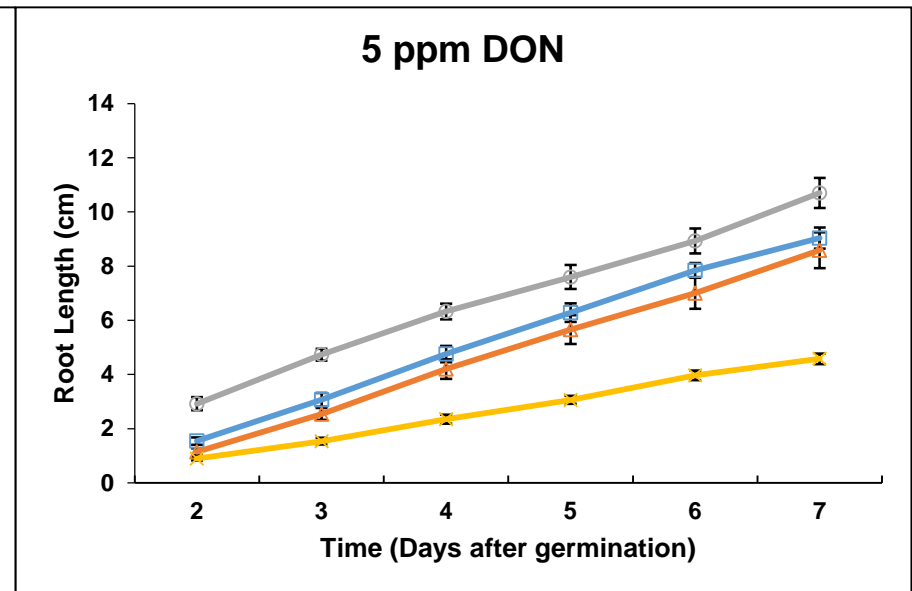
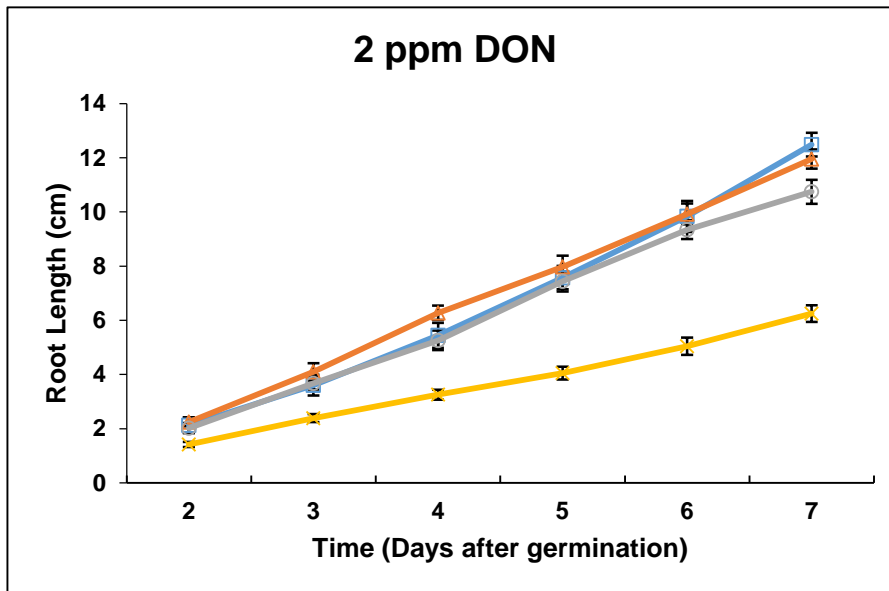
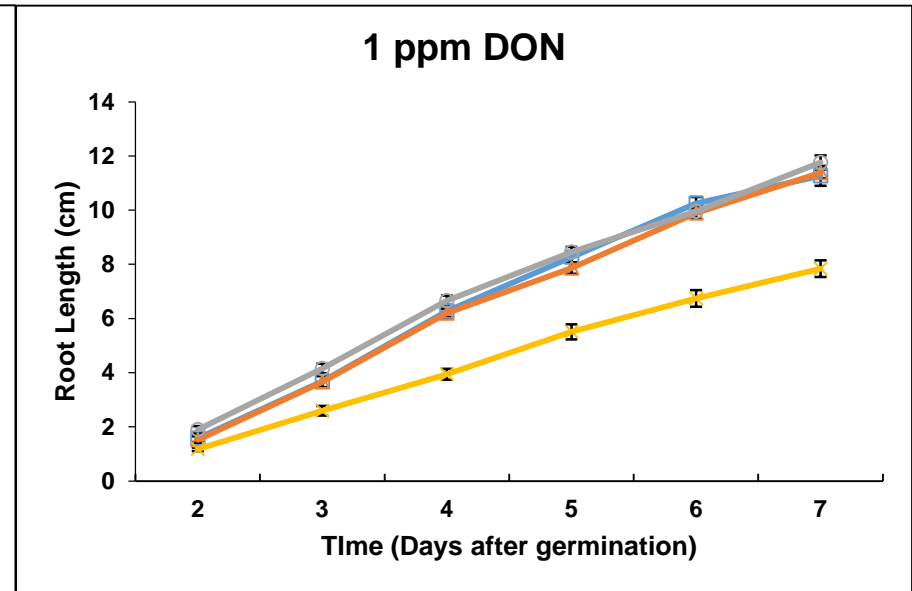
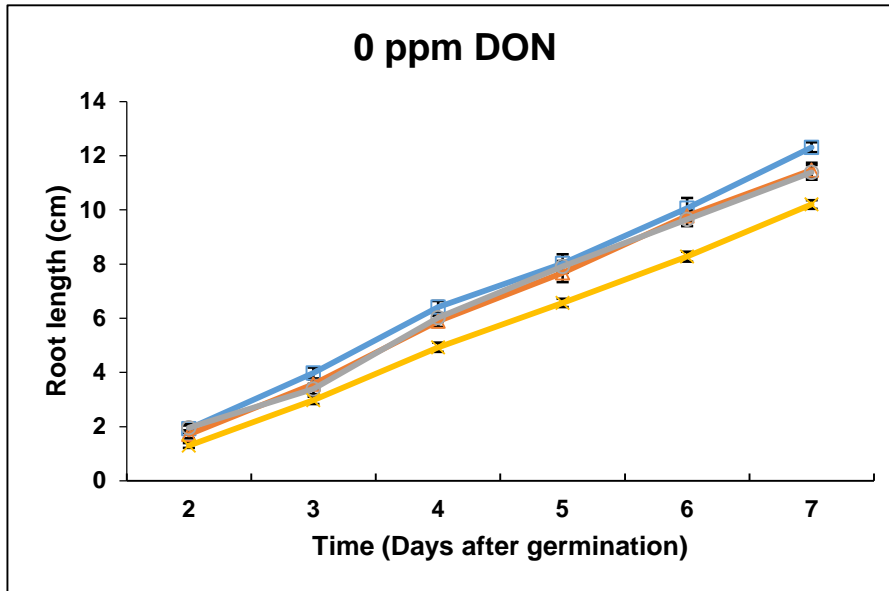
NIV



# Transgenic barley overexpressing *HvUGT13248* exhibits resistance to DON



# Transgenic barley overexpressing *HvUGT13248* exhibit resistance to DON



# Summary

- We developed transgenic wheat lines carrying the *HvUGT13248* gene
- Transgenic wheat exhibited FHB resistance
- Transgenic wheat carrying *HvUGT13248* rapidly converted DON to D3G
- The *HvUGT13248* transgene in combination with *Fhb1* provides a reduction in severity, VSK, incidence and DON accumulation
- Transgenic wheat carrying *HvUGT13248* exhibited type II resistance to a NIV-*Fg* strain
- Transgenic barley carrying *HvUGT13248* exhibits resistance to DON



# Acknowledgements

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of Food and  
Agriculture



# Toxin concentrations in transgenic wheat carrying *HvUGT132248* in field trials. 2012-2014.

