

Characterization of Deoxynivalenol Accumulation in Corn Hybrids in Southwestern Ontario – 2022-2023

Key Findings:

- Grain samples were taken from Pioneer Product Knowledge Plots (PKPs) across southwestern Ontario in 2022 and 2023 and tested for deoxynivalenol (DON).
- DON accumulation in corn is a complex biological process influenced by the host, environment, and disease.
- Hybrid results in this study were consistent with both anecdotal and research experience, where hybrids with a *Gibberella* ear rot trait score of 4 or less tended to have higher levels of DON.

Gibberella Ear Rot of Corn

- *Gibberella* ear rot is caused by the fungus *Gibberella zeae*.
- Spores of the fungus are produced on crop residue and spread to corn ears by wind and splashing rain.
- Infection of corn ears occurs through young silks and disease progression is favoured by humid weather during and after pollination.
- *Gibberella* ear rot can be most readily identified by the red or pink colour of the mould.
- *Gibberella zeae* produces the mycotoxin deoxynivalenol (DON), also called vomitoxin. DON causes feed refusal and poor weight gain in livestock.

Study Description

- Grain samples were taken from Pioneer Product Knowledge Plots (PKPs) across southwestern Ontario in 2022 and 2023.
- 2,396 grain corn samples were evaluated for DON content across 290 locations throughout southwestern Ontario representing 162 corn hybrids, which included 52 Pioneer® brand corn products.
- Grain submissions were subsampled, dried, ground, and run on an automated ELISA machine for analysis. DON results were validated and reported in ppm on a dry matter basis.

Results

Location Results

- Figures 1 and 2 show the location means at sampled locations across Southwestern Ontario in 2022 and 2023, respectively, where location mean DON level was greater than 0.25 ppm.

- Disease severity in 2022 was low overall, but individual fields were still moderately affected by *Gibberella* ear rot. The mean location average was 1.56 ppm, and the highest location average was 9.4 ppm. The highest reported DON across all locations and hybrids was 17.8 ppm.
- Disease incidence and severity of *Gibberella* ear rot in 2023 was higher. The mean location average in 2023 was 2.9 ppm. The highest location average was 10.2 ppm, while the highest reported DON across all locations and hybrids was 30.2 ppm.

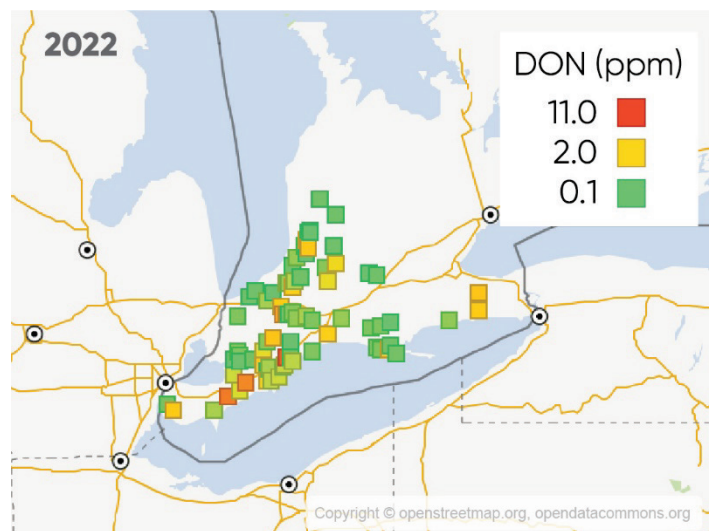


Figure 1. Location mean DON levels (ppm) at 2022 sampling sites.

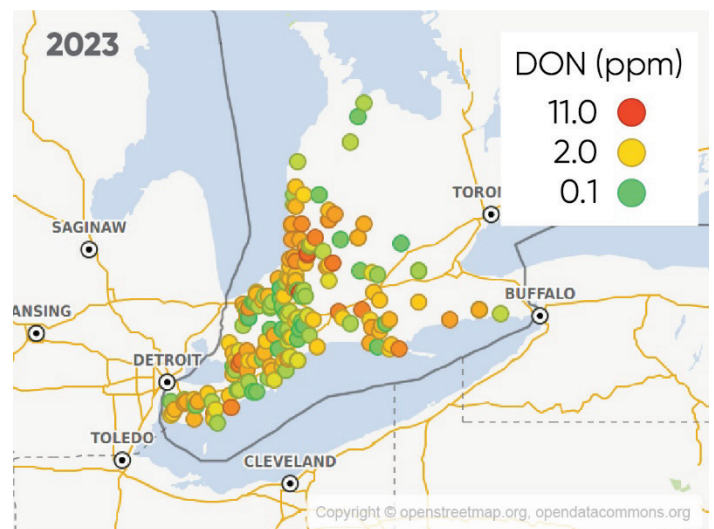


Figure 2. Location mean DON levels (ppm) at 2023 sampling sites.

Table 1. Average DON level by corn hybrid as a percentage of location mean across 2022 and 2023 sampling sites, total number of locations sampled, and hybrid Gibberella ear rot trait score.

Pioneer Brand Product ¹	DON Average (% of location mean)	n	Gibberella Trait Score (1-9)
P0075Q™ (Q,LL,RR2)	41.4%	88	6
P0306Q™ (Q,LL,RR2)	48.0%	9	4
P0035Q™ (Q,LL,RR2)	48.2%	161	5
P9624Q™ (Q,LL,RR2)	48.7%	51	7
P9233Q™ (Q,LL,RR2)	51.8%	15	5
P0806AM™ (AM,LL,RR2)	52.0%	65	4
P9823Q™ (Q,LL,RR2)	54.9%	94	5
P0720Q™ (Q,LL,RR2)	59.0%	85	4
P9316Q™ (Q,LL,RR2)	63.7%	16	6
P0075AM™ (AM,LL,RR2)	67.2%	67	6
P9998Q™ (Q,LL,RR2)	68.6%	5	4
P9845AM™ (AM,LL,RR2)	72.5%	44	4
P0404AM™ (AM,LL,RR2)	73.9%	33	5
P0506AM™ (AM,LL,RR2)	74.0%	17	5
P0157AMXT™ (AMXT,LL,RR2)	78.9%	10	4
P0035AM™ (AM,LL,RR2)	80.4%	66	5
P0306AM™ (AM,LL,RR2)	83.3%	10	4
P1136AM™ (AM,LL,RR2)	84.2%	22	6
P87040AM™ (AM,LL,RR2)	84.3%	4	
P9466AML™ (AML,LL,RR2)	84.7%	43	5
P0404Q™ (Q,LL,RR2)	85.4%	79	5
P0529Q™ (Q,LL,RR2)	87.5%	161	5
P9026AM™ (AM,LL,RR2)	107.1%	14	
P9845PCE™ (PW,ENL,RIB)	112.2%	45	4
P9946AML™ (AML,LL,RR2)	121.3%	13	6
P04511AM™ (AM,LL,RR2)	124.1%	97	4
P9535AM™ (AM,LL,RR2)	126.4%	33	4
P0720AM™ (AM,LL,RR2)	127.9%	43	4
P0859AM™ (AM,LL,RR2)	139.0%	41	3
P04922Q™ (Q,LL,RR2)	143.8%	70	3
P97299AM™ (AM,LL,RR2)	164.6%	63	3
P9998AM™ (AM,LL,RR2)	185.2%	5	4
P1197AM™ (AM,LL,RR2)	215.5%	6	5
P0953AM™ (AM,LL,RR2)	235.5%	56	3
P0487Q™ (Q,LL,RR2)	236.3%	72	3
P8859AM™ (AM,LL,RR2)	242.5%	4	

¹ All Pioneer products are hybrids unless designated with AM, AML, AMT, AMX, AMXT, Q, V, PCE, PCUE, PWE & PWUE, in which case they are brands.



Figure 3. *Gibberella zeae*, the fungal pathogen that causes Gibberella ear rot, can produce the mycotoxin deoxynivalenol (DON). Gibberella ear rot can be most readily identified by the red or pink color of the mold.

Hybrid Results

- Across years, 162 unique hybrids were evaluated. Results are reported for 36 Pioneer® brand corn products for which more than four samples were collected. DON accumulation is reported for each hybrid as a percent of the location mean. (Table 1).
- Across years, DON accumulation by hybrid – as a percentage of the location average – ranged from 41% to 243%.
- The results, expressed as a percentage of the location average, provide an indication of relative risk of DON accumulation under 2022 and 2023 environmental conditions. In many cases, hybrids that had above-average DON levels relative to the location average were still low in absolute terms.
- Pioneer brand corn products are rated for genetic resistance to Gibberella ear rot. Each rating is backed by thousands of research hours and on-farm trials. Trait scores range from 1 (most susceptible) to 9 (most resistant).
- Trait scores for Gibberella ear rot range from 3 to 7 for current Pioneer brand corn products, illustrating that – while there is no complete resistance to Gibberella ear rot – significant genetic differences do exist.
- Hybrid results in this study were consistent with both anecdotal and research experience, where hybrids with a Gibberella ear rot trait score of 4 or less tended to have higher levels of DON.

Conclusions

- DON accumulation in corn is a complex biological process influenced by the host, environment, and disease.
- The results of this evaluation support that, while no complete resistance exists for Gibberella ear rot, there are genetic mechanisms of tolerance to the disease in corn. Hybrids respond differently to infection by Gibberella ear rot and resulting DON accumulation.
- Understanding a hybrid's relative risk of infection and DON accumulation is important to manage the risk on your farm. Working closely with your Pioneer agency will allow you to select products as part of a package that will enable you manage risk of DON specific to your operation.
- Your Pioneer sales agency has the knowledge, including the PKP DON database, and experience to use the Pioneer product scores to help position products on your fields.



AM - Optimum® AcreMax® Insect Protection system with YGCB, HX1, LL, RR2. Contains a single-bag integrated refuge solution for above-ground insects. In EPA-designated cotton growing counties, a 20% separate corn borer refuge must be planted with Optimum AcreMax products. AMXT (Optimum® AcreMax® XTreme) - Contains a single-bag integrated refuge solution for above- and below-ground insects. The major component contains the Agrisure® RW trait, a Bt trait, and the Herculex® XTRA genes. In EPA-designated cotton growing counties, a 20% separate corn borer refuge must be planted with Optimum AcreMax XTreme products. AML - Optimum® AcreMax® Leptra® products with AVBL, YGCB, HX1, LL, RR2. Contains a single-bag integrated refuge solution for above-ground insects. In EPA-designated cotton growing counties, a 20% separate corn borer refuge must be planted with Optimum AcreMax Leptra products. PCE – Powercore® Enlist® Refuge Advanced® corn products with HX1, VTP, ENL, LL, RR2. Contains a single-bag integrated refuge solution for above-ground insects. In EPA-designated cotton-growing counties, a 20% separate corn borer refuge must be planted with PowerCore Enlist Refuge Advanced products. PWE – PowerCore® Enlist® corn products with HX1, VTP, ENL, LL, RR. A separate 5% corn borer refuge in the corn belt, and a separate 20% corn borer refuge in EPA-designated cotton-growing counties must be planted PowerCore Enlist products.

Liberty®, LibertyLink® and the Water Droplet Design are registered trademarks of BASF. ®Roundup and Roundup Ready are registered trademarks of Bayer Group. Agrisure® and Agrisure Viptera® are trademarks of, and used under license from, a Syngenta Group Company. Agrisure® technology incorporated into these seeds is commercialized under a license from Syngenta Crop Protection AG. POWERCORE® is a registered trademark of Monsanto Technology LLC. POWERCORE® multi-event technology developed by Corteva Agriscience and Monsanto. Liberty®, LibertyLink® and the Water Droplet Design are registered trademarks of BASF. ®Roundup and Roundup Ready are registered trademarks of Bayer Group. Always follow IRM, grain marketing and all other stewardship practices and pesticide label directions. B.t. products may not yet be registered in all states. Check with your seed representative for the registration status in your state.

The foregoing is provided for informational use only. Please contact your Pioneer sales professional for information and suggestions specific to your operation. 2022-2023 data are based on average of all comparisons made in 290 locations through Dec. 1, 2023. Multi-year and multi-location is a better predictor of future performance. Do not use these or any other data from a limited number of trials as a significant factor in product selection. Product responses are variable and subject to a variety of environmental, disease, and pest pressures. Individual results may vary. RU240606

Author: Sheila Murphy

Vol. 14 No. 9 June 2024