

2024

Ontario Corn Hybrid DON Screening Trials 2024 Report



Conducted by the Ontario Corn Committee

OCC Hybrid Performance for DON 2024 Report

February 2025

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Executive Summary. The ongoing project assesses corn hybrid sensitivity to deoxynivalenol (DON) accumulation. The data were reviewed first by the OCC DON Sub-committee, with representatives from the seed industry, OMAFA, and the University of Guelph. In 2024, the study evaluated 65 hybrids entered voluntarily by seed companies; this was an increase from 45 entries in 2023. Seed companies were encouraged to enter hybrids. Hybrids were tested in misted, inoculated disease nurseries at two locations with three planting dates, exposing each hybrid to six environments. Only five environments were included in the final analysis. Initially, DON-hybrid indices were calculated relative to the average of two high-DON check hybrids that were suggested by seed companies in the spring of 2024. After a review of the data by the OCC DON sub-committee in January 2025, only one of the check hybrids was used as the reference. Of the 65 hybrids tested in 2024, DON concentrations were statistically lower (better) in 31 hybrids compared to the high-check hybrid, 33 hybrids were statistically similar, and one hybrid produced DON statistically higher than the high-check hybrid. Multi-year data analysis showed general consistency in hybrid rankings across years, with only a few exceptions. This is a relative risk assessment of hybrids; additional data sources should be used for hybrid selection decisions. The success of this project is due to incredible collaboration among academics, extension services, and industry partners, with funding from government and agricultural organizations. This report provides valuable information for growers to choose or position hybrids with unbiased third-party knowledge and DON risk of corn hybrids.

Introduction. Gibberella ear rot concerns the agricultural industry mainly because of mycotoxins. Deoxynivalenol (DON) is the main mycotoxin produced by the fungal pathogen *Fusarium graminearum*. DON is the most common mycotoxin in corn. It is well known that DON concentrations depend highly on interactions among hybrids, pathogens, and the environment. In 2019, the Ontario Corn Committee (OCC) approved a project to investigate and refine protocols for testing hybrid sensitivity to DON accumulation. In 2023, the first report of hybrid assessments was publically released thanks to an overwhelming collaborative effort among academics, extension and industry. Protocols continue to be refined with new knowledge. The variability inherent in this work was sufficiently constrained to support statistical differences among hybrid entries and confidence in the results. **It needs to be emphasized that this is a relative risk assessment of hybrids and that additional data sources (e.g., seed company information, field trial results, etc.) should be used for better hybrid decisions based on DON risk. Currently, there are no DON-resistant hybrids.**

Notes on the inoculation trials. Briefly, seed companies voluntarily submitted hybrids for testing. Hybrids were tested in misted, inoculated disease nurseries at the Ridgetown Campus and at the Huron Research Station (Exeter).

- The hybrid entries vary each year depending on seed company decisions and hybrid turnover in the marketplace. Some seed companies chose not to participate. In 2024, there were 65 hybrid entries plus 4 check (2 low-check and 2 high-check) hybrids. In 2023, there were only 45 entries.
- In every year since 2020, hybrid entries were planted on three dates at each location to expose various hybrid maturities to different weather conditions around silking and during grain-fill. The first planting was relatively early (early to mid-May), then mid (late May), and finally a relatively late planting (mid-June), with three replications per planting date. Thus, each hybrid entry was exposed to six “environments” (two locations × three planting dates) with three replications for a total of 18 DON measurements per hybrid per year. All check or reference hybrids were replicated more.

- From 2019 to 2023, the same “high DON check” or “high susceptible” hybrid was used every year. It was a hybrid that had consistently high DON in farm fields during the epidemic of 2018. In 2024, the seed supply of this hybrid was no longer available, so two new “high check” hybrids were suggested by seed company representatives. All check hybrid names are confidential by company request. In early 2024, the OCC DON Sub-committee also suggested two “low DON checks” and these were incorporated in the 2024 trials.
- In all years, corn was planted in 30” rows to achieve a final stand of 34,400 plants per acre (see photo in Appendix Figure 1). Each hybrid was planted in a single row of approximately 25 plants. Ten plants were spray-inoculated in each row by hand at the optimal time for infection (first sign of silk browning). The trials were mist-irrigated on timers every day for approximately four weeks after inoculation (see photo in Appendix Figure 2). At harvest, corn was hand-harvested, the ears were photographed, then they were dried, shelled, and finally the grain was ground and analyzed for DON in the mycotoxin lab at Ridgeway Campus.
- In 2023, the late-planted block at the Huron Research Station was not inoculated and was subsequently discarded because of late silking during the end of August. In 2024, the late-planted block also silked very late but was inoculated at the end of August (!). Due to the open fall, most of this late corn matured but DON concentrations were variable and probably not relevant to an environment in a typical grower field, so thus the late-planted block data at Huron were not included in this report.
- DON data were analyzed using PROC GLIMMIX. Because the variability in DON concentrations tends to increase with the DON level, a lognormal distribution was specified to stabilize variability for statistical analysis.
- Hybrid indices were calculated based on the de-transformed log means relative to the average DON of the high DON check hybrid(s) in each year. Hybrids that were statistically different from the check hybrid(s) were identified at a p-level of 0.05 with the Tukey-Kramer option. In 2024, single-year data were presented across each environment (i.e., planting date) and also averaged across environments. In the multi-year combined analysis, data were combined across all environments. Each combination of year, location, and planting date was treated as an “environment” in the analysis as a random effect. This report does not show any comparisons to the 2 low DON checks, but the data will be used in future year presentations of multi-year data.

Results

- Once again, this report shows a relative risk assessment of a relatively small number of hybrids that were entered voluntarily by seed companies. For whatever reason, not all hybrids were entered by seed companies, and not all seed companies participated. Additional data sources (e.g., seed company information, field trial results, etc.) should be used for better hybrid decisions based on DON risk.
- After review, the OCC DON sub-committee requested the removal of one of the high-DON check hybrids because of excessively high DON, which caused some deception of several hybrid entries with known commercial “DON issues”. The dropped high-check hybrid is not available in Ontario, likely because of the high DON issues. Nevertheless, it is important to note the progress of seed companies to keep highly susceptible hybrids out of the marketplace. See Figure 3 in the Appendix for the hybrid check comparisons.
- The data are presented as indices relative to only high-check hybrid. For example, a hybrid with an index of 100 would have the same DON concentration, numerically, as the high-check. For example, a hybrid with an index of 50 would indicate that the average DON was 50% of the high-check. Statistical analysis is important to determine whether the difference between each hybrid entry to the high-check was real, considering the variability in the testing.

- The data were analyzed over multiple years (Table 1) if data were available. The 1-year column in Table 1 is identical to the last column in Table 2 (i.e., 2024 data). Note that the hybrids were sorted by their CHU rating. For reference, the average DON concentrations of the high-check hybrid are presented at the bottom of each table.
- Some seed companies decided not to enter certain hybrids in 2023 after testing in 2022, but they were re-entered in 2024. So thus a "2022 and 2024" column was included in the multi-year Table 1 to account for this, else we would lose multi-year info on some of those hybrids if 2-year data meant only 2023-2024.
- In general, hybrids with multi-year data ranked similarly across years using only 2 years of data, with only a few exceptions. Of the 65 hybrids entered in 2024, 33 hybrids were similar to the high-check hybrid (note "nd" or "not different" statistically in the last column to the right). There was one hybrid entry that was statistically higher than the high-check hybrid.
- Using only 2024 data, a relative risk assessment of hybrid susceptibility to accumulate DON is also presented as indices by environment (see Table 2). The environments are based on location and planting dates. As expected, there was some variability across the five environments; however, there was sufficient consistency or evidence to identify statistical differences in hybrid sensitivity to DON accumulation.

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Acknowledgments: This project was funded in part by the Governments of Canada and Ontario under the Sustainable Canadian Agricultural Partnership (Sustainable CAP), a five-year, federal-provincial-territorial initiative. We also acknowledge the Ontario Corn Committee, Grain Farmers of Ontario, OMAFA, Greenfield Ethanol, Ontario Pork, Suncor, Ingredion, OCC DON sub-committee, seed corn companies (listed below), Seeds Canada, Ontario Agribusiness Association (OABA), and the Agricultural Research and Innovation Ontario (ARIO) for research station infrastructure. Also in alphabetical order: Dr. Nasim Alijani (UG-Ridgetown), Ahmed Alim (UG-Ridgetown), Jonathan Brinkman (UG-Ridgetown), Dr. Josh Cowan (GFO), Colin Depuydt (UG-Ridgetown), Darrell Galbraith (UG-Ridgetown), Scott Jay (UG-Ridgetown-OMAF), Dr. Katiana Eli (UG-Ridgetown), Michael Heaman (UG-Ridgetown), David Morris (OCC), Todd Phibbs (UG-Ridgetown), Ben Rosser (OMAF), Dr. Art Schaafsma (UG-Ridgetown), Carlene Scott (UG-Ridgetown), Cheryl Van Herk (UG-Ridgetown-OMAF), Ken Van Raay (UG-Ridgetown), Marty Vermey (GFO), and many summer students.

Seed Company Sponsors (2019-2024):

Brevant, Corteva Agriscience	Maizex, Maizex Seeds Inc.
Country Farm, Country Farm Seeds Ltd.	NK Brand, Syngenta Seeds Inc.
CROPLAN, Winfield United	Pioneer, Pioneer Hi-Bred Canada
DeDell, De Dell Seeds Incorporated	PRIDE Seeds, AgReliant Genetics Inc.
DEKALB, Bayer CropScience Inc.	Saatbau, Saatbau Linz
Horizon, Horizon Seeds Canada Inc.	



Appendix



Figure 1. Precision planting the OCC DON experiment at Ridgetown.



Figure 2. Overview of the OCC DON trial showing the overhead misting lines at Ridgetown.

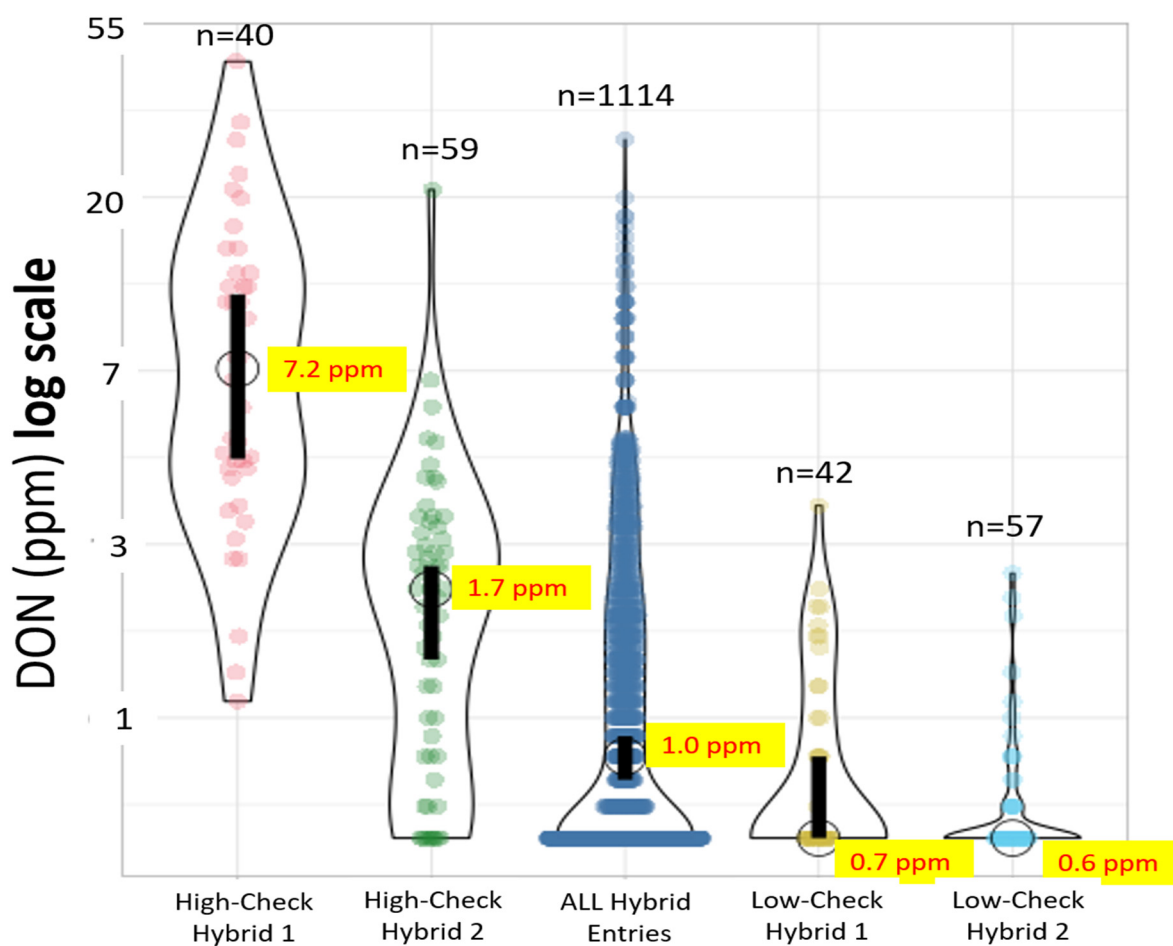


Figure 3. Deoxynivalenol (DON) concentrations in corn hybrid entries and checks across five Ontario environments (2024). Violin plots illustrate the distribution of DON concentrations (ppm, log scale) for two high-DON check hybrids, all hybrid entries (excluding checks), and two low-DON check hybrids. Each coloured data point within each violin plot represents a single sample. Average DON concentrations are indicated on each plot.

Interpretation: The violin plots depict the range and frequency of DON levels observed in each hybrid category. The wider sections of the "violin" indicate areas where DON concentrations are more frequent. As expected, the high-check hybrids exhibited substantially higher DON levels (averaging 7.2 and 1.7 ppm for Hybrid 1 and Hybrid 2, respectively) compared to the majority of hybrid entries (average 1.0 ppm). The low-check hybrids showed the lowest DON concentrations (0.7 and 0.6 ppm). High-Check Hybrid 1, although not commercially available in Ontario due to its susceptibility to DON accumulation, was included to ensure the trials provided conditions conducive to DON development. Subsequent analysis focused on comparing hybrid entries to the high-check Hybrid 2, as determined by the OCC DON sub-committee. The inclusion of a highly susceptible check demonstrates the effectiveness of breeding efforts in reducing DON accumulation in modern Ontario maize hybrids.

Table 1. Relative DON risk assessment indices by hybrid relative to susceptible checks (not shown) from 2021-2024. Hybrids are sorted by CHU rating. As always, use one-year data with caution. The colour scheme highlights hybrid effects within column. A hybrid with an index of 100 means that the DON concentration was the same as the susceptible check(s) within column. Note statistical differences for evidence that hybrid differences (or not) are real. Several hybrids were entered by companies in 2022 and 2024, but not in 2023, hence the "2022 and 2024 only" column.

Hybrid	Hybrid CHU	2021-2024		2022-2024		2022 and 2024 only		2023-2024		2024		Interpretation
DKC36-48RIB	2600	31	*	29	*	29	*	33	*	37	*	Hybrids with "nd" are not different statistically compared to the susceptible check hybrid.
A5424G2 RIB	2625							38	*	35	*	
DL 3007	2700									27	*	
A5925	2750									47	*	
J4107 STX	2750									48	*	
P9316Q	2750							34	*	36	*	
DKC42-05RIB	2800	34	*	30	*	24	*	40	*	37	*	
NK9400-V	2800									90	nd	
P9466AML	2800							66	nd	105	nd	
DKC093-76RIB	2825									39	*	
A6566G8 RIB	2850							46	*	53	nd	
A6572G2 RIB	2850	65	*	80	nd	73	nd	86	nd	77	nd	
B96H83AM	2850	30	*	24	*	24	*	29	*	38	*	
MZ 3505DBR	2850					35	*			53	nd	
MZ 3528DBR	2850									51	nd	
P9624Q	2850							26	*	32	*	
DKC45-74RIB	2875							60	nd	41	*	
HZ 3690	2875									55	nd	
NK9601-AA	2875							44	*	56	nd	
CP3790VT2P	2900									70	nd	
DKC46-40RIB	2900	50	*	42	*	41	*	41	*	40	*	Each hybrid with "*" contained DON statistically lower compared to the susceptible check hybrids.
MZ 3717SSP	2900									49	*	
CP3823SS	2925									32	*	
P9823V	2925									56	nd	
B99A24V	2950									31	*	
CP3980VT2P	2950					97	nd			112	nd	
DKC48-08RIB	2950									45	*	
K4709 SSP	2950									73	nd	
MZ 3930DBR	2950					94	nd			100	nd	
P9845PCE	2950							117	nd	125	nd	
P9845V	2950									54	nd	
HZ 4258	2975									72	nd	
I4809 VT2Pro	2975									52	nd	
MZ 4049SMX	2975					24	*			40	*	
P0035Q	2975									30	*	
4188VT2P/RIB	3000					97	nd			76	nd	
B00R96AM	3000	46	*	37	*	49	*	40	*	80	nd	
DL 5021	3000									37	*	

Hybrid	Hybrid CHU	2021-2024		2022-2024		2022 and 2024 only		2023-2024		2024		Interpretation
P0075Q	3000									34	*	Hybrid(s) with "+" contained DON statistically HIGHER than the susceptible check hybrid(s).
A7199G9 RIB	3025							80	nd	82	nd	
NK0123-AA	3025									38	*	
DKC50-30RIB	3050					29	*			36	*	
DKC101-33RIB	3075									70	nd	
CP4377TRE	3100									139	nd	
MZ 4158DBR	3100					70	nd			65	nd	
NK0252-D	3100									106	nd	
B04D72Q	3125	59	*	57	*	58	nd	50	*	48	*	
DKC103-07RIB	3125									119	nd	
P0404Q	3125									88	nd	
CP4615TRE	3150									272	+	
MZ 4577SMX	3150	64	*	55	*	64	nd	45	*	52	nd	
P0529Q	3150							33	*	47	*	
DKC105-44RIB	3175									32	*	
I5108 VT2Pro	3175									46	*	
A7599G9 RIB	3200									59	nd	
B07M64Q	3200									63	nd	
CP4757VT2P	3200									58	nd	
MZ 4608SMX	3200	22	*	21	*	22	*	23	*	29	*	
DKC58-64RIB	3250									26	*	
MZ 4703DBR	3250									31	*	
MZ 4799SMX	3250									33	*	
P0720Q	3250									102	nd	
P0806AM	3250							45	*	59	nd	
A8303G8 RIB	3400									40	*	
P1136AM	3400									61	nd	
Hybrid diff (<i>P</i> -value)		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		Low statistical p- values indicate strong evidence that real hybrid differences exist, considering variability.
Ave. DON in Check(s) (ppm)		8.6		4.3		2.3		6.0		2.1		
No. environments tested		22		16		11		10		5		
No. observations per hybrid		66		48		33		30		15		

Table 2. Relative DON risk assessment indices by hybrid and environments in 2024. Hybrids are sorted by CHU rating. Always interpret one-year data with caution. The colour scheme highlights relative hybrid effects within column.

Hybrid	Hybrid CHU	Exeter environments		Ridgetown environments			Overall mean		Interpretation
		1	2	3	4	5			
DKC36-48RIB	2600	12	36	62	31	85	37	*	This hybrid produced an average of 48% of DON compared to the susceptible check hybrid across 5 environments in 2024. However, note variability across environments. Hybrids with an asterisk (*) are statistically lower in DON compared to the susceptible check hybrid.
A5424G2 RIB	2625	12	36	49	32	71	35	*	
DL 3007	2700	12	36	33	21	49	27	*	
A5925	2750	18	38	84	35	117	47	*	
J4107 STX	2750	22	36	126	42	63	48	*	
P9316Q	2750	15	36	92	27	44	36	*	
DKC42-05RIB	2800	12	36	70	33	64	37	*	
NK9400-V	2800	33	81	121	234	79	90	nd	
P9466AML	2800	47	273	190	64	80	105	nd	
DKC093-76RIB	2825	12	36	43	53	87	39	*	
A6566G8 RIB	2850	20	60	58	84	76	53	nd	
A6572G2 RIB	2850	45	87	87	107	74	77	nd	
B96H83AM	2850	29	47	26	46	47	38	*	
MZ 3505DBR	2850	12	52	170	61	60	53	nd	
MZ 3528DBR	2850	24	47	98	43	72	51	nd	
P9624Q	2850	14	57	21	21	94	32	*	Hybrids with "nd" are not different statistically compared to the susceptible check
DKC45-74RIB	2875	22	36	46	54	63	41	*	
HZ 3690	2875	68	161	22	27	79	55	nd	
NK9601-AA	2875	19	61	80	98	63	56	nd	
CP3790VT2P	2900	15	300	104	61	61	70	nd	
DKC46-40RIB	2900	29	36	37	47	55	40	*	
MZ 3717SSP	2900	36	101	56	22	65	49	*	
CP3823SS	2925	22	36	38	25	44	32	*	
P9823V	2925	59	42	131	37	44	56	nd	
B99A24V	2950	12	36	43	24	62	31	*	
CP3980VT2P	2950	150	207	118	59	83	112	nd	Note variability across environments in this hybrid. Despite the variability across environments, an average index of 37 is statistically lower than the susceptible check.
DKC48-08RIB	2950	28	71	41	42	52	45	*	
K4709 SSP	2950	45	258	33	45	126	73	nd	
MZ 3930DBR	2950	100	100	100	100	100	100	nd	
P9845PCE	2950	85	324	118	64	148	125	nd	
P9845V	2950	19	66	97	21	191	54	nd	
HZ 4258	2975	82	265	42	46	47	72	nd	
I4809 VT2Pro	2975	35	88	48	27	94	52	nd	
MZ 4049SMX	2975	16	44	62	24	92	40	*	
P0035Q	2975	20	66	20	21	44	30	*	
4188VT2P/RIB	3000	51	129	121	55	58	76	nd	
B00R96AM	3000	35	143	119	46	117	80	nd	
DL 5021	3000	12	170	38	21	44	37	*	
P0075Q	3000	19	36	25	55	47	34	*	

		Exeter environments		Ridgetown environments					Intrpretation
Hybrid	Hybrid CHU	1	2	3	4	5	Overall mean		
A7199G9RIB	3025	72	52	133	51	147	82	nd	
NK0123-AA	3025	43	36	32	29	58	38	*	
DKC50-30RIB	3050	14	68	26	50	50	36	*	
DKC101-33RIB	3075	120	110	60	47	44	70	nd	
CP4377TRE	3100	116	370	197	82	76	139	nd	
MZ 4158DBR	3100	34	58	70	101	84	65	nd	
NK0252-D	3100	247	275	89	38	59	106	nd	
B04D72Q	3125	16	315	41	21	58	48	*	
DKC103-07RIB	3125	158	80	95	180	114	119	nd	
P0404Q	3125	48	314	56	52	116	88	nd	
CP4615TRE	3150	122	659	251	226	326	272	+	
MZ 4577SMX	3150	13	47	45	88	153	52	nd	
P0529Q	3150	18	155	48	28	61	47	*	
DKC105-44RIB	3175	12	120	21	22	47	32	*	
I5108 VT2Pro	3175	17	130	25	36	104	46	*	
A7599G9 RIB	3200	16	71	49	85	157	59	nd	
B07M64Q	3200	17	141	76	77	72	63	nd	
CP4757VT2P	3200	42	130	96	21	61	58	nd	
MZ 4608SMX	3200	15	38	23	33	48	29	*	
DKC58-64RIB	3250	12	38	27	22	44	26	*	
MZ 4703DBR	3250	12	36	19	43	79	31	*	
MZ 4799SMX	3250	19	55	23	21	72	33	*	
P0720Q	3250	55	312	69	118	80	102	nd	
P0806AM	3250	63	150	19	53	72	59	nd	
A8303G8 RIB	3400	16	49	76	24	74	40	*	
P1136AM	3400	56	53	57	52	94	61	nd	
Hybrid difference (P-value)		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
Ave DON in High Check (ppm)		4.0	1.4	2.6	2.4	1.1	2.1		
No. observations per hybrid		3	3	3	3	3	15		

Hybrid(s) with "+" contained DON statistically HIGHER than the susceptible check hybrid(s).

Low statistical p-values indicate strong evidence that hybrid differences exist, even considering variability.