

2021–22 and 2022–23

Combined Report for the Winter North American Barley Scab Evaluation Nurseries

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INTRODUCTION and BACKGROUND

The goal of the winter North American Barley Scab Evaluation Nursery (Winter NABSEN) is to increase resistance to head blight (scab) disease in varieties of winter barley cultivated across North America. More specifically, we seek to identify lines that possess genetic resistance in the form of inherently accumulating low levels of the fungal toxin deoxynivalenol (DON). A key objective of the winter NABSEN is to assess scab resistance of new lines being developed by North American breeding programs. To accomplish that objective, barley lines are planted into nurseries designed to impose high levels of disease pressure. These nurseries are planted at multiple locations, over multiple years. This report details the information and results obtained from the nurseries grown the 2021–22 and 2022–23 seasons.

The coordinator of the winter NABSEN is Eric Stockinger at Ohio State University. Seed of all entries were sent to the Stockinger lab late August. Seed was treated with NipsIt™ SUITE Cereals OF Seed Protectant (Valent, <https://www.valent.com/>) following the manufacturer's recommendation and allowed to dry. Seed was then packaged and shipped to the nursery participants.

Seven participants planted the winter NABSEN the 2021–22 season, eight planted it the 2022–23 season. The participants, their respective locations, and methods used are provided in Table 1.

Eight checks, selected and vetted by the participants were included both seasons. These lines were selected based on previous observations, including NABSEN participants (Brooks, 2020; Cowger, 2021; Cowger et al., 2019). This information is provided in Table 2.

Six breeders submitted lines for inclusion in the NABSEN 2021–22 season, and seven the 2022–23 season (Table 3).

Thirty-seven contributor's lines were tested 2021–22, and 50 were tested 2022–23. Most of the lines selected for inclusion in the nursery by each breeder were tested only one of the two seasons. The lines tested, the breeding program that submitted those lines, and the pedigree of the line (if provided) is shown in Tables 4 and 5. Lines tested both trial years are asterisked in the respective table.

Each line was planted in two or three reps, typically using a headrow format. Six participants utilized corn cob "spawn" inoculation, spore inoculation, overhead mist irrigation, or some combination of all three. Participants scored for disease using one or more of the following: disease index (IND), disease incidence (INC), diseased-head severity (DHS), Fusarium damaged kernels (FDK) defined by Paul et al. (2005), or FHB index as defined by Sneller et al. (2010). Additional data recorded may have included planting date, winter survival, heading date, height, disease scoring date, lodging, maturity date, thousand grain weight, and fungal toxin nivalenol (NIV) levels. At maturity, the reps were hand-harvested. Reps were threshed, either as individual reps or a composite of the reps. Threshed material was ground to a fine powder and shipped to a

lab equipped to assess DON levels. The target quantity of sample used for DON analysis was 100 g.

Raw data or the mean values of reps were returned to Eric Stockinger, the latter of which were generated by the respective NABSEN participant. If means were provided, then those are presented here. If raw data was provided, then means and standard deviation were calculated and are presented here. Data provided included disease incidence, disease severity, disease index, fusarium damaged kernels, heading date, ppm DON, or some combination of one or more of those traits.

Data obtained from each participant, except the DON data, is presented in Supplemental Tables 1 to 15. For each location and year, data is presented in a separate table. DON data obtained from the 2021–22 season for all locations are presented together in a single table, Table 6, and DON data from the 2022–23 season for all locations are presented together in Table 7.

RESULTS

As DON levels are one of the best indicators of resistance, a key question raised was were differences detected in DON levels across the entries, locations and years within the two-year multi-location trial? To address this question, an analysis of variance was carried out.

ANOVA indicated that there were significant differences across lines, highly significant differences across locations, and highly significant differences between the two trial years (Table 8).

Ranking of all lines across all locations is shown in Figure 1. Several lines from the Minnesota, Oregon, Ohio, and Virginia programs exhibited DON levels at the low end (Figure 1). In comparison, a majority of lines at the high end were from the Nebraska and Montana programs, while intermediate to high levels were observed for lines from the Idaho program.

Variation in mean DON levels for each location for the two trial years were significant (Figure 2). DON levels and the variation in DON levels were very high for the Ohio and Virginia locations, and very low for the Idaho, Maryland, North Carolina and Nebraska locations. The single year of DON data from the New York location suggested that it might be more similar to the Ohio and Virginia locations than to the low DON locations (Figure 2).

As location differences indicated that several locations had low DON levels, the data were reanalyzed using only the two high DON locations, Ohio and Virginia for the two trial years. This analysis indicated that the differences across lines was highly significant (Table 9).

A comparison of mean DON levels between the Wooster OH and Blacksburg VA locations was then made for the NABSEN set grown the 2021–22 season, and the NABSEN set grown the 2022–23 season. These comparisons indicated significant correlation in mean DON levels between the two locations for the two trial years (Figure 3).

To test for the predictability of the Ohio and Virginia locations, mean DON values combined for the Ohio and Virginia locations were compared to the mean DON values combined for all locations. This comparison indicated these two locations were very predictive of the DON accumulation levels of a given line (Figure 4). Ranking of lines for DON accumulation using only the Ohio and Virginia data is shown in Figure 5. The ranking parallels that obtained using all location data, albeit the two are not identical.

CONCLUSIONS

DON accumulation levels were highly dependent upon the location the NABSEN lines were grown, and the year the trial was grown. High variation in DON accumulation across lines occurred at the Wooster OH and Blacksburg VA locations. This high variation allowed for stratification of DON levels across lines. Moreover, there was a high correlation between the Ohio and Virginia locations in DON levels, and how a line performed at these locations was a good predictor of how a line would perform at other North American locations. The one year of data from the Ithaca NY location suggests that it might be more similar to the Ohio and Virginia locations than to the low DON locations. In the future, testing barley mapping populations at these locations might enable a robust genetic interrogation of DON accumulation to identify the genetic basis of this trait.

REFERENCES

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Dr. David Francis graciously provided help with the statistical analyses. The author expresses deep gratitude for this help.

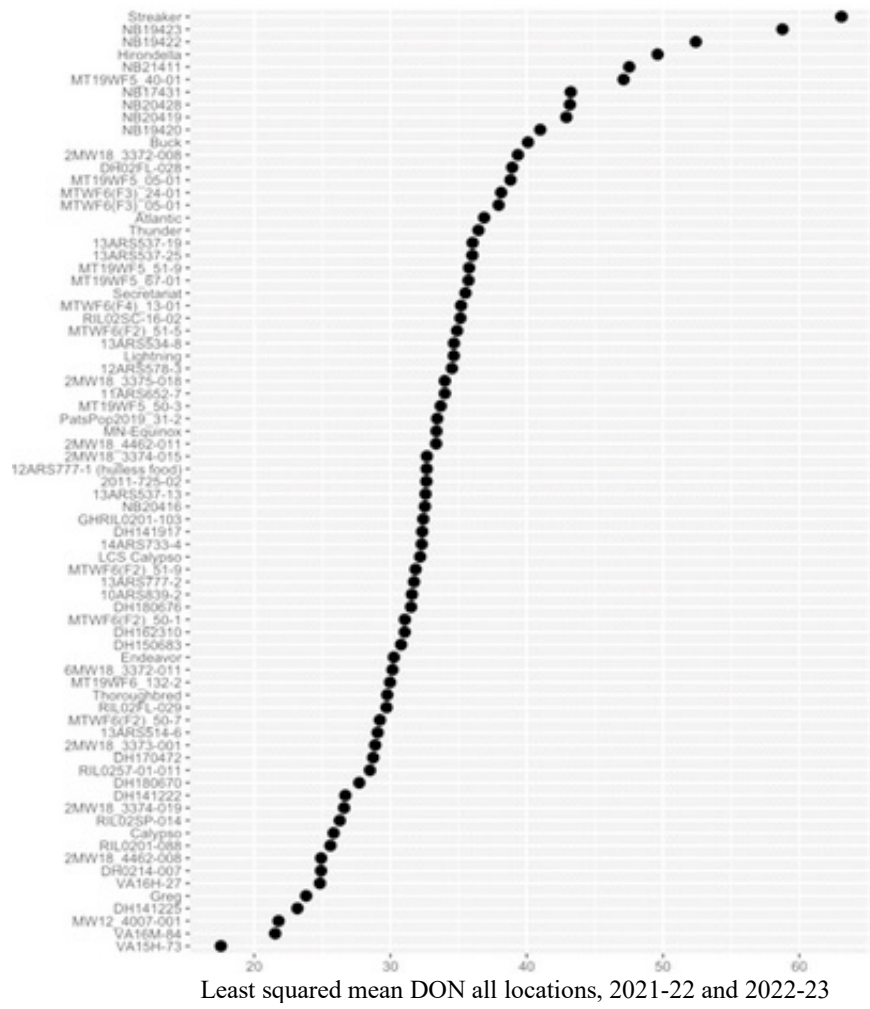


Figure 1. Ranking of lines from low DON (bottom) to high DON (top) using the complete data set.

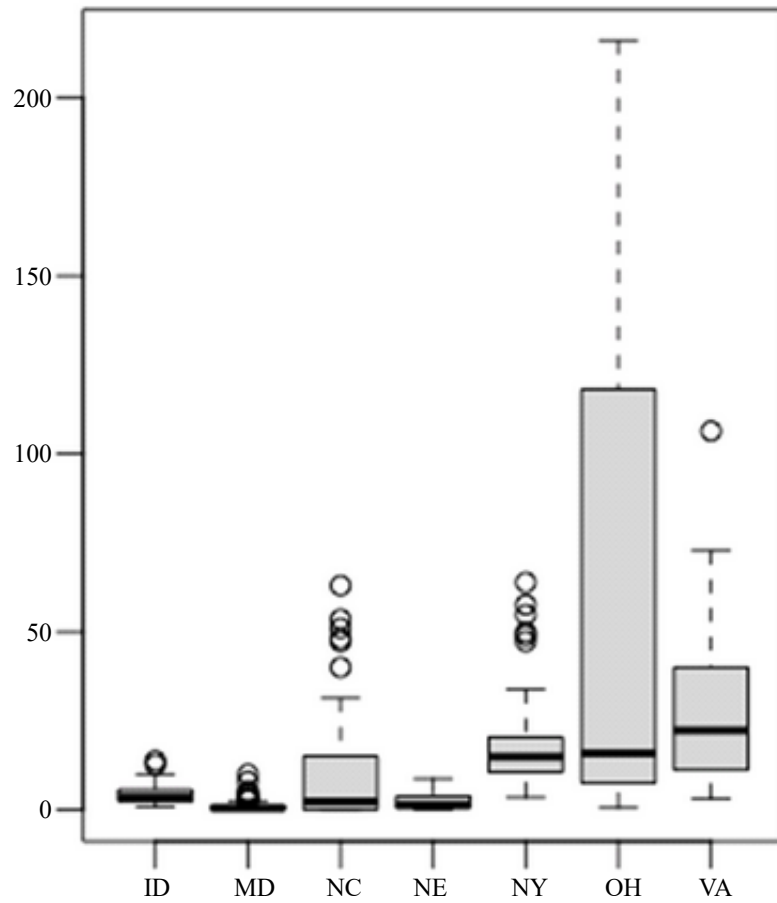


Figure 2. Variation in mean DON levels at each location.

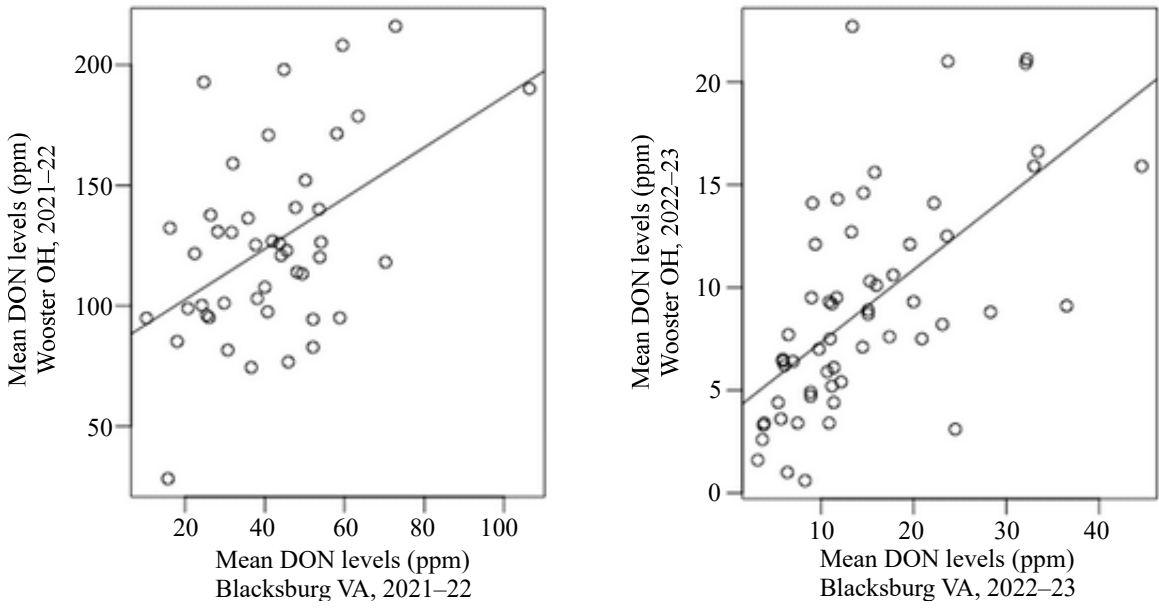


Figure 3. Mean DON levels Wooster OH vs. Blacksburg VA.
(A) The 2021-2022 season. p-value: 0.0008199; R-squared: 0.2136.
(B) The 2022-2023 season. p-value: 2.558e-07; R-squared: 0.3744.

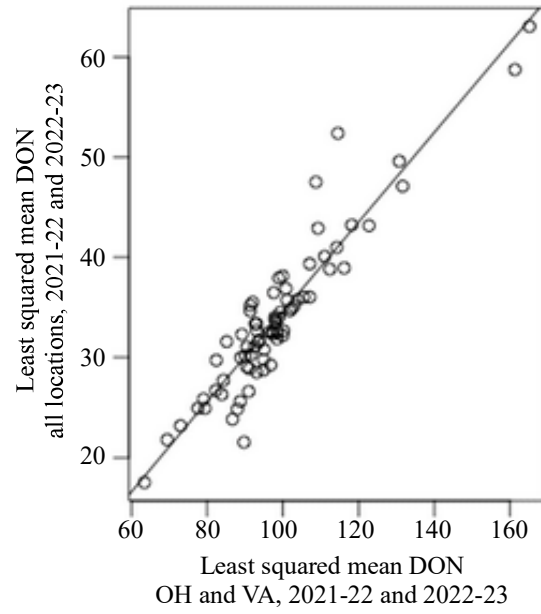


Figure 4. Two-year DON data set, OH and VA vs. two-year DON data set all locations. p-value: $< 2.2e-16$; R-squared: 0.8622.

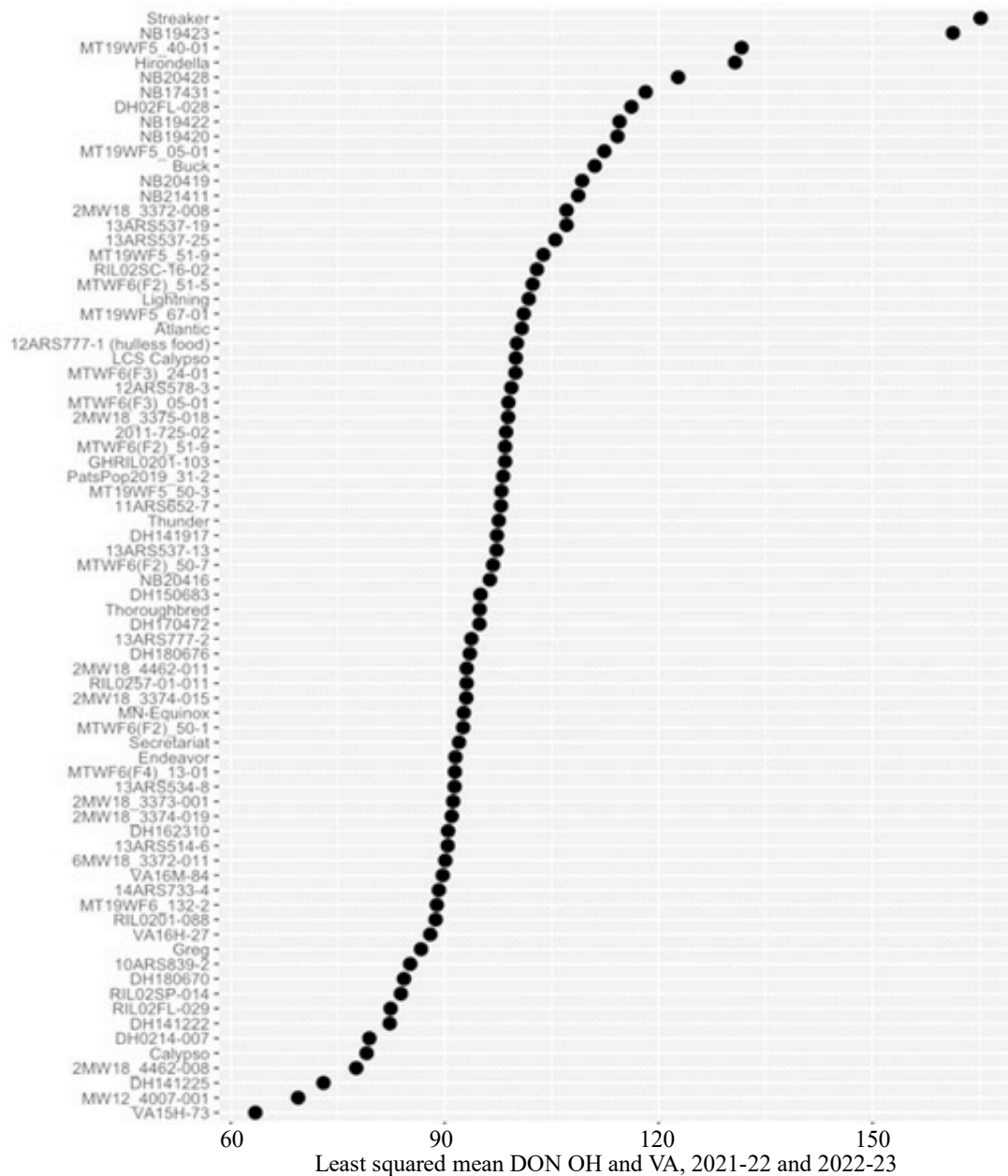


Figure 5. Ranking of lines from low DON (bottom) to high DON (top) using only the Ohio and Virginia data.

Table 1. Cooperator, institution, nursery location and disease-inducing methods used.

Cooperator	Institution	Location	Spawn	Spore	Irrigation
Christina Cowger	North Carolina State University	Raleigh, NC	Yes	Yes	Yes
Katherine Frels	University of Nebraska	Lincoln, NE	Yes	Yes	Yes
Juliet Marshall	University of Idaho	Idaho Falls, ID	Yes	Yes	Yes
Nidhi Rawat	University of Maryland	College Park, MD	Yes	No	Yes
Nicholas Santantonio	Virginia State University	Blacksburg, VA	Yes	Yes	Yes
Jamie Sherman	Montana State University	Bozeman, MT*	No	No	No
Mark E. Sorrells	Cornell University	Ithaca, NY	Yes	Yes	Yes
Eric J. Stockinger	The Ohio State University	Wooster, OH	Yes	Yes	Yes

Table 2. Lines selected as checks (controls).

Control #	Line	Row	Rationale for inclusion	Additional notable characteristics
Control #1	Endeavor	2-row	Resistant	Winter-hardness is inadequate
Control #2	VA15H-73	2 row	Resistant	Hull-less
Control #3	Calypso	2-row	Resistant	Deficiens phenotype (suppression of lateral floret growth)
Control #4	Wintmalt	2-row	Susceptible	-
Control #5	Thoroughbred	6 row	Resistant	-
Control #6	Hirondella	6 row	Susceptible	-
Control #7	Atlantic	6 row	Susceptible	Early
Control #8	Secretariat	6 row	Susceptible	Early

Table 3. Contributors, breeding program, and number of lines submitted

Contributor	Breeding program	Lines 2021–22	Lines 2022–23	Lines repeated*
Katherine Frels	University of Nebraska	5	5	2
Pat Hayes	Oregon State University	7	7	2
Gongshe Hu	USDA Aberdeen Idaho	6	8	3
Nicholas Santantonio	Virginia State University	-	8	-
Jamie Sherman	Montana State University	7	7	2
Kevin Smith	University of Minnesota	6	6	2
Eric Stockinger	The Ohio State University	6	8	5

*2021–22 & 2022–23

Table 4. Entries for the 2021–22 NABSEN.

Entry	Institution	Line	Pedigree
2021-22 NABSEN-001	OR State U.	DH141225	10.1044/04_028_36
2021-22 NABSEN-002	OR State U.	Buck	Strider/Doyce
2021-22 NABSEN-003	OR State U.	Streaker	Maja/Legacy/Maja/3/Doyce
2021-22 NABSEN-004	OR State U.	DH180670	DH120304/1-4
2021-22 NABSEN-005	OR State U.	Thunder*	Wintmalt/Charles
2021-22 NABSEN-006	OR State U.	Lightning*	TC6W265/HERZ 29494/2991
2021-22 NABSEN-007	OR State U.	DH141222	10.1044/Violetta
2021-22 NABSEN-008	USDA Idaho	13ARS777-2	
2021-22 NABSEN-009	USDA Idaho	13ARS537-19*	
2021-22 NABSEN-010	USDA Idaho	10ARS839-2*	
2021-22 NABSEN-011	USDA Idaho	13ARS537-25*	
2021-22 NABSEN-012	USDA Idaho	11ARS652-7	
2021-22 NABSEN-013	USDA Idaho	12ARS578-3	
2021-22 NABSEN-014	U. NE–Lincoln	NB20416	
2021-22 NABSEN-015	U. NE–Lincoln	NB20428	
2021-22 NABSEN-016	U. NE–Lincoln	NB19423	
2021-22 NABSEN-017	U. NE–Lincoln	NB19420*	
2021-22 NABSEN-018	U. NE–Lincoln	NB17431*	
2021-22 NABSEN-019	MT State U.	MT19WF5_05-01	
2021-22 NABSEN-020	MT State U.	MT19WF5_40-01	
2021-22 NABSEN-021	MT State U.	MT19WF5_67-01	
2021-22 NABSEN-022	MT State U.	PatsPop2019_31-2	
2021-22 NABSEN-023	MT State U.	MT19WF5_50-3	
2021-22 NABSEN-024	MT State U.	MT19WF5_51-9	
2021-22 NABSEN-025	MT State U.	MT19WF6_132-2	
2021-22 NABSEN-026	U. MN Twin Cities	2MW18_3372-008*	
2021-22 NABSEN-027	U. MN Twin Cities	2MW18_4462-008	
2021-22 NABSEN-028	U. MN Twin Cities	2MW18_3375-018	
2021-22 NABSEN-029	U. MN Twin Cities	2MW18_4462-011*	
2021-22 NABSEN-030	U. MN Twin Cities	MW12_4007-001	
2021-22 NABSEN-031	U. MN Twin Cities	6MW18_3372-011	
2021-22 NABSEN-032	OH State U.	2011-725-02*	Endeavor/MO B2549
2021-22 NABSEN-033	OH State U.	DH0214-007*	2011-725-02/2WI14-7514
2021-22 NABSEN-034	OH State U.	DH02FL-028*	2011-725-02/Flagon
2021-22 NABSEN-035	OH State U.	RIL02FL-029*	2011-725-02/Flagon
2021-22 NABSEN-036	OH State U.	RIL02SC-16-02	2011-725-02/SC 85942
2021-22 NABSEN-037	OH State U.	RIL02SP-014*	2011-725-02/Sprite
	Control #1	Endeavor*	
	Control #2	VA15H-73*	
	Control #3	Calypso*	
	Control #4	Wintmalt*	
	Control #5	Thoroughbred*	
	Control #6	Hirondella*	
	Control #7	Atlantic*	

*Also tested the 2022–23 season.

Table 5. Entries for the 2022–23 NABSEN.

Entry	Institution	Line	Pedigree
2022-23 NABSEN-001	U. MN Twin Cities	2MW18_3372-008*	
2022-23 NABSEN-002	U. MN Twin Cities	2MW18_3373-001	
2022-23 NABSEN-003	U. MN Twin Cities	2MW18_3374-015	
2022-23 NABSEN-004	U. MN Twin Cities	2MW18_3374-019	
2022-23 NABSEN-005	U. MN Twin Cities	2MW18_4462-011*	
2022-23 NABSEN-006	U. MN Twin Cities	MN-Equinox	
2022-23 NABSEN-007	MT State U.	MTWF6(F2)_50-1	Lavina/Vavilov_13976
2022-23 NABSEN-008	MT State U.	MTWF6(F2)_50-7	Lavina/Vavilov_13976
2022-23 NABSEN-009	MT State U.	MTWF6(F2)_51-5	Lavina/Dicktoo
2022-23 NABSEN-010	MT State U.	MTWF6(F2)_51-9	Lavina/Dicktoo
2022-23 NABSEN-011	MT State U.	MTWF6(F3)_05-01	Vavilov_13470/Arturio
2022-23 NABSEN-012	MT State U.	MTWF6(F3)_24-01	Vavilov_20251/Azurel
2022-23 NABSEN-013	MT State U.	MTWF6(F4)_13-01	Vavilov_13976/Salamandre
2022-23 NABSEN-014	U. NE–Lincoln	NB17431*	
2022-23 NABSEN-015	U. NE–Lincoln	NB19420*	
2022-23 NABSEN-016	U. NE–Lincoln	NB19422	
2022-23 NABSEN-017	U. NE–Lincoln	NB20419	
2022-23 NABSEN-018	U. NE–Lincoln	NB21411	
2022-23 NABSEN-019	OH State U.	2011-725-02*	Endeavor/MO B2549
2022-23 NABSEN-020	OH State U.	DH0214-007*	2011-725-02/2WI14-7514
2022-23 NABSEN-021	OH State U.	DH02FL-028*	2011-725-02/Flagon
2022-23 NABSEN-022	OH State U.	GHRIL0201-103	2011-725-02/2011-725-01
2022-23 NABSEN-023	OH State U.	RIL0201-088	2011-725-02/2011-725-01
2022-23 NABSEN-024	OH State U.	RIL0257-01-011	2011-725-02/2WI14-7505
2022-23 NABSEN-025	OH State U.	RIL02FL-029*	2011-725-02/Flagon
2022-23 NABSEN-026	OH State U.	RIL02SP-014*	2011-725-02/Sprite
2022-23 NABSEN-027	OR State U.	DH141917	04-028-36/Thunder
2022-23 NABSEN-028	OR State U.	DH150683	04-028-36/DH131772
2022-23 NABSEN-029	OR State U.	DH162310	DH130939/Calypso
2022-23 NABSEN-030	OR State U.	DH170472	DH130939/Calypso
2022-23 NABSEN-031	OR State U.	DH180676	DH120304/DH140322
2022-23 NABSEN-032	OR State U.	Lightning*	TC6W265/HERZ 29494/2991
2022-23 NABSEN-033	OR State U.	Thunder*	Wintmalt/Charles
2022-23 NABSEN-034	USDA Idaho	10ARS839-2	
2022-23 NABSEN-035	USDA Idaho	12ARS777-1	
2022-23 NABSEN-036	USDA Idaho	13ARS514-6	
2022-23 NABSEN-037	USDA Idaho	13ARS534-8	
2022-23 NABSEN-038	USDA Idaho	13ARS537-13	
2022-23 NABSEN-039	USDA Idaho	13ARS537-19*	
2022-23 NABSEN-040	USDA Idaho	13ARS537-25*	
2022-23 NABSEN-041	USDA Idaho	14ARS733-4	
2022-23 NABSEN-042	VA Tech	Greg* (VA15H-73)	
2022-23 NABSEN-043	VA Tech	VA16H-27	
2022-23 NABSEN-044	VA Tech	VA16M-84	

2022-23 NABSEN-045	VA Tech	VA20MFHB-18DH533
2022-23 NABSEN-046	VA Tech	VA20MFHB-18DH535
2022-23 NABSEN-047	VA Tech	VA21HFHB-19DH0152
2022-23 NABSEN-048	VA Tech	VA21HFHB-19DH0301
2022-23 NABSEN-049	VA Tech	VA21HFHB-19DH0714
2022-23 NABSEN-050		Thoroughbred*
2022-23 NABSEN-051		Hirondella*
2022-23 NABSEN-052		Atlantic*
2022-23 NABSEN-053		Secretariat*
2022-23 NABSEN-054		Endeavor*
2022-23 NABSEN-055		VA15H-73*
2022-23 NABSEN-056		Calypso*
2022-23 NABSEN-057		Wintmalt*

*Also tested the 2021–22 season.

Table 6. Mean DON values (ppm), or mean DON values and standard deviation, for each location* that tested for DON the 2021-22 season.

Entry	MD [†]	NE [‡]	NC [‡]	NC [‡]	OH [‡]	OH	VA [‡]	VA
	Mean	Mean	Mean	Std dev	Mean	Std dev	Mean	Std dev
2021-22 NABSEN-001	0.3	1.4	0.0	0.0	81.6	27.3	30.7	19.2
2021-22 NABSEN-002	2.9	7.2	0.1	0.1	118.1	56.7	70.3	8.9
2021-22 NABSEN-003	10.0	6.6	0.4	0.3	190.2	86.5	106.4	23.7
2021-22 NABSEN-004	0.7	1.1	0.0	0.0	82.8	37.0	52.1	2.2
2021-22 NABSEN-005	1.1	4.6	0.0	0.0	125.9	47.9	43.7	7.2
2021-22 NABSEN-006	1.2	2.0	0.1	0.1	126.9	35.3	41.9	29.2
2021-22 NABSEN-007	0.5	0.2	0.0	0.0	101.1	17.1	29.8	2.3
2021-22 NABSEN-008	2.2	0.8	0.0	0.0	95.0	39.4	58.8	21.2
2021-22 NABSEN-009	0.5	0.6	0.0	0.1	152.1	23.5	50.2	17.3
2021-22 NABSEN-010	8.0	2.7	0.1	0.1	76.7	23.7	45.9	11.3
2021-22 NABSEN-011	0.8	4.6	0.0	0.0	140.1	16.6	53.6	27.5
2021-22 NABSEN-012	1.5	4.5	0.0	0.0	114.0	23.7	48.1	11.9
2021-22 NABSEN-013	1.9	3.8	0.0	0.0	120.9	11.5	44.1	19.7
2021-22 NABSEN-014	1.2	0.6	0.0	0.0	130.8	33.7	28.2	6.1
2021-22 NABSEN-015	2.0	0.2	0.0	0.0	170.9	45.7	40.9	1.8
2021-22 NABSEN-016	2.9	0.2	0.0	0.0	216.1	10.9	72.8	4.2
2021-22 NABSEN-017	2.9	0.4	0.1	0.1	192.9	31.7	24.7	0.7
2021-22 NABSEN-018	4.7	0.6	0.3	0.2	198.1	17.1	44.8	9.0
2021-22 NABSEN-019	0.9	0.2	0.0	0.0	159.1	17.9	32.0	5.8
2021-22 NABSEN-020	2.9	1.2	0.0	0.0	171.5	45.9	58.1	3.6
2021-22 NABSEN-021	5.3	2.7	0.3	0.5	123.0	3.2	45.5	5.3
2021-22 NABSEN-022	1.7	0.5	0.4	0.5	113.3	10.1	49.4	12.2
2021-22 NABSEN-023	1.0	3.3	0.1	0.0	130.5	16.0	31.7	0.4
2021-22 NABSEN-024	1.1	1.8	0.1	0.1	120.2	28.1	53.8	10.2
2021-22 NABSEN-025	1.8	M	0.0	0.1	121.7	19.2	22.4	13.1
2021-22 NABSEN-026	2.1	0.5	0.1	0.1	126.4	18.0	54.1	2.9
2021-22 NABSEN-027	0.9	0.2	0.1	0.1	96.1	16.4	25.4	8.0
2021-22 NABSEN-028	0.9	3.0	0.1	0.1	137.7	36.8	26.4	15.5
2021-22 NABSEN-029	2.5	0.7	0.1	0.1	132.3	28.6	16.2	13.9
2021-22 NABSEN-030	1.5	0.4	0.0	0.0	94.9	18.3	10.3	4.2
2021-22 NABSEN-031	1.5	0.9	0.0	0.0	94.4	17.2	52.1	3.9

2021-22 NABSEN-032	2.0	2.5	0.0	0.0	125.3	17.4	37.7	12.5
2021-22 NABSEN-033	2.1	0.5	0.0	0.0	85.2	15.4	18.0	4.3
2021-22 NABSEN-034	4.1	2.6	0.1	0.0	178.7	19.3	63.4	0.4
2021-22 NABSEN-035	3.0	0.5	0.0	0.0	74.4	2.4	36.6	3.2
2021-22 NABSEN-036	1.1	0.4	0.1	0.1	136.4	28.5	35.8	3.0
2021-22 NABSEN-037	0.7	0.4	0.0	0.1	98.9	10.7	20.7	1.3
Control #1	0.4	3.5	0.0	0.0	97.5		40.7	4.5
Control #2	0.4	0.6	0.0	0.0	28.5		15.7	8.4
Control #3	1.5	1.4	0.0	0.0	100		24.2	2.7
Control #4	0.4	0.4	0.0	0.0	141		47.7	1.2
Control #5	2.2	0.7	0.1	0.1	103		38.1	9.9
Control #6	1.1	6.3	0.3	0.2	208		59.5	13.9
Control #7	nd	0.1	0.2	0.1	108		40.0	6.1
Control #8	nd	0.7	1.1	1.2	95.1		26.0	1.0

*Maryland (MD), Nebraska (NE), North Carolina (NC), Ohio (OH), and Virginia (VA).

†Mean of two reps.

‡Mean of three reps.

Table 7. Mean DON values (ppm), or mean DON values and standard deviation, for each location* that tested for DON the 2022-23 season.

Entry	ID [†]	ID	MD [†]	MD	NE [‡]	NE	NC [§]	NY [†]	NY	OH [§]	OH	VA [§]
	Mean	Std dev	Mean	Std dev	Raw	Std dev	Mean	Mean	Std dev	Mean	Std dev	Mean
NABSEN-001	5.8	0.5	0.6	0.8	nd	nd	51.0	16.0	0.4	9.1	2.6	36.5
NABSEN-002	3.0	1.3	0.2	nd	nd	nd	11.8	15.6	3.5	4.9	1.5	8.9
NABSEN-003	9.4	1.4	0.4	nd	nd	nd	17.5	22.4	5.9	6.1	1.7	11.4
NABSEN-004	4.5	1.0	nd	nd	nd	nd	25.1	5.8	0.7	6.4	2.8	7.0
NABSEN-005	2.8	2.2	0.1	nd	3.4	nd	20.6	13.2	1.6	7.1	1.1	14.5
NABSEN-006	2.3	1.2	0.7	nd	nd	nd	40.0	11.6	1.3	7.0	0.8	9.8
NABSEN-007	2.3	1.0	0.2	0.1	8.7	nd	1.2	3.5	0.8	5.9	1.7	10.7
NABSEN-008	2.4	0.4	0.3	0.1	nd	nd	7.8	11.0	0.3	7.6	0.5	17.4
NABSEN-009	4.6	0.0	0.6	0.2	nd	nd	29.2	10.0	2.1	12.5	2.3	23.6
NABSEN-010	3.3	0.8	0.5	0.3	nd	nd	17.0	13.0	4.4	7.5	0.3	20.9
NABSEN-011	3.7	1.1	0.1	0.0	7.7	nd	28.0	11.9	6.9	9.3	1.2	20.0
NABSEN-012	3.8	0.9	0.3	0.0	2.8	nd	19.9	23.9	3.4	8.2	1.2	23.1
NABSEN-013	3.5	0.0	0.3	0.3	4.2	nd	27.9	11.2	3.7	3.4	1.1	10.9
NABSEN-014	4.2	0.1	0.3	0.0	5.2	nd	31.4	14.9	3.3	3.1	0.7	24.5
NABSEN-015	5.7	5.9	0.1	0.0	7.3	nd	16.0	18.0	4.2	8.8	2.1	28.3
NABSEN-016	6.7	3.1	0.1	0.0	4.4	nd	63.0	47.3	21.8	15.9	3.5	44.6
NABSEN-017	12.7	1.3	0.1	0.0	nd	nd	47.3	18.5	2.4	16.6	5.0	33.4
NABSEN-018	13.8	1.1	0.2	0.0	8	nd	53.5	23.4	8.6	15.9	0.2	33.0
NABSEN-019	4.9	2.6	0.1	0.0	nd	nd	15.1	11.5	2.8	14.6	6.9	14.6
NABSEN-020	3.8	0.5	0.4	0.3	nd	nd	9.3	11.6	2.0	6.4	1.1	5.9
NABSEN-021	4.9	3.1	0.4	0.1	nd	nd	5.8	17.2	3.7	9.2	0.6	11.2
NABSEN-022	6.5	0.1	0.4	0.2	nd	nd	13.9	16.4	9.1	10.6	5.5	17.8
NABSEN-023	1.6	0.6	0.3	0.1	nd	nd	3.3	10.6	0.8	0.6	0.1	8.3
NABSEN-024	5.3	2.6	0.1	0.0	nd	nd	10.7	8.4	3.3	5.4	0.4	12.2
NABSEN-025	1.9	1.4	0.2	0.0	3	nd	13.4	20.4	1.8	5.2	1.3	11.2
NABSEN-026	3.6	2.8	0.2	0.1	nd	nd	11.3	9.0	0.5	4.7	1.7	8.9
NABSEN-027	6.6	2.5	0.2	0.1	nd	nd	14.4	17.8	0.7	14.3	4.7	11.8
NABSEN-028	4.8	2.8	0.1	0.1	nd	nd	17.4	12.0	0.8	12.1	2.5	9.4
NABSEN-029	6.8	2.2	0.1	0.0	nd	nd	24.6	13.5	4.9	6.5	2.9	5.9
NABSEN-030	1.7	0.1	0.2	0.1	nd	nd	10.9	9.5	0.6	9.5	1.3	11.7
NABSEN-031	1.2	0.3	0.2	0.1	nd	nd	18.1	22.2	14.7	9.5	2.6	9.0

NABSEN-032	7.1	0.6	0.2	0.0	nd	nd	13.6	21.2	8.4	22.7	6.9	13.4
NABSEN-033	2.9	2.5	0.3	0.2	nd	nd	24.5	49.9	19.4	7.5	1.5	11.0
NABSEN-034	2.6	0.6	0.4	0.4	nd	nd	9.6	54.8	41.9	4.4	0.7	11.4
NABSEN-035	2.6	2.1	0.2	0.1	nd	nd	12.4	20.2	6.8	12.1	3.8	19.6
NABSEN-036	2.6	0.4	0.1	0.0	nd	nd	14.0	16.5	0.8	6.2	2.0	6.1
NABSEN-037	3.5	0.3	0.1	0.0	nd	nd	3.7	57.6	29.4	7.7	0.2	6.5
NABSEN-038	8.5	6.5	0.3	0.1	nd	nd	1.9	29.9	10.5	12.7	1.3	13.3
NABSEN-039	2.4	0.0	0.3	0.2	nd	nd	1.9	33.8	19.0	8.7	1.9	15.1
NABSEN-040	8.7	0.6	0.2	0.0	nd	nd	2.3	29.0	10.2	10.1	2.5	16.0
NABSEN-041	1.2	0.4	0.3	0.2	nd	nd	4.7	48.9	48.3	4.4	4.7	5.4
NABSEN-042	1.8	0.3	0.3	0.1	nd	nd	2.9	4.2	1.0	1.6	0.6	3.2
NABSEN-043	2.2	1.3	0.1	0.0	nd	nd	2.4	8.0	7.1	1.0	0.1	6.4
NABSEN-044	1.0	0.5	0.2	0.0	nd	nd	nd	3.7	1.5	3.4	0.6	7.5
NABSEN-045	0.9	0.5	0.4	0.2	nd	nd	nd	14.6	6.9	8.9	1.4	15.1
NABSEN-046	4.4	0.3	0.2	nd	nd	nd	nd	9.8	6.1	9.3	2.8	10.9
NABSEN-047	4.5	2.4	0.1	0.0	nd	nd	17.7	3.5	1.0	3.6	0.6	5.7
NABSEN-048	1.2	0.1	0.1	nd	nd	nd	8.4	4.9	1.1	3.3	0.2	3.8
NABSEN-049	0.9	0.4	0.1	0.0	nd	nd	8.3	5.0	0.4	2.6	0.6	3.7
NABSEN-050	4.0	3.4	0.3	0.3	nd	nd	nd	19.2	0.5	14.1	2.7	22.2
NABSEN-051	9.6	2.5	0.4	0.2	nd	nd	nd	63.9	39.0	20.9	4.2	32.1
NABSEN-052	9.8	1.2	0.5	0.6	nd	nd	29.8	13.2	0.1	21.1	3.8	32.2
NABSEN-053	10.0	0.4	0.3	0.1	nd	nd	48.1	14.9	1.1	21.0	2.9	23.7
NABSEN-054	2.6	0.6	0.2	0.1	nd	nd	12.2	19.3	1.6	10.3	3.6	15.3
NABSEN-055	2.0	1.5	0.2	nd	nd	nd	4.0	3.7	1.3	3.4	1.6	3.9
NABSEN-056	3.6	1.0	0.3	0.2	nd	nd	15.4	13.5	0.3	15.6	3.0	15.8
NABSEN-057	2.4	0.2	0.2	0.2	nd	nd	26.0	16.2	11.0	14.1	2.7	9.1

*Idaho (ID), Maryland (MD), Nebraska (NE), North Carolina (NC), New York (NY), Ohio (OH), and Virginia (VA).

†Mean of two reps.

‡Measurements were made on what was harvestable from one, or at most two, plants surviving the extreme drought experienced at Lincoln Nebraska.

§Mean of three reps.

Table 8. Analysis of Variance testing for differences in mean DON levels across entries, locations and years.

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Line	82	80010	976	1.3318	0.0367 *
LOC	6	254789	42465	57.962	< 2.2e-16 ***
Year	1	36950	36950	50.4344	4.491e-12 ***
Residuals	478	350198	733		

Table 9. ANOVA testing for differences in mean DON levels across entries and trial years using the Ohio and Virginia locations.

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Line	82	218613	2666	2.2677	2.230e-05 ***
LOC	1	57890	57890	49.2404	1.493e-10 ***
Year	1	86407	86407	73.4966	4.351e-14 ***
Residuals	119	139903	1176		

Supplemental Table 1. Mean* and standard deviation values for disease incidence, severity, and index at Idaho Falls ID, the 2021–22 season.

Entry	INC (%) (mean)	INC (%) (std dev)	DHS (%) (mean)	DHS (%) (std dev)	Index (mean)	Index (std dev)
2021-22 NABSEN-001	0.0	0.0	0.0	0.0	0.0	0.0
2021-22 NABSEN-002	8.3	7.1	3.3	0.4	0.3	0.2
2021-22 NABSEN-003	20.0	9.4	3.3	1.7	0.7	0.6
2021-22 NABSEN-004	10.0	4.7	2.1	0.4	0.2	0.1
2021-22 NABSEN-005	16.7	4.7	1.6	0.6	0.3	0.2
2021-22 NABSEN-006	1.7	2.4	0.6	0.8	0.0	0.0
2021-22 NABSEN-007	0.0	0.0	0.0	0.0	0.0	0.0
2021-22 NABSEN-008	6.7	0.0	1.2	0.0	0.1	0.0
2021-22 NABSEN-009	10.0	14.1	0.8	1.1	0.2	0.2
2021-22 NABSEN-010	0.0	0.0	0.0	0.0	0.0	0.0
2021-22 NABSEN-011	13.3	9.4	1.5	0.4	0.2	0.2
2021-22 NABSEN-012	1.7	2.4	0.6	0.8	0.0	0.0
2021-22 NABSEN-013	16.7	9.4	1.0	1.4	0.1	0.1
2021-22 NABSEN-014	0.0	0.0	0.0	0.0	0.0	0.0
2021-22 NABSEN-015	0.0	0.0	0.0	0.0	0.0	0.0
2021-22 NABSEN-016	3.3	4.7	0.6	0.8	0.0	0.1
2021-22 NABSEN-017	0.0	0.0	0.0	0.0	0.0	0.0
2021-22 NABSEN-018	5.0	2.4	1.2	0.0	0.1	0.0
2021-22 NABSEN-019	3.3	0.0	1.2	0.0	0.0	0.0
2021-22 NABSEN-020	6.7	0.0	1.2	0.0	0.1	0.0
2021-22 NABSEN-021	3.3	4.7	0.6	0.8	0.0	0.1
2021-22 NABSEN-022	15.0	2.4	1.9	0.1	0.3	0.1
2021-22 NABSEN-023	0.0	0.0	0.0	0.0	0.0	0.0
2021-22 NABSEN-024	1.7	2.4	1.2	1.7	0.0	0.1
2021-22 NABSEN-025	1.7	2.4	0.6	0.8	0.0	0.0
2021-22 NABSEN-026	1.7	2.4	0.6	0.8	0.0	0.0
2021-22 NABSEN-027	0.0	0.0	0.0	0.0	0.0	0.0
2021-22 NABSEN-028	5.0	7.1	0.8	1.1	0.1	0.1
2021-22 NABSEN-029	3.3	0.0	1.2	0.0	0.0	0.0
2021-22 NABSEN-030	1.7	2.4	1.2	1.7	0.0	0.1

2021-22 NABSEN-031	3.3	4.7	0.9	1.3	0.1	0.1
2021-22 NABSEN-032	5.0	7.1	0.8	1.1	0.1	0.1
2021-22 NABSEN-033	3.3	4.7	0.6	0.8	0.0	0.1
2021-22 NABSEN-034	10.0	0.0	1.6	0.6	0.2	0.1
2021-22 NABSEN-035	5.0	2.4	1.2	0.0	0.1	0.0
2021-22 NABSEN-036	1.7	2.4	0.6	0.8	0.0	0.0
2021-22 NABSEN-037	3.3	0.0	1.2	0.0	0.0	0.0
Control #1	5.0	2.4	1.2	0.0	0.1	0.0
Control #2	1.7	2.4	0.6	0.8	0.0	0.0
Control #3	5.0	7.1	0.6	0.8	0.1	0.1
Control #4	0.0	0.0	0.0	0.0	0.0	0.0
Control #5	6.7	4.7	2.2	0.3	0.1	0.1
Control #6	21.7	21.2	2.5	0.1	0.5	0.5
Control #7	28.3	16.5	6.1	0.5	1.7	0.9
Control #8	26.7	18.9	2.1	0.1	0.5	0.4

*Mean of two reps.

Location: Kimberly, Idaho

Planting Date: 10/5/2021

Corn spawn inoculation date: 5/4/2022

Conidia Inoculation (100, 000 spores/ml): 6/2.2022 and 6/9/2022

Disease rating: 7/1/2022

Notes: 1) misting system was deployed immediately after conidia inoculation
2) 30 heads per entry were rated for FHB severity

Supplemental Table 2. Mean* and standard deviation values for disease incidence per 20 heads counted, derived percent incidence, severity, and index at Idaho Falls ID the 2022–23 season.

Entry	INC/20 Count (mean)	INC/20 Count (std dev)	INC (%) (mean)	INC (%) (std dev)	DHS (mean)	DHS (std dev)	Index (mean)	Index (std dev)
2022-23 NABSEN-001	7.0	1.4	70.0	14.1	23.2	19.6	17.6	17.0
2022-23 NABSEN-002	5.0	2.8	50.0	28.3	9.6	7.5	5.9	6.4
2022-23 NABSEN-003	8.0	2.8	80.0	28.3	23.1	19.4	21.2	22.1
2022-23 NABSEN-004	4.0	1.4	40.0	14.1	20.7	21.7	9.8	11.6
2022-23 NABSEN-005	2.5	0.7	25.0	7.1	5.7	0.5	1.4	0.3
2022-23 NABSEN-006	5.0	7.1	50.0	70.7	23.6	n/d	23.6	n/d
2022-23 NABSEN-007	3.0	1.4	30.0	14.1	17.0	9.9	5.8	5.4
2022-23 NABSEN-008	2.0	0.0	20.0	0.0	15.5	4.9	3.1	1.0
2022-23 NABSEN-009	6.0	5.7	60.0	56.6	43.4	44.4	38.6	51.2
2022-23 NABSEN-010	3.5	0.7	35.0	7.1	13.7	6.2	5.0	3.1
2022-23 NABSEN-011	6.5	2.1	65.0	21.2	26.8	1.8	17.2	4.5
2022-23 NABSEN-012	4.0	0.0	40.0	0.0	21.3	3.9	8.5	1.6
2022-23 NABSEN-013	3.5	0.7	35.0	7.1	14.7	13.2	5.6	5.7
2022-23 NABSEN-014	7.0	4.2	70.0	42.4	46.8	32.2	39.6	42.4
2022-23 NABSEN-015	10.0	0.0	100.0	0.0	93.2	5.1	93.2	5.1
2022-23 NABSEN-016	10.0	0.0	100.0	0.0	87.9	4.7	87.9	4.7
2022-23 NABSEN-017	9.5	0.7	95.0	7.1	90.1	11.5	85.2	4.5
2022-23 NABSEN-018	10.0	0.0	100.0	0.0	95.4	2.0	95.4	2.0
2022-23 NABSEN-019	6.0	1.4	60.0	14.1	8.9	2.1	5.2	0.0
2022-23 NABSEN-020	5.0	2.8	50.0	28.3	6.0	2.8	3.4	3.1
2022-23 NABSEN-021	7.0	1.4	70.0	14.1	6.7	1.9	4.8	2.3
2022-23 NABSEN-022	4.5	3.5	45.0	35.4	6.6	3.6	3.6	4.0
2022-23 NABSEN-023	1.0	1.4	10.0	14.1	6.0	n/d	1.2	n/d
2022-23 NABSEN-024	7.5	2.1	75.0	21.2	8.6	0.2	6.4	1.7
2022-23 NABSEN-025	3.5	2.1	35.0	21.2	5.2	1.7	2.0	1.7
2022-23 NABSEN-026	2.0	1.4	20.0	14.1	4.7	0.9	1.0	0.8
2022-23 NABSEN-027	12.5	7.8	62.5	38.9	6.4	2.5	4.5	4.1
2022-23 NABSEN-028	14.0	7.1	70.0	35.4	18.6	18.1	16.2	19.2
2022-23 NABSEN-029	7.5	0.7	37.5	3.5	4.8	0.3	1.8	0.3
2022-23 NABSEN-030	6.0	1.4	30.0	7.1	4.4	0.6	1.3	0.1
2022-23 NABSEN-031	3.5	2.1	35.0	21.2	5.4	0.8	1.8	0.8

2022-23 NABSEN-032	14.0	2.8	70.0	14.1	7.4	2.3	5.3	2.7
2022-23 NABSEN-033	8.0	4.2	40.0	21.2	5.5	1.0	2.3	1.6
2022-23 NABSEN-034	4.0	1.4	40.0	14.1	8.8	1.1	3.6	1.7
2022-23 NABSEN-035	12.0	1.4	60.0	7.1	7.9	0.7	4.7	0.1
2022-23 NABSEN-036	3.0	0.0	30.0	0.0	5.4	1.9	1.6	0.6
2022-23 NABSEN-037	4.0	1.4	40.0	14.1	10.3	7.0	4.6	4.2
2022-23 NABSEN-038	7.0	2.8	70.0	28.3	13.7	4.6	10.2	7.1
2022-23 NABSEN-039	3.5	0.7	17.5	3.5	4.5	0.7	0.8	0.3
2022-23 NABSEN-040	7.5	0.7	75.0	7.1	11.2	0.3	8.4	0.6
2022-23 NABSEN-041	3.0	1.4	30.0	14.1	7.5	2.1	2.4	1.7
2022-23 NABSEN-042	4.0	1.4	40.0	14.1	5.5	0.2	2.2	0.8
2022-23 NABSEN-043	6.5	4.9	65.0	49.5	20.8	18.1	18.0	22.1
2022-23 NABSEN-044	2.0	1.4	20.0	14.1	4.7	0.9	1.0	0.8
2022-23 NABSEN-045	3.0	1.4	30.0	14.1	5.0	1.4	1.6	1.1
2022-23 NABSEN-046	3.0	1.4	30.0	14.1	6.5	0.7	2.0	1.1
2022-23 NABSEN-047	6.0	1.4	60.0	14.1	8.4	0.6	5.0	0.8
2022-23 NABSEN-048	4.5	3.5	45.0	35.4	7.7	5.2	4.4	5.1
2022-23 NABSEN-049	3.0	1.4	30.0	14.1	6.0	2.8	2.0	1.7
2022-23 NABSEN-050	5.0	7.1	50.0	70.7	96.4	n/d	96.4	n/d
2022-23 NABSEN-051	18.0	2.8	90.0	14.1	54.8	24.1	47.6	13.9
2022-23 NABSEN-052	10.0	0.0	100.0	0.0	61.6	19.8	61.6	19.8
2022-23 NABSEN-053	10.0	0.0	100.0	0.0	27.6	8.5	27.6	8.5
2022-23 NABSEN-054	4.5	0.7	22.5	3.5	5.5	2.1	1.2	0.3
2022-23 NABSEN-055	1.5	2.1	15.0	21.2	9.3	n/d	2.8	n/d
2022-23 NABSEN-056	13.0	4.2	65.0	21.2	5.3	0.1	3.4	1.1
2022-23 NABSEN-057	15.5	3.5	77.5	17.7	8.2	0.3	6.4	1.7

*Mean of two reps

Supplemental Table 3. Mean* values for disease incidence, severity, index, and thousand kernel weight (TKW) at College Park MD, the 2021–22 season.

Entry	INC (%) (mean)	DHS (mean)	Index (mean)	TKW
2021-22 NABSEN-001	31	27	8	53
2021-22 NABSEN-002	33	45	15	33
2021-22 NABSEN-003	62	57	35	30
2021-22 NABSEN-004	43	28	12	49
2021-22 NABSEN-005	35	34	12	40
2021-22 NABSEN-006	36	40	14	50
2021-22 NABSEN-007	35	26	9	55
2021-22 NABSEN-008	37	33	12	38
2021-22 NABSEN-009	32	28	9	45
2021-22 NABSEN-010	46	54	25	45
2021-22 NABSEN-011	23	32	7	49
2021-22 NABSEN-012	39	36	14	47
2021-22 NABSEN-013	38	34	13	41
2021-22 NABSEN-014	47	38	18	35
2021-22 NABSEN-015	45	42	19	36
2021-22 NABSEN-016	48	44	21	31
2021-22 NABSEN-017	55	38	21	36
2021-22 NABSEN-018	54	42	23	31
2021-22 NABSEN-019	31	28	9	35
2021-22 NABSEN-020	37	33	12	44
2021-22 NABSEN-021	48	46	22	37
2021-22 NABSEN-022	39	33	13	46
2021-22 NABSEN-023	41	33	14	32
2021-22 NABSEN-024	33	41	14	38
2021-22 NABSEN-025	45	32	14	35
2021-22 NABSEN-026	50	44	22	49
2021-22 NABSEN-027	31	29	9	47
2021-22 NABSEN-028	37	30	11	50
2021-22 NABSEN-029	45	41	18	46

2021-22 NABSEN-030	37	30	11	40
2021-22 NABSEN-031	35	28	10	36
2021-22 NABSEN-032	33	43	14	46
2021-22 NABSEN-033	41	38	16	44
2021-22 NABSEN-034	45	45	20	47
2021-22 NABSEN-035	45	32	14	49
2021-22 NABSEN-036	51	27	14	52
2021-22 NABSEN-037	27	16	4	48
Control #1	33	28	9	49
Control #2	38	24	9	44
Control #3	45	32	14	56
Control #4	56	23	13	47
Control #5	45	41	18	39
Control #6	33	29	10	47
Control #7	61	56	34	nd [†]
Control #8	59	48	28	nd

*Mean of two reps.

[†]Not determined (nd)

Supplemental Table 4. Mean* values for disease incidence and FDK at College Park MD, the 2022–23 season.

Entry	INC (0-9) (mean)	INC (0-9) (std dev)	FDK (%) (mean)	FDK (%) (std dev)
2022-23 NABSEN-001	0.0	0.0	0.7	0.5
2022-23 NABSEN-002	0.5	0.7	0.7	0.9
2022-23 NABSEN-003	0.0	0.0	0.0	0.0
2022-23 NABSEN-004	0.0	0.0	0.3	0.0
2022-23 NABSEN-005	0.0	0.0	0.0	0.0
2022-23 NABSEN-006	0.0	0.0	0.0	0.0
2022-23 NABSEN-007	0.0	0.0	0.0	0.0
2022-23 NABSEN-008	1.0	1.4	3.5	0.7
2022-23 NABSEN-009	1.0	1.4	0.0	0.0
2022-23 NABSEN-010	0.0	0.0	0.0	0.0
2022-23 NABSEN-011	0.0	0.0	0.0	0.0
2022-23 NABSEN-012	0.5	0.7	0.5	0.7
2022-23 NABSEN-013	0.0	0.0	0.0	0.0
2022-23 NABSEN-014	0.0	0.0	0.2	0.2
2022-23 NABSEN-015	0.0	0.0	0.3	0.0
2022-23 NABSEN-016	0.5	0.7	0.5	0.7
2022-23 NABSEN-017	0.0	0.0	0.2	0.2
2022-23 NABSEN-018	0.5	0.7	1.2	0.2
2022-23 NABSEN-019	0.0	0.0	0.3	0.0
2022-23 NABSEN-020	0.5	0.7	0.8	0.7
2022-23 NABSEN-021	1.0	1.4	0.0	0.0
2022-23 NABSEN-022	1.5	2.1	0.0	0.0
2022-23 NABSEN-023	0.0	0.0	0.3	0.5
2022-23 NABSEN-024	0.0	0.0	0.0	0.0
2022-23 NABSEN-025	1.0	1.4	1.3	0.9
2022-23 NABSEN-026	0.0	0.0	0.0	0.0
2022-23 NABSEN-027	0.0	0.0	0.0	0.0
2022-23 NABSEN-028	0.5	0.7	0.3	0.5
2022-23 NABSEN-029	0.0	0.0	0.0	0.0

2022-23 NABSEN-030	1.0	1.4	0.0	0.0
2022-23 NABSEN-031	0.5	0.7	1.2	0.7
2022-23 NABSEN-032	0.0	0.0	0.0	0.0
2022-23 NABSEN-033	0.0	0.0	0.8	1.2
2022-23 NABSEN-034	1.5	2.1	0.5	0.2
2022-23 NABSEN-035	0.0	0.0	0.2	0.2
2022-23 NABSEN-036	0.0	0.0	0.0	0.0
2022-23 NABSEN-037	0.0	0.0	0.0	0.0
2022-23 NABSEN-038	0.0	0.0	0.2	0.2
2022-23 NABSEN-039	1.0	1.4	0.0	0.0
2022-23 NABSEN-040	0.5	0.7	0.2	0.2
2022-23 NABSEN-041	1.0	0.0	0.2	0.2
2022-23 NABSEN-042	1.0	1.4	0.7	0.9
2022-23 NABSEN-043	0.0	0.0	0.0	0.0
2022-23 NABSEN-044	1.0	1.4	0.0	0.0
2022-23 NABSEN-045	0.5	0.7	0.0	0.0
2022-23 NABSEN-046	0.5	0.7	0.2	0.2
2022-23 NABSEN-047	1.0	1.4	0.3	0.5
2022-23 NABSEN-048	0.0	0.0	0.2	0.2
2022-23 NABSEN-049	0.0	0.0	2.8	1.6
2022-23 NABSEN-050	0.0	0.0	0.0	0.0
2022-23 NABSEN-051	0.5	0.7	0.2	0.2
2022-23 NABSEN-052	1.0	1.4	0.3	0.5
2022-23 NABSEN-053	0.0	0.0	0.0	0.0
2022-23 NABSEN-054	0.0	0.0	0.0	0.0
2022-23 NABSEN-055	0.0	0.0	0.0	0.0
2022-23 NABSEN-056	1.0	0.0	0.3	0.5
2022-23 NABSEN-057	0.0	0.0	0.0	0.0

*Mean of two reps.

Supplemental Table 5. Heading and maturity dates each rep; mean* values for winter survival, height, and yield estimates at Bozeman MT, the 2021–22 season.

Entry	Heading date (rep 1)	Heading Date (rep 2)	Maturity Date (rep 1)	Maturity Date (rep 2)	Winter survival (%) (mean)	Winter survival (%) (std dev)	Height (cm) (mean)	Height (cm) (std dev)	Yield (bu/ac) (mean)	Yield (std dev)
2021-22 NABSEN-001	11-Jun	12-Jun	24-Jul	22-Jul	100.0	0.0	97.5	1.4	183	7
2021-22 NABSEN-002	11-Jun	13-Jun	21-Jul	22-Jul	100.0	0.0	96.0	3.5	170	13
2021-22 NABSEN-003	12-Jun	13-Jun	25-Jul	25-Jul	100.0	0.0	91.0	2.8	105	29
2021-22 NABSEN-004	8-Jun	12-Jun	25-Jul	27-Jul	97.5	3.5	96.0	0.7	96	24
2021-22 NABSEN-005	9-Jun	9-Jun	23-Jul	25-Jul	100.0	0.0	92.3	4.6	218	13
2021-22 NABSEN-006	9-Jun	10-Jun	23-Jul	22-Jul	97.5	3.5	94.3	3.2	148	6
2021-22 NABSEN-007	7-Jun	8-Jun	21-Jul	21-Jul	95.0	7.1	95.3	4.6	171	21
2021-22 NABSEN-008	14-Jun	14-Jun	24-Jul	26-Jul	95.0	7.1	102.5	4.9	144	11
2021-22 NABSEN-009	5-Jun	4-Jun	21-Jul	22-Jul	77.5	10.6	88.3	1.8	174	7
2021-22 NABSEN-010	19-Jun	19-Jun	25-Jul	28-Jul	65.0	49.5	100.5	0.7	89	14
2021-22 NABSEN-011	6-Jun	5-Jun	20-Jul	24-Jul	90.0	7.1	88.3	2.5	165	4
2021-22 NABSEN-012	15-Jun	14-Jun	26-Jul	25-Jul	97.5	3.5	96.8	1.8	164	22
2021-22 NABSEN-013	12-Jun	12-Jun	24-Jul	24-Jul	100.0	0.0	92.8	0.4	140	20
2021-22 NABSEN-014	9-Jun	10-Jun	21-Jul	21-Jul	100.0	0.0	111.3	2.5	166	14
2021-22 NABSEN-015	7-Jun	8-Jun	20-Jul	20-Jul	100.0	0.0	110.8	5.3	120	38
2021-22 NABSEN-016	11-Jun	12-Jun	19-Jul	20-Jul	100.0	0.0	110.0	2.8	173	33
2021-22 NABSEN-017	7-Jun	9-Jun	16-Jul	18-Jul	100.0	0.0	108.0	4.2	120	21
2021-22 NABSEN-018	8-Jun	8-Jun	22-Jul	21-Jul	100.0	0.0	103.5	7.1	199	29
2021-22 NABSEN-019	9-Jun	11-Jun	21-Jul	26-Jul	97.5	3.5	109.0	4.9	191	10
2021-22 NABSEN-020	8-Jun	8-Jun	21-Jul	23-Jul	95.0	7.1	102.3	2.5	182	16
2021-22 NABSEN-021	10-Jun	11-Jun	23-Jul	26-Jul	100.0	0.0	99.5	2.8	170	28
2021-22 NABSEN-022	7-Jun	9-Jun	21-Jul	23-Jul	90.0	7.1	95.8	1.1	132	20
2021-22 NABSEN-023	7-Jun	8-Jun	18-Jul	19-Jul	88.0	9.9	116.0	1.4	69	3
2021-22 NABSEN-024	7-Jun	9-Jun	20-Jul	20-Jul	97.5	3.5	110.5	2.1	160	6
2021-22 NABSEN-025	13-Jun	13-Jun	NA	NA	5.0	0.0	#DIV/0!	#DIV/0!	NA	NA
2021-22 NABSEN-026	6-Jun	9-Jun	21-Jul	24-Jul	83.0	4.2	106.8	5.3	137	3
2021-22 NABSEN-027	5-Jun	6-Jun	21-Jul	21-Jul	100.0	0.0	96.5	4.2	165	2
2021-22 NABSEN-028	1-Jun	2-Jun	20-Jul	21-Jul	70.0	0.0	87.8	1.1	73	0
2021-22 NABSEN-029	7-Jun	7-Jun	20-Jul	21-Jul	97.5	3.5	94.3	3.2	175	22
2021-22 NABSEN-030	4-Jun	4-Jun	19-Jul	21-Jul	85.0	21.2	104.8	6.0	161	4

2021-22 NABSEN-031	7-Jun	8-Jun	17-Jul	21-Jul	97.5	3.5	108.8	1.8	112	16
2021-22 NABSEN-032	7-Jun	7-Jun	21-Jul	22-Jul	100.0	0.0	100.0	4.2	183	0
2021-22 NABSEN-033	6-Jun	7-Jun	22-Jul	23-Jul	100.0	0.0	100.0	0.0	137	10
2021-22 NABSEN-034	12-Jun	12-Jun	23-Jul	22-Jul	100.0	0.0	105.0	0.7	166	10
2021-22 NABSEN-035	15-Jun	16-Jun	25-Jul	24-Jul	100.0	0.0	105.8	2.5	157	18
2021-22 NABSEN-036	10-Jun	8-Jun	22-Jul	22-Jul	97.5	3.5	105.5	0.7	163	15
2021-22 NABSEN-037	9-Jun	10-Jun	20-Jul	20-Jul	100.0	0.0	104.0	1.4	151	7
Control #1	10-Jun	11-Jun	21-Jul	21-Jul	97.5	3.5	103.0	0.0	170	28
Control #2	7-Jun	7-Jun	16-Jul	18-Jul	97.5	3.5	106.0	7.8	76	7
Control #3	12-Jun	12-Jun	25-Jul	25-Jul	97.5	3.5	103.0	6.4	176	19
Control #4	7-Jun	6-Jun	21-Jul	21-Jul	100.0	0.0	98.5	1.4	153	5
Control #5	6-Jun	8-Jun	14-Jul	16-Jul	90.0	0.0	98.3	1.1	110	12
Control #6	8-Jun	9-Jun	21-Jul	26-Jul	95.0	0.0	92.0	4.2	213	3
Control #7	31-May	3-Jun	20-Jul	21-Jul	47.5	17.7	86.5	3.5	80	16
Control #8	3-Jun	2-Jun	24-Jul	21-Jul	70.0	28.3	88.5	1.4	99	14

*Mean of two reps

Supplemental Table 6. Winter survival and yield estimates at Bozeman MT, the 2022–23 season.

Entry	Winter Survival (%)	Yield (bu/ac)
2022–23 NABSEN-001	50	47
2022–23 NABSEN-002	100	71
2022–23 NABSEN-003	80	58
2022–23 NABSEN-004	100	85
2022–23 NABSEN-005	94	98
2022–23 NABSEN-006	100	88
2022–23 NABSEN-007	100	80
2022–23 NABSEN-008	100	71
2022–23 NABSEN-009	88	79
2022–23 NABSEN-010	100	71
2022–23 NABSEN-011	100	127
2022–23 NABSEN-012	51	94
2022–23 NABSEN-013	75	86
2022–23 NABSEN-014	81	86
2022–23 NABSEN-015	100	114
2022–23 NABSEN-016	85	108
2022–23 NABSEN-017	100	119
2022–23 NABSEN-018	100	105
2022–23 NABSEN-019	80	86
2022–23 NABSEN-020	74	68
2022–23 NABSEN-021	81	80
2022–23 NABSEN-022	50	88
2022–23 NABSEN-023	50	68
2022–23 NABSEN-024	7	15
2022–23 NABSEN-025	76	80
2022–23 NABSEN-026	50	65
2022–23 NABSEN-027	25	62
2022–23 NABSEN-028	50	97
2022–23 NABSEN-029	50	61
2022–23 NABSEN-030	76	74
2022–23 NABSEN-031	5	21
2022–23 NABSEN-032	10	22
2022–23 NABSEN-033	2	8

2022-23 NABSEN-034	50	86
2022-23 NABSEN-035	50	64
2022-23 NABSEN-036	64	92
2022-23 NABSEN-037	50	95
2022-23 NABSEN-038	50	83
2022-23 NABSEN-039	50	72
2022-23 NABSEN-040	89	90
2022-23 NABSEN-041	80	98
2022-23 NABSEN-042	44	37
2022-23 NABSEN-043	57	44
2022-23 NABSEN-044	9	49
2022-23 NABSEN-045	7	42
2022-23 NABSEN-046	7	39
2022-23 NABSEN-047	43	43
2022-23 NABSEN-048	7	30
2022-23 NABSEN-049	5	29
2022-23 NABSEN-050	98	97
2022-23 NABSEN-051	49	88
2022-23 NABSEN-052	4	13
2022-23 NABSEN-053	5	9
2022-23 NABSEN-054	80	97
2022-23 NABSEN-055	75	58
2022-23 NABSEN-056	37	69
2022-23 NABSEN-057	52	94

Supplemental Table 7. Mean* values for disease incidence, severity, index, and FDK at Lincoln NE, the 2021–22 season.

Entry	INC (0-9) mean	DHS (%) mean	Index (%)	FDK (%)
2021-22 NABSEN-001	75	11	9	14
2021-22 NABSEN-002	20	21	4	17
2021-22 NABSEN-003	20	11	2	25
2021-22 NABSEN-004	80	14	11	19
2021-22 NABSEN-005	25	9	3	20
2021-22 NABSEN-006	25	9	2	19
2021-22 NABSEN-007	73	21	18	21
2021-22 NABSEN-008	37	13	8	23
2021-22 NABSEN-009	30	22	7	22
2021-22 NABSEN-010	nd	nd	nd	24
2021-22 NABSEN-011	30	22	7	14
2021-22 NABSEN-012	30	22	7	17
2021-22 NABSEN-013	nd	nd	nd	20
2021-22 NABSEN-014	43	10	5	18
2021-22 NABSEN-015	77	20	16	19
2021-22 NABSEN-016	80	9	7	20
2021-22 NABSEN-017	63	14	11	18
2021-22 NABSEN-018	37	10	4	19
2021-22 NABSEN-019	45	11	5	23
2021-22 NABSEN-020	35	8	3	21
2021-22 NABSEN-021	nd	nd	nd	18
2021-22 NABSEN-022	83	16	14	21
2021-22 NABSEN-023	15	8	1	15
2021-22 NABSEN-024	33	16	6	21
2021-22 NABSEN-025	55	19	9	17
2021-22 NABSEN-026	70	24	20	19
2021-22 NABSEN-027	20	9	2	20
2021-22 NABSEN-028	80	10	8	21
2021-22 NABSEN-029	30	12	4	

2021-22 NABSEN-030	83	22	18	23
2021-22 NABSEN-031	53	16	9	18
2021-22 NABSEN-032	30	11	3	32
2021-22 NABSEN-033	63	21	14	22
2021-22 NABSEN-034	33	11	4	20
2021-22 NABSEN-035	10	5	1	22
2021-22 NABSEN-036	40	11	5	21
2021-22 NABSEN-037	57	16	9	20
Control #1	50	43	22	22
Control #2	60	19	12	27
Control #3	30	8	3	15
Control #4	57	17	10	22
Control #5	50	13	6	17
Control #6	40	17	7	18
Control #7	73	25	20	19
Control #8	55	13	7	20

*Mean of three reps.

†Not determined (nd)

Supplemental Table 8. Raw data* for disease incidence, severity, index, and FDK at Lincoln NE, the 2022–23 season.

Entry	INC mean	DHS mean	Index	FDK
NABSEN-005	36	32	77	0
NABSEN-007	-14	-12	-11	5
NABSEN-011	16	-9	-0.9	0
NABSEN-012	-14	-12	-11	0
NABSEN-014	37	18	36	30
NABSEN-015	27	12	25	10
NABSEN-016	20	3	10	5
NABSEN-017	31	15	53	nd [†]
NABSEN-018	27	15	35	0
NABSEN-025	13	17	23	20
NABSEN-029	3	6	3.2	nd
NABSEN-031	3	6	3.2	.
NABSEN-047	63	57	88	nd
NABSEN-048	32	22	37	nd
NABSEN-049	13	7	4.2	nd

*Measurements were made on what was harvestable from one, or at most two, plants surviving the extreme drought experienced at Lincoln Nebraska.

[†]Not determined (nd)

Supplemental Table 9. Heading date each rep, mean* values and standard deviation for disease incidence, severity, index, and fungal toxin nivalenol (NIV) levels, at Raleigh NC, the 2021–22 season.

Entry	Date	Date	Date	INC	INC	DHS	DHS	Index	Index	NIV	NIV
	100% headed, rep 1	100% headed, rep 2	100% headed, rep 3	(%) (mean)	(%) (std dev)	(does not include zeroes) (mean)	(does not include zeroes), (std dev)	(DI*DS/ 100) (mean)	(DI*DS/ 100), (std dev)	(ppm) (mean)	(ppm) (std dev)
2021-22 NABSEN-001	20-Apr	19-Apr	19-Apr	55.0	21.2	6.5	0.7	3.7	1.8	0.4	0.2
2021-22 NABSEN-002	7-Apr	5-Apr	13-Apr	80.0	10.0	9.3	1.2	7.5	1.7	0.2	0.1
2021-22 NABSEN-003	8-Apr	12-Apr	8-Apr	90.0	10.0	16.7	5.8	15.3	6.4	0.3	0.1
2021-22 NABSEN-004	13-Apr	14-Apr	14-Apr	86.7	15.3	6.3	2.1	5.7	2.7	0.8	0.4
2021-22 NABSEN-005	31-Mar	31-Mar	4-Apr	43.3	25.2	11.7	2.9	5.5	4.4	0.2	0.2
2021-22 NABSEN-006	7-Apr	13-Apr	13-Apr	80.0	8.7	10.7	1.2	8.5	0.9	0.6	0.1
2021-22 NABSEN-007	6-Apr	8-Apr	8-Apr	38.3	27.5	9.0	7.8	2.8	1.8	0.1	0.1
2021-22 NABSEN-008	6-Apr	7-Apr	7-Apr	66.7	20.8	10.3	4.5	7.5	5.4	0.2	0.2
2021-22 NABSEN-009	30-Mar	29-Mar	29-Mar	76.7	5.8	10.7	1.2	8.1	0.2	1.0	0.3
2021-22 NABSEN-010	19-Apr	18-Apr	18-Apr	68.3	37.5	13.3	5.8	9.8	7.8	1.3	1.2
2021-22 NABSEN-011	30-Mar	30-Mar	28-Mar	58.3	46.5	14.3	13.7	11.2	14.0	0.8	0.6
2021-22 NABSEN-012	5-Apr	3-Apr	3-Apr	66.7	32.1	9.3	1.2	6.5	3.6	1.1	0.5
2021-22 NABSEN-013	4-Apr	4-Apr	31-Mar	63.3	20.8	11.7	2.9	7.7	4.0	0.3	0.1
2021-22 NABSEN-014	7-Apr	5-Apr	4-Apr	53.3	37.9	4.7	1.2	2.7	2.2	0.0	0.0
2021-22 NABSEN-015	8-Apr	8-Apr	7-Apr	41.7	14.4	5.0	0.0	2.1	0.7	0.0	0.0
2021-22 NABSEN-016	16-Apr	14-Apr	11-Apr	38.3	33.3	2.7	0.6	0.9	0.6	0.0	0.0
2021-22 NABSEN-017	12-Apr	11-Apr	11-Apr	51.7	36.9	2.7	1.2	1.6	1.5	0.0	0.0
2021-22 NABSEN-018	8-Apr	8-Apr	8-Apr	20.0	17.3	3.7	1.5	0.8	0.7	0.2	0.1
2021-22 NABSEN-019	7-Apr	6-Apr	7-Apr	36.7	30.6	7.3	3.1	3.3	3.4	0.0	0.1
2021-22 NABSEN-020	4-Apr	3-Apr	4-Apr	36.0	16.4	6.7	3.1	2.7	2.2	0.2	0.2
2021-22 NABSEN-021	12-Apr	8-Apr	12-Apr	68.3	7.6	6.3	3.2	4.3	2.3	0.9	0.6
2021-22 NABSEN-022	13-Apr	12-Apr	13-Apr	80.0	17.3	6.3	2.1	5.0	1.9	0.4	0.3
2021-22 NABSEN-023	28-Mar	28-Mar	28-Mar	20.0	26.0	4.3	1.2	1.0	1.3	0.9	0.3
2021-22 NABSEN-024	14-Apr	2-Apr	12-Apr	75.0	15.0	10.0	8.7	8.3	8.5	0.1	0.1
2021-22 NABSEN-025	29-Mar	30-Mar	31-Mar	53.3	30.6	6.7	2.3	4.0	2.9	1.6	0.5
2021-22 NABSEN-026	8-Apr	12-Apr	8-Apr	51.7	37.5	16.7	11.5	11.5	14.7	0.2	0.2
2021-22 NABSEN-027	30-Mar	29-Mar	29-Mar	6.7	2.9	6.7	2.9	0.4	0.1	0.3	0.1
2021-22 NABSEN-028	3-Apr	4-Apr	30-Mar	70.0	26.5	12.7	4.0	9.6	5.6	1.5	0.9

2021-22 NABSEN-029	3-Apr	6-Apr	1-Apr	53.3	20.8	6.7	2.9	3.7	2.3	0.1	0.1
2021-22 NABSEN-030	7-Apr	6-Apr	4-Apr	50.0	0.0	11.7	2.9	5.8	1.4	0.1	0.1
2021-22 NABSEN-031	6-Apr	1-Apr	6-Apr	18.3	10.4	4.7	0.6	0.8	0.4	0.2	0.2
2021-22 NABSEN-032	7-Apr	8-Apr	8-Apr	46.7	15.3	5.3	2.3	2.7	1.9	0.1	0.1
2021-22 NABSEN-033	3-Apr	3-Apr	31-Mar	30.0	20.0	6.0	2.0	1.7	1.2	0.0	0.0
2021-22 NABSEN-034	12-Apr	12-Apr	12-Apr	33.3	25.2	4.0	0.0	1.3	1.0	0.0	0.1
2021-22 NABSEN-035	18-Apr	18-Apr	17-Apr	37.5	17.7	7.0	1.4	1.8	2.0	0.4	0.1
2021-22 NABSEN-036	14-Apr	14-Apr	12-Apr	65.0	21.8	4.3	1.2	2.8	1.1	0.5	0.6
2021-22 NABSEN-037	12-Apr	12-Apr	12-Apr	63.3	15.3	11.0	3.6	7.0	2.6	0.2	0.0
Control #1	3-Apr	2-Apr	31-Mar	70.0	17.3	5.7	3.8	4.1	3.4	0.8	0.0
Control #2	7-Apr	12-Apr	11-Apr	18.3	7.6	3.7	1.2	0.7	0.4	0.0	0.0
Control #3	12-Apr	12-Apr	12-Apr	53.3	15.3	5.7	1.5	3.2	1.7	0.0	0.1
Control #4	6-Apr	4-Apr	5-Apr	53.3	5.8	7.7	4.0	4.2	2.4	0.1	0.1
Control #5	5-Apr	6-Apr	5-Apr	20.0	10.0	5.0	0.0	1.0	0.5	0.0	0.0
Control #6	8-Apr	6-Apr	7-Apr	76.7	15.3	16.7	7.6	12.7	6.4	0.1	0.0
Control #7	3-Apr	4-Apr	4-Apr	88.3	7.6	15.0	5.0	13.1	3.6	0.2	0.1
Control #8	3-Apr	N/A	31-Mar	86.7	5.8	18.3	7.6	15.8	6.8	0.1	0.1

*Mean of three reps.

Notes:

Two-row plots, 2 g per row

50 ml corn spawn applied 3X per plot at 1-wk intervals

3/12 = hard freeze (~25 deg F)

3/27-28 = light freeze (~30-32 deg F)

Heading	Rated
3/28-3/30	5/3
3/31-4/8	5/9
4/9-4/15	5/12
4/16-4/19	5/16

Supplemental Table 10. Heading date and disease index at Raleigh NC, the 2021–22 season.

Entry	Date 100% headed	Index (DI*DS/100)
2022-23 NABSEN-001	12-Apr	32
2022-23 NABSEN-002	8-Apr	9
2022-23 NABSEN-003	1-Apr	31
2022-23 NABSEN-004	1-Apr	14
2022-23 NABSEN-005	5-Apr	45
2022-23 NABSEN-006	8-Apr	33
2022-23 NABSEN-007	15-Mar	3
2022-23 NABSEN-008	1-Apr	2
2022-23 NABSEN-009	10-Apr	4
2022-23 NABSEN-010	31-Mar	2
2022-23 NABSEN-011	9-Apr	11
2022-23 NABSEN-012	12-Apr	7
2022-23 NABSEN-013	6-Apr	17
2022-23 NABSEN-014	5-Apr	13
2022-23 NABSEN-015	11-Apr	11
2022-23 NABSEN-016	3-Apr	68
2022-23 NABSEN-017	2-Apr	68
2022-23 NABSEN-018	1-Apr	64
2022-23 NABSEN-019	11-Apr	12
2022-23 NABSEN-020	2-Apr	5
2022-23 NABSEN-021	20-Apr	5
2022-23 NABSEN-022	16-Apr	14
2022-23 NABSEN-023	18-Apr	7
2022-23 NABSEN-024	19-Apr	26
2022-23 NABSEN-025	13-Apr	6
2022-23 NABSEN-026	11-Apr	11
2022-23 NABSEN-027	12-Apr	17
2022-23 NABSEN-028	5-Apr	11
2022-23 NABSEN-029	3-Apr	21
2022-23 NABSEN-030	12-Apr	7

2022-23 NABSEN-031	4-Apr	65
2022-23 NABSEN-032	13-Apr	8
2022-23 NABSEN-033	3-Apr	65
2022-23 NABSEN-034	15-Apr	12
2022-23 NABSEN-035	12-Apr	10
2022-23 NABSEN-036	13-Apr	18
2022-23 NABSEN-037	18-Mar	5
2022-23 NABSEN-038	21-Mar	17
2022-23 NABSEN-039	15-Mar	19
2022-23 NABSEN-040	13-Mar	7
2022-23 NABSEN-041	6-Apr	5
2022-23 NABSEN-042	7-Apr	1
2022-23 NABSEN-043	11-Apr	1
2022-23 NABSEN-047	9-Apr	11
2022-23 NABSEN-048	5-Apr	3
2022-23 NABSEN-049	1-Apr	4
2022-23 NABSEN-052	1-Apr	75
2022-23 NABSEN-053	1-Apr	74
2022-23 NABSEN-054	31-Mar	8
2022-23 NABSEN-055	9-Apr	2
2022-23 NABSEN-056	14-Apr	17
2022-23 NABSEN-057	7-Apr	25

Supplemental Table 11. Heading date*, score date, mean† values and standard deviation for disease incidence, severity, index, and FDK at Ithaca NY, the 2022–23 season.

Entry	Heading date	Score date	INC (%) (mean)	INC (%) (std dev)	DHS mean	DHS (std dev)	DHS (mean)	DHS (std dev)	Index (mean)	Index (std dev)	FDK (mean)	FDK (std dev)
2022-23 NABSEN-001	20-May	15-June	36.7	30.6	1.9	0.8	16.0	10.0	7.9	9.2	5.0	0.0
2022-23 NABSEN-002	19-May	15-June	16.7	2.9	1.6	0.5	11.3	5.0	2.0	1.2	5.0	0.0
2022-23 NABSEN-003	16-May	13-June	56.7	7.6	1.5	0.1	10.7	1.2	6.1	1.5	12.5	3.5
2022-23 NABSEN-004	17-May	13-June	18.3	12.6	1.1	0.1	6.3	0.6	1.2	0.9	5.0	7.1
2022-23 NABSEN-005	17-May	13-June	51.7	16.1	1.8	0.2	14.0	2.0	7.3	2.5	5.0	0.0
2022-23 NABSEN-006	15-May	13-June	41.7	18.9	1.6	0.5	12.3	6.0	5.0	3.5	2.5	3.5
2022-23 NABSEN-007	17-May	13-June	40.0	20.0	1.6	0.3	11.7	3.1	4.9	3.6	0.0	0.0
2022-23 NABSEN-008	20-May	15-June	20.0	26.5	1.2	1.0	9.0	8.2	2.4	2.8	5.0	0.0
2022-23 NABSEN-009	19-May	15-June	31.7	25.2	1.3	0.3	8.3	2.5	3.1	2.9	7.5	3.5
2022-23 NABSEN-010	20-May	15-June	25.0	13.2	1.6	0.4	11.7	3.8	2.6	1.0	7.5	3.5
2022-23 NABSEN-011	20-May	15-June	45.0	30.4	1.3	0.3	9.0	2.6	4.6	3.4	5.0	0.0
2022-23 NABSEN-012	24-May	20-June	56.7	20.2	1.4	0.3	9.3	3.1	5.6	3.0	0.0	0.0
2022-23 NABSEN-013	18-May	15-June	11.7	7.6	1.1	0.1	6.7	1.2	0.8	0.7	7.5	3.5
2022-23 NABSEN-014	16-May	13-June	40.0	25.0	1.7	0.6	13.3	7.0	6.5	6.1	2.5	3.5
2022-23 NABSEN-015	18-May	15-June	66.7	7.6	2.0	0.6	18.3	8.1	12.3	5.6	10.0	7.1
2022-23 NABSEN-016	19-May	15-June	88.3	7.6	1.8	0.5	14.7	6.7	13.1	6.3	5.0	0.0
2022-23 NABSEN-017	17-May	13-June	46.7	15.3	1.5	0.3	10.7	3.1	4.7	1.1	2.5	3.5
2022-23 NABSEN-018	17-May	13-June	51.7	14.4	1.6	0.4	12.0	3.5	6.4	3.1	2.5	3.5
2022-23 NABSEN-019	18-May	15-June	28.3	16.1	1.4	0.4	10.0	4.0	3.2	2.5	5.0	0.0
2022-23 NABSEN-020	16-May	13-June	20.0	5.0	1.1	0.2	7.0	1.7	1.4	0.2	5.0	7.1
2022-23 NABSEN-021	24-May	20-June	63.3	7.6	2.3	0.4	21.0	6.6	13.5	5.4	7.5	3.5
2022-23 NABSEN-022	21-May	16-June	38.3	7.6	1.7	0.3	13.0	2.6	5.1	1.9	5.0	0.0
2022-23 NABSEN-023	26-May	20-June	43.3	7.6	1.5	0.6	10.7	6.4	4.9	3.6	7.5	3.5
2022-23 NABSEN-024	23-May	16-June	20.0	8.7	1.1	0.2	7.3	2.3	1.5	1.0	2.5	3.5
2022-23 NABSEN-025	20-May	15-June	26.7	11.5	1.1	0.2	7.0	1.7	2.0	1.4	7.5	3.5
2022-23 NABSEN-026	18-May	15-June	20.0	5.0	1.5	0.2	11.3	2.5	2.4	1.1	5.0	0.0
2022-23 NABSEN-027	20-May	15-June	28.3	17.6	1.6	0.3	12.0	3.6	3.0	1.3	5.0	0.0
2022-23 NABSEN-028	22-May	16-June	33.3	24.7	2.0	0.9	18.7	14.4	4.0	2.4	5.0	0.0
2022-23 NABSEN-029	16-May	13-June	33.3	10.4	1.6	0.3	11.7	2.5	4.0	2.0	5.0	0.0
2022-23 NABSEN-030	21-May	16-June	8.3	5.8	1.0	0.0	6.0	0.0	0.5	0.3	5.0	0.0
2022-23 NABSEN-031	19-May	15-June	16.7	5.8	1.8	0.3	13.3	2.5	2.1	0.5	10.0	0.0

2022-23 NABSEN-032	20-May	15-June	25.0	18.0	1.1	0.2	7.0	1.7	2.0	1.8	5.0	0.0
2022-23 NABSEN-033	17-May	13-June	63.3	15.3	1.7	0.3	13.3	3.1	8.7	3.9	5.0	0.0
2022-23 NABSEN-034	26-May	20-June	51.7	15.3	1.5	0.4	11.0	4.0	6.1	3.7	15.0	0.0
2022-23 NABSEN-035	24-May	20-June	43.3	11.5	1.5	0.3	10.7	3.5	4.9	2.5	15.0	0.0
2022-23 NABSEN-036	21-May	16-June	41.7	30.1	2.2	0.2	19.3	3.1	8.5	6.3	5.0	0.0
2022-23 NABSEN-037	20-May	15-June	81.7	12.6	1.8	0.2	13.7	2.1	11.3	3.5	5.0	0.0
2022-23 NABSEN-038	15-May	13-June	85.0	13.2	2.4	0.3	22.7	5.8	18.9	4.1	2.5	3.5
2022-23 NABSEN-039	13-May	13-June	53.3	14.4	1.4	0.2	9.7	1.5	5.2	1.7	5.0	0.0
2022-23 NABSEN-040	16-May	13-June	68.3	11.5	1.8	0.4	14.3	4.9	10.0	4.5	5.0	0.0
2022-23 NABSEN-041	20-May	15-June	11.7	10.4	0.7	0.6	4.0	3.5	0.7	0.6	7.5	3.5
2022-23 NABSEN-042	17-May	13-June	16.7	16.1	1.5	0.4	11.3	4.5	1.5	0.9	5.0	7.1
2022-23 NABSEN-043	18-May	15-June	16.7	11.5	1.3	0.3	9.3	2.9	1.3	0.4	5.0	0.0
2022-23 NABSEN-044	20-May	15-June	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	3.5
2022-23 NABSEN-045	20-May	15-June	8.3	7.6	0.8	0.7	5.0	4.6	0.7	0.7	2.5	3.5
2022-23 NABSEN-046	20-May	15-June	18.3	20.2	1.0	1.1	8.0	9.2	2.7	3.9	0.0	0.0
2022-23 NABSEN-047	18-May	15-June	30.0	17.3	1.7	0.5	13.3	5.9	3.6	1.2	7.5	3.5
2022-23 NABSEN-048	15-May	13-June	30.0	8.7	1.5	0.5	11.3	5.0	3.6	2.5	0.0	0.0
2022-23 NABSEN-049	14-May	13-June	10.0	0.0	1.0	0.0	6.0	0.0	0.6	0.0	5.0	0.0
2022-23 NABSEN-050	15-May	13-June	50.0	40.0	1.8	0.7	14.3	8.0	9.3	9.7	5.0	0.0
2022-23 NABSEN-051	21-May	16-June	80.0	15.0	2.1	0.7	19.7	9.7	16.7	10.4	5.0	0.0
2022-23 NABSEN-052	13-May	13-June	71.7	44.8	1.8	0.7	15.3	8.1	13.4	10.6	7.5	3.5
2022-23 NABSEN-053	14-May	13-June	90.0	13.2	2.5	0.5	24.7	9.2	23.0	10.9	5.0	0.0
2022-23 NABSEN-054	18-May	15-June	41.7	30.1	1.4	0.3	9.3	3.1	4.5	3.9	2.5	3.5
2022-23 NABSEN-055	15-May	13-June	6.7	7.6	0.8	0.7	5.0	4.6	0.6	0.7	0.0	0.0
2022-23 NABSEN-056	20-May	15-June	16.7	2.9	1.3	0.0	8.7	0.6	1.4	0.1	2.5	3.5
2022-23 NABSEN-057	18-May	15-June	33.3	28.4	1.3	0.5	8.7	4.6	3.7	4.7	2.5	3.5

*Heading date for each of the three reps were the same; score dates for each of the three reps were the same.

†Means were determined from three reps.

Supplemental Table 12. Heading date (for control lines), mean and standard deviation for FHB index and lodging scores at Wooster OH, the 2021–22 season.

Entry	Date 50% headed	FHB index (mean)	FHB index (std dev)	Lodging (0-9) (mean)	Lodging (0-9) (std dev)
2021-22 NABSEN-001	N/A	16.5	6.0	0.0	0.0
2021-22 NABSEN-002	N/A	20.4	2.0	3.0	5.2
2021-22 NABSEN-003	N/A	18.5	4.5	2.0	1.7
2021-22 NABSEN-004	N/A	19.6	5.8	0.0	0.0
2021-22 NABSEN-005	N/A	29.1	5.6	0.0	0.0
2021-22 NABSEN-006	N/A	25.4	5.4	0.0	0.0
2021-22 NABSEN-007	N/A	33.3	3.8	0.0	0.0
2021-22 NABSEN-008	N/A	27.4	5.0	0.0	0.0
2021-22 NABSEN-009	N/A	41.9	5.6	0.0	0.0
2021-22 NABSEN-010	N/A	11.1	4.8	0.0	0.0
2021-22 NABSEN-011	N/A	40.4	2.9	0.0	0.0
2021-22 NABSEN-012	N/A	20.0	4.8	0.0	0.0
2021-22 NABSEN-013	N/A	43.7	6.5	0.0	0.0
2021-22 NABSEN-014	N/A	34.6	9.3	0.0	0.0
2021-22 NABSEN-015	N/A	44.4	4.9	0.0	0.0
2021-22 NABSEN-016	N/A	49.1	14.1	1.5	2.6
2021-22 NABSEN-017	N/A	64.4	13.0	0.0	0.0
2021-22 NABSEN-018	N/A	33.5	2.2	2.0	3.5
2021-22 NABSEN-019	N/A	26.5	3.9	6.0	2.6
2021-22 NABSEN-020	N/A	29.8	7.8	0.0	0.0
2021-22 NABSEN-021	N/A	19.3	5.5	6.0	5.2
2021-22 NABSEN-022	N/A	38.0	3.5	0.0	0.0
2021-22 NABSEN-023	N/A	49.6	12.5	6.0	0.0
2021-22 NABSEN-024	N/A	42.2	8.9	0.0	0.0
2021-22 NABSEN-025	N/A	37.8	16.3	2.0	3.5
2021-22 NABSEN-026	N/A	54.4	1.0	0.0	0.0
2021-22 NABSEN-027	N/A	45.0	3.6	0.0	0.0
2021-22 NABSEN-028	N/A	30.6	3.9	0.0	0.0
2021-22 NABSEN-029	N/A	41.7	12.5	0.0	0.0
2021-22 NABSEN-030	N/A	46.5	3.5	0.0	0.0
2021-22 NABSEN-031	N/A	34.6	5.2	0.0	0.0

2021-22 NABSEN-032	N/A	26.7	0.6	0.0	0.0
2021-22 NABSEN-033	N/A	19.1	3.6	0.0	0.0
2021-22 NABSEN-034	N/A	30.6	1.0	0.0	0.0
2021-22 NABSEN-035	N/A	9.1	2.0	0.0	0.0
2021-22 NABSEN-036	N/A	27.6	7.7	0.0	0.0
2021-22 NABSEN-037	N/A	25.4	5.6	0.0	0.0
Control #1	14-May	23.1		2	
Control #2	11-May	15.9		2	
Control #3	14-May	30.4		0	
Control #4	11-May	38.0		0	
Control #5	10-May	54.1		0	
Control #6	15-May	37.6		0	
Control #7	5-May	84.3		0	
Control #8	5-May	83.0		0	

Not available

Supplemental Table 13. Heading date for NABSEN entries at Wooster OH 2022–23.

Entry	Date 50% headed
2022-23 NABSEN-001	16-May
2022-23 NABSEN-002	13-May
2022-23 NABSEN-003	11-May
2022-23 NABSEN-004	13-May
2022-23 NABSEN-005	16-May
2022-23 NABSEN-006	12-May
2022-23 NABSEN-007	15-May
2022-23 NABSEN-008	18-May
2022-23 NABSEN-009	21-May
2022-23 NABSEN-010	16-May
2022-23 NABSEN-011	19-May
2022-23 NABSEN-012	22-May
2022-23 NABSEN-013	18-May
2022-23 NABSEN-014	19-May
2022-23 NABSEN-015	18-May
2022-23 NABSEN-016	17-May
2022-23 NABSEN-017	13-May
2022-23 NABSEN-018	15-May
2022-23 NABSEN-019	16-May
2022-23 NABSEN-020	13-May
2022-23 NABSEN-021	23-May
2022-23 NABSEN-022	20-May
2022-23 NABSEN-023	24-May
2022-23 NABSEN-024	19-May
2022-23 NABSEN-025	21-May
2022-23 NABSEN-026	16-May
2022-23 NABSEN-027	21-May
2022-23 NABSEN-028	15-May
2022-23 NABSEN-029	11-May
2022-23 NABSEN-030	19-May
2022-23 NABSEN-031	17-May
2022-23 NABSEN-032	17-May

2022-23 NABSEN-033	18-May
2022-23 NABSEN-034	27-May
2022-23 NABSEN-035	23-May
2022-23 NABSEN-036	21-May
2022-23 NABSEN-037	14-May
2022-23 NABSEN-038	11-May
2022-23 NABSEN-039	11-May
2022-23 NABSEN-040	10-May
2022-23 NABSEN-041	20-May
2022-23 NABSEN-042	16-May
2022-23 NABSEN-043	18-May
2022-23 NABSEN-044	17-May
2022-23 NABSEN-045	18-May
2022-23 NABSEN-046	16-May
2022-23 NABSEN-047	15-May
2022-23 NABSEN-048	12-May
2022-23 NABSEN-049	10-May
2022-23 NABSEN-050	12-May
2022-23 NABSEN-051	19-May
2022-23 NABSEN-052	10-May
2022-23 NABSEN-053	9-May
2022-23 NABSEN-054	19-May
2022-23 NABSEN-055	14-May
2022-23 NABSEN-056	19-May
2022-23 NABSEN-057	14-May

Supplemental Table 14. Heading date, Fusarium head blight plant response, and FDK at Blacksburg VA, the 2021–22 season.

Entry	Heading date (rep 1)	Heading date (rep 2)	FHB Plant Response (0-9) (mean)	FHB Plant Response (0-9) (std dev)	FDK (mean)	FDK (std dev)
2021-22 NABSEN-001	6-May	N/A*	3.5	0.7	4.0	nd [†]
2021-22 NABSEN-002	N/A	N/A	7.5	0.7	62.5	0.7
2021-22 NABSEN-003	N/A	N/A	7.0	1.4	61.0	15.6
2021-22 NABSEN-004	N/A	N/A	4.0	0.0	25.0	1.4
2021-22 NABSEN-005	5-May	2-May	5.5	0.7	19.0	5.7
2021-22 NABSEN-006	N/A	N/A	4.0	nd	8.5	6.4
2021-22 NABSEN-007	6-May	5-May	4.5	0.7	16.0	5.7
2021-22 NABSEN-008	N/A	N/A	4.0	0.0	12.5	3.5
2021-22 NABSEN-009	1-May	1-May	6.5	0.7	22.0	0.0
2021-22 NABSEN-010	N/A	N/A	2.5	0.7	16.5	19.1
2021-22 NABSEN-011	28-Apr	28-Apr	6.0	0.0	36.5	26.2
2021-22 NABSEN-012	N/A	N/A	4.5	0.7	25.0	28.3
2021-22 NABSEN-013	N/A	N/A	7.0	0.0	37.0	32.5
2021-22 NABSEN-014	2-May	N/A	8.0	nd	13.5	4.9
2021-22 NABSEN-015	5-May	3-May	8.0	0.0	13.0	0.0
2021-22 NABSEN-016	N/A	N/A	9.0	nd	61.0	1.4
2021-22 NABSEN-017	5-May	N/A	5.0	0.0	9.0	8.5
2021-22 NABSEN-018	N/A	5-May	5.5	0.7	21.5	26.2
2021-22 NABSEN-019	4-May	5-May	6.0	1.4	5.5	2.1
2021-22 NABSEN-020	N/A	N/A	4.0	0.0	15.0	1.4
2021-22 NABSEN-021	N/A	N/A	3.0	0.0	3.5	2.1
2021-22 NABSEN-022	N/A	N/A	6.0	1.4	21.0	12.7
2021-22 NABSEN-023	30-Apr	1-May	8.5	0.7	39.5	37.5
2021-22 NABSEN-024	N/A	N/A	6.5	0.7	26.0	1.4
2021-22 NABSEN-025	30-Apr	28-Apr	6.0	2.8	57.0	36.8
2021-22 NABSEN-026	N/A	N/A	6.5	0.7	21.5	2.1
2021-22 NABSEN-027	2-May	30-Apr	7.0	0.0	7.0	4.2
2021-22 NABSEN-028	2-May	2-May	4.0	2.8	10.5	3.5
2021-22 NABSEN-029	6-May	4-May	3.5	2.1	6.0	nd

2021-22 NABSEN-030	2-May	2-May	4.0	nd	10.0	7.1
2021-22 NABSEN-031	5-May	N/A	5.5	2.1	14.0	9.9
2021-22 NABSEN-032	6-May	6-May	5.0	0.0	21.5	3.5
2021-22 NABSEN-033	2-May	2-May	3.0	nd	4.5	0.7
2021-22 NABSEN-034	N/A	N/A	5.0	nd	8.0	0.0
2021-22 NABSEN-035	N/A	N/A	3.0	0.0	46.5	50.2
2021-22 NABSEN-036	6-May	N/A	4.5	0.7	29.0	22.6
2021-22 NABSEN-037	5-May	N/A	4.0	nd	23.0	24.0
Control #1	5-May	N/A	5.0	0.0	10.0	2.8
Control #2	5-May	N/A	2.5	0.7	12.5	0.7
Control #3	4-May	3-May	4.0	1.4	26.0	19.8
Control #4	4-May	4-May	4.5	0.7	31.5	2.1
Control #5	5-May	2-May	5.0	nd	27.0	21.2
Control #6	6-May	6-May	7.0	0.0	25.5	2.1
Control #7	1-May	30-Apr	9.0	0.0	35.0	21.2
Control #8	28-Apr	28-Apr	7.0	nd	30.0	38.2

*Not available (N/A)

†Not determined (nd)

Supplemental Table 15. Heading date,
Fusarium head blight plant response, and
FDK at Blacksburg VA, the 2022–23 season.

Entry	FHB Plant Response (0-9)	FDK %
2022-23 NABSEN-001	4.5	50
2022-23 NABSEN-002	1.5	52.5
2022-23 NABSEN-003	3	42.5
2022-23 NABSEN-004	1	35
2022-23 NABSEN-005	1.5	52.5
2022-23 NABSEN-006	4	32.5
2022-23 NABSEN-007	3	82.5
2022-23 NABSEN-008	3	80
2022-23 NABSEN-009	2.5	90
2022-23 NABSEN-010	3	80
2022-23 NABSEN-011	4.5	72.5
2022-23 NABSEN-012	4	70
2022-23 NABSEN-013	2.5	42.5
2022-23 NABSEN-014	4	87.5
2022-23 NABSEN-015	4	75
2022-23 NABSEN-016	4	90
2022-23 NABSEN-017	3	80
2022-23 NABSEN-018	3.5	92.5
2022-23 NABSEN-019	2	27.5
2022-23 NABSEN-020	2	47.5
2022-23 NABSEN-021	3.5	35
2022-23 NABSEN-022	2	40
2022-23 NABSEN-023	1.5	35
2022-23 NABSEN-024	2	27.5
2022-23 NABSEN-025	2	27.5
2022-23 NABSEN-026	1	35
2022-23 NABSEN-027	2.5	57.5
2022-23 NABSEN-028	1.5	32.5
2022-23 NABSEN-029	1.5	50

2022-23 NABSEN-030	2	42.5
2022-23 NABSEN-031	3.5	40
2022-23 NABSEN-032	1.5	27.5
2022-23 NABSEN-033	1.5	32.5
2022-23 NABSEN-034	1	73.88
2022-23 NABSEN-035	3.5	60
2022-23 NABSEN-036	1	45
2022-23 NABSEN-037	1	32.5
2022-23 NABSEN-038	3.5	32.5
2022-23 NABSEN-039	2	45
2022-23 NABSEN-040	5	52.5
2022-23 NABSEN-041	0.5	40
2022-23 NABSEN-042	0	35
2022-23 NABSEN-043	1	30
2022-23 NABSEN-044	1	50
2022-23 NABSEN-045	2.5	47.5
2022-23 NABSEN-046	1	17.5
2022-23 NABSEN-047	1	27.5
2022-23 NABSEN-048	2.5	17.5
2022-23 NABSEN-049	2	25
2022-23 NABSEN-050	4	62.5
2022-23 NABSEN-051	4.5	40
2022-23 NABSEN-052	4	70
2022-23 NABSEN-053	3.5	82.5
2022-23 NABSEN-054	2	40
2022-23 NABSEN-055	0	42.5
2022-23 NABSEN-056	2	45
2022-23 NABSEN-057	1	42.5
