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Field evaluation of sunflower hybrids and breeding lines for resistance to Sclerotinia head rot

Carrington, Langdon, and Oakes, ND (2012)

Michael Wunsch, **Michael Schaefer**, and **Billy Kraft** – NDSU Carrington Research Extension Center
Amanda Arens and **Scott Halley** – NDSU Langdon Research Extension Center
Leonard Besemann and **Walt Albus** – NDSU Carrington Research Extension Center, Oakes Irrigation Research Site

KEY FINDINGS:

The commercial oilseed hybrids Syngenta '3990 NS/CL/DM', Syngenta 'NX24122', Seeds 2000 'Camaro', Seeds 2000 'Camaro II', Syngenta 'NX24123', Croplan '343 DMR HO', Seeds 2000 'Cobalt II', Seeds 2000 'Torino', and Seeds 2000 'Cobalt' performed well. At physiological maturity, these hybrids exhibited sharp, statistically significant reductions in Sclerotinia head rot incidence and/or severity index relative to the most susceptible entries in at least 2 of 4 field trials.

- Syngenta '3990 NS/CL/DM' and Seeds 2000 'Cobalt' exhibited significantly reduced susceptibility to Sclerotinia head rot in 4 of 4 trials in which they were tested in 2012. In trials conducted in Carrington, Langdon, and Oakes, they exhibited statistically significant reductions in head rot relative to the most susceptible entries..
- Syngenta 'NX24122', Syngenta 'NX24123', & Croplan '343 DMR HO' exhibited significantly reduced susceptibility to Sclerotinia head rot in 3 of 4 trials in which they were tested in 2012. In Oakes and Carrington but not Langdon, they exhibited significantly reduced susceptibility to head rot relative to the most susceptible entries.
- Seeds 2000 'Camaro II' and Seeds 2000 'Cobalt II' exhibited significantly reduced susceptibility to Sclerotinia head rot in 2 of 4 trials in which they were tested in 2012. In both trials conducted Carrington, they exhibited sharp, statistically significant reductions in Sclerotinia head rot relative to the most susceptible entries.
- Seeds 2000 'Camaro' and Seeds 2000 'Torino' exhibited significantly reduced susceptibility to Sclerotinia head rot in 1 of 1 trials in which they were tested in 2012. In a six-replicate trial conducted in Carrington, they exhibited sharp, statistically significant reductions in Sclerotinia head rot relative to the susceptible checks.

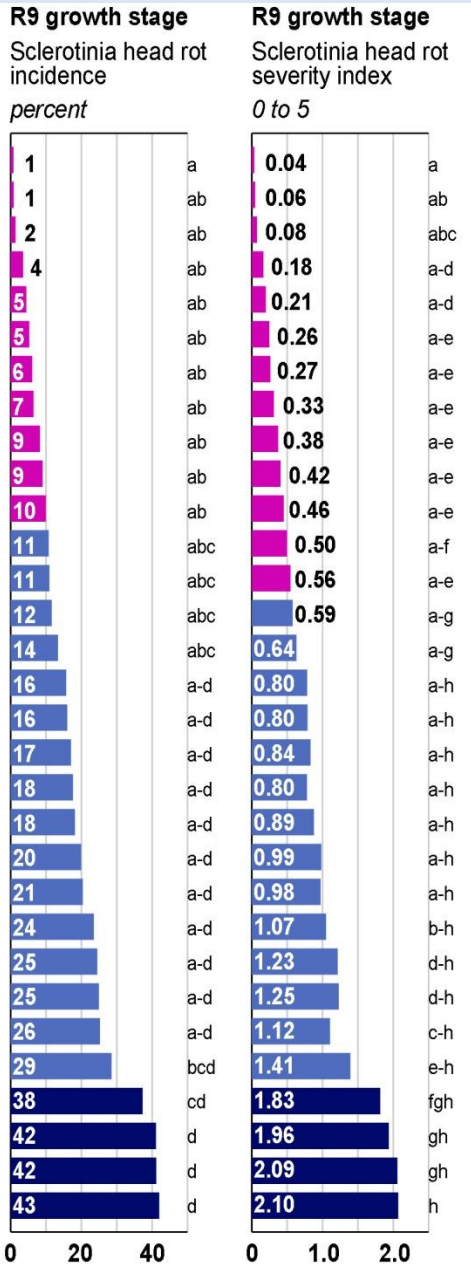
The commercial non-oil hybrid Genosys 12GCF05 performed well. In the trial conducted in Langdon, in one of two trials conducted in Carrington, and in the combined analysis across both trials conducted in Carrington, it exhibited sharp, statistically significant reductions in Sclerotinia head rot relative to the most susceptible entries.

Multiple experimental hybrids and breeding lines exhibited significantly reduced susceptibility to Sclerotinia head rot relative to the susceptible checks. The strong performance of the non-oil experimental entries Seeds 2000 'X2793' and Seeds 2000 'X3293' is particularly notable.

Carrington, ND – large (six-replicate) screening trial

Within-column means followed by different letters are significantly different. (*P* < 0.05; Tukey multiple comparison procedure).

Hybrid / Breeding Line	Status	Type	R9 growth stage Sclerotinia head rot incidence *percent*		R9 growth stage Sclerotinia head rot severity index *0 to 5*	
Syngenta '3990 NS/CL/DM'	commercial	**Oil**	1	a	0.04	a
Syngenta 'NX24122'	commercial	**Oil**	1	ab	0.06	ab
Seeds 2000 'Camaro'	commercial	**Oil**	2	ab	0.08	abc
Seeds 2000 'Camaro II'	commercial	**Oil**	4	ab	0.18	a-d
Mycogen 'E1013231'	experimental	**Oil**	5	ab	0.21	a-d
Syngenta 'NX24123'	commercial	**Oil**	5	ab	0.26	a-e
Croplan '343 DMR HO' (resistant check)	commercial	**Oil**	6	ab	0.27	a-e
Seeds 2000 'Cobalt II'	commerciall	**Oil**	7	ab	0.33	a-e
Seeds 2000 'X2793'	experimental	**Non-oil**	9	ab	0.38	a-e
Seeds 2000 'Torino'	commercial	**Oil**	9	ab	0.42	a-e
Genosys 'M12-213R'	experimental	**Oil**	10	ab	0.46	a-e
Seeds 2000 'X3293'	experimental	**Non-oil**	11	abc	0.50	a-f
Seeds 2000 'Cobalt'	commercial	**Oil**	11	abc	0.56	a-e
Genosys 'M12-209R'	experimental	**Oil**	12	abc	0.59	a-g
Genosys 'M12-199R'	experimental	**Oil**	14	abc	0.64	a-g
Genosys '12GCF05'	commercial	**Non-oil**	16	a-d	0.80	a-h
Seeds 2000 'X2193'	experimental	**Non-oil**	16	a-d	0.80	a-h
Genosys 'M12-219R'	experimental	**Oil**	17	a-d	0.84	a-h
Mycogen 'E411501'	experimental	**Oil**	18	a-d	0.80	a-h
Genosys 'M12-189R'	experimental	**Oil**	18	a-d	0.89	a-h
Genosys 'M12-193R'	experimental	**Oil**	20	a-d	0.99	a-h
Syngenta 'NX24121'	experimental	**Oil**	21	a-d	0.98	a-h
Genosys 'M12-203R'	experimental	**Oil**	24	a-d	1.07	b-h
Genosys '12GCF09'	commercial	**Non-oil**	25	a-d	1.23	d-h
Genosys 'M12-187R'	experimental	**Oil**	25	a-d	1.25	d-h
Mycogen 'E101163'	experimental	**Oil**	26	a-d	1.12	c-h
Genosys 'M12-223R'	experimental	**Oil**	29	bcd	1.41	e-h
Croplan '305 DMR NS' (susceptible check)	commercial	**Oil**	38	cd	1.83	fgh
Mycogen '8N270CLDM' (susceptible check)	commercial	**Oil**	42	d	1.96	gh
Genosys '12GCF07'	commercial	**Non-oil**	42	d	2.09	gh
Genosys 'M12-217R'	experimental	**Oil**	43	d	2.10	h



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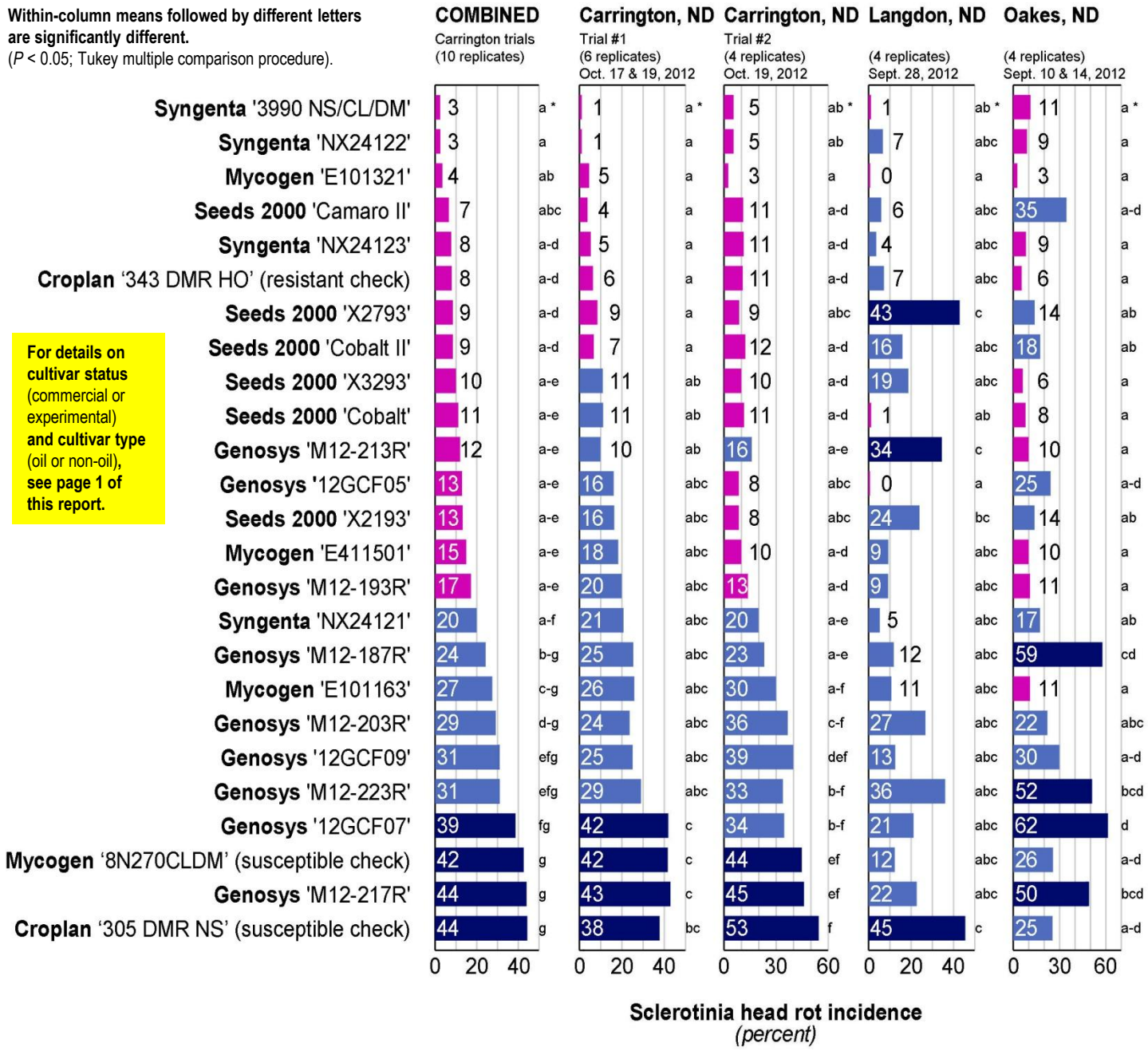
Multi-location screening results:
SCLEROTINIA HEAD ROT INCIDENCE (percent)

Two trials conducted in Carrington (6 replicates and 4 replicates), one trial conducted in Langdon (4 replicates), & one trial conducted in Oakes (4 replicates)

Results from the trial conducted in Langdon, ND should be treated cautiously. The inoculation protocol followed at this location in 2012 is likely to have produced moderately biased results. Although all plants in all entries were inoculated during bloom, entries were at different stages of bloom at the time of inoculation. Sunflowers differ in susceptibility to Sclerotinia head rot at different growth stages, and inoculating at different stages of bloom may result in misrepresentations of the true relative susceptibility of different entries.

In all other trials, inoculations were conducted over multiple dates such that all plants in all entries were inoculated twice at early bloom (approx. 20 to 40% of the disk flowers open or completed bloom) **at twice at mid- to late blooom** (approx. 50 to 80% of the disk flowers open or completed bloom)**.** Research conducted to-date suggests that this inoculation method results in unbiased Sclerotinia head rot susceptibility assessments.

Within-column means followed by different letters are significantly different.
(*P* < 0.05; Tukey multiple comparison procedure).



For details on cultivar status (commercial or experimental) **and cultivar type** (oil or non-oil), **see page 1 of this report.**

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Multi-location screening results:
SCLEROTINIA HEAD ROT SEVERITY INDEX (0 to 5 scale)

Two trials conducted in Carrington (6 replicates and 4 replicates), one trial conducted in Langdon (4 replicates), & one trial conducted in Oakes (4 replicates)

Results from the Langdon location should be treated cautiously. The inoculation protocol followed at this location in 2012 is likely to have produced moderately biased results. Although all plants in all entries were inoculated during bloom, entries were at different stages of bloom at the time of inoculation. Sunflowers differ in susceptibility to Sclerotinia head rot at different growth stages, and inoculating at different stages of bloom may result in misrepresentations of the true relative susceptibility of different entries.

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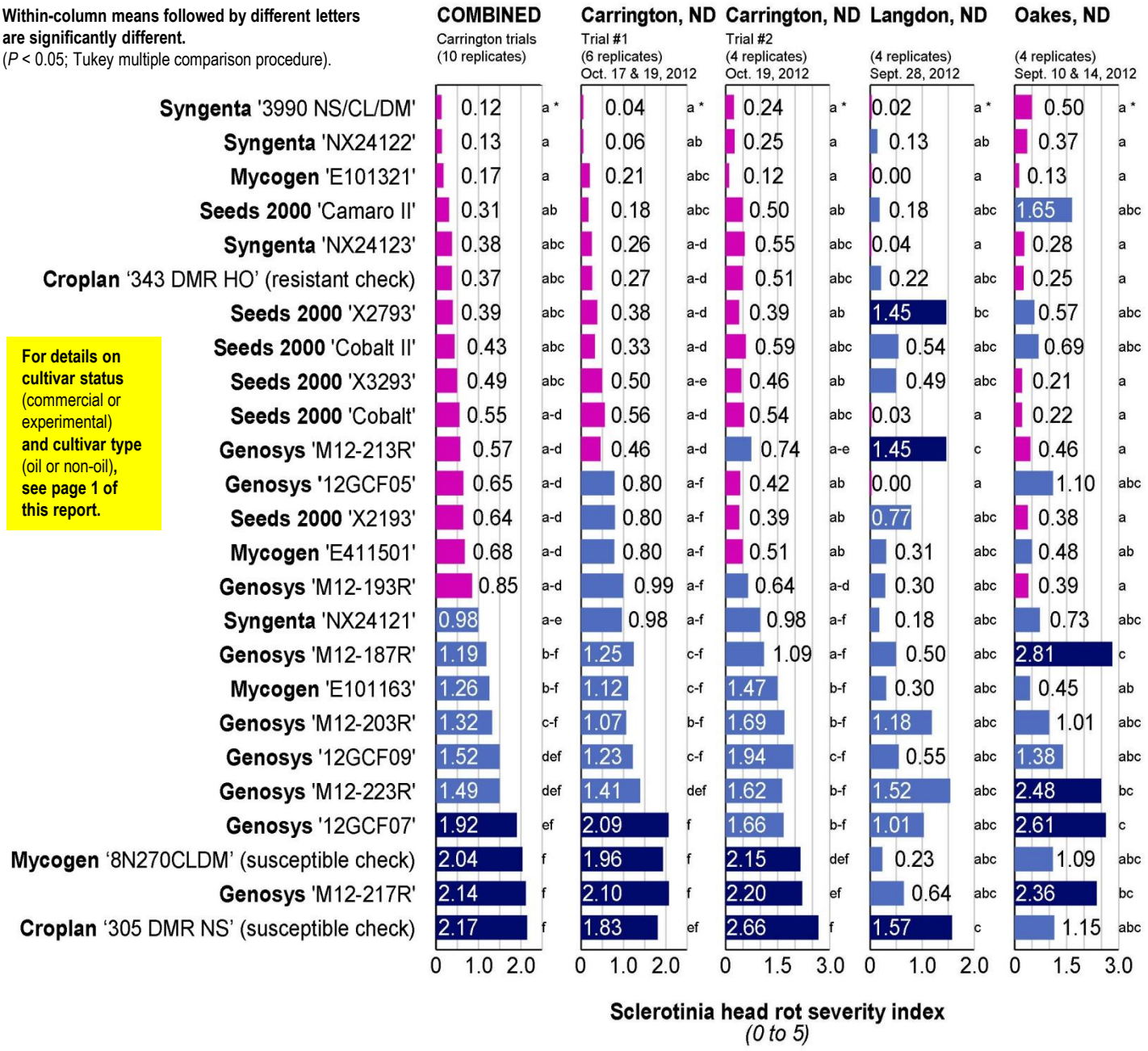

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Locations of trials: NDSU Carrington Research Extension Center, Carrington, ND (47.5083,-99.1314); Oakes Irrigation Research Site of the NDSU Carrington Research Extension Center, Oakes, ND (46.0676,-98.0917); NDSU Langdon Research Extension Center, Langdon, ND (48.7548,-98.3385).
GPS coordinates of trial: 47.508302,-99.131399
Randomized complete block design
Replicates: In a 31-entry trial conducted in Carrington, six replicates were conducted. In 25-entry trials conducted in Carrington, Langdon and Oakes, four replicates were conducted.
Row spacing: 30 inches / **Rows per plot:** 1
Seeded plot size: one row, 35 feet long (Carrington trials); two rows, 15 feet long (Langdon); one row, 20 feet long (Oakes)
Final plot size after alleys were cut: one row, 29 feet long (Carrington trials); two rows, 11 feet long (Langdon); one row, 17 feet long (Oakes)
Previous crop: spring wheat (Carrington), spring wheat (Langdon), spring wheat (Oakes)
Planting date: June 5, 2012 (Carrington); May 31, 2012 (Oakes); May 14, 2012 (Langdon)
Seeding rate: 2.8 seeds/linear foot of row = 49,000 seeds/ac
Final plant population: 1 plant every 10 inches of row = 21,000 plants/ac
** The final plant population was achieved by manually thinning the sunflowers at the V2 to V4 growth stage (two to four true leaves).
Inoculation methods:
** Spore solutions were prepared by adding laboroatory-grown ascospores of Sclerotnia sclerotiorum to water and adding a few of Tween 20. The spore solutions were adjusted such that hand-held spray bottles delivered 15,000 spores per spray, and inoculations were conducted by applying three squirts of the spray bottle (15,000 spores) to the front of each head.
** When the first heads reached R5.2 (20% of the head area flowering or already flowered), all heads that were at growth stage R5.2 or higher were inoculated, and a dot of spray paint was placed on one of the upper leaves indicating that the plant has been inoculated.
** Two to three days later, every head that was inoculated at the first inoculation date was inoculated again, and a second spray paint dot was applied to the previously marked leaves. Spores were also applied to all plants that had reached or passed the R5.2 growth stage but had not been previously inoculated, and these plants were marked with spray paint. This processed continued every one to six days until all plants had been inoculated twice during the R5 growth stage. No plants were inoculated more than twice.
** Inoculations were conducted August 8 (1:00-3:00 pm), August 10 (1:00-3:00 pm), August 15 (1:00 pm - 5:00 pm), August 17 (8:00 am - 6:00 pm), August 20 (10:00 am - 3:00 pm), August 22 (8:30 - 11:30 am), August 27 (10:00 am to 12:00 pm), and August 30 (9:30 am) in Carrington; July 27, July 30, August 1, August 6, August 8, and August 10 in Oakes; Aug. 6, Aug. 8, and Aug. 10 in Langdon.
Disease assessments: Sclerotinia head rot was assesed on at the R9 growth stage (physiological maturity) on October 17 and 19 (Carrington trial #1), October 19 (Carrington trial #2), September 28 (Langdon), and September 10 and 14 (Oakes). Each plant in each row was evaluated on a 0 to 5 scale: 0 = no Sclerotinia head rot, 1 = 1 to 25% of head exhibiting symptoms of Sclerotinia head rot, 2 = 26 to 50% of head exhibiting symptoms of Sclerotinia head rot, 3 = 51 to 75% of head exhibiting symptoms of Sclerotinia head rot, 4 = 76 to 99% of head exhibiting symptoms of Sclerotinia head rot, and 5 = 100% of head exhibiting Sclerotinia head rot. Plants exhibiting damage from sunflower midge were excluded from the analysis.
This trial was not harvested.
Statistical analysis: Data were evaluated with analysis of variance . The assumption of constant variance was assessed by plotting residuals against predicted values, and the assumption of normality was assessed with a normal probability plot. To meet these assumptions, a systematic natural-log transformation [LN(x+1)]was applied to the disease incidence and disease severity index data. Single-degree-of-freedom contrasts were performed for all pairwise comparisons of isolates; to control the Type I error rate at the level of the experiment, the Tukey multiple comparison procedure was employed. Analyses were conducted with replicate and treatment as main factor effects, and they were implemented in PROC GLM of SAS (version 9.2; SAS Institute, Cary, NC).

FUNDING: This project was funded by the **USDA National Sclerotinia Initiative, Genosys LLC, Seeds 2000, Syngenta**, and **Mycogen Seeds.**

IMPORTANT NOTICE:

- Variety performance differs in response to environmental conditions, agronomic practices, and biotic and abiotic stresses including diseases.
- This report summarizes variety performance as tested at the NDSU Carrington Research Extension Center and NDSU Langdon Research Extension Center in 2012 under the conditions partially summarized in the methods section (above).
- Variety performance may differ under other conditions; when choosing varieties, always evaluate results from multiple trials.
- This report is shared for educational purposes and is not an endorsement of any specific products.