

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

Carrington, Langdon, and Oakes, ND
(2013)

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KEY FINDINGS:

Multiple experimental confection and oil lines showed promising results. At physiological maturity, the experimental confection entrees NuSeed Global 'NHW11915', 'NHW11917', 'NHW12706', and 'NHW12806' and the experimental oilseed entrees Mycogen '246321' and NuSeed / Seeds 2000 'NLK12M008' exhibited significant reductions in Sclerotinia head rot incidence and/or severity index relative to the most susceptible entrees in at least two of the three screening locations.

The commercial non-oil hybrid Genosys '12GCF05' performed well. In two of three trials, it exhibited statistically significant reductions in Sclerotinia head rot severity index relative to the most susceptible entrees. This confection hybrid also performed well in trials conducted in 2012.

The susceptibility of the oilseed hybrids NuSeed / Seeds 2000 'Camaro II' and 'Cobalt II' observed across screening locations in 2013 was representative of the moderate performance exhibited by these lines in the Oakes nursery in 2012 but sharply different from the low susceptibility observed in the Carrington nursery in 2012. The results are a reminder of the need for multi-year, multi-location testing.

RESULTS – Sclerotinia head rot severity index:

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

Disease severity index: average Sclerotinia head rot severity across all plants, including those not exhibiting disease, at the R9 growth stage (physiological maturity). Disease assessments were conducted 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.

Sample sizes: The average number of plants evaluated per entry was 245 in Carrington (27 per replicate), 81 in Langdon (20 per rep), and 72 in Oakes (18 per rep).

Company	Entry	Type	Status	Carrington, ND 9 REPLICATES R9 growth stage 0 to 5			Oakes, ND 4 REPLICATES R9 growth stage 0 to 5			Langdon, ND 4 REPLICATES R9 growth stage 0 to 5		
				Mean	SE	Significance	Mean	SE	Significance	Mean	SE	Significance
NuSeed Global	NHW11915	Confection	experimental	0.8	0.1	ab	1.6	0.2	ab	1.7	0.2	ab
Mycogen	246321	Oil	experimental	0.5	0.1	a	1.7	0.2	ab	2.3	0.3	a-d
NuSeed Global	NHW11917	Confection	experimental	1.1	0.2	a-d	1.7	0.2	ab	2.5	0.3	a-d
Mycogen	101321	Oil	experimental	1.0	0.2	abc	2.4	0.3	a-e	2.0	0.2	abc
Croplan	343 DRM HO	Oil	resistant check	1.9	0.2	b-h	2.2	0.2	a-d	1.5	0.1	a
NuSeed Global	NHW12706	Confection	experimental	1.7	0.2	a-f	1.1	0.1	a	3.1	0.3	a-d
NuSeed Global	NHW12806	Confection	experimental	1.9	0.2	b-h	1.7	0.2	ab	2.3	0.3	a-d
NuSeed / Seeds 2000	NLK12M008	Oil	experimental	1.4	0.2	a-e	2.0	0.2	abc	2.6	0.3	a-d
Genosys	12GCF05	Confection	commercially available	1.4	0.2	a-e	2.0	0.2	abc	3.0	0.3	a-d
NuSeed / Seeds 2000	NHK12S076	Oil	experimental	1.7	0.2	a-g	NOT TESTED		NOT TESTED			
Genosys	12G20	Oil	commercially available	2.0	0.2	b-i	NOT TESTED		NOT TESTED			
Mycogen	303321	Oil	experimental	3.0	0.3	g-n	2.6	0.2	a-e	2.9	0.3	a-d
Genosys	12GCF18	Confection	commercially available	2.9	0.2	f-m	2.6	0.2	a-f	3.1	0.3	a-d
Genosys	12GCF07	Confection	commercially available	2.4	0.2	d-k	2.9	0.2	a-f	3.5	0.3	a-d
NuSeed / Seeds 2000	NHK12M010	Oil	experimental	2.3	0.2	c-i	3.4	0.3	b-f	3.7	0.3	a-d
Genosys	11G08	Oil	commercially available	2.3	0.2	c-i	NOT TESTED		NOT TESTED			
NuSeed Global	NHW11929	Confection	experimental	2.5	0.2	e-l	NOT TESTED		NOT TESTED			
Croplan	305 DMR NS	Oil	susceptible check	3.1	0.2	h-o	4.6	0.3	ef	2.0	0.2	abc
Genosys	12GCF12	Confection	commercially available	3.7	0.3	k-o	2.7	0.2	a-f	3.4	0.3	a-d
NuSeed / Seeds 2000	NHK12S075	Oil	experimental	2.5	0.2	e-l	3.5	0.3	b-f	4.0	0.3	bcd
NuSeed / Seeds 2000	NHK12S029	Oil	experimental	3.2	0.2	i-o	NOT TESTED		NOT TESTED			
NuSeed / Seeds 2000	Camaro II	Oil	commercially available	3.5	0.2	j-o	3.3	0.2	a-f	3.4	0.3	a-d
NuSeed / Seeds 2000	Cobalt II	Oil	commercially available	3.6	0.2	k-o	3.9	0.3	c-f	3.2	0.3	a-d
Mycogen	8N270CLDM	Oil	susceptible check	4.1	0.2	mno	4.0	0.2	c-f	3.1	0.2	a-d
NuSeed / Seeds 2000	NLK12S069	Oil	experimental	3.5	0.2	j-o	4.3	0.3	def	3.6	0.3	a-d
NuSeed / Seeds 2000	NSK13M305	Confection	experimental	4.1	0.2	mno	3.8	0.2	b-f	3.4	0.3	a-d
NuSeed / Seeds 2000	NSK13M302	Confection	experimental	3.7	0.2	k-o	4.1	0.2	c-f	4.0	0.3	bcd
NuSeed / Seeds 2000	X4216	Oil	experimental	3.7	0.2	l-o	NOT TESTED		NOT TESTED			
NuSeed / Seeds 2000	NSK13M301	Confection	experimental	4.1	0.2	mno	4.0	0.2	c-f	4.4	0.3	cd
NuSeed / Seeds 2000	NSK13M304	Confection	experimental	3.9	0.2	mno	4.4	0.3	def	4.3	0.3	cd
Genosys	12GCF15	Confection	commercially available	4.3	0.2	no	4.8	0.3	f	3.7	0.3	a-d
NuSeed / Seeds 2000	NLK12S070	Oil	experimental	3.9	0.2	mno	4.5	0.3	def	4.5	0.3	d
NuSeed / Seeds 2000	NSK13M303	Confection	experimental	4.4	0.2	o	NOT TESTED		NOT TESTED			

P>F: < 0.0001
CV: 26.3

P>F: < 0.0001
CV: 26.1

P>F: < 0.0001
CV: 27.5

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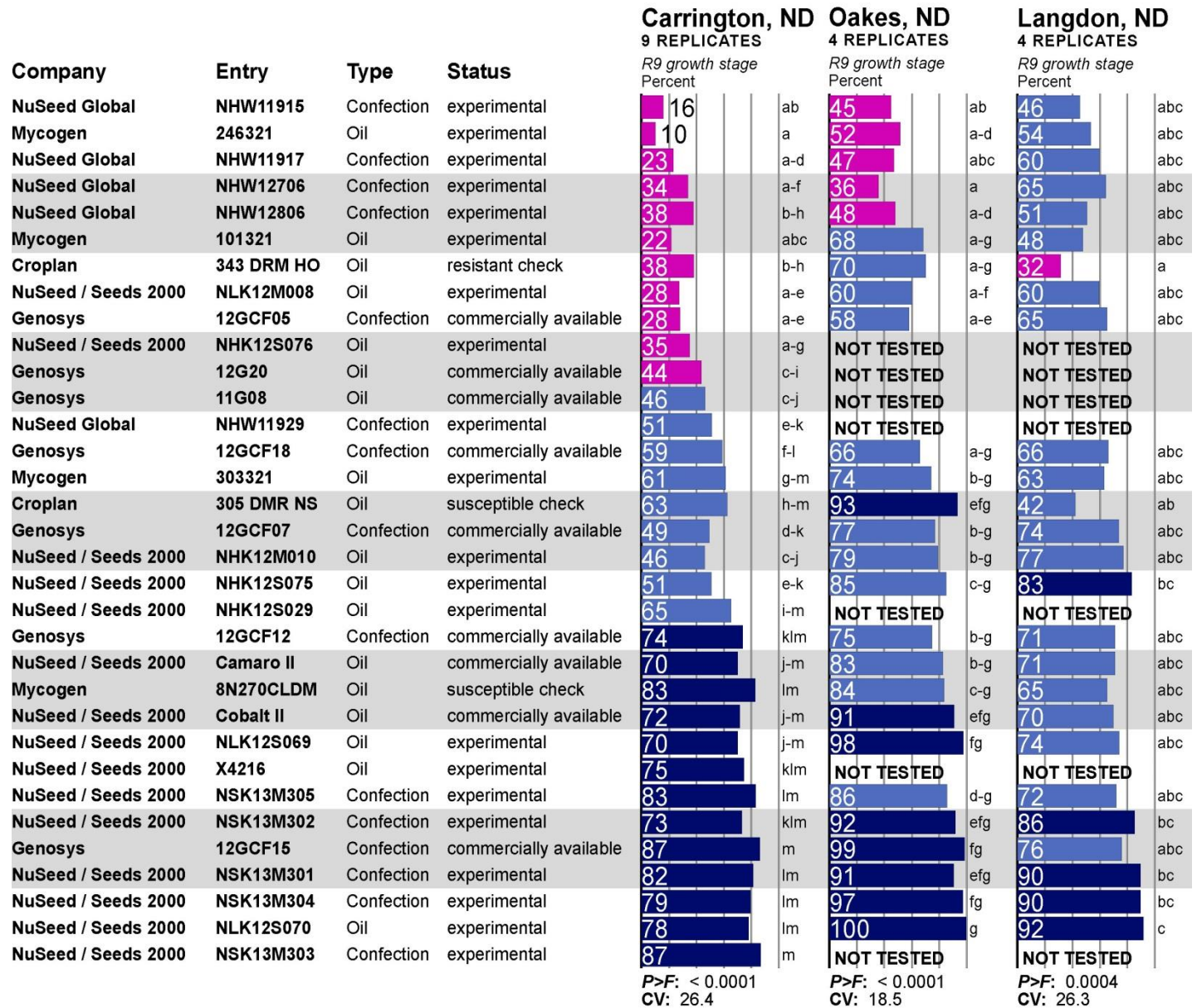
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RESULTS – Sclerotinia head rot incidence:

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

Disease incidence: Percent of plants exhibiting Sclerotinia head rot

Sample sizes: The average number of plants evaluated per entry was 245 in Carrington (27 plants per replicate), 81 in Langdon (20 plants per replicate), and 72 in Oakes (18 plants per replicate).



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Locations of trials (with approximate GPS coordinates in parentheses): NDSU Carrington Research Extension Center, Carrington, ND (47° 30.470', -99° 7.767'); Oakes Irrigation Research Site of the NDSU Carrington Research Extension Center, Oakes, ND (46.07, -98.09); NDSU Langdon Research Extension Center, Langdon, ND (48.75, -98.34).

Randomized complete block design

Replicates: The study in Carrington had nine replicates, and the studies in Langdon and Oakes had four replicates.

Row spacing: 30 inches

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), fallow (Langdon), fallow (Oakes)

Planting date: June 10, 2013 (Carrington); June 4, 2013 (Oakes); May 23, 2013 (Langdon)

Seeding rate: 3.83 seeds/linear foot of row = 60,000 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 laboratory-grown ascospores of *Sclerotinia sclerotiorum* to water and adding a one to two drops of Tween 20. Spore solutions were adjusted to deliver 15,000 spores were delivered to the front of each head with a spray bottle. (A total of 30,000 spores were applied per head across both inoculation dates).

** Inoculations were conducted over multiple days such that every head was inoculated twice - once at approximately R5.4 to R5.6 (40 to 60% of the disk flowers blooming or already bloomed) and once at approximately R5.5 to R5.9 (50 to 90% of the disk flowers blooming or already bloomed). Plants received a dot of spray paint on an upper leaf at each inoculation; once a plant received two dots of spray paint, the plant received no additional inoculations.

** In Carrington: Inoculations were conducted August 13 at 10:45 to 11:15 am, August 15 at 8:15 to 9:15 am, August 19 at 8:45 to 11:00 am, August 21 at 8:30 to 11:00 am; August 23 at 7:00 to 11:30 am (passes 19 to 50) plus August 25 at 2:15 to 8:15 am (passes 1 to 18); August 26 at 4:30 to 6:40 am (range 1) plus August 27 at 1:00 to 9:30 am (ranges 2 to 6); August 29 at 3:30 to 7:30 am (ranges 1 and 2) plus August 30 at 2:00 to 8:00 am (ranges 3 to 6); August 31 at 6:00 to 8:00 am (all ranges); and September 3 at 8:15 to 9:20 am (all ranges). In Langdon: Inoculations were conducted Aug. 2, 5, 7, 9, 12, 14, 16, 19, and 22. In Oakes: Inoculations were conducted August 12, 14, 16, 21, 23, 26, 28, and 30.

Disease assessments: *Sclerotinia* head rot was assessed on at the R9 growth stage (physiological maturity) on October 15 and 16 in Carrington, on October 9 in Langdon, and as sunflowers reached the R9 growth stage on September 19, Sept. 23, Sept. 25, and Oct. 10 in 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.

Irrigation: Microsprinklers were established over the trials in a 20-foot grid, and irrigation was applied as necessary to promote disease establishment.

These trials were 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. All data met model assumptions. 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 9.3; SAS Institute, Cary, NC).

FUNDING:

This project was funded by the **USDA National Sclerotinia Initiative, Genosys LLC, NuSeed / Seeds 2000, NuSeed Global, 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 2013 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.