Advances in the Development of Sunflower Germplasm with Resistance to Both Sclerotinia Stalk Rot and Head Rot - 2005

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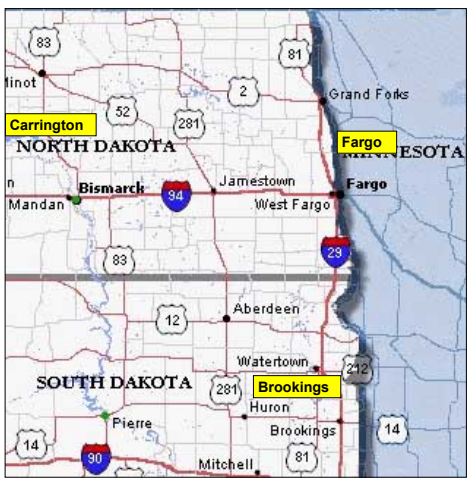
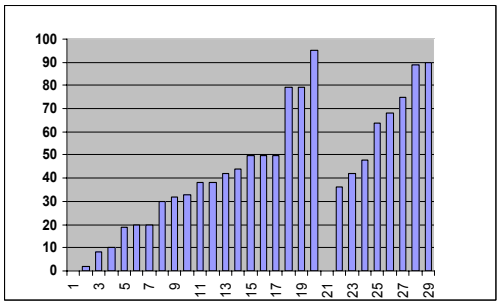
Newest *Sclerotinia* mist plot at Fargo, ND, with 'FargoDome' in background. Mist cycle is monitored, but not controlled by leaf wetness sensors.



Location of three mist irrigated Sclerotinia nurseries at Fargo and Carrington, ND, and Brookings SD.



Histogram showing % plants susceptible to *Sclerotinia* stalk rot in greenhouse tests. *Helianthus exilis* (20 accessions) on left, *H. porterii* (8 accessions) on right.

Helianthus exilis plants in inoculated greenhouse test, with center plant wilting due to Sclerotinia stalk rot.

ABSTRACT

The inheritance of Sclerotinia head rot resistance of three maintainer and three restorer lines crossed to create NuSun and traditional sunflower hybrids was studied using a factorial mating design. The General Combining Ability (GCA) effects accounted for a greater proportion of variance than Specific Combining Ability (SCA) effects, indicating that additive gene effects were more important than dominance gene effects controlling resistance to Sclerotinia head rot. NuSun hybrids with high levels of resistance were created by using specific combinations of lines.

Field and greenhouse evaluation of annual and perennial wild *Helianthus* species with artificial inoculation again produced peduncle necrosis and mummified heads rather than the typical rot symptoms observed on large heads of cultivated sunflower. This suggests that identification of head rot resistance in wild sunflower may be appropriately done with F_1 interspecific crosses with cultivated sunflower, where more typical head rot symptoms would be produced.

Greenhouse evaluations for Sclerotinia stalk rot resistance were made on multiple collections of several newly collected species, including *H. exilis, H. porterii, H. schweinitzii*, and other southeastern U.S. perennial species. One population of *H. exilis*, the serpentine sunflower from CA, had no infection, and several others had < 10% infection, and highly resistant populations of *H. porterii* were also noted.

Seventy-two commercial hybrids were tested for resistance to Sclerotinia stalk rot at five locations in North Dakota, South Dakota and Minnesota using artificial inoculation. Three locations generated no data due to natural disasters (hail, herbicide injury, and seedling loss due to downy mildew), but the remaining two locations generated data allowing statistical separation of the disease response of the hybrids. Stalk rot severity on confection hybrids ranged from 32 to 85% infection, and on NuSun hybrids, from 15 to 75% infection. Four NuSun or high oleic hybrids had less infection than the resistant check (21%), indicating that commercial hybrids in a NuSun background exist with disease resistance superior to the highest levels observed on conventional oilseed hybrids. Comparison of head rot and stalk rot ratings from inoculated trials show that high levels of resistance to both diseases is currently not found in any currently available commercial hybrids.

Inoculated field test at Carrington, ND showing susceptible row on right, wilting due to Sclerotina stalk rot, and highly resistant row on lef.

Gerald Seiler, research botanist, & Tom Gulya, pathologist, inoculating wild sunflowers with *Sclerotinia* ascospores.

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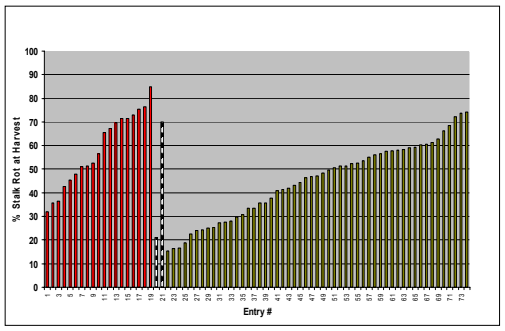
Gerald Seiler collecting seeds of *Helianthus exilis* in northern CA. This species has potential for *Sclerotinia* resistance based on its adaptation of serpentine soils, low in Ca and high in Mg.

Helianthus porterii on a granite rock outcrop in North Carolina. This species had received little attention before our 2003 collecting trip, as no seed was available in the USDA PI collection.



Ratings of 75 commercial sunflower hybrids for resistance to Sclerotinia stalk rot in inoculated trials. Red bars are confection hybrids and green bars are NuSun hybrids. Data is the average of two locations. Striped bars are the resistant and susceptilbe check varieties (older oilseed hybrids no longer sold).

Granular chemical applicator used to apply *Sclerotinia* inoculum on millet in furrows beside sunflowers plants in field trials.