



Sunflower Sclerotinia Head Rot Screening Nursery



R.A. Henson¹, T.J. Gulya², S.A. Radi², and J.J. Rau¹
¹North Dakota State University Carrington Research Extension Center
²USDA-ARS, Fargo, North Dakota

ABSTRACT
Sclerotinia sclerotiorum head rot is a devastating disease of sunflower (*Helianthus annuus* L.). For the past four seasons, sunflower germplasm has been evaluated for susceptibility to head rot at the North Dakota State University Carrington Research Extension Center. Entries consist of production hybrids and experimental lines submitted by private breeding programs. Individual heads are inoculated with ascospores and plots are misted frequently to provide favorable conditions for disease development. After several weeks of misting, inoculated heads are evaluated for head rot symptoms. To date, substantial progress has been made in developing the infrastructure (water delivery and misting systems) and methodology (inoculation and evaluation) for conducting a head rot screening nursery. Additional work on methodology is needed to optimize labor and land inputs and to increase the precision of the results. Progress toward resistant commercial hybrids is difficult to assess, since entries vary from year to year and increasingly more entries are experimental lines. However, there are signs of progress. The best entry in the first screening nursery is used as the resistant check and several entries in subsequent years were rated less susceptible. Promising germplasm does exist in both oilseed and confection types.

INTRODUCTION
Sclerotinia sclerotiorum head rot is a devastating disease of sunflower (*Helianthus annuus* L.). For the past four seasons, sunflower germplasm has been evaluated for susceptibility to head rot at the North Dakota State University Carrington Research Extension Center. Entries consist of production hybrids and experimental lines submitted by private breeding programs.

MATERIALS & METHODS

Planting Date: 9 June 2003

Seeding Rate: 148,000 seeds ha⁻¹, thinned to 49,400 after emergence

Plot Size: 1 row (0.77m) x 23 m

Design: Randomized Complete Block 1, 2, or 3 reps entry⁻¹

Susceptible Check: A standard confection hybrid

Resistant Check: The best entry in the 2000 head rot screening nursery

Disease Inoculation: 10 heads per plot (each head inoculated once, minimum of 25,000 ascospores per head)


Inoculation Dates: 19, 22, and 27 August (to encompass differences in maturity)

Misting: 3-4 minutes every half hour from inoculation to final disease rating

Evaluation: Individual heads, 5 and 6 weeks after first inoculation date

Disease Rating Scale:
 0 = No symptoms
 1 = 0 - 12.5% of head showing symptoms
 2 = 12.5 - 25% of head showing symptoms
 3 = 25 - 50% of head showing symptoms
 4 = 50 - 100% of head showing symptoms
 5 = 100% of head showing symptoms

Calculations:
 Disease Incidence = % of inoculated heads showing symptoms
 Disease Severity = weighted average of heads showing symptoms
 [Example: ((# plants_{rating=1} x 0.0625) + (# plants_{rating=2} x 0.1875) + (# plants_{rating=3} x 0.375) + (# plants_{rating=4} x 0.75) + (# plants_{rating=5} x 1.0)) / total # plants with symptoms]



Inoculating sunflower heads.

RESULTS & DISCUSSION

Despite very hot, dry, windy weather during incubation, use of the misting system resulted in acceptable disease pressure.

- ★ Variability among plants and reps was high (C.V. = 46%).
- ★ Mean disease incidence of the 35 entries in the 2003 nursery ranged from 0 to 73 percent (Fig. 1). Severity ratings ranged from 0.0 to 0.8 (maximum = 1.0).
- ★ The correlation between disease severity and incidence was highly significant (0.55). However, exceptions do exist and both criteria should continue to be evaluated.
- ★ Disease ratings were lower with later inoculation dates. This may be an indication of higher resistance in germplasm with longer maturity or may be an artifact of less favorable conditions for disease development later in the season.
- ★ Correlations of the disease incidence rankings of entries using 1, 2, or 3 reps of data were highly significant, suggesting that a reduced number of reps may be used (Table 1). However, occasional problems with stand establishment, lodging, and deer predation increase the risk of planting only 1 rep.
- ★ Promising germplasm exists within both confection and oilseed germplasm.

SUMMARY

To date, substantial progress has been made in developing the infrastructure (water delivery and misting systems) and methodology (inoculation and evaluation) for conducting a head rot screening nursery. Each year, new lessons are learned and new questions arise. Additional work on methodology is needed to maximize labor and land inputs and to increase the precision of the results.

Progress toward resistant commercial hybrids is difficult to assess from the results of the screening nursery, since entries vary from year to year. Also, more and more entries are experimental lines and not released hybrids. A line may show promise as a source of disease resistance in a breeding program, but may lack other traits needed in a commercial hybrid. However, there are signs of progress. The best of the 82 entries in the first screening nursery in 2000 was used as the resistant check in subsequent years. Eighty-five entries were evaluated in 2001, 58 in 2002, and 35 in 2003. In all years, several entries were rated more resistant than the resistant check.



Sunflower head rot misting system in action.

Figure 1. Sclerotinia ratings of commercial sunflower entries, Carrington, 2003.

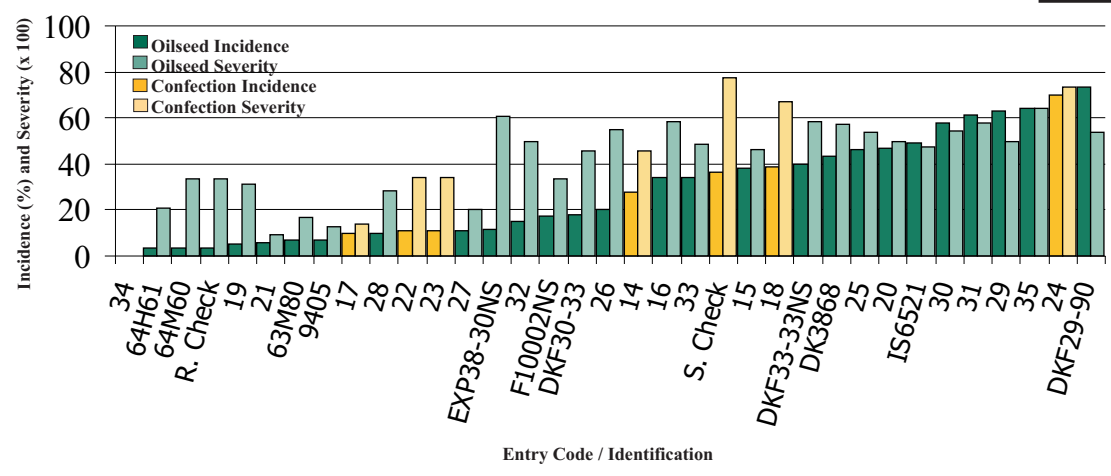


Table 1. Correlation coefficients for disease incidence rankings among entries using 1, 2 or 3 reps.

	3 Reps	2 Reps	1 Rep
2 Reps (n=14)	0.947	1	0.921
P-value	<0.0001	---	<0.0001
3 Reps (n=14)	1	0.947	0.881
P-value	---	<0.0001	<0.0001
2 Reps (n=35)	---	1	0.921
P-value	---	---	<0.0001



ACKNOWLEDGMENTS

The authors wish to thank the National Sunflower Association, the North Dakota State Board of Agricultural Research and Education and the North Dakota State University Agricultural Experiment Station for support of this project. Blaine Schatz and Dr. Marty Draper for scientific collaboration, Nikolay Bolsheshev, Marjorie Olson, Jane Forde, Tim Indergaard, Todd Ingebretson, Betty Montgomery and Stacey Rzaszutak for technical assistance, and Myna Friedt for poster preparation.

Disease rating 1.



Disease rating 2.



Disease rating 3.



Disease rating 4.



Disease rating 5.

