# Sunflower Sclerotinia Head Rot Screening Nursery

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## Introduction

*Sclerotinia sclerotiorum* head rot is a devastating disease of sunflower (*Helianthus annuus* L.). For the past five 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.

In a companion trial, fungicide products and rates were evaluated when applied to either the face or the back of the head.

Sunflower head rot misting system in action.

## Materials & Methods

Inoculating sunflower heads.

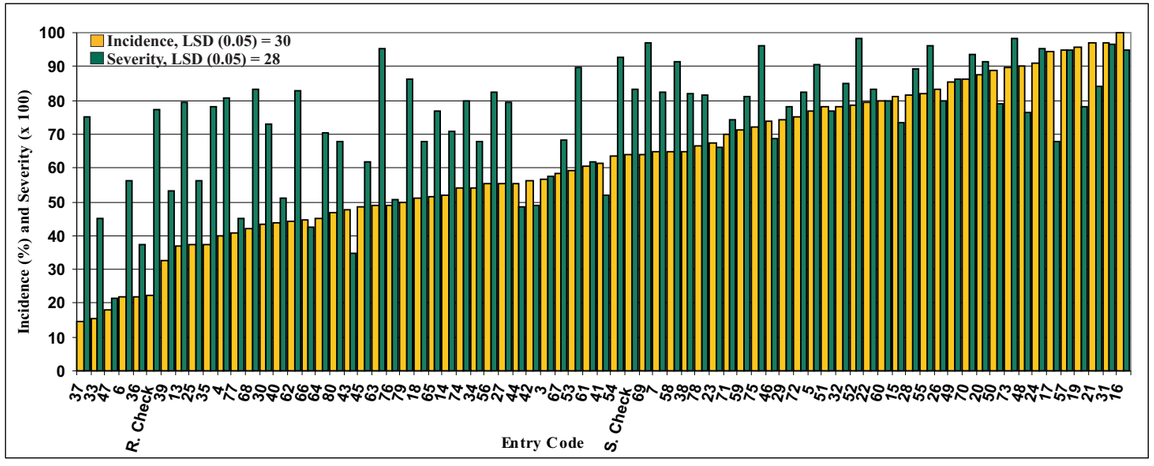
| | |
|---|---|
| Planting Date: | 7 June 2004 |
| Seeding Rate: | 60,000 seeds acre$^{-1}$, thinned to 20,000 after emergence |
| Plot Size: | 1 row (30") x 25' |
| Design: | Randomized Complete Block, 3 reps entry$^{-1}$ |
| Susceptible Check: | A standard confection hybrid |
| Resistant Check: | The 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, 23, and 27 August and 5 September (to encompass differences in maturity) |
| Misting: | 3-4 minutes every half hour from inoculation to final disease rating |
| Evaluation: | Individual heads on 23 September and 10 October |
| Disease Rating Scale: | 0 = No symptoms<br>1 = 0 - 12.5% of head showing symptoms<br>2 = 12.5 - 25% of head showing symptoms<br>3 = 25 - 50 % of head showing symptoms<br>4 = 50 - 100% of head showing symptoms<br>5 = 100% of head showing symptoms |
| Calculations: | Disease Incidence = % of inoculated heads showing symptoms<br>Disease Severity = weighted average of heads showing symptoms<br>[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] |

Mycelial growth on sunflower head.

**Table 1. Correlation coefficiencts among rankings for incidence and severity ratings on two evaluation dates, NDSU Carrington, 2004.**

| | Evaluation 1 | | Evaluation 2 | |
|---|---|---|---|---|
| | Incidence | Severity | Incidence | Severity |
| Incidence Evaluation 1 | 1 | 0.789 | 0.899 | 0.778 |
| P-value | | <0.0001 | <0.0001 | <0.0001 |
| Severity Evaluation 1 | 0.789 | 1 | 0.624 | 0.848 |
| P-value | <0.0001 | | <0.0001 | <0.0001 |
| Incidence Evaluation 2 | 0.899 | 0.624 | 1 | 0.575 |
| P-value | <0.0001 | <0.0001 | | <0.0001 |

## Figure 1. Sclerotinia ratings (2nd evaluation) of commercial sunflower entries, Carrington, 2004.




## Results & Discussion

★ Use of the misting system resulted in good disease pressure.

★ Variability was lower than in previous years (C.V. = 30% for incidence and 23% for severity).

★ Mean disease incidence of the 75 entries in the second evaluation ranged from 14.5 to 100 percent (Fig.1). Severity ratings ranged from 0.21 to 0.98 (maximum = 1.00).

★ The correlation between disease severity and incidence was highly significant (Table 1). However, exceptions do exist and both criteria should continue to be evaluated. Correlations of ratings on the two evaluation dates were also highly significant.

★ Disease ratings were lower with later inoculation (data not shown). 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 replicates of data were highly significant, suggesting that a reduced number of reps may be used (Table 2). However, occasional problems with stand establishment, lodging, and deer predation increase the risk of planting only one replicate.

★ Promising germplasm exists within both confection and oilseed germplasm.

★ Fungicide treatments and applications had a minimal effect on disease ratings (Table 3).

## 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, 35 in 2003, and 75 in 2004. In all years, several entries were rated more resistant than the resistant check.

**Table 2. Correlation coefficients of head rot ratings using 1, 2, or 3 reps.**

| *Incidence Evaluation 1* | 3 Reps | 2 Reps | *Severity Evaluation 1* | 3 Reps | 2 Reps |
|---|---|---|---|---|---|
| 3 Reps | 1 | 0.953 | 3 Reps | 1 | 0.920 |
| P-value | | <0.0001 | P-value | | <0.0001 |
| 2 Reps | 0.953 | 1 | 2 Reps | 0.920 | 1 |
| P-value | <0.0001 | | P-value | <0.0001 | |
| 1 Rep | 0.852 | 0.856 | 1 Rep | 0.806 | 0.838 |
| P-value | <0.0001 | <0.0001 | P-value | <0.0001 | <0.0001 |
| *Incidence Evaluation 2* | 3 Reps | 2 Reps | *Severity Evaluation 2* | 3 Reps | 2 Reps |
| 3 Reps | 1 | 0.960 | 3 Reps | 1 | 0.923 |
| P-value | | <0.0001 | P-value | | <0.0001 |
| 2 Reps | 0.960 | 1 | 2 Reps | 0.923 | 1 |
| P-value | <0.0001 | | P-value | <0.0001 | |
| 1 Rep | 0.802 | 0.842 | 1 Rep | 0.825 | 0.861 |
| P-value | <0.0001 | <0.0001 | P-value | <0.0001 | <0.0001 |

**Table 3. Sunflower head rot infection response to fungicide treatments.**

| Fungicide Treatment[1] | Head Area Treated | Total Plants Evaluated | Incidence | Weighted Severity |
|---|---|---|---|---|
| Endura 4.5 + 4.5[2] | --- | 69 | 64 | 0.80 |
| Endura 6.0 + 4.5 | --- | 56 | 76 | 0.73 |
| Endura 6.0 + 6.0 | --- | 60 | 68 | 0.75 |
| Endura 6.0 + JAU 5.7 | --- | 63 | 60 | 0.89 |
| Endura 9.0 + 6.0 | --- | 64 | 70 | 0.78 |
| JAU 5.7 + Endura 6.0 | --- | 65 | 60 | 0.74 |
| JAU 5.7 + JAU 5.7 | --- | 61 | 60 | 0.87 |
| Topsin 1 lb + Topsin 1 lb | --- | 70 | 67 | 0.84 |
| Untreated | --- | 53 | 69 | 0.81 |
| --- | Back | 277 | 62 | 0.78 |
| --- | Face | 284 | 69 | 0.82 |
| Mean | | --- | 66 | 0.80 |
| C.V. (%) | | --- | 24.5 | 19.2 |

[1]Treatments applied on 20 Aug. (buds opening) and on 3 Sept., ascospores applied on 27 Aug.

[2]Numbers indicate fluid ounces or mass / acre

Disease rating 1.

Disease rating 2.

Disease rating 3.

Disease rating 4.

Disease rating 5.

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