

# Sunflower Head Rot Screening Nursery and Fungicide Evaluation

Bob Henson<sup>1</sup>, Khalid Rashid<sup>2</sup>, Scott Halley<sup>3</sup>, Marty Draper<sup>4</sup>, and Tom Gulya<sup>5</sup>

<sup>1</sup>North Dakota State University Carrington Research Extension Center, <sup>2</sup>Agriculture and Agrifoods Canada - Morden, <sup>3</sup>North Dakota State University Langdon Research Extension Center, <sup>4</sup>South Dakota State University Brookings, <sup>5</sup>USDA-ARS Sunflower Research Unit - Fargo

## INTRODUCTION

*Sclerotinia sclerotiorum* head rot is a devastating disease of sunflower (*Helianthus annuus* L.). Since 2000, germplasm submitted by private breeding programs has been evaluated at the North Dakota State University Carrington Research Extension Center. Evaluations at South Dakota State University Brookings were begun in 2001. Valuable information has been generated for plant breeders, but not for growers. Seed companies and researchers alike want more confidence in the data before releasing it to the public. To remedy this situation, the project was significantly expanded in 2005. Initial screenings are now conducted in Carrington and Morden, Manitoba. Seed companies are required to submit a minimum number of commercial hybrids, to insure that some data are generated for growers. This germplasm is also tested for resistance to *Sclerotinia* stalk rot (Tom Gulya) and sunflower midge (Gary Brewer). The best entries in these initial screenings are re-evaluated at Carrington, Morden, Langdon, and Brookings (in 2005, this group was selected from the 2004 Carrington initial screening).

Until hybrids resistant to *Sclerotinia* are commercially available, other control measures are needed. Fungicides are effectively used to manage this disease in other crops, but chemical control of sunflower head rot is not well-defined. Research is needed to evaluate products, rates, and timings.

## MATERIALS & METHODS

	Carrington	Morden	Langdon
Planting Date:	3 June	25 May	19 May
Plot Size:	1 (30") row x 25'	1 (30") row x 10'	2 (30") rows x 15'

At flowering, heads at all sites were inoculated with a solution of ascospores (*Sclerotinia*-infected millet was also scattered on heads at Morden) and misted to keep the heads continually moist during reproductive development.



Inoculating sunflower heads.

Disease was rated on individual heads using the 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.

Incidence was scored as the percentage of inoculated heads showing disease symptoms.

Severity was calculated as the weighted average of heads showing disease symptoms.  
 [Example: ((# plants<sub>Rating 1</sub> x 0.0625) + (# plants<sub>Rating 2</sub> x 0.1875) + (# plants<sub>Rating 3</sub> x 0.375) + (# plants<sub>Rating 4</sub> x 0.75) + (# plants<sub>Rating 5</sub> x 1.0)) / total # plants showing symptoms]

## RESULTS & DISCUSSION

### Initial Screening

- ★ 72 entries and 8 checks were evaluated, representing 15 companies
- ★ Disease incidence at Carrington ranged from 18 to 100% (Fig. 1). The relatively low C.V. of 29.5% at the second evaluation indicates that considerable progress in methodology has been achieved.
- ★ At Morden, disease incidence ranged from 0 to 13.5% (data not shown), possibly due to very hot weather after inoculation.
- ★ The correlation between relative rankings at the two sites was low (R = 0.173, P = 0.126). However, the low disease pressure at Morden casts doubt upon the validity of this comparison.
- ★ Both confection and oil types were represented in the less susceptible germplasm. Performance under the heavy disease pressure at Carrington suggests that these entries will show good disease tolerance under most production conditions.

### Repeat Evaluation

- ★ Good disease pressure was achieved at both Carrington (27 to 89% incidence) and Langdon (24 to 52% incidence), allowing a valid comparison of the data (Table 1).
- ★ The correlation between relative rankings at Carrington and Langdon was high (R = 0.761, P < 0.0001), showing good repeatability between sites.
- ★ The Brookings site was lost to flooding and the Morden data were confounded by stalk rot.

### General Comments on Germplasm Evaluation:

The modifications made to this project in 2005 show considerable promise for continuing the generation of valuable data for breeding programs and also for producing results to divulge to growers. Some of the problems at sites this year can be corrected (e.g. site selection to avoid stalk rot) and others were due to abnormal weather (flooding and excessive heat). Where a valid comparison between sites was permitted (Carrington and Langdon repeat evaluation), good agreement was observed. Future plans include a continuation of the present site structure and expanding to two additional locations for the repeat evaluation. Plant breeders have expressed interest in the possibility of evaluating more breeding lines. Discussions are currently in progress on how to address this need.

### Fungicide Evaluation

Fungicide evaluations for control of *Sclerotinia* head rot were conducted at Carrington, Langdon, Morden, and Brookings. Since treatments varied widely among sites, each cooperator will present his results separately and only the Carrington data is discussed here.

At Carrington, the same methodology was used as for the germplasm evaluations. Treatments were based upon Endura (boscalid) and Topsin 4.5 F (thiophanate-methyl), with dates of multiple applications separated by 14-day intervals. Endura tended to reduce disease incidence on both evaluation dates and the 3-application treatment significantly reduced severity on the second evaluation (Table 2).

Although the Endura treatments show some promise in controlling head rot, better control is needed. Since both these products have been shown to be effective in other crops, application technology may be the limiting factor. The flowering period for sunflower is quite long and maintaining protection against disease will likely require multiple applications. More work is needed in studying application timing in relation to favorable weather for disease infection and development. Also, variations in head orientation and position in the canopy complicate obtaining uniform, adequate coverage. Directed sprays and different nozzle types and / or configurations may be needed. Adjuvants to improve fungicide absorption by the plant may also be beneficial. The results of the various treatments applied at the individual sites this year should provide direction in designing the next round of fungicide treatment investigations.



Sunflower head rot misting system in action.

Table 1. Head rot ratings in selections from the 2004 evaluation, NDSU Carrington and Langdon, 2005.

Company	Hybrid	Incidence (%)		Rank	
		Carrington	Langdon	Carrington	Langdon
Seeds2000	X936	27	24	1	8
USDA Check	277	31	20	2	6
Interstate	Hysun450	40	3	3	1
Monsanto	EXP35-10NS	40	17	3	3
Seeds2000	X978	43	7	5	2
Proseed	9405	44	19	6	5
USDA Check	441X440	55	24	7	9
Proseed	C9011	56	39	8	13
Seeds2000	X4794	60	18	9	4
Interstate	4540NS	65	27	10	10
Legend Seeds	LSF126N	66	21	11	7
Mycogen	8N510	73	30	12	11
USDA Check	270	76	58	13	16
Mycogen	8N352	86	31	14	12
Croplan Genetics	CL135	87	41	15	14
CHS	RH318	89	52	16	15

Table 2. Disease ratings in the sunflower head rot fungicide evaluation, NDSU Carrington, 2005.

Treatment (Rate in oz.)	1st Evaluation		2nd Evaluation	
	Incidence	Severity	Incidence	Severity
Endura (4.5 + 4.5)	42	0.71	62	0.95
Endura (3 applications of 4.5)	32	0.68	53	0.82
Endura (6.0 + 6.0)	33	0.76	46	0.91
Endura (9.0 + 9.0)	37	0.67	56	0.95
Topsin 4.5 F (20)	54	0.75	69	0.94
Topsin 4.5 F (40)	55	0.72	71	0.97
Untreated	48	0.74	67	0.97
Mean	43	0.72	61	0.93
C.V. (%)	34.9	18.9	25.3	6.8
P-value	0.193	0.952	0.256	0.039

Figure 1. Head rot incidence in the 2005 initial screening, NDSU Carrington.

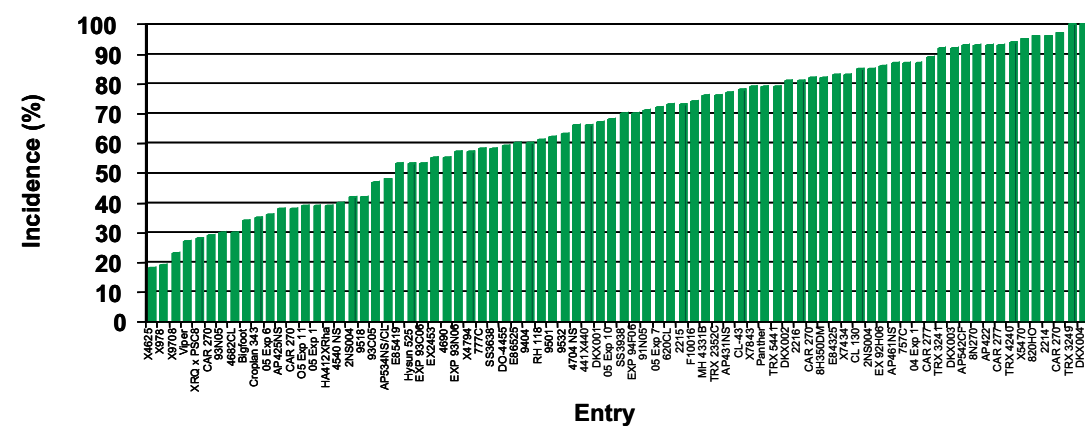
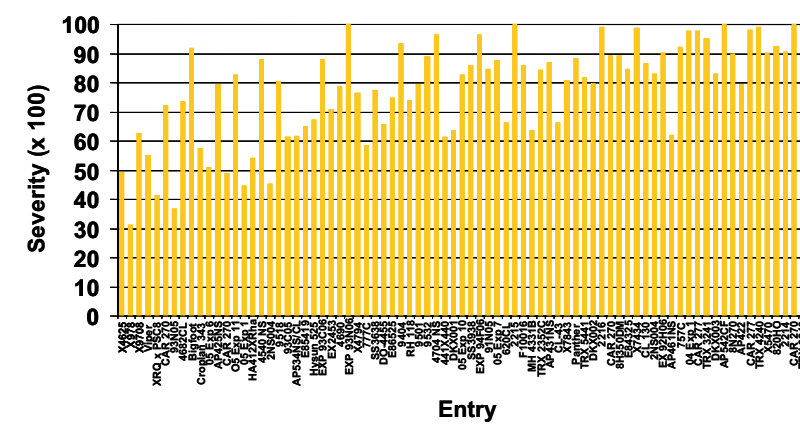


Figure 2. Head rot severity in the 2005 initial screening, NDSU Carrington.



Disease rating 1.



Disease rating 2.



Disease rating 3.



Disease rating 4.



Disease rating 5.

## ACKNOWLEDGMENTS

This research was made possible by a grant from the U.S. Department of Agriculture under Agreement No. 58-5442-4-279, a cooperative project with the USDA-ARS *Sclerotinia* Initiative. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture. The authors wish to thank M. Swanson, S. Radi, N. Bolsheshev, and B. Montgomery for technical assistance and M. Friedt and S. Rzaszutak for poster presentation.