

Evaluation of fungicides for Management of Sclerotinia Head Rot on Sunflower, 2011

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Introduction:

Sclerotinia head rot (also called white mold), caused by the fungal pathogen *Sclerotinia sclerotiorum*, continues to be a major yield-limiting factor in sunflower production in the United States. Recent improvements in fungicide options for white molds management in other crops and a high market price for sunflowers has resulted in a revival of interest of fungicides as a potential management option for disease. Additionally, with some improvements in genetics for resistance the possibility of fungicide application in an IPM strategy may be viable.

Objective:

Evaluate fungicides for management of sclerotinia head rot in sunflower.

Materials and Methods:

Three locations were selected to host fungicides trials in 2011, namely; North Dakota State Universities (NDSU) Carrington Research Extension Center in Carrington, ND (CREC), the NDSU Langdon Research Extension Center in Langdon, ND (LREC) and the University of Nebraska's Panhandle Research Extension Center in Scotts Bluff, NE (UNSB). Confection hybrid Jaguar was used in all locations. In each location, the trials were designed as RCBD with four replications and planted in four row plots with row width 30 inches and length 25 feet. Sunflowers were produced according to recommended University production practices for each region, including stand density, weed control, planting and harvest dates, etc..

Sunflower heads were inoculated with a suspension of *Sclerotinia sclerotiorum* ascospores multiple times during the R5.0 to R5.9 growth stages. Supplemental irrigation was used as deemed appropriate to facilitate infection and disease development. Fungicides tested in this study ranged from 12-14 treatments and included chemicals from different FRAC groups and with an emphasis on chemicals that have shown promise for white mold management on other crops. Fungicides were applied at two different time periods, with the first application at approximately R5.2 to R5.6 growth stages and the second application approximately 7-10 days later. Disease was evaluated as incidence (total heads infected), severity on a 0-5 scale where: 0 = no symptoms, 1 = 1 to 25% of the head diseased; 2 = 26 to 50% of the head diseased; 3 = 51 to 75% of the head diseased; 4 = 76 to 99% of the head diseased; 5 = 100% of the head diseased. A disease severity index (DSI) was determined using both incidence and severity data. Yield was determined at harvest. Data was analyzed with SAS v.9.2. in CREC and LREC and ARM 8 (UNSB).

Results and Discussion:

Disease developed at LREC (Table 1) and CREC (Table 2), although a severe hail storm (2 – 3 cm stones) on 24 July in CREC severely damaged sunflowers in that location and yield could not be obtained from the trial. Disease did not develop at UNSB (Table 3), likely to due to temperatures that exceed 85 degree F throughout the later R stages of growth. Disease difference between the non-treated controls and the treatments were not observed in any measure at CREC or LREC. Statistical differences in disease heads were observed at UNSB, but incidence was very low and results are not conclusive. No treatment resulted in yield higher than the non-treated control at any location.

Conclusion:

Although fungicides did not perform well enough to reduce disease or improve yield, this may have been due in part to the high level of variability in the plots. Sclerotinia head rot and sunflower yield components are notoriously variable in small plot research, and in order to improve the resolution of the data in effort to observe treatment differences large plots need to be used in 2012.

Table 1. Field evaluation of fungicides for management of Sclerotinia head rot on sunflower, Langdon, ND 2011

| TREATMENT (Application timing ¹) | | Sample size ² | SCLEROTINIA HEAD ROT | | | | | YIELD lbs/ac | TEST WEIGHT lbs/bu | | | |
|---|--|--------------------------|-----------------------------------|---------------------------------|--------|----------------------------|--------|-----------------|-----------------------|-----|------|-----|
| | | | September 15 | | | | | | | | | |
| | | | Incidence ³ percent | Severity ⁴ 1 to 5 | | DSI ⁵ 0 to 5 | | | | | | |
| 1 | Non-treated check | 57 | 35 | ab * | 2.5 | a * | 0.9 | ab * | 1954 | a * | 20.1 | a * |
| 2 | Vertisan 1.67EC 30 fl oz/ac (A,B) | 49 | 35 | ab | 3.0 | a | 1.0 | ab | 1923 | a | 20.2 | a |
| 3 | Approach 2.08SC 12 fl oz/ac (A,B) | 49 | 50 | ab | 2.4 | a | 1.2 | ab | 1192 | a | 19.0 | a |
| 4 | Q8X63 200SC 28.8 fl oz/ac (A,B) | 45 | 31 | ab | 2.3 | a | 0.7 | ab | 2072 | a | 20.1 | a |
| 5 | Endura 70WG 9 oz/ac (A,B) | 44 | 11 | a | 1.2 | a | 0.1 | a | 2067 | a | 19.6 | a |
| 6 | Merivon (BAS 703 01F) 6 fl oz/ac (A,B) | 44 | 17 | ab | 1.8 | a | 0.4 | ab | 1923 | a | 19.4 | a |
| 7 | ProPulse 400SC 10.3 fl oz/ac (A,B) | 43 | 28 | ab | 1.6 | a | 0.5 | ab | 1941 | a | 19.8 | a |
| 8 | Topsin 4.5FL 40 fl oz/ac (A,B) | 47 | 27 | ab | 1.9 | a | 0.6 | ab | 1901 | a | 19.7 | a |
| 9 | Quash 50WG 4 oz/ac (A,B) | 45 | 22 | ab | 1.8 | a | 0.4 | ab | 1457 | a | 19.4 | a |
| 10 | Omega 500F 1 pt/ac (A,B) | 43 | 42 | ab | 2.2 | a | 0.9 | ab | 2198 | a | 19.2 | a |
| 11 | Domark 230ME 5 fl oz/ac (A,B) | 42 | 19 | ab | 1.7 | a | 0.4 | ab | 1557 | a | 19.6 | a |
| 12 | Switch 62.5WG 14 oz/ac (A,B) | 51 | 51 | ab | 2.9 | a | 1.4 | b | 1893 | a | 19.9 | a |
| 13 | Rovral 4F 2 pt/ac (A,B) | 61 | 43 | ab | 2.3 | a | 1.0 | ab | 1723 | a | 20.2 | a |
| 14 | Priaxor 500SC 6.0 fl oz/ac (A,B) | 52 | 57 | b | 2.2 | a | 1.3 | ab | 1976 | a | 20.6 | a |
| Treatment differences, <i>F</i> : ⁶ | | | 2.44 | 1.30 | 2.61 | 1.25 | 1.69 | | | | | |
| Treatment differences, <i>P</i> > <i>F</i> : ⁷ | | | 0.0259 | 0.2891 | 0.0181 | 0.3005 | 0.1246 | | | | | |
| C.V.: | | | 52.7 | 38.1 | 64.5 | 24.0 | 3.3 | | | | | |

¹ Application timing: A = August 9; B = August 14

² Sample size: Number of plants evaluated for sclerotinia head rot (total across all four replicates of experiment).

³ Incidence: Percent of plants exhibiting Sclerotinia head rot symptoms.

⁴ Severity: Sclerotinia head rot severity on plants showing disease; a 1 to 5 scale was used, with 1 = 1 to 25% of the head diseased; 2 = 26 to 50% of the head diseased; 3 = 51 to 75% of the head diseased; 4 = 76 to 99% of the head diseased; 5 = 100% of the head diseased. Only diseased plants (sometimes a lower number than the sample size) contributed to this rating.

⁵ Disease severity index: A combination of disease severity and disease incidence; a 0 to 5 scale was used, with 0 = no symptoms, 1 = 1 to 25% of the head diseased; 2 = 26 to 50% of the head diseased; 3 = 51 to 75% of the head diseased; 4 = 76 to 99% of the head diseased; 5 = 100% of the head diseased.

⁶ **Treatment differences, *F*:** *F*-values associated with the test of the null hypothesis that there are no differences among treatments. ANOVA was executed in PROC GLM of SAS (version 9.13). Replicate, treatment, and replicate-by-treatment interaction were included in the model; the reported *F* statistic is from the Type I sum of squares and shows the effect of the treatments after controlling for the effect of experimental replicate.

⁷ **Treatment differences, *P* > *F*:** Probability of observing an *F*-statistic greater than that observed; an assessment of the significance of treatment differences.

* **Within-column means followed by different letters are significantly different** (alpha = 0.05; Tukey multiple comparison procedure)

Table 2. Field evaluation of fungicides for management of Sclerotinia head rot on sunflower, Carrington, ND 2011

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¹ NDSU Carrington Research Extension Center, Carrington, ND; ² NDSU Department of Plant Pathology, Fargo, ND.

| TREATMENT (Application timing ¹) | | Sample size ² | SCLEROTINIA HEAD ROT September 19 (R8 growth stage) | | | Sample size ² | SCLEROTINIA HEAD ROT September 30 (R9 growth stage) | | |
|---|--|--------------------------|--|-----------------------|------------------|--------------------------|--|-----------------------|------------------|
| | | | Incidence ³ | Severity ⁴ | DSI ⁵ | | Incidence ³ | Severity ⁴ | DSI ⁵ |
| | | | percent | 1 to 5 | 0 to 5 | | percent | 1 to 5 | 0 to 5 |
| 1 | Non-treated check | 79 | 67 a* | 2.8 a* | 1.9 a* | 79 | 98 a* | 3.2 a* | 3.2 a* |
| 2 | Vertisan 1.67EC 30 fl oz/ac (A,B) | 69 | 73 a | 2.7 a | 2.0 a | 68 | 98 a | 3.4 a | 3.3 a |
| 3 | Approach 2.08SC 12 fl oz/ac (A,B) | 79 | 56 a | 2.5 a | 1.4 a | 78 | 92 a | 2.7 a | 2.5 a |
| 4 | Q8X63 200SC 28.8 fl oz/ac (A,B) | 81 | 80 a | 3.0 a | 2.4 a | 80 | 98 a | 3.5 a | 3.4 a |
| 5 | Endura 70WG 9 oz/ac (A,B) | 77 | 72 a | 2.3 a | 1.7 a | 77 | 96 a | 3.0 a | 2.9 a |
| 6 | Merivon (BAS 703 01F) 6 fl oz/ac (A,B) | 67 | 81 a | 2.7 a | 2.2 a | 67 | 95 a | 3.2 a | 3.0 a |
| 7 | ProPulse 400SC 10.3 fl oz/ac (A,B) | 59 | 68 a | 2.7 a | 1.9 a | 58 | 95 a | 3.0 a | 2.9 a |
| 8 | Topsin 4.5FL 40 fl oz/ac (A,B) | 81 | 74 a | 3.1 a | 2.4 a | 78 | 95 a | 3.5 a | 3.3 a |
| 9 | Quash 50WG 4 oz/ac (A,B) | 65 | 81 a | 3.2 a | 2.6 a | 64 | 97 a | 3.8 a | 3.7 a |
| 10 | Omega 500F 1 pt/ac (A,B) | 71 | 82 a | 2.9 a | 2.4 a | 70 | 99 a | 3.6 a | 3.6 a |
| 11 | Domark 230ME 5 fl oz/ac (A,B) | 71 | 75 a | 2.7 a | 2.0 a | 70 | 97 a | 3.4 a | 3.3 a |
| 12 | Switch 62.5WG 14 oz/ac (A,B) | 69 | 72 a | 2.8 a | 2.1 a | 69 | 96 a | 3.1 a | 3.0 a |
| 13 | Rovral 4F 2 pt/ac (A,B) | 64 | 75 a | 2.7 a | 2.0 a | 61 | 98 a | 3.4 a | 3.3 a |
| 14 | Priaxor 500SC 6.0 fl oz/ac (A,B) | 70 | 76 a | 2.8 a | 2.1 a | 69 | 97 a | 3.0 a | 2.9 a |
| Treatment differences, <i>F</i> : ⁶ | | | 0.93 | 1.29 | 1.20 | | 0.55 | 1.32 | 1.29 |
| Treatment differences, <i>P</i> > <i>F</i> : ⁷ | | | 0.5336 | 0.2770 | 0.3316 | | 0.8699 | 0.2587 | 0.2750 |
| C.V.: | | | 14.37 | 5.31 | 27.49 | | 4.99 | 5.40 | 17.76 |

¹ Application timing: A = Sunday, Aug. 14; R5.2 to R5.6 growth stage; B = Wednesday, Aug. 24 at 8:00-9:30 pm; R5.8 to R6 growth stage

² Sample size: Number of plants evaluated for sclerotinia head rot.

³ Incidence: Percent of plants exhibiting Sclerotinia head rot symptoms.

⁴ Severity: Sclerotinia head rot severity on plants showing disease: a 1 to 5 scale was used, with 1 = 1 to 25% of the head diseased; 2 = 26 to 50% of the head diseased; 3 = 51 to 75% of the head diseased; 4 = 76 to 99% of the head diseased; 5 = 100% of the head diseased. Only diseased plants (sometimes a lower number than the sample size) contributed to this rating.

⁵ **Disease severity index:** A combination of disease severity and disease incidence; a 0 to 5 scale was used, with 0 = no symptoms, 1 = 1 to 25% of the head diseased; 2 = 26 to 50% of the head diseased; 3 = 51 to 75% of the head diseased; 4 = 76 to 99% of the head diseased; 5 = 100% of the head diseased.

⁶ **Treatment differences, *F*:** *F*-values associated with the test of the null hypothesis that there are no differences among treatments.

⁷ **Treatment differences, *P* > *F*:** Probability of observing an *F*-statistic greater than that observed; an assessment of the significance of treatment differences.

* **Within-column means followed by different letters are significantly different** (alpha = 0.05; Tukey multiple comparison procedure)

Table 3. Field evaluation of fungicides for management of Sclerotinia head rot on sunflower, Scotts Bluff, NE, 2011

Robert Harveson, Kathy Nielson and Clay Carlson

¹ University of Nebraska, Scotts Bluff

| | | 10-11-11 | | | | |
|--|------------------------------------|--------------------------|-----------------------------|------------|-----|--|
| TREATMENT (Application timing ¹) | | Total Heads ² | Diseased Heads ³ | Yield lb/A | | |
| 1 | Non-treated check | 34 a | 0 b | 2145 | ab | |
| 2 | Topsin 4.5FL 30 fl oz/ac (A,B) | 31 a | 0.50 ab | 1702 | c | |
| 3 | Proline 5.7 fl oz/ac | 29 a | 0 b | 1832 | bc | |
| 4 | Rovral 4F 2 pt/ac (A,B) | 33 a | 0.25 ab | 1833 | bc | |
| 5 | Quadris 12.0 fl oz/ac | 33 a | 0 b | 2053 | abc | |
| 6 | Approach 2.08SC 12 fl oz/ac (A,B) | 34 a | 0 b | 2213 | a | |
| 7 | ProPulse 400SC 10.3 fl oz/ac (A,B) | 31 a | 0 b | 1811 | bc | |
| 8 | Endura 70WG 9 oz/ac (A,B) | 33 a | 0.75 a | 1995 | abc | |
| 9 | Vertisan 1.67EC 30 fl oz/ac (A,B) | 34 a | 0 b | 2052 | abc | |
| 10 | Stratego 5.0 fl oz/ac | 32 a | 0.50 ab | 1919 | abc | |
| 11 | Omega 500F 1 pt/ac (A,B) | 30 a | 0 b | 1878 | abc | |
| 12 | Headline SC 12 fl oz/ac | 30 a | 0 b | 1730 | c | |
| LSD (P=0.05) | | 6.0 | 0.6219 | 376.82 | | |
| C.V.: | | 2.03452 | 2.03452 | 2.03452 | | |

¹ Application timing: A = August 28 2011: R5 growth stage; B = October 11, 2011

² Total Heads: Number of plants evaluated for sclerotinia head rot.

³ Diseased Heads: Number of plants exhibiting Sclerotinia head rot symptoms.