# Quantifying Yield Loss from Rhizopus Head Rot in Sunflower

Bob Harveson, University of Nebraska, Panhandle REC, Scottsbluff, Sam Markell, North Dakota State University, and Febina Mathew, South Dakota State University,

Michelle Gilley, NDSU, Scott Fitterer, BASF, David Carruth, BASF, Nathan Braun, SDSU, Brian Kontz, SDSU, Tyler Patrick, UNL, PHREC, Allison Rickey, UNL, PHREC, Clay Carlson, UNL, PHREC

# Rhizopus Head Rot

- Rhizopus head rot (RHR) has historically been considered a disease of minor importance
- Identified as a major constraint for Central High Plains (Kansas, Colorado, and Nebraska)
- In last several years has been problematic in Northern Plains (North Dakota, South Dakota, and Minnesota)
- Recent NSA surveys have been identified from 40% of fields in Northern Plains

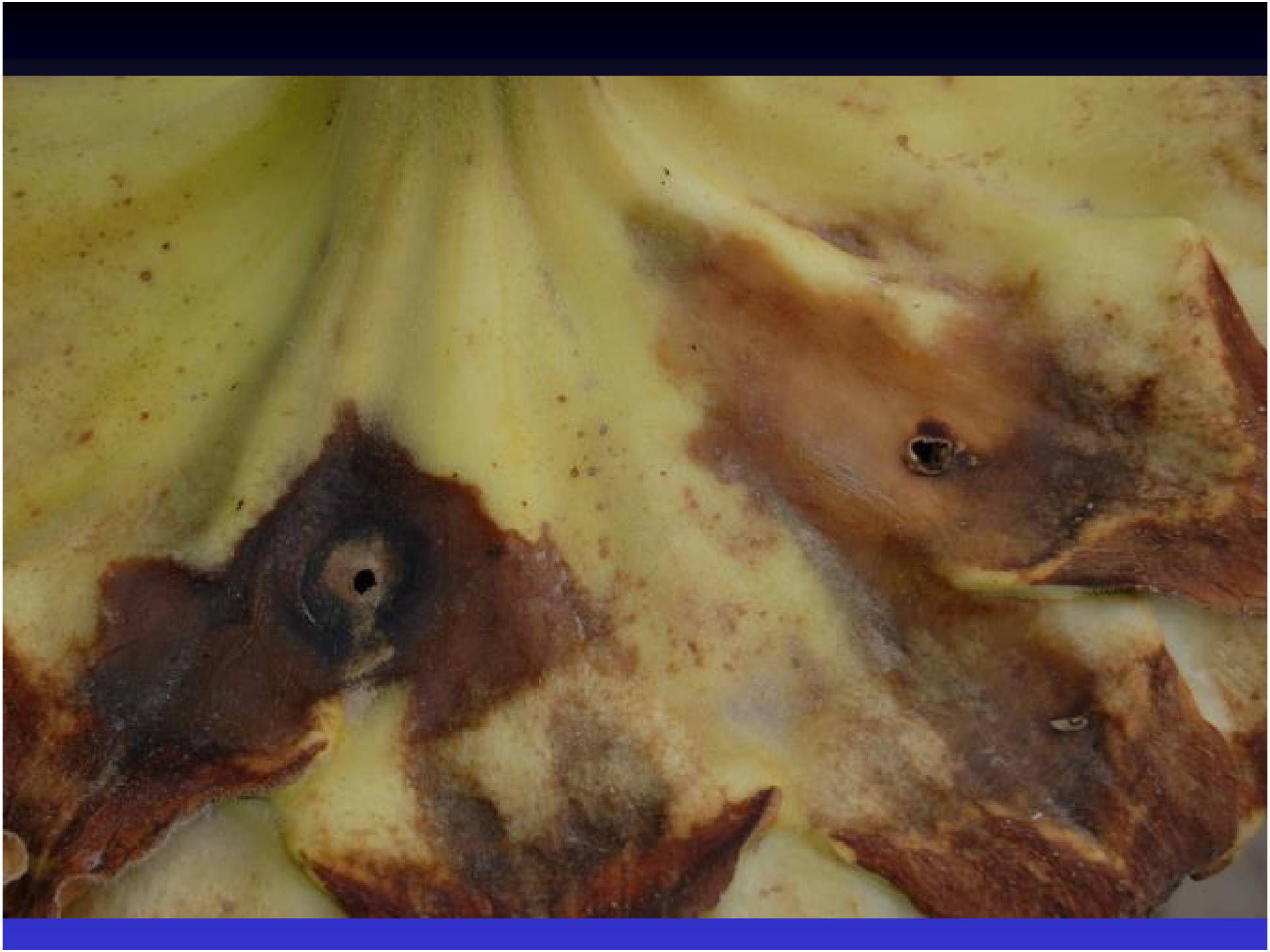
# Rhizopus Head Rot

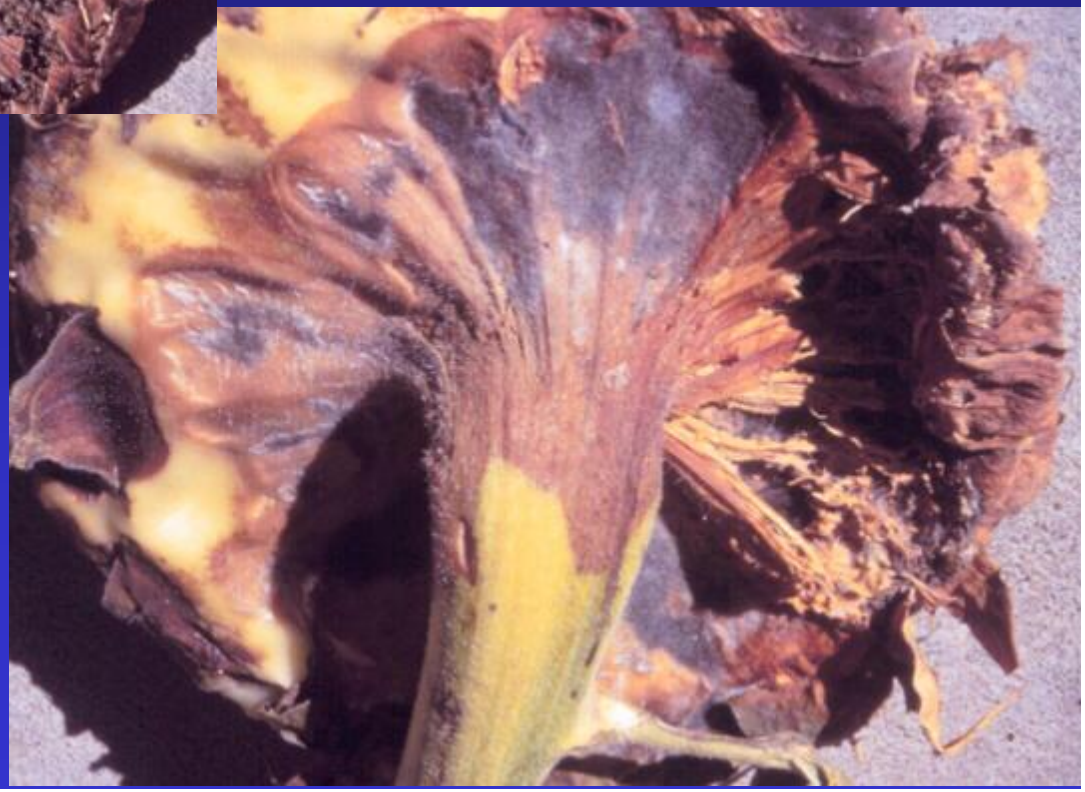
- Pathogen
  - *Rhizopus arrhizus*, *R. stolonifer*, and *R. microsporus*
- Life Cycle and Infection
  - Overwinters in soils as sporangia and opportunistically infects through wounds under conditions of high humidity
- Capable of causing serious yield losses

# Seed Drop – Hail and Disease

# Signs and Symptoms

- Dark spots on back of ripening heads
- Watery soft rot that turns dark with age
- Grayish, fuzzy fungal growth seen on flower side of head
- Heads dry prematurely, shrivel, and become shredded
- Disease severity and spread increased by summer thunderstorms/hail





# Hail Damage Initiates Infection

# Objectives

- Induce disease and document the extent of potential damage to both oil and confectionary sunflower yields under field conditions
- Multiple geographically and environmentally different locations within sunflower production areas of the Great Plains

# Methodology

- Plots established in North Dakota, South Dakota, and Nebraska
- All planted in May
- NE – confectionary type and sprinkler irrigated
- ND and SD – oil type and rainfed

# Methodology

- Plots - four 30 inch rows – 25 ft in length
- Inoculated August (at R5 stage)
- Disease ratings – ND and SD – late September – and mid October in NE
- NE harvested in October, SD in Nov

# Inoculations

- 5 heads from each inner row – 10 total/plot
- Treatments
  - Control
  - Wound with ball-peen hammer
  - Wound with hammer + inoculation
  - Wound with a cork borer
  - Wound with cork borer + inoculation

# Disease Ratings 0-4

- 0 = no signs or symptoms of disease
- 1 = 1-25% of head affected
- 2 = 26-50% of head affected
- 3 = 51-75% of head affected
- 4 – 76-100% of head affected

# Disease Index Procedure

$$\frac{(\#\text{ rated } 0 \times 0) + (\#\text{ rated } 1 \times 1) + (\#\text{ rated } 2 \times 2) + (\#\text{ rated } 3 \times 3) + (\#\text{ rated } 4 \times 4)}{(\text{Total number of heads} \times 4) \times 100}$$

# Rating of 1(left) and 2 (right)

# Rating of 3 (left) and 4 (right)

# Ratings of 4


Rating of 4

# Nebraska Results - 2018

| | Disease | Seed (lbs) | Head (lbs) |
|---|---|---|---|
| Control | 5.7c | 2.4b | 9.0c |
| Hammer | 20.1b | 2.3b | 10.2c |
| Hammer + Inoc | 32.5a | 1.0a | 3.8a |
| Cork borer | 18.7b | 2.3b | 10.0c |
| Cork borer + Inoc | 31.5a | 1.7a | 5.5b |

# South Dakota Results - 2018

| | Disease | Seed Yield (lbs) |
|---|---|---|
| Control | 15.7a | 1.9a |
| Hammer | 13.8a | 1.7a |
| Hammer + Inoc | 13.0a | 1.9a |
| Cork borer | 10.2a | 1.7a |
| Cork borer + Inoc | 15.1a | 1.8a |

# Conclusions in 2018

- No disease developed in ND (2 heads)
- Little disease in SD – no difference in treatments
- NE disease – less disease than in 2017 but yield reduction was 60% for one treatment
- No severe hailstorms for any site

# Nebraska Results 2017 – (Field 1)

| | Disease | Yield (lbs) |
|---|---|---|
| Control | 33.0c | 9.3a |
| Hammer | 78.5a | 5.5b |
| Hammer + Inoc | 75.5ab | 6.2b |
| Cork borer | 63.5b | 6.4b |
| Cork borer + Inoc | 84.0a | 5.5b |

# Nebraska Results 2017 - (Field 2)

| | Disease | Yield (lbs) |
|---|---|---|
| Control | 19.0b | 7.3a |
| Hammer | 65.9a | 6.7ab |
| Hammer + Inoc | 59.5a | 4.4c |
| Cork borer | 51.5a | 4.9bc |
| Cork borer + Inoc | 59.7a | 5.3bc |

# Summary (2017-2018)

- Able to establish adequate disease levels in 4 of 7 site years
- ND (2017-2018) and SD (2018) sites too cool for optimal disease development
- Severity of disease strongly influenced by storms (wounds in plants) and weather conditions
- 30-60% yield reductions documented

# Thank you for your support – Questions?