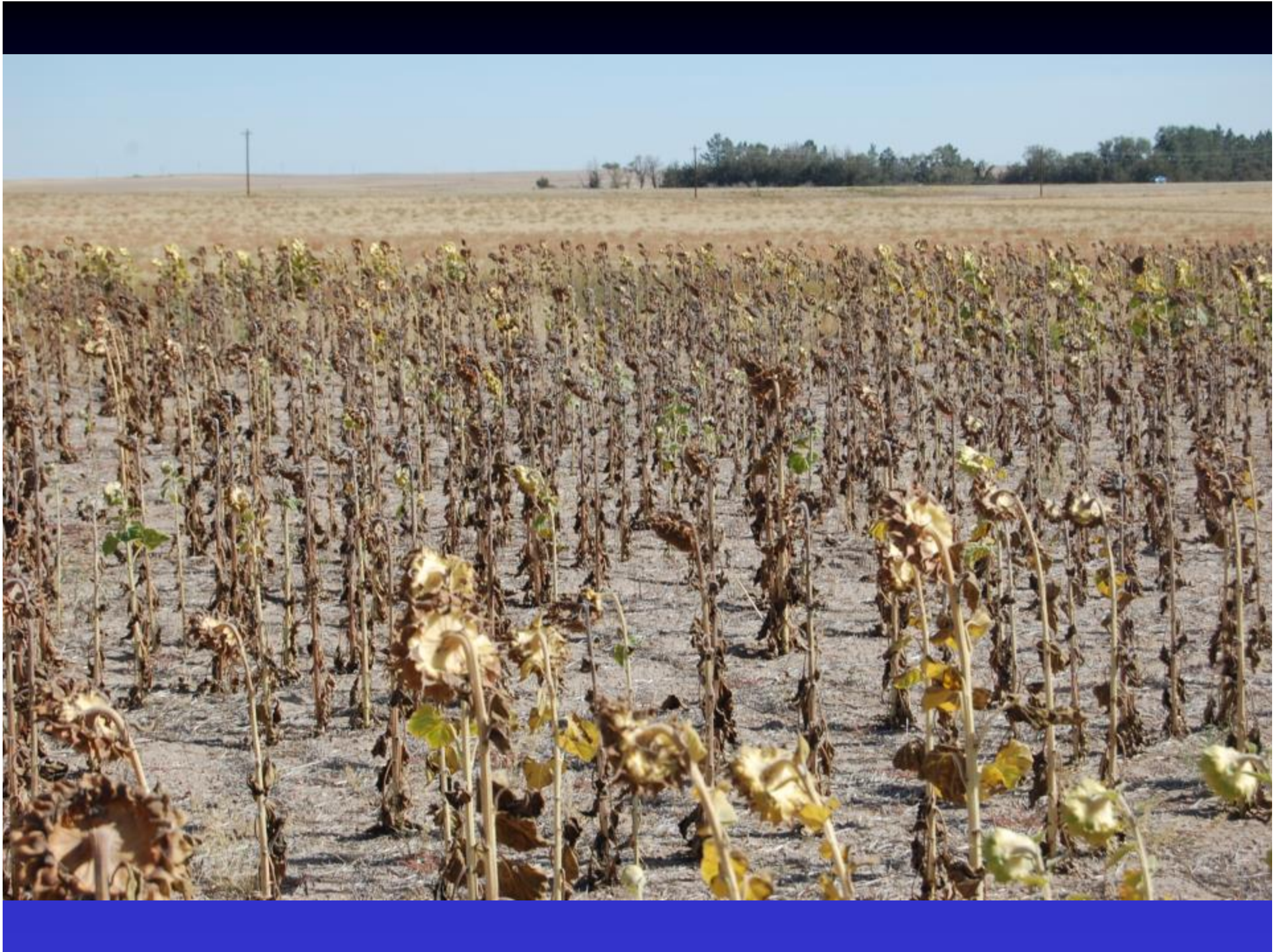


# Quantification of Yield Loss from Rhizopus Head Rot in Sunflower

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# Rhizopus Head Rot

- Caused by several fungal pathogens: *Rhizopus arrhizus*, *R. stolonifer*, and *R. microsporus*
- Overwinters in soils and opportunistically infects through wounds under conditions of high humidity and warm temperatures
- 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, and become shredded
- Disease severity and spread increased by summer thunderstorms/hail

# Hail Damage and Infection











# Purpose of the Project

- In 2016, it was problematic in North Dakota, South Dakota, and Minnesota
- More commonly seen in CHP – Nebraska, Colorado, and Kansas
- 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
- Plots 4 30 inch rows – 25 ft in length
- NE – confectionary type and sprinkler irrigated
- ND and SD – oil type and rainfed
- Inoculated mid-August (10 plants per plot at R5 stage)
- Disease ratings – late September to mid-October
- Harvest late October

# 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 Rating Procedure

$$(\# \text{ rated } 0 \times 0) + (\# \text{ rated } 1 \times 1) + (\# \text{ rated } 2 \times 2) + (\# \text{ rated } 3 \times 3) + (\# \text{ rated } 4 \times 4)$$

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$$(\text{Total number of heads} \times 4) \times 100$$



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



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



# Ratings of 4



## 2019 –August Hail Storms (Nebraska)

- Three SEVERE hailstorms occurred within 4 days in Scottsbluff and devastated the crop
  - 8/15/19 afternoon storm – 3:00 pm
  - 8/16/19 early morning storm – 3:00 am
  - 8/19/19 afternoon storm – 2:00 pm

**August 15**



**August 16**



**August 20**



**September 13**



**August 28**





# 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 2019

	Disease	Yield (lbs)
Control	14.7b	1.1a
Hammer	22.0a	0.9bc
Hammer + Inoc	25.2a	0.8c
Cork borer	26.4a	0.9bc
Cork borer + Inoc	24.0a	0.9bc

# 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



# South Dakota Results 2019

	Disease	Yield (g)
Control	76a	423.3bc
Hammer	66a	546.0ab
Hammer + Inoc	67a	291.1c
Cork borer	62a	604.1a
Cork borer + Inoc	79a	356.5c

# Summary (2017-2019)

- Able to establish adequate disease levels in 6 of 9 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
- Treatments more consistently produced higher disease levels with lower yields

# Yield Reductions

- Several treatments compared to controls:
  - 2017 – 40%-45% in NE and 30% in SD
  - 2018 – 45-60% in NE
  - 2019 – 45-50% in both NE and SD

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**Thank you for your support – Questions?**

