Evaluation of *Helianthus* germplasm for resistance to *Plasmopara halstedii* (downy mildew) and *Puccinia helianthi* (rust)

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Challenges and Limiting Factors

Disease- **#1** biological yield-limiting factor

1. Downy mildew
   - *Plasmopara halstedii*

2. Rust
   - *Puccinia helianthi*

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Downy Mildew Symptoms

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Photos: Friskop

Downy Mildew Yield Losses

Photo: Markell

Challenges and Limiting Factors

Disease- **#1** biological yield-limiting factor

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Challenges and Limiting Factors

Disease- **#1** biological yield-limiting factor

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2. Rust
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Symptoms and Signs

Photos: Markell

Management

- Genetic resistance is an effective management tool for both diseases
- Resistance genes are frequently overcome
- New sources of resistance are needed

Sources of resistance

- North American collection of wild *Helianthus* germplasm previously screened

- A disproportionate amount of resistance genes have been identified in germplasm originating from Texas

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http://www.flowerpictures.net/flower_database/c_flowers/common_sunflower.html

Objective

Identify new potential sources of resistance to:

1. *Plasmopara halstedii*
2. *Puccinia helianthi*

Materials and Methods

Host

- Wild *Helianthus* accessions derived from Texas
  - 182 *H. annuus*
  - 33 *H. argophyllus*
  - Obtained from the USDA North Central Regional Plant Introduction Station

Pathogen

- *P. halstedii* and *P. helianthi* isolates collected from North Dakota
  - Commonly detected races
  - Highly virulent races

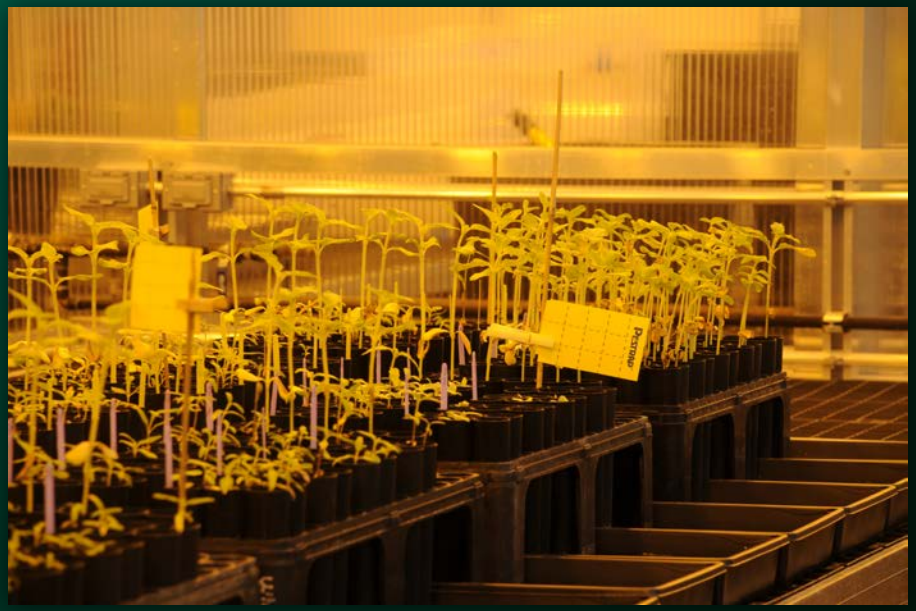

Photo: Humann

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Inoculation and Evaluation

Downy Mildew

- Seedlings were inoculated with *P. halstedii* zoosporangia
- Incidence was evaluated 11 days post-inoculation
  - % Resistance = Resistant plants / Total plants

Resistant

Susceptible

Photos: Humann

Results

1. Downy mildew
   – *Plasmopara halstedii*

2. Rust
   – *Puccinia helianthi*

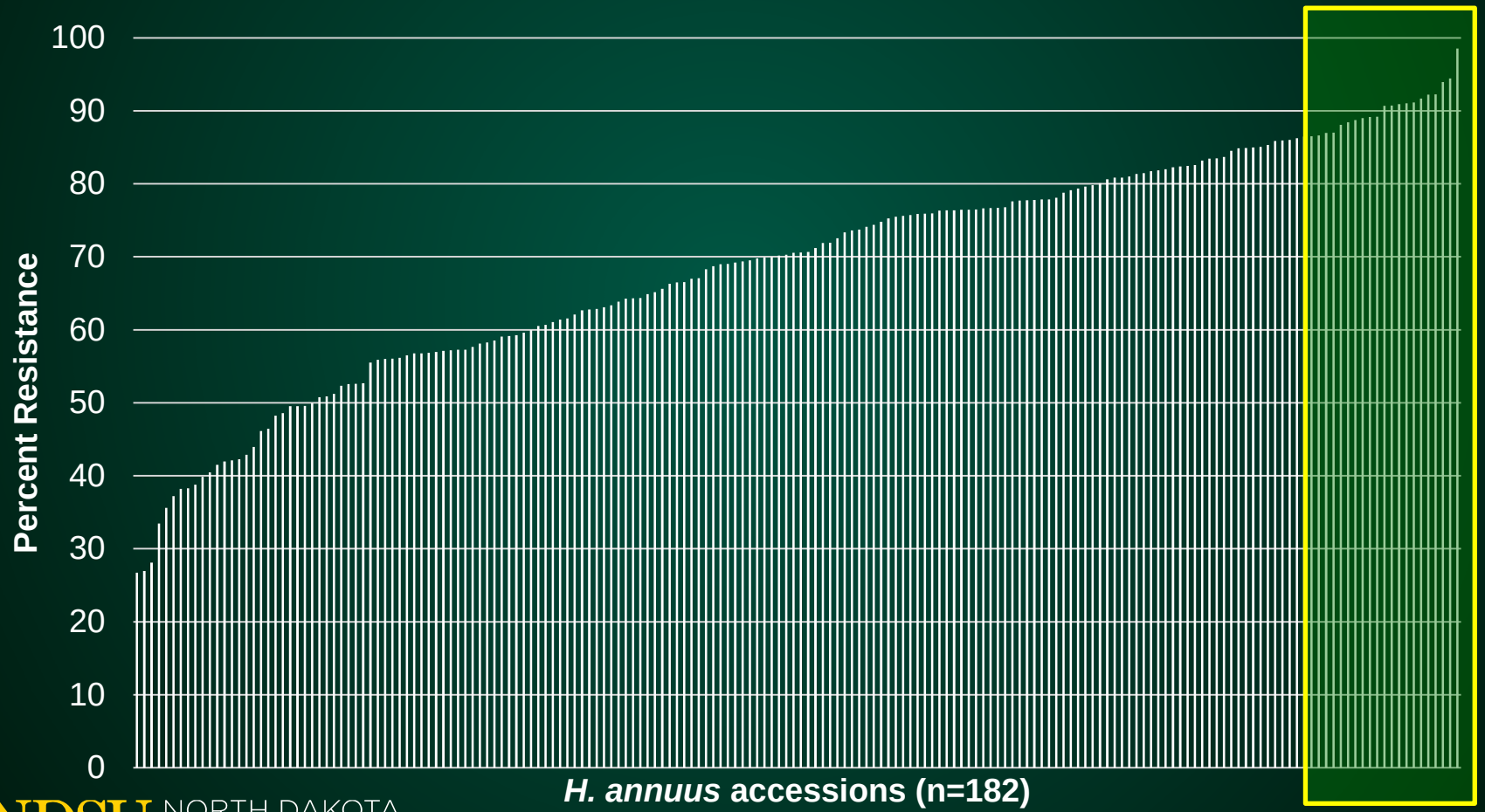
Downy Mildew
P. halstedii

Common Race

Highly Virulent Race

H. annuus

H. argophyllus



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Downy Mildew
P. halstedii

Common Race

Highly Virulent Race

H. annuus

H. argophyllus

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Downy Mildew
P. halstedii

Common Race

Highly Virulent Race

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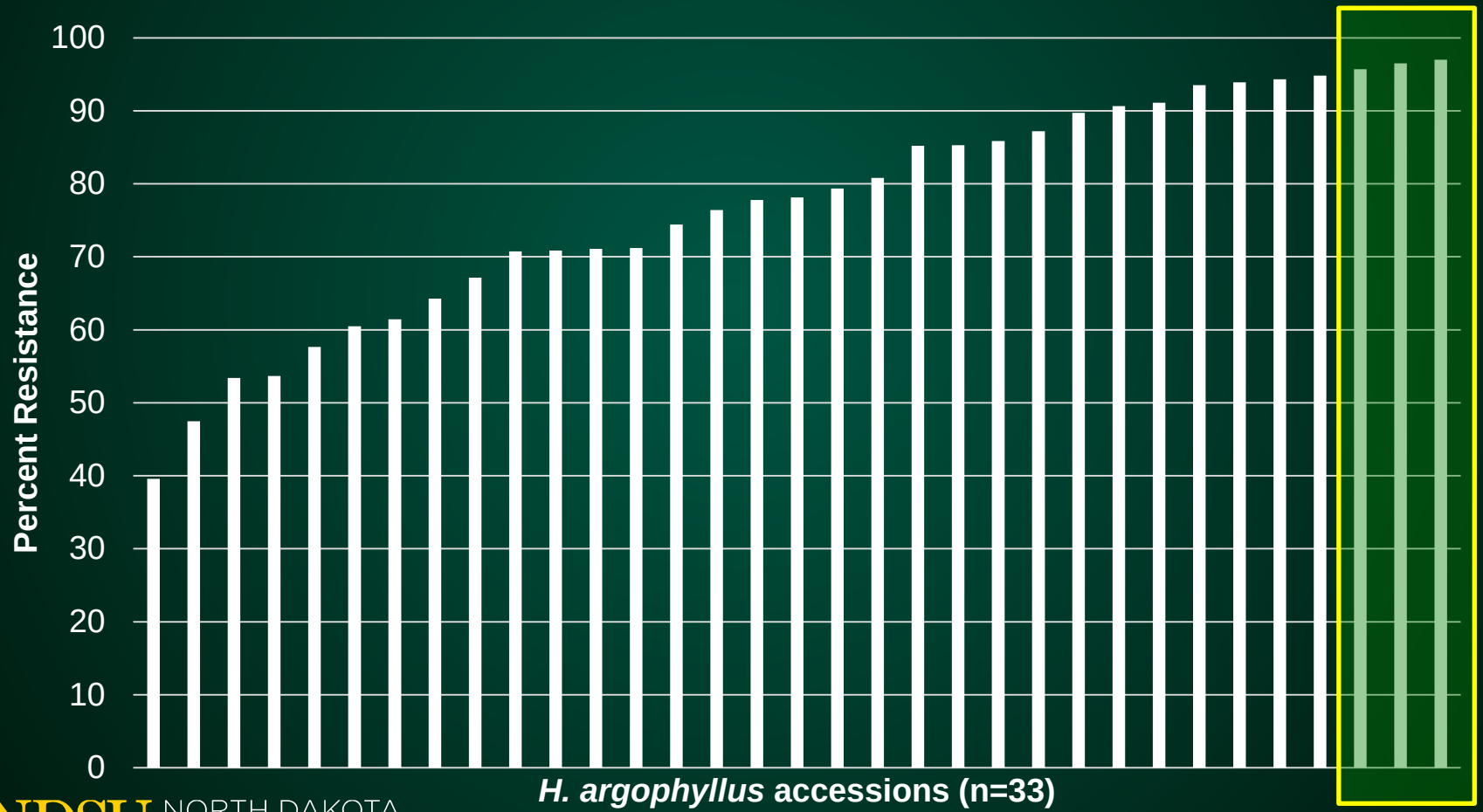

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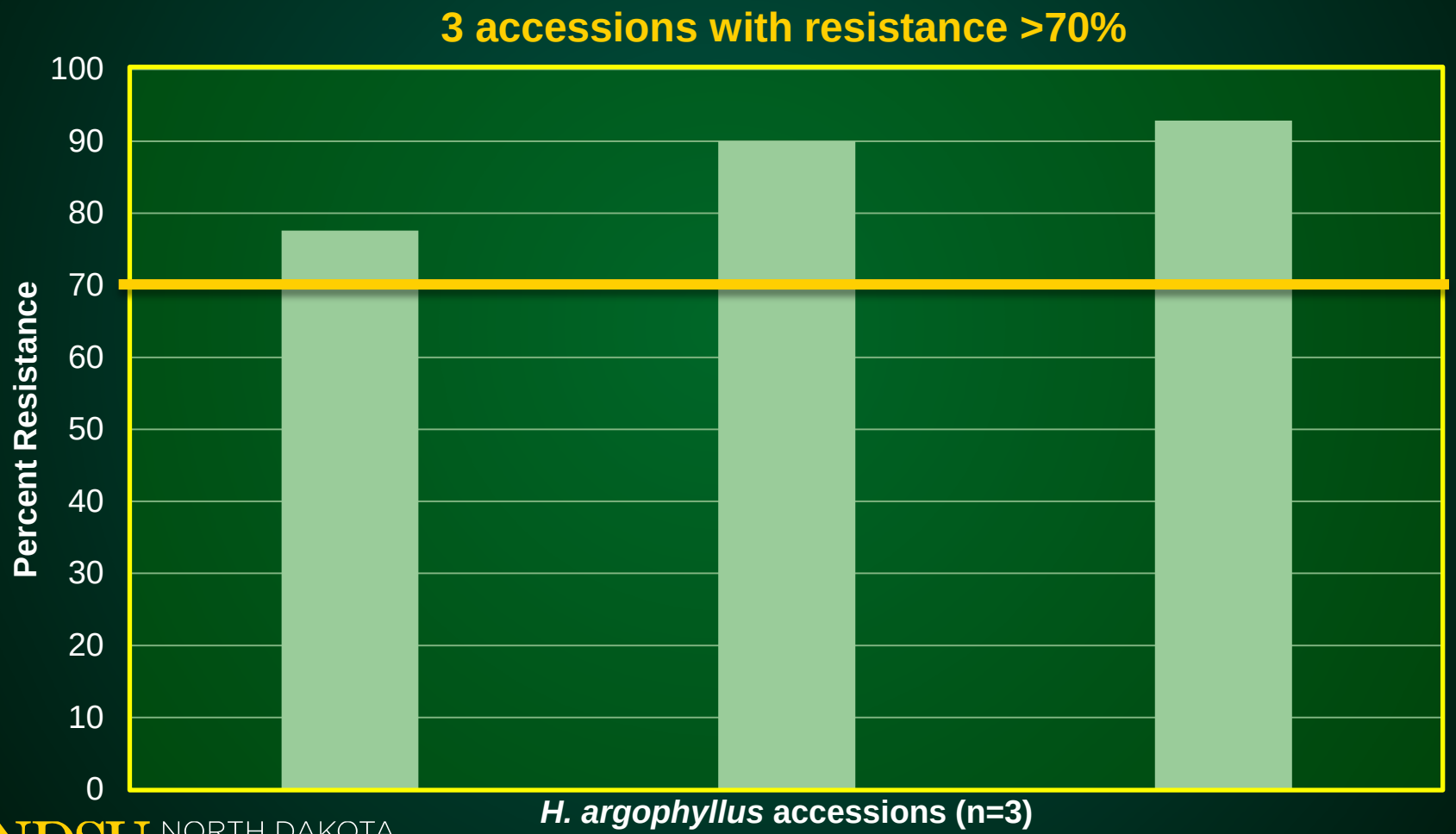
Downy Mildew
P. halstedii

Common Race	*H. annuus*
Highly Virulent Race	***H. argophyllus***



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Inoculation and Evaluation

Rust

- Plants inoculated 14 days after planting with *P. helianthi* urediniospores
- Infection types were evaluated 14 days post-inoculation
  - % Resistance = Resistant plants / Total plants

Resistant Reactions (0, ;, 1, 2)

Susceptible Reactions (3, 4, 5)

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Photo: Humann

Results

1. Downy mildew
   – *Plasmopara halstedii*

2. Rust
   – *Puccinia helianthi*

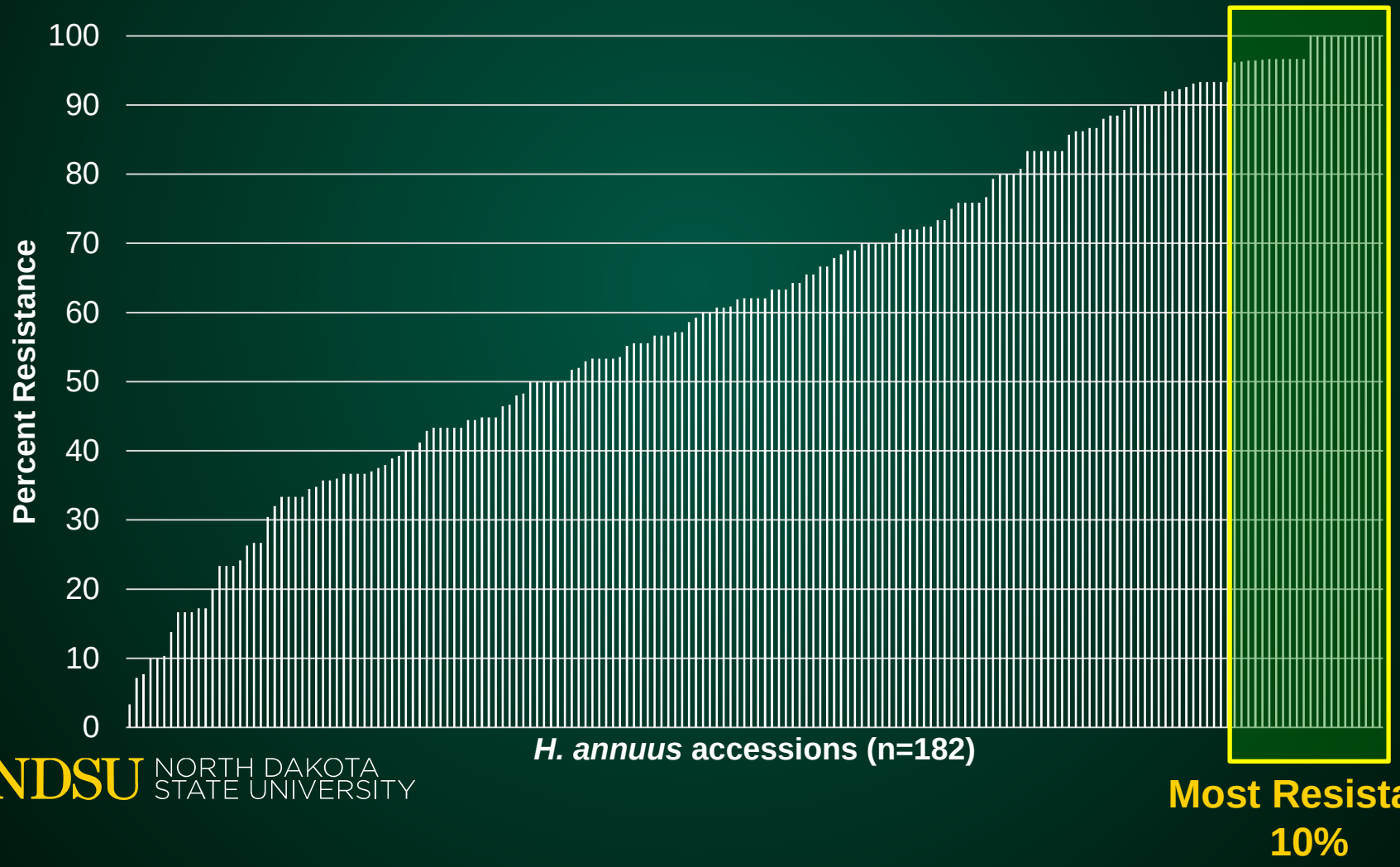
Rust
P. helianthi

Common Race

Highly Virulent Race

H. annuus

H. argophyllus



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Rust
P. helianthi

Common Race

Highly Virulent Race

H. annuus

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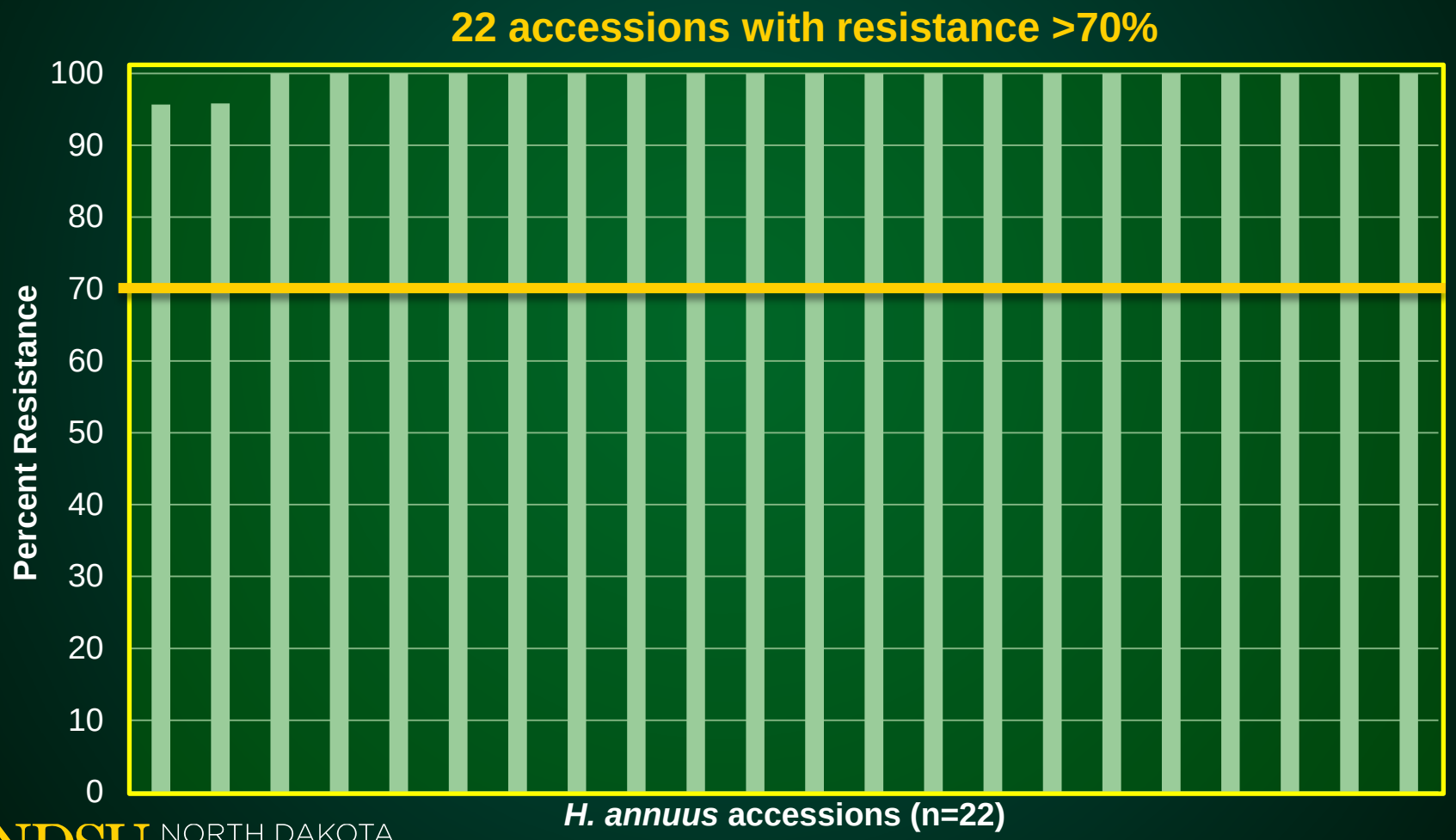

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Rust
P. helianthi

Common Race

Highly Virulent Race

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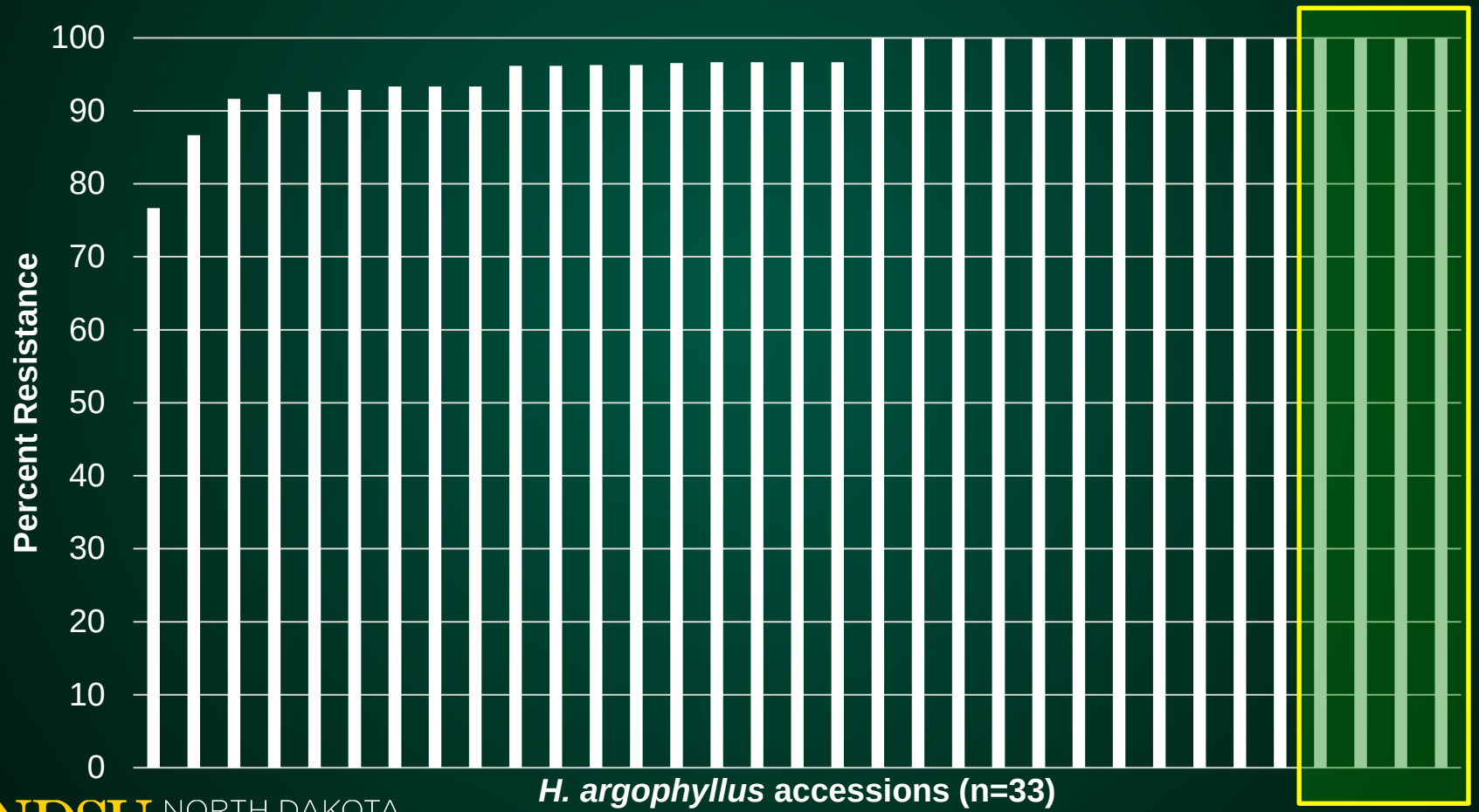

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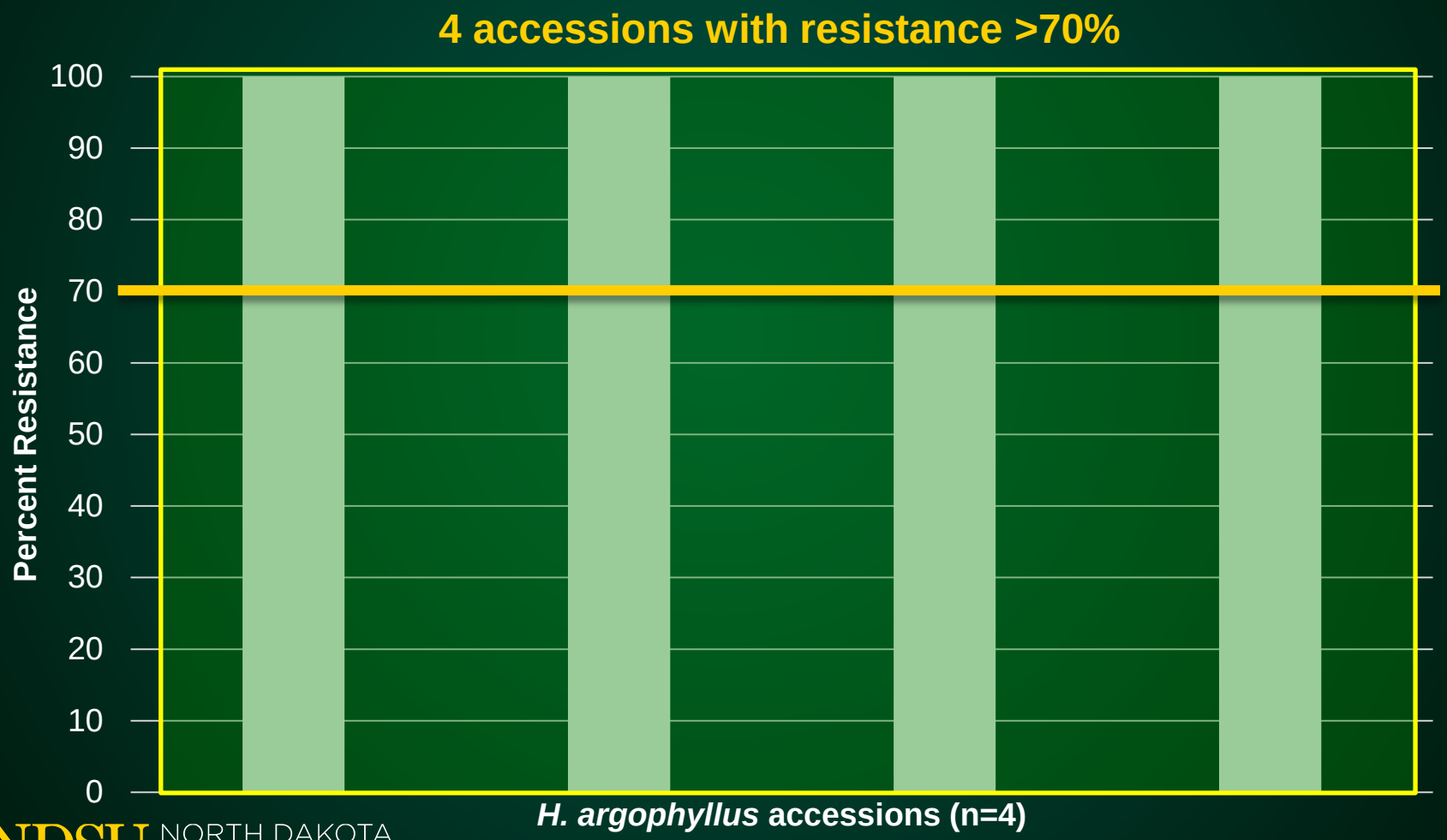
Rust
P. helianthi

Common Race	*H. annuus*
Highly Virulent Race	***H. argophyllus***



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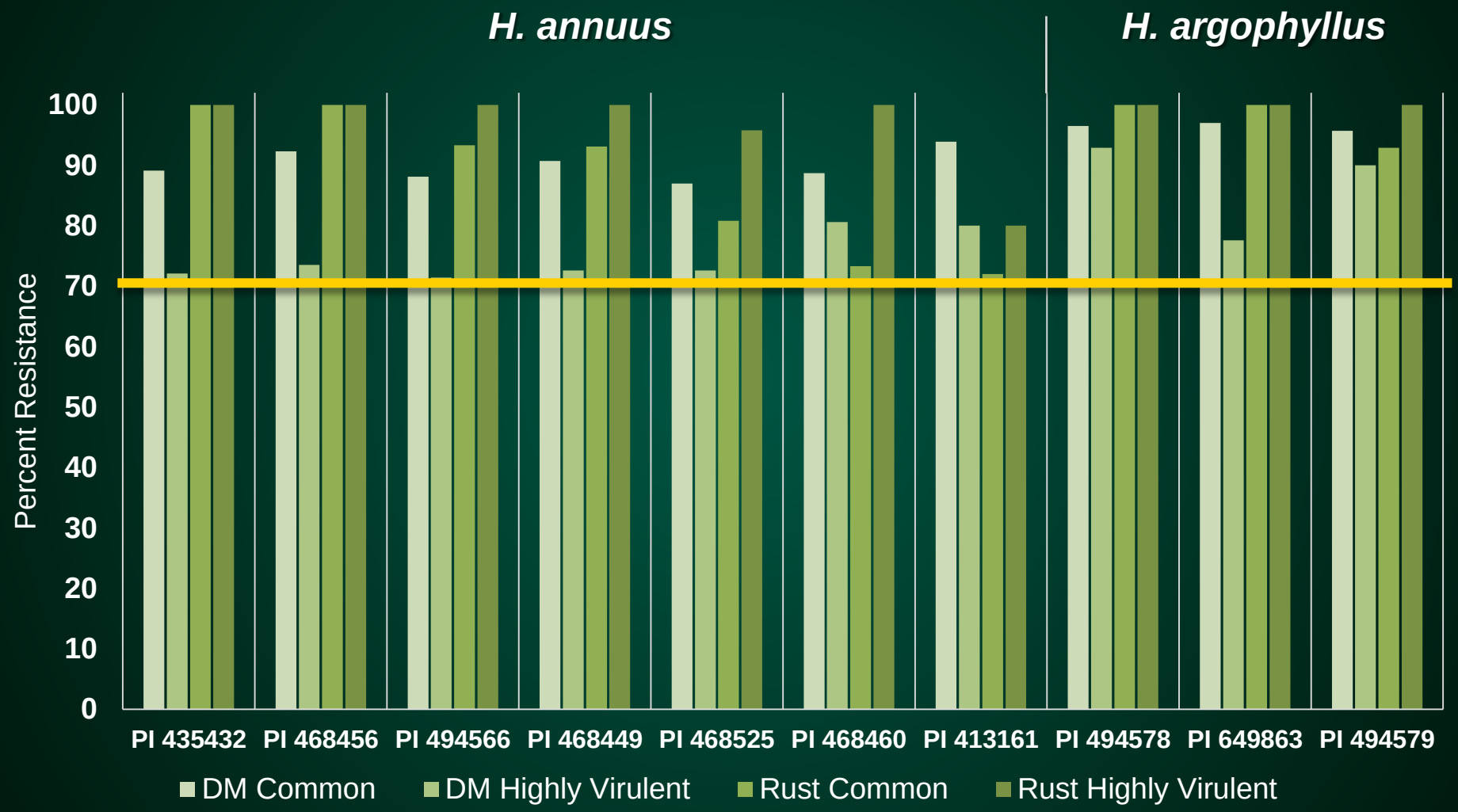
Accessions resistant to both pathogens



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Conclusions and Future Work

- Accessions resistant to both pathogens were identified
  - Seven *H. annuus*
  - Three *H. argophyllus*

- Future work will focus on characterizing the genes conferring resistance in these accessions

Acknowledgements

- USDA North Central Regional Plant Introduction Station
- National Sunflower Association
- North Dakota Agricultural Experiment Station
- DuPont Crop Protection
- NDSU Plant Path Ext. Group

National Sunflower Association

NDSU Extension Service
North Dakota State University

NDSU
North Dakota State University
ND Agricultural Experiment Station

Questions