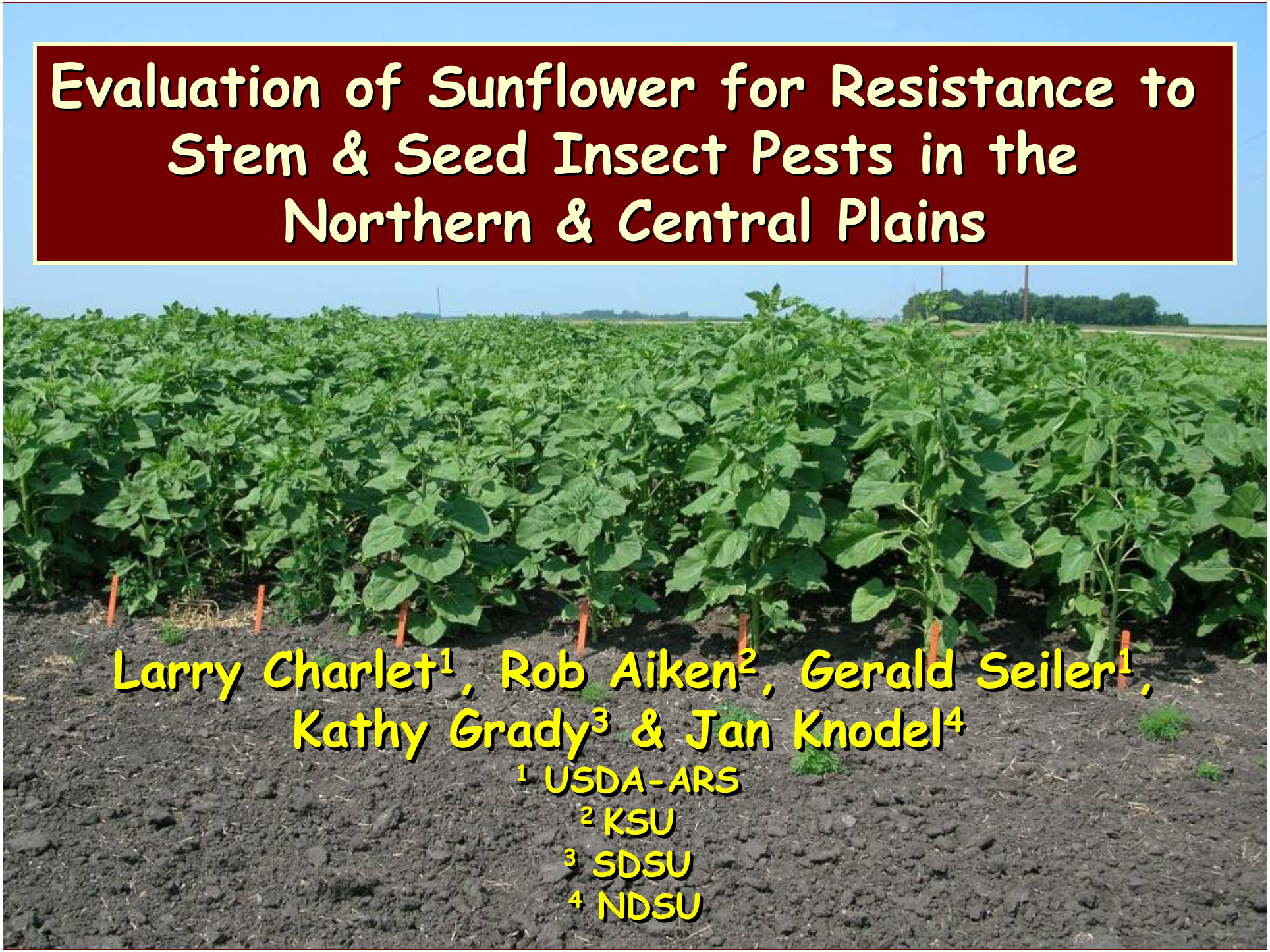
Evaluation of Sunflower for Resistance to Stem & Seed Insect Pests in the Northern & Central Plains



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Sunflower stem weevil

Sunflower moth

- ✓ Nurseries for sunflower stem weevil & sunflower moth in cooperation with Kansas State University
- ✓ Plants exposed to natural populations
- ✓ Heads & stalks harvested after maturity & sent to Fargo for evaluation
- ✓ Heads dried & threshed individually and seed examined for characteristic damage
- ✓ Stalks split & number of larvae determined

Sunflower Stem Weevil Trial 2006

- 31 lines or hybrids tested
- Mean infestation ranged from 5 to 51 larvae/stalk
- 12 had < 20 larvae/stalk
- Ames 3454, PI 431516, and PI 386230 had 9 or less larvae/stalk & were also low in 2005
- 60 S_1 line progeny from a reciprocal phenotypic recurrent selection program also were tested
- Mean infestation ranged from 0 to 140 larvae/stalk with 16 having 20 or less larvae/stalk
- 32 were selected for reevaluation in 2007

Sunflower Moth Trial 2006

- 22 lines or crosses tested
- Mean damage ranged from 1 to 81% seed damage/head
- 8 had < 20% seed damage/head
- Ames 3269, PI 170414, and PI 170385 had 12 or less seed damage/head & were low in 2005 (3% or less)
- 58 S_1 line progeny from a reciprocal phenotypic recurrent selection program also were tested
- Mean infestation ranged from 0.2 to 60% seed damage/head with 36 having 10% or less seed damage/head
- 25 were selected for reevaluation in 2007 (those with 4% or less seed damage/head

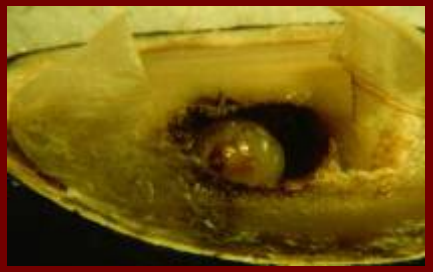
Banded sunflower moth

- ✓ Nursery for banded sunflower moth in cooperation with NDSU
- ✓ Plants exposed to natural populations
- ✓ Heads harvested after maturity & taken to Fargo for evaluation
- ✓ Heads dried & threshed individually and seed examined for characteristic damage

Banded Sunflower Moth Trial 2006

- 22 lines or crosses tested
- Mean damage ranged from 0.5 to 29% seed damage/head
- 16 had < 6% seed damage/head
- PI 170401, PI 195573, PI 505651, PI 219649 & PI 432516 had < 2% seed damage/head & 2 were low in 2005 (3 were new this year)
- 60 S_1 line progeny from a reciprocal phenotypic recurrent selection program also were tested
- Mean infestation ranged from 0.4 to 14% damage/head with 17 having < 3% seed damage/head
- 28 were selected for reevaluation in 2007 (those with 5% or less seed damage/head)

Red sunflower seed weevil



- ✓ Nurseries for red sunflower seed weevil in cooperation with SDSU & NDSU (2nd nursery at Prosper, ND)
- ✓ Plants exposed to natural populations
- ✓ Heads harvested after maturity & sent to Fargo for evaluation
- ✓ Heads dried & threshed individually and seed examined for characteristic damage

Red Sunflower Seed Weevil Trial 2006

- 19 lines or crosses tested
- Mean damage ranged from 7 to 52% seed damage/head at Highmore (1 to 24% at Prosper)
- 10 had < 20% seed damage/head
- PI 175728, PI 162453, PI 193775, PI 431545 & Ames 3269 had < 12% seed damage/head & 3 of these also had low sunflower moth damage in earlier trials
- 60 S_1 line progeny from a reciprocal phenotypic recurrent selection program also were tested
- Mean infestation ranged from 0.3 to 40% seed damage/head with 25 having < 13% seed damage/head
- 32 were selected for reevaluation in 2007 (those with 15% or less damage/head)

Mapleton, ND

- ✓ Nursery established in cooperation with NDSU on Mark Andrew's farm
- ✓ Plants subjected to natural infestation
- ✓ Hybrids evaluated in the field in early August
- ✓ Ratings based on necrosis index & the Bracken Scale for injury to head

Sunflower midge

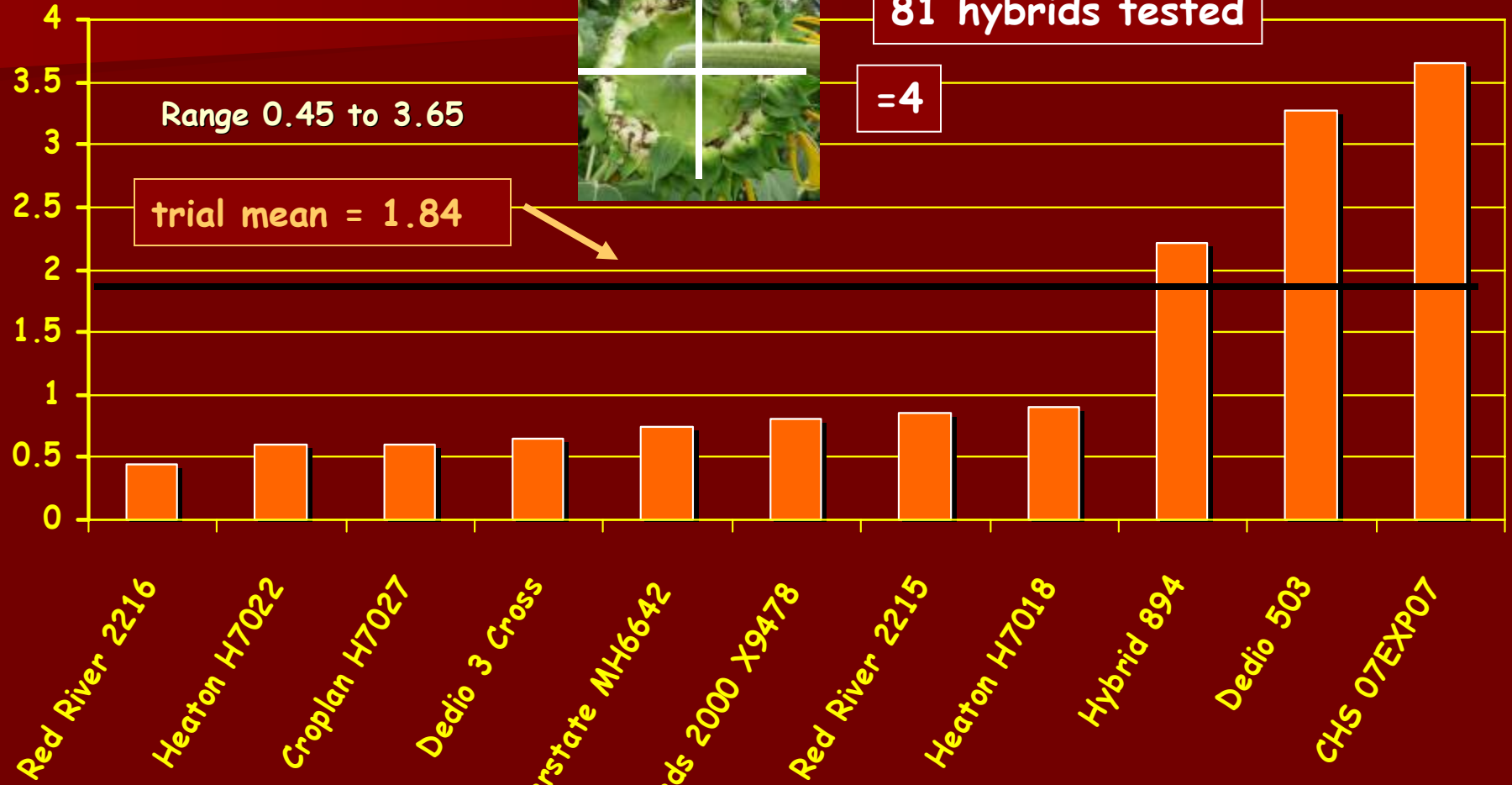
Sunflower Midge Trial 2007
Necrosis Index (0-5)

81 hybrids tested

=4

Range 0.45 to 3.65

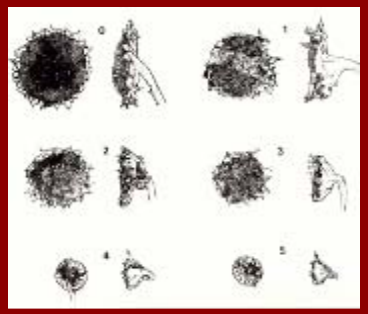
trial mean = 1.84



[5=50% or > of each quadrant with necrosis]

Trial at Mapleton, ND

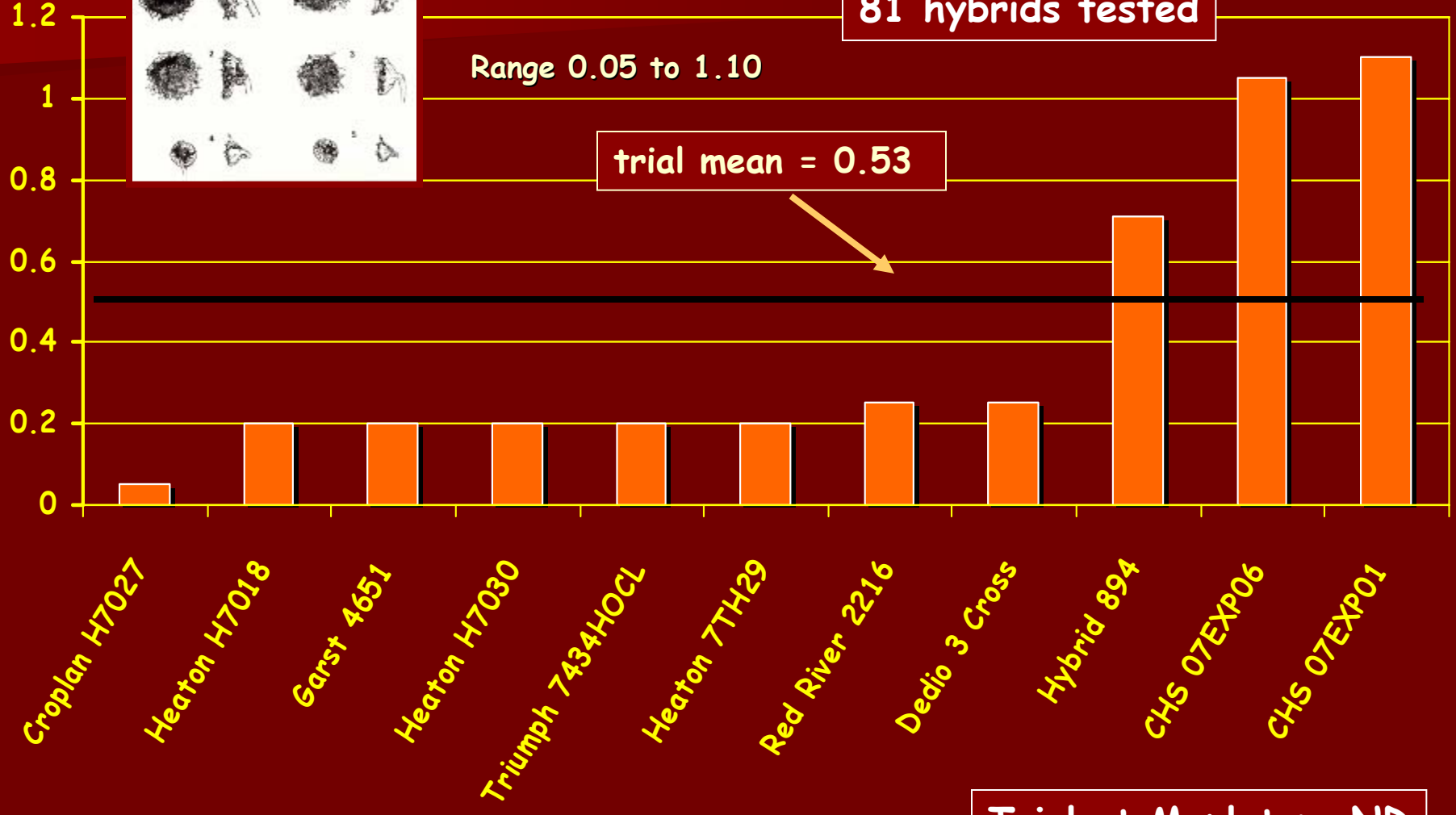
Sunflower Midge Trial 2007
Bracken Scale (0-5)



81 hybrids tested

Range 0.05 to 1.10

trial mean = 0.53



Trial at Mapleton, ND

Results from 2006 Trials

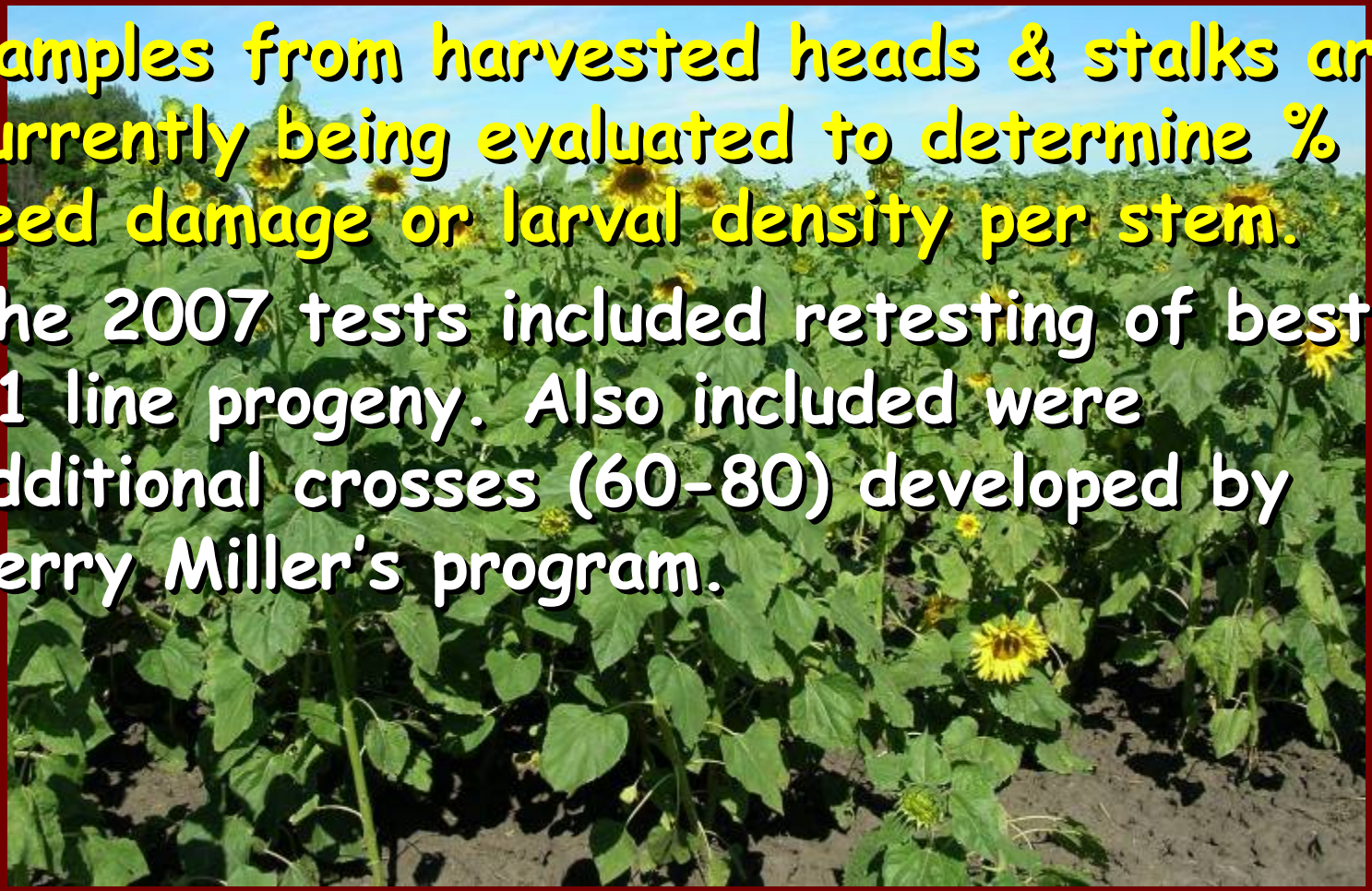
- Banded sunflower moth - over 90% reduction in seed damage in a number of lines compared to most susceptible tested.
- Red sunflower seed weevil - 80% reduction in damaged seeds in heads from a number of lines evaluated.
- Sunflower moth - a number of lines showed over 90% reduction in seed damage compared to the most susceptible lines used as checks.
- Sunflower stem weevil – Some lines showed over 90% less larvae per stalk than the susceptible checks.

Results from 2007 Midge Trial

- Total of 81 hybrids tested at Mapleton, ND, a nursery used for over 20 years
- 3 indices used to evaluate – round, necrosis (0-5), & Bracken scale (0-5)
- Overall midge damage in nursery was very low in 2007
- Necrosis ranged 0.45-3.65 (mean 1.83)
- Bracken ranged from 0.05-1.1 (mean 0.53)
- Necrosis index again appears to be the most sensitive measure for evaluation

Current Plans

- Trials were continued in 2007 at the same locations & included new & retested lines.
- Samples from harvested heads & stalks are currently being evaluated to determine % seed damage or larval density per stem.
- The 2007 tests included retesting of best S1 line progeny. Also included were additional crosses (60-80) developed by Jerry Miller's program.



Future Plans & Directions




- ✓ 3-year support from NSA for Postdoctoral scientist
  - ✓ Host-plant resistance of sunflower insect pests
- ✓ Sunflower insects:
  - ✓ Sunflower stem weevil
  - ✓ Longhorned (*Dectes*)
  - ✓ Sunflower moth
- ✓ USDA-ARS Sunflower Unit (entomologist, geneticist, botanist, molecular biologist)
- ✓ Goal = to accelerate the sunflower resistance program for insect pest problems in the central Plains production region.

Future Plans & Directions

- ✓ 3-year support from NSA for Postdoctoral scientist
  - ✓ Sunflower seed maggot *Neotrephritis finalis* (Loew)
- ✓ Biology, economic impact, pest management strategies
- ✓ Work under Drs. Knodel & Charlet
- ✓ Mangala Ganehiarachchi Post-doctoral scientist

Thank you!