Evaluating Germplasm for Resistance to Reniform Nematode

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Major objectives

- Evaluate all available accessions of *G. hirsutum* (TX list) for reaction to reniform nematode.
- Determine heritability of resistance.
- Incorporate resistance into adapted germplasm.
Evaluation process

- Accessions are evaluated in the greenhouse in the initial stage.
Reniform resistance evaluation

- 4 reps (single plants) are evaluated per accession, inoculated with a “mix” of reniform populations.
- 50 accessions per screening.
Reniform resistance evaluation

- After 60 days, nematode populations are determined and a reproductive factor calculated.
- Multilevel approach is used.
Reniform evaluation

- Two factors related to resistance are initially examined:
  - Vermiform numbers, a measure of the ability of the nematodes to survive, and
  - Eggs, which measure reproduction.
Reniform evaluation

- Accessions in the lowest 10 percentile for each parameter will be advanced to the next level of evaluation.
- Final evaluation will take place in the field to confirm any greenhouse resistance.
Progress so far (2003 meeting):

- Approx. 1000 accessions evaluated (about 25% of total collection)
- 865 accessions had complete data
- Problems with germination
- Paymaster 1218 in every set
Progress so far (present):

- Complete data for 1603 accessions
  - Paymaster 1218 in every set
- Preliminary analysis
  - Data normalized through log transformation
  - Vermiform vs. eggs
    - Paymaster 1218
    - Accessions
    - Accessions standardized based on PM 1218
Vermiform or eggs?

Paymaster 1218

- 200-fold differences for eggs
- 80-fold differences for vermiform

Run no.: Aug02 Mar03 Nov03 Aug04
Log(counts) – 865 accessions
Log(counts) – 1603 accessions

Relative Frequency

- Vermiform
- Eggs

Frequency

log(count)

0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40

3 4 5 6 7 8 9 10 11 12 13 14
Counts relative to PM 1218 (2003)

Relative Frequency of Normalized Logs

Frequency

log(accession count)/log(PM 1218 count)

Vermiform
Eggs
Counts relative to PM 1218

Relative Frequency of Standardized Log Values

- **Vermiform**
- **Eggs**

Ratio of log(counts)

Frequency

Values range from 0.6 to 1.4.
Criteria for 2\textsuperscript{nd} round testing

- Lowest 2 entries in each run for
  - Vermiform counts
  - Egg counts
  - Sum = 175 entries
- Actually tested – 134 entries
  - No seed available: 21 entries
  - At least one of the lowest 2 identical for vermiform and eggs: 20 entries
Original vs. Second round
-Vermiform

![Graph showing log (count original) vs. log (count rescreening)]
Criteria for 3rd round evaluation

- Create groups based on following criteria
  - Candidates with lowest counts in 1st and 2nd rounds: 10 entries
    - 2 entries best in both rounds – RESISTANCE?
  - Candidates with low counts in 1st round but intermediate in 2nd round: 10 entries
  - Candidates with low counts in 1st round but highest in 2nd round: 12 entries
Procedures for 3rd round

- Rescreening in the greenhouse
  - Increased reps
  - Other check cultivars besides PM 1218
- Field studies
  - Raise entries in the GH and transplant into reniform infested field
    - Avoids confounding with emergence problems
  - “Control” spatial variation
    - Check plots and/or augmented designs
    - Nearest neighbor analysis
Further avenues

- “Purity” of entries
  - Based on pollen color, entry 1419 looks like a mixture of *hirsutum* and *barbadense*

- Choice of check cultivars in evaluation
  - Vermiform survival vs. reproduction
  - Evaluate common cultivars
  - PM 1218 now well characterized

- Hybridize “resistant” entries with best agronomic types