Waste Not, Want Not: The Importance of Being Earnest About Gene Stewardship
Disease Notes

Detection of Virulence to Wheat Stem Rust Resistance Gene Sr31 in *Puccinia graminis* f. sp. *tritici* in Uganda

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Effective APR Resources

- Sr2/Yr30
- Lr34/Yr18/Sr57
- Lr46/Yr29
- Lr67/Yr46/Sr55
- Sr56 on 5BL

- Others
  - 1A
  - 2B
  - 3D
  - 4A
  - 6B
  - 7A
<table>
<thead>
<tr>
<th>New or Revived Major Genes</th>
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<tbody>
<tr>
<td>• Sr22</td>
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<td>• Sr25</td>
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<td>• Sr26</td>
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<td>• Sr28</td>
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<td>• Sr37</td>
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<td>• Sr39</td>
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What Will Be the Fate of These Genes?

• Will they provide the protection we need?
• Will they affect yield or quality?
• Will they last?
• Will our investments be rewarded or wasted?
What is Stewardship?

• Stewardship can be defined as the careful and responsible management of something entrusted to one’s care.
• What does it mean for us?
  – Genes remain useful for a long period of time
  – Stewardship and durability are inescapably linked concepts
Components of Stewardship

• Integrated Disease Management
  – Keep populations small; get rid of rust suckers
  – Break or weaken green bridges
  – Use fungicides if practical

• Know your enemy
  – Phenotyping (race surveys)
  – Biogeography: Hot spots for diversity (barberries, etc.)
  – Genomics: Understand avirulence genes (effectors)

• Know your cultivars:
  – Gene postulation, genotyping, analyzing unknowns

• Know your R-genomes:
  – Mechanisms, matching avirulence genes
  – Synergism or antagonism between genes

• Deploy genes intelligently
  – Use minor gene Adult Plant Resistance (APR)
  – Use good strategies for major gene resistance
Deployment Strategies

a. Traditional approach: plug, plant, and pray
b. Rotations in space and time
c. Pyramids
d. Regional deployment
e. Multilines and mixtures

MacDonald and Linde, 2002
Don’t Provide Stepping Stones
Simultaneous Mutation Probability = $m^n$
Bigger is Better
Hot Spots Need Extra Care

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<tr>
<th>Race</th>
<th>Country (year of 1st detection)</th>
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<tr>
<td>TTTSK</td>
<td>Kenya (2007), Tanzania (2009)</td>
</tr>
<tr>
<td>TTKSP</td>
<td>South Africa (2007)</td>
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Singh et al. 2011
What is Our Priority?

• Protect the crop
• Protect the resistance genes
Stewardship Groups

1. No stewardship needed
2. Common pool: Combinations with at least three genes recommended
3. Reserved pool: Bigger pyramids required
Nominations for Reserve Pool

- Sr22
- Sr25
- Sr26
- Sr28
- Sr32
- Sr33
- Sr35
- Sr37
- Sr39
- Sr40
- Sr43
- Sr44
- Sr45
- Sr46
- Sr47
- Sr50
- Sr51
- Sr53
Proposals

1. Need better international support for common pool resistance gene combinations
   a) support marker-assisted selection
   b) monitor genes in candidate varieties
   c) rapidly fix and replace weak combinations

2. Need reserved set of genes for higher level of stewardship
   a) share with any responsible party
   b) following stewardship rules is mandatory
A Chain is Only As Strong As the Weakest Link
We’re All In This Together
If you want to join the rust-genes listserv on Google Groups

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The Importance of Being Earnest

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