Breeding for resistance to TOSPO (GBNV) and Discovery of Its Trait Linked Markers – Status & Challenges

Resistant Source

The Problem

Upto 80% losses reported in several parts of India, SEA

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Objectives

- Confirm Field resistance to TOSPO (GBNV) in *S. peruvianum* at hot spot
- Overcome cross incompatibility & obtain BC populations
- Develop a phenotypic screening protocol
- Screen segregating populations at BC2F3 for phenotypic & genotypic variation & identify trait linked molecular markers
- Develop stable *S. esculentum* lines with larger fruit sizes
- Develop TOSPO (GBNV) resistant hybrids
Phenotypic rating scale for TOSPO (GBNV) infection

Scores:
1 - Whole plant diseased;
2 - Few green stems/leaves no fruit set;
3 - 50% plant covered, may have a fruit or two;
4 - Only top stems & leaves show symptoms
5 - Healthy Plant
Freq Distribution in R, S, BC2F3 (K14), BC2F4 (K15)

TOSPO Ratings – Pooled data

Sus Parent

BC2F3 - K 14

S. peruvianum (R parent)

BC2F4 - K 15
Response of R progenies vs R & S parents

K14 vs K15 vs S16 vs K16

GBNV Score K14 | GBNV Score K15 | GBNV Score S16 | GBNV Score K16
---|---|---|---
R progenies | 4.3 | 4.6 | 4.7 | 4.3
S lines | 2.4 | 2.0 | 2.5 | 3.1
Inter | 1.6 | 2.5 | 1.6 | 2.4
Sus | 1.5 | 2.3 | 1.6 | 1.2
S. peru | 4.8 | 4.9 | 5.0 | 4.8

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Progress of Individual families
K14 vs K15 vs S16 vs K16

K = Kharif (wet season)
Mapping Population

Project in collaboration with seqID, Canada

- BC2F3 families were used
- 3 parental lines for reference
- Phenotypes were scored 1-5
Marker Discovery Status

- 7000 SNP panel was used
- 1,767 showed segregation in the population
- 556 SNPs selected for linkage construction and QTL analysis based on Polymorphic SNP’s between SP2 and RP1 (original parents)

- Performed 3 separate analyses
  - Single marker
  - Interval mapping
  - Composite interval mapping

- Two QTLs detected
## Tospo Rating of Advanced Lines (> 30 g fruit weight)

<table>
<thead>
<tr>
<th>Field Code K 16</th>
<th>Fruit Wt (g)</th>
<th>TOSPO Score K16 (Mean ± SD)</th>
<th>TOSPO Score K15 (Mean ± SD)</th>
<th>TOSPO Score K14 (Mean ± SD)</th>
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<tbody>
<tr>
<td>GBE025</td>
<td>80</td>
<td>4.21 ± 0.58</td>
<td>5 ± 0</td>
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<tr>
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<td>4.25 ± 0.50</td>
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<tr>
<td>SEL-4</td>
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<td>1.71 ± 0.49</td>
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<td>US-440</td>
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<td>1.67 ± 0.87</td>
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<tr>
<td>SYN-1389</td>
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<td>2.14 ± 1.07</td>
<td>1.33 ± 0.57</td>
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</table>
R Parent (*S. peruvianum*) and new R lines with S parents.
Few Advanced Lines with better fruit size
## Data on Few Top Cross Hybrids – K16

<table>
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<tr>
<th>Field Code</th>
<th>Fruit Wt (g)</th>
<th>TOSPO Score K16 (Mean ± SD)</th>
<th>TOSPO Score R15</th>
<th>TOSPO Score K15 (Mean ± SD)</th>
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</thead>
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<td>TC-5</td>
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<td>4.93 ± 0.27</td>
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<td>4 ± 0</td>
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<tr>
<td>TC-7</td>
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<td>4.86 ± 0.36</td>
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<td>Syn 1057</td>
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<td>2 ± 0.82</td>
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<td>Not included</td>
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<td>Sel-4</td>
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<td>1.71 ± 0.49</td>
<td>1.8 ± 0.56</td>
<td>1.7 ± 0.56</td>
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</tbody>
</table>
Top Cross Block Kharif 2016
Commercial Hybrids and One TC Hybrid
K 16 Hyderabad

Commercial Check | Top Cross Hybrid | Commercial Check
Top Cross Hybrids vs Check for TOSPO on Fruits
Current Status

- Developed a reliable infection rating scale for GBNV through visual symptom
- GBNV strain confirmed through ELISA test
- Own testing site in best hot spot for GBNV infection – Hyderabad
- Currently we have BC2F6, BC2F7 lines ready
- 6 top cross hybrids have shown high level of tolerance & good fruit size
- New top cross hybrids with four testers are ready for testing in K 17
- Several new accessions in various species collected for identifying new additional sources of field resistance for TOSPO.
- Seeds of F1, F2 & BC1 of new species using three S.esculentum lines ready
- Patent being filed and application under PPV&FR in progress

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Discussion

- Multilocation testing & Artificial Screening ???

- Way Forward ????

- Lines/ hybrids and marker details can be licensed

- Model Non exclusive

- Another project ????
Thank You