

Double haploid populations as a tool for improved markers for Tomato Spotted Wilt Virus (TSWV) resistance breeding

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Overview

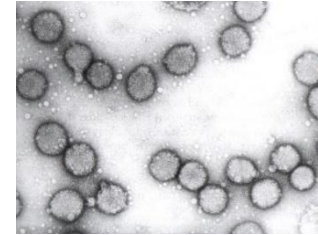
- Tomato Spotted Wilt Virus (TSWV)
 - Economic Impact
 - Control Methods
 - Sources of Resistance
- Doubled Haploid (DH) lines
 - Benefits of DH lines
- Population Selection & Evaluation
 - Deformity
 - Existing Markers
 - Disease Incidence
- Conclusions



Tomato Spotted Wilt Virus - TSWV

■ Economic impact of the disease

- Impact in Georgia peanuts, vegetables and tobacco
- Perceived northward migration of the virus
- In Georgia alone, an estimated average losses of \$11.3 million in tobacco 1996-2006



Source: USDA RAMP Project



■ Control Methods

- Eliminate infected plants
- Insecticide treatments for vector control
- Eliminate weeds
- Genetic resistance

Tomato Spotted Wilt Virus - TSWV

■ Sources of Resistance

Nicotiana species

- *N. alata*
- *N. sanderae*
- *N. glauca*
- *N. langsdorfii*
- *N. longiflora*
- *N. trigonophylla*
- *N. forgetiana*
- *N. fragrans*
- *N. noctiflora*
- *N. palmeri*

N. tabacum - Polalta

- Hypersensitive response
- *N. alata* source
- *N. otophora* bridge pollination
- Poor agronomic performance



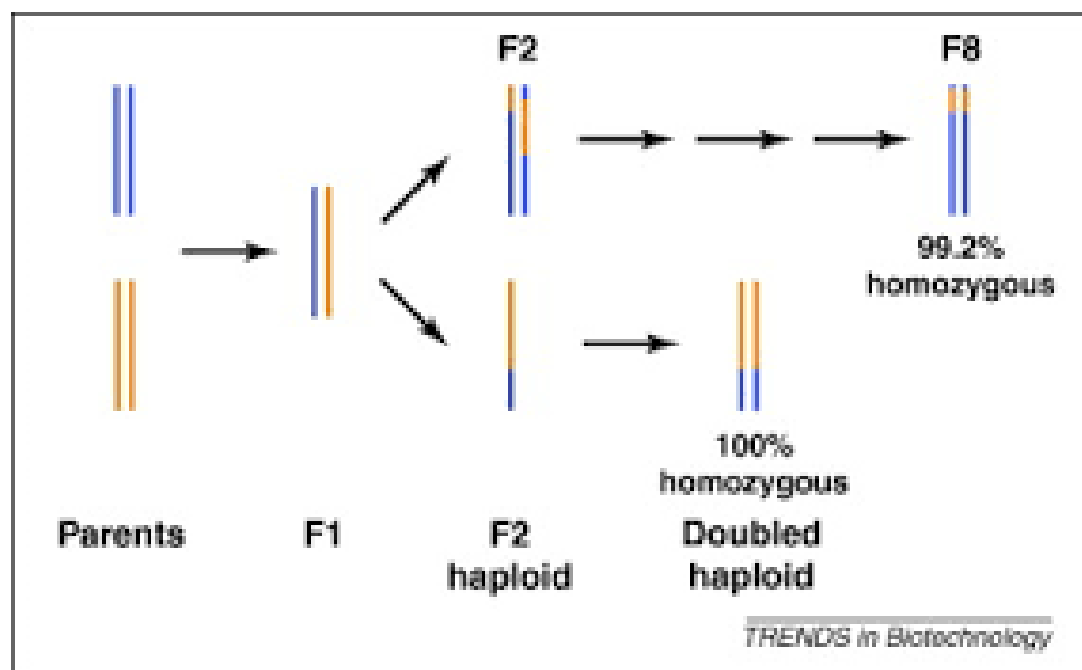
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Doubled Haploids (DH) Lines- Benefits

- ✓ Backcross breeding
- ✓ Trait Mapping
- ✓ Accelerating Breeding

Can we use DH to break the linkage of deformity?



Population Selection & Evaluation



Deformity Scale

0-no symptoms;

1-thickened veins or leaves;

2-nonparallel and thickened veins;

3-wide, irregular and thickened veins;

4-wide, irregular venation and narrow leaves;

5-wide, irregular nerves and ribbon-shaped leaves;

6-irregular venation and tumors on blossoms



SCAR Markers



AFLP Fragment	PCR Product Size (bp)	
	Palalta	K326
ACT/CTA268	161/200	200
AAG/CGA228	117	---
AAC/CCC172	117	---
ACG/CCG169	105	---

Trojak-Goluch, Anna. "Morphological and chemical characteristics of doubled haploids of flue-cured tobacco combining resistance to *Thielaviopsis basicola* and TSWV." *Breeding science*. Japanese Society of Breeding. Vol. 66.2. (2016): 293-299.

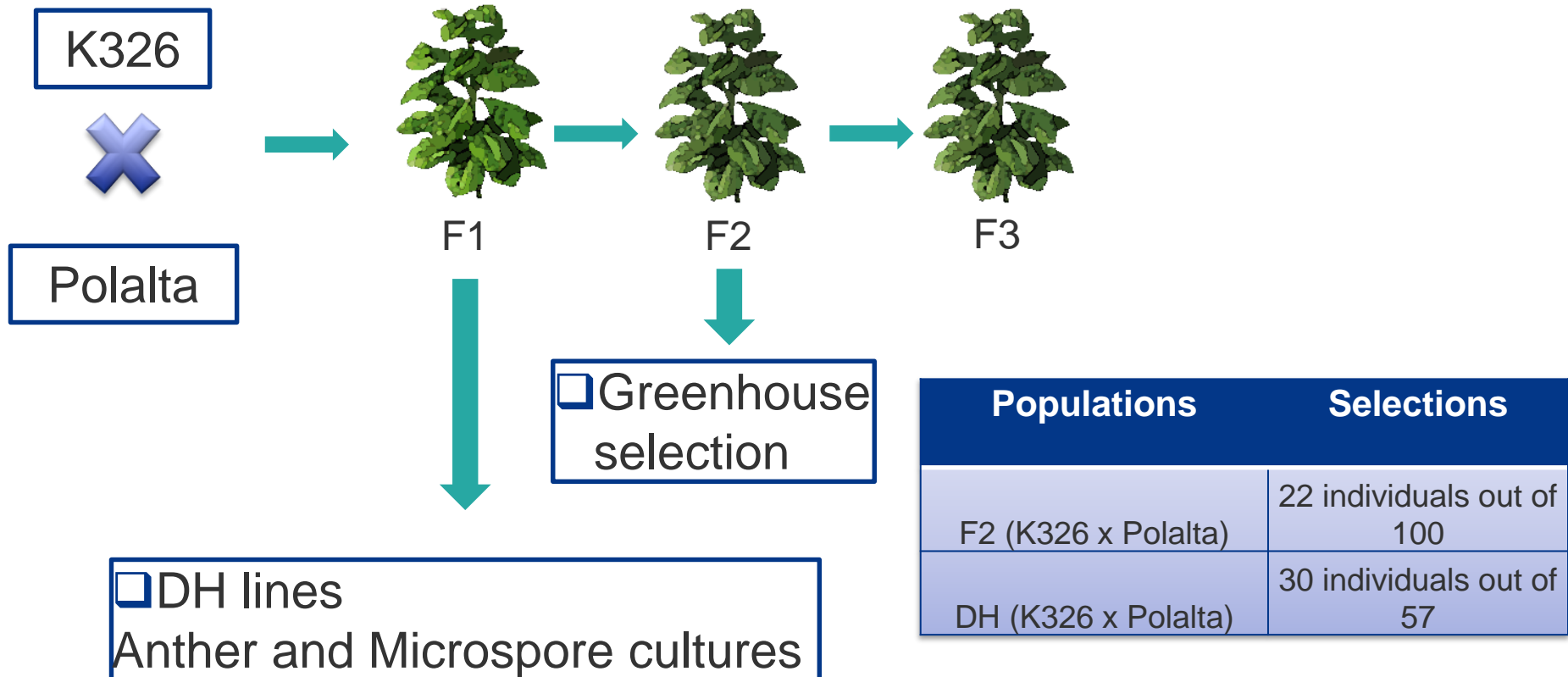
Moon, H; Nicholson, J S "Markers linked to Tomato Spotted Wilt Virus Resistance in tobacco." *Crop Science*. Agricultural & Environmental Science Database. Vol. 47.5. (2007): 1887-1894.



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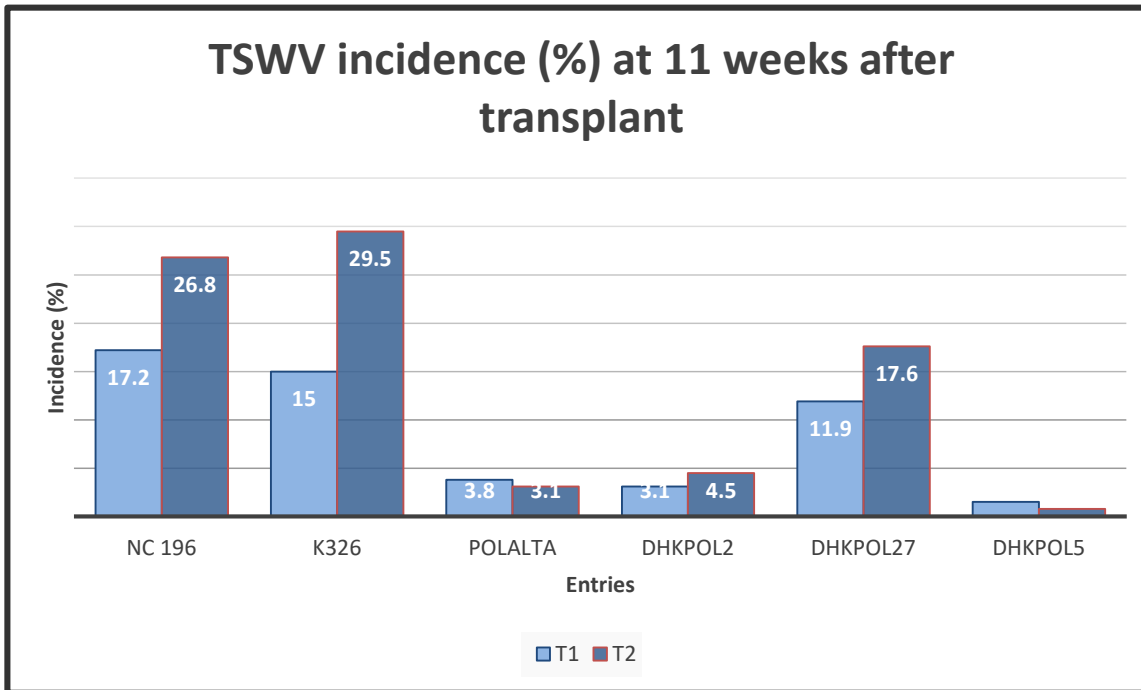
DH and Inbred Line Development and Selections



Evaluation of DH and Inbred Lines

2019- Tifton, GA

- ❑ 54 entries in CRBD
- ❑ Incidence data collected weekly for 11 weeks
- ❑ 2 transplant dates (T1 and T2)
- ❑ 4 reps of 30 plants



DHKPOL2



DHKPOL5

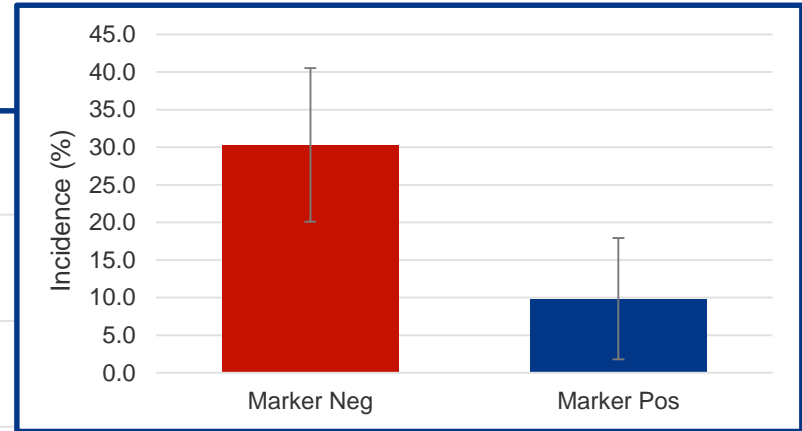
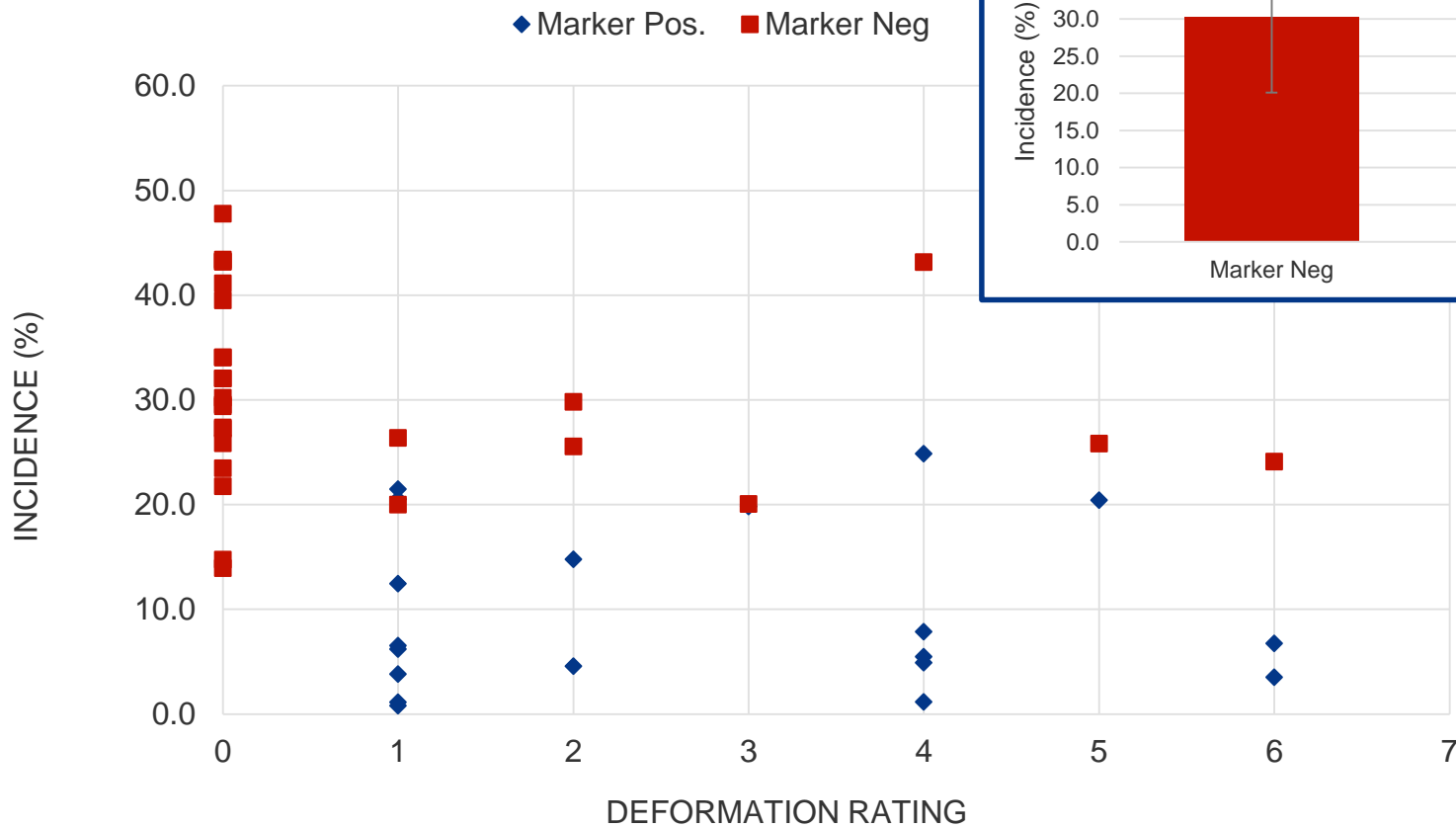
❑ Polalta Double Haploid lines show low virus incidence



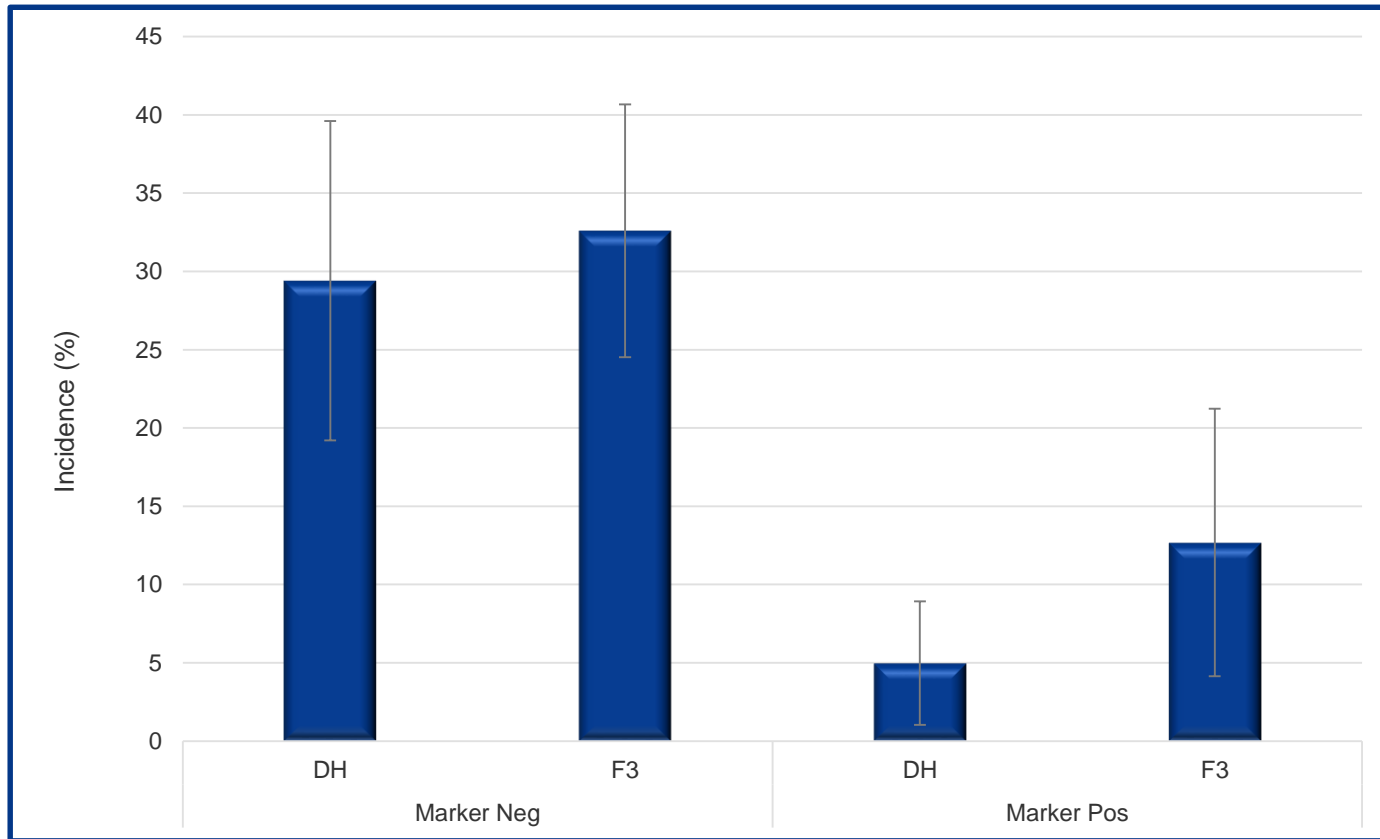
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Deformation and Resistance Do Not Correlate



Disease Incidence: DH vs Inbred lines



❑ Double Haploid lines have higher resistance and less variability than inbred lines



Conclusions and Future Considerations

- Evaluation of both DH and inbred lines showed the feasibility of resistance without adverse phenotypic deformation.
- Marker positive lines exhibited disease incidence similar to the donor parent.
- DH lines are an appropriate tool for TSWV resistance breeding
- Future Considerations
 - Tracking the resistance trait by improving the existing markers
 - Finding and tracking the trait for deformity
 - Evaluation of hybrids made with TSWV-DH lines for resistance stability



Acknowledgments

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Thank you
Questions?

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