Exploiting Hybrid Potato Breeding for Accelerating Introgression and Stacking of New Resistance Sources against *Phytophthora infestans*

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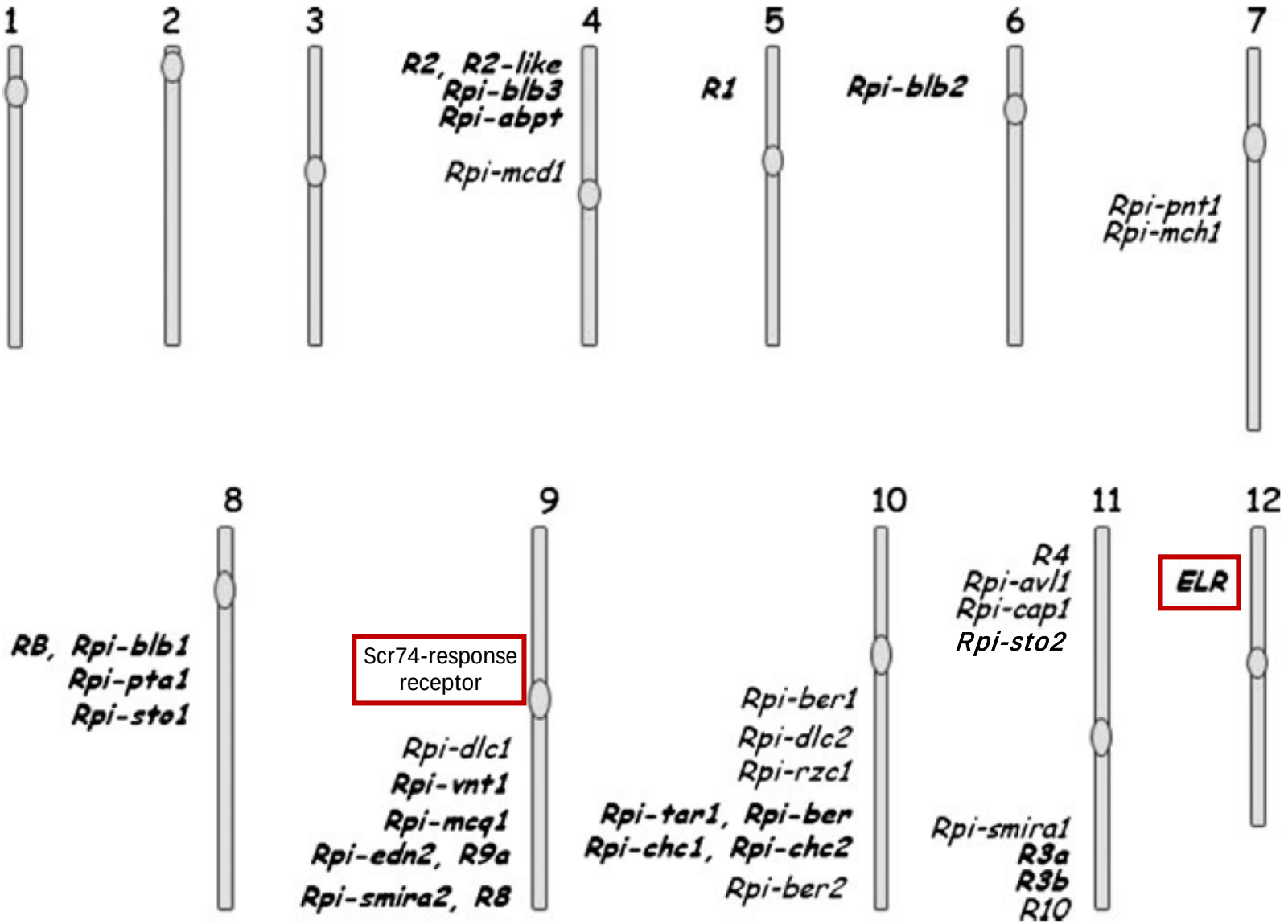
EuroBlight Workshop

14-05-2019

Content

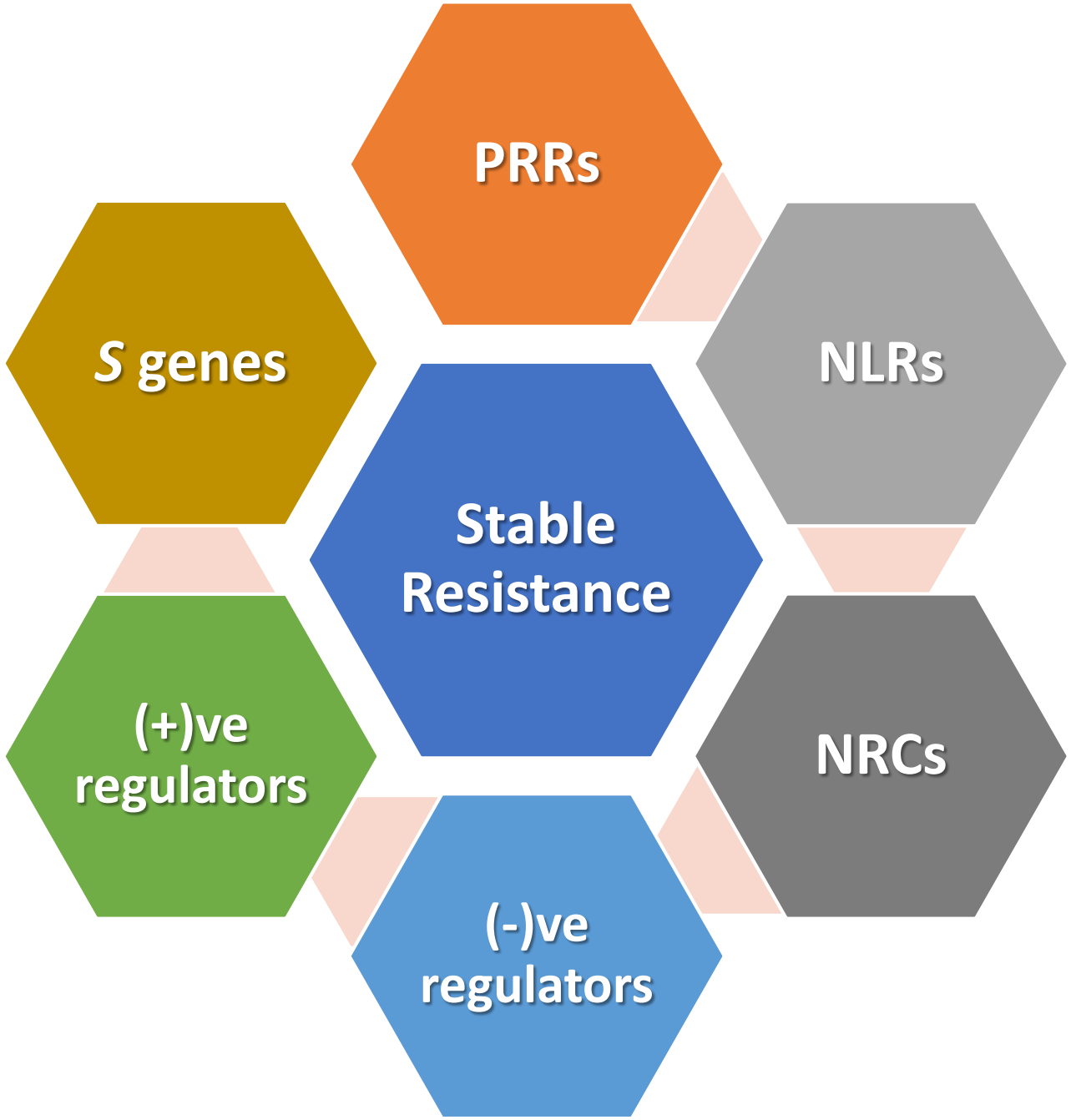
- **The state-of-the-art in resistance to late blight**
- Utilizing hybrid potato breeding for developing resistance to late blight
- Packing up all of the *Solanum* weapons against late blight



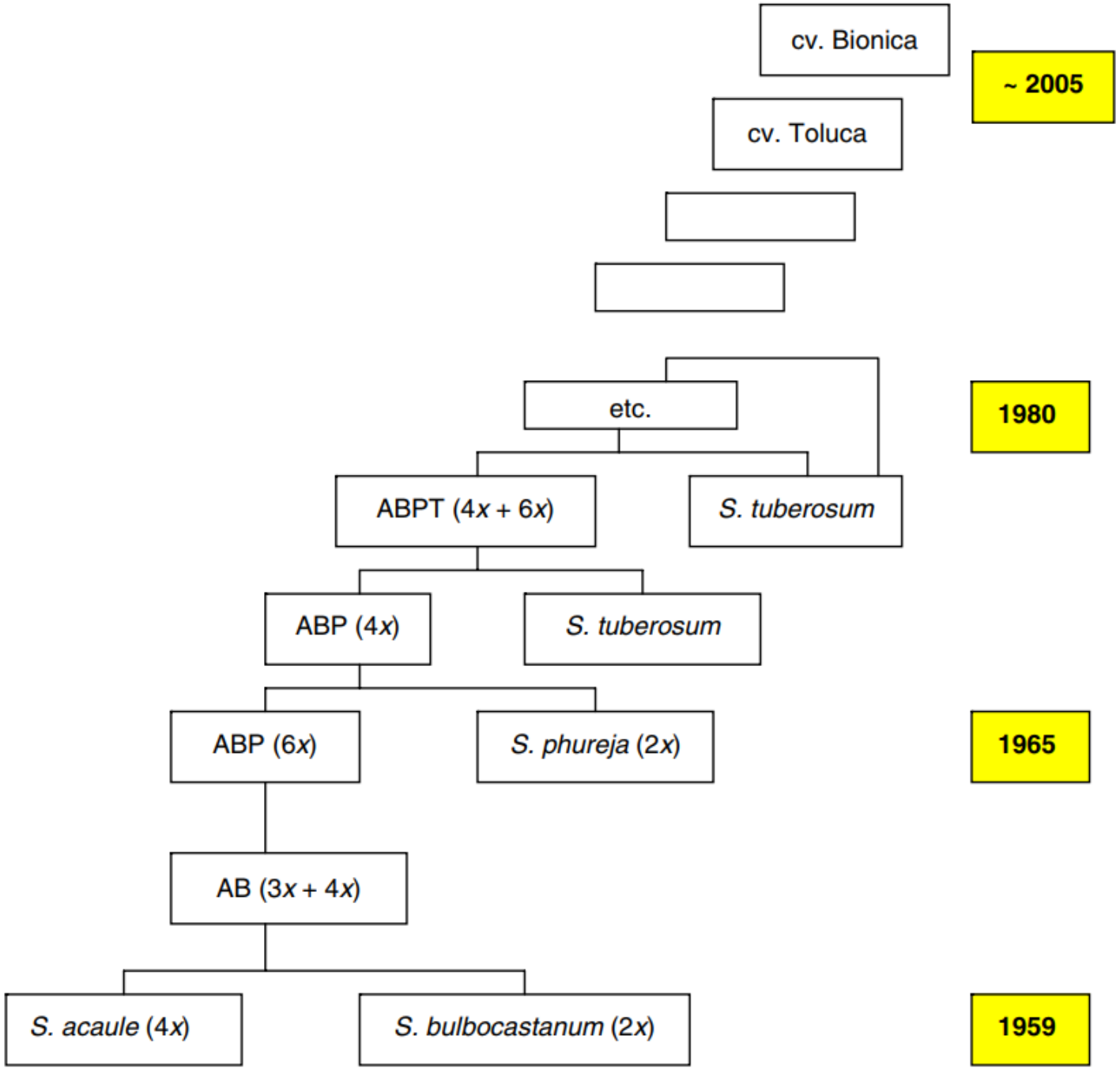
- Up to date, there are about 70 *mapped* and/or ***cloned*** resistance to *P. infestans* (*Rpi*) genes from potato and its wild relatives, and are located on chromosome IV, V, VI, VII, VIII, IX, X and XI.

- Two PRRs were mapped on Scr74-response receptor on chromosome IX and *ELR* chromosome XII.

Haverkort *et al*. (2016)



Breeding potato for a stable resistance against the late blight



The traditional tetraploid breeding of potato cv. Bionica took about 46 years to introduced the *Rpi-blb2* gene from *Solanum bulbocastanum*

Haverkort *et al*. (2009)

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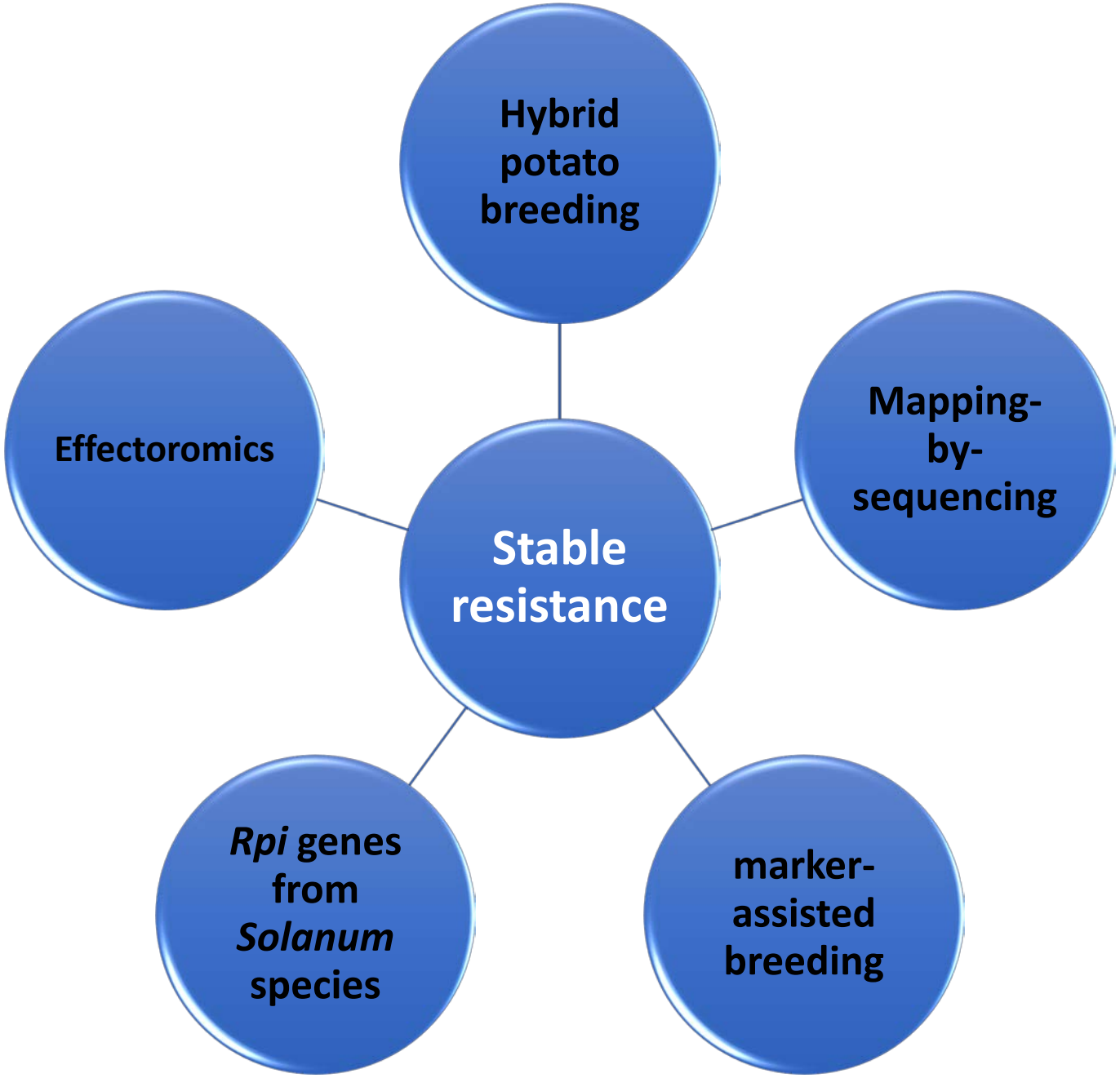

Hybrid potato breeding
Effectoromics
Mapping-by-sequencing
Stable resistance
Rpi genes from *Solanum* species
marker-assisted breeding

Hybrid potato breeding for accelerating introgression and stacking of *Rpi* genes at Solynta

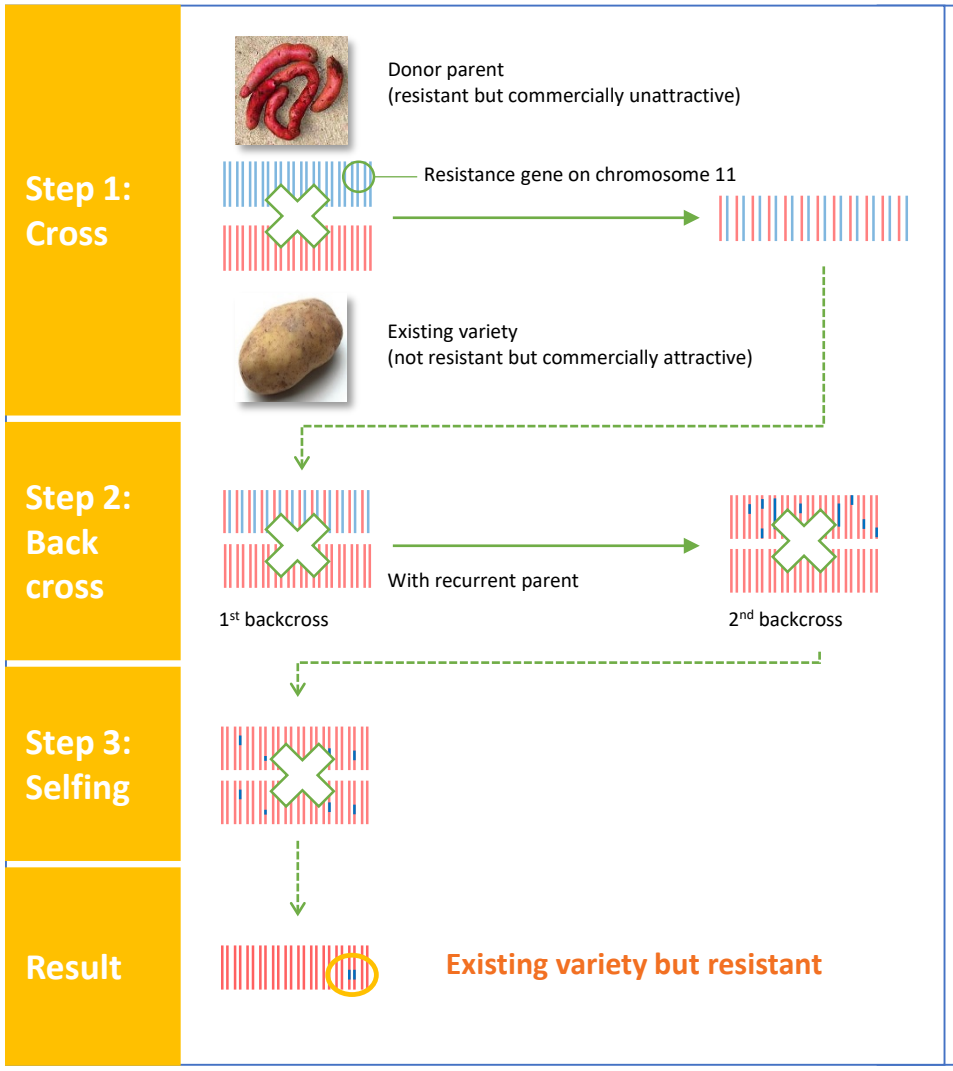
- Introgression and stacking of new traits can be achieved within **few to some years** (Lindhout *et al.*, 2011, 2018; Ying *et al*., 2019).

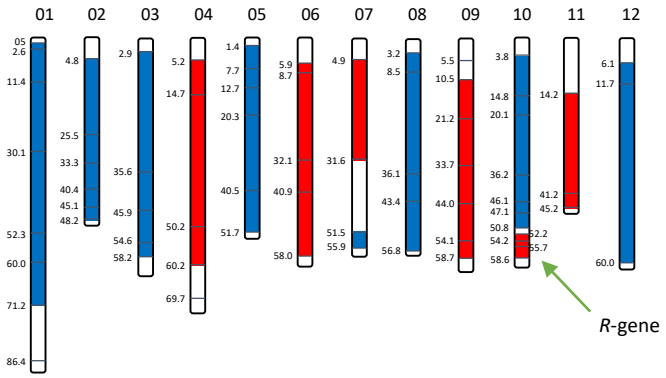
Hybrid Potato Breeding Scheme

Ying *et al*. (2019)

Trait introduction and stacking via marker-assisted backcross breeding

EU H2020 Project





R1 x R2

R1+R2

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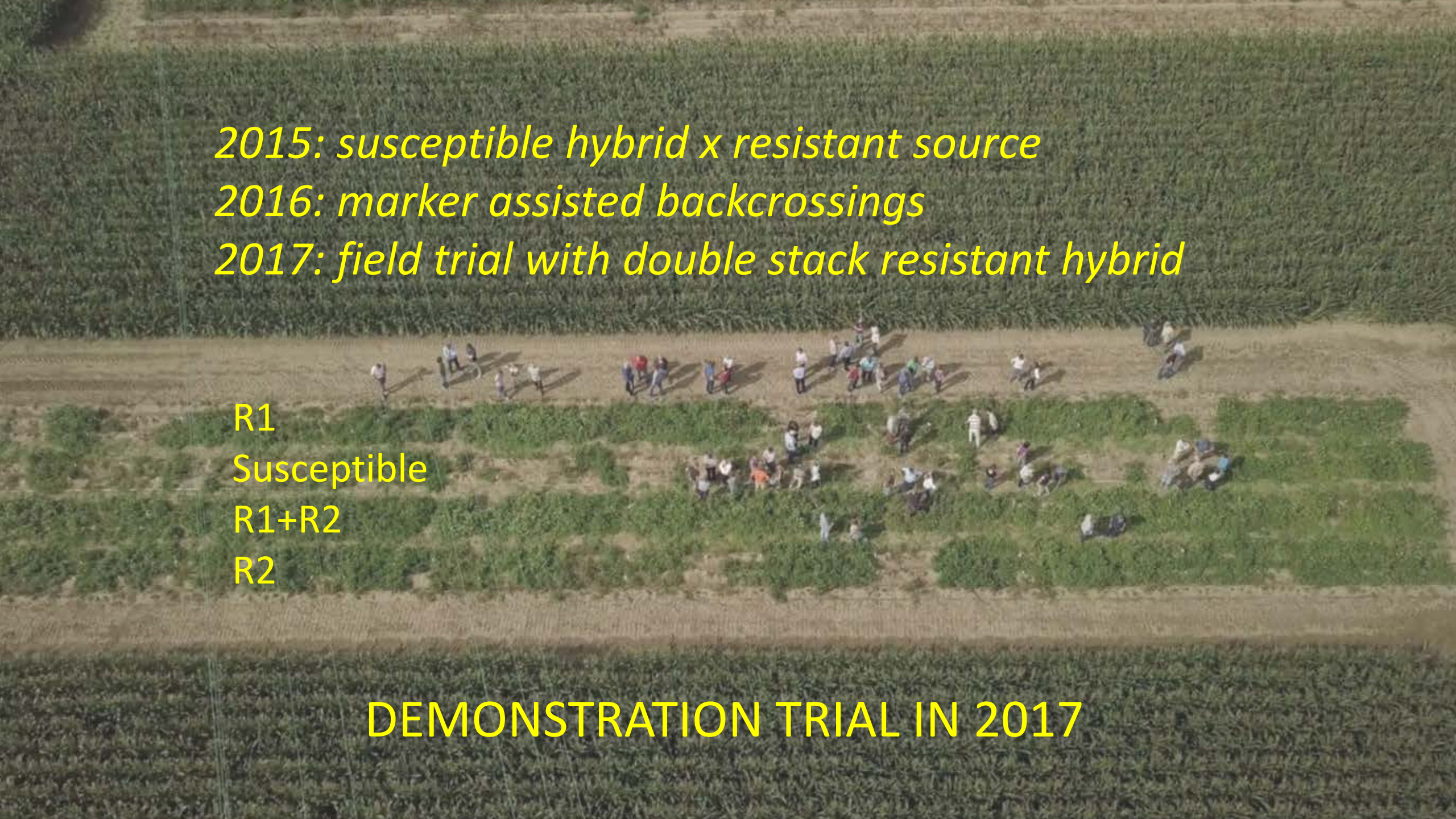
Rpi genes-donor *Solanum* species used for gene pyramiding

S. avilesii 478-2
Rpi-avl1, Chr11
position ~1.8 Mb

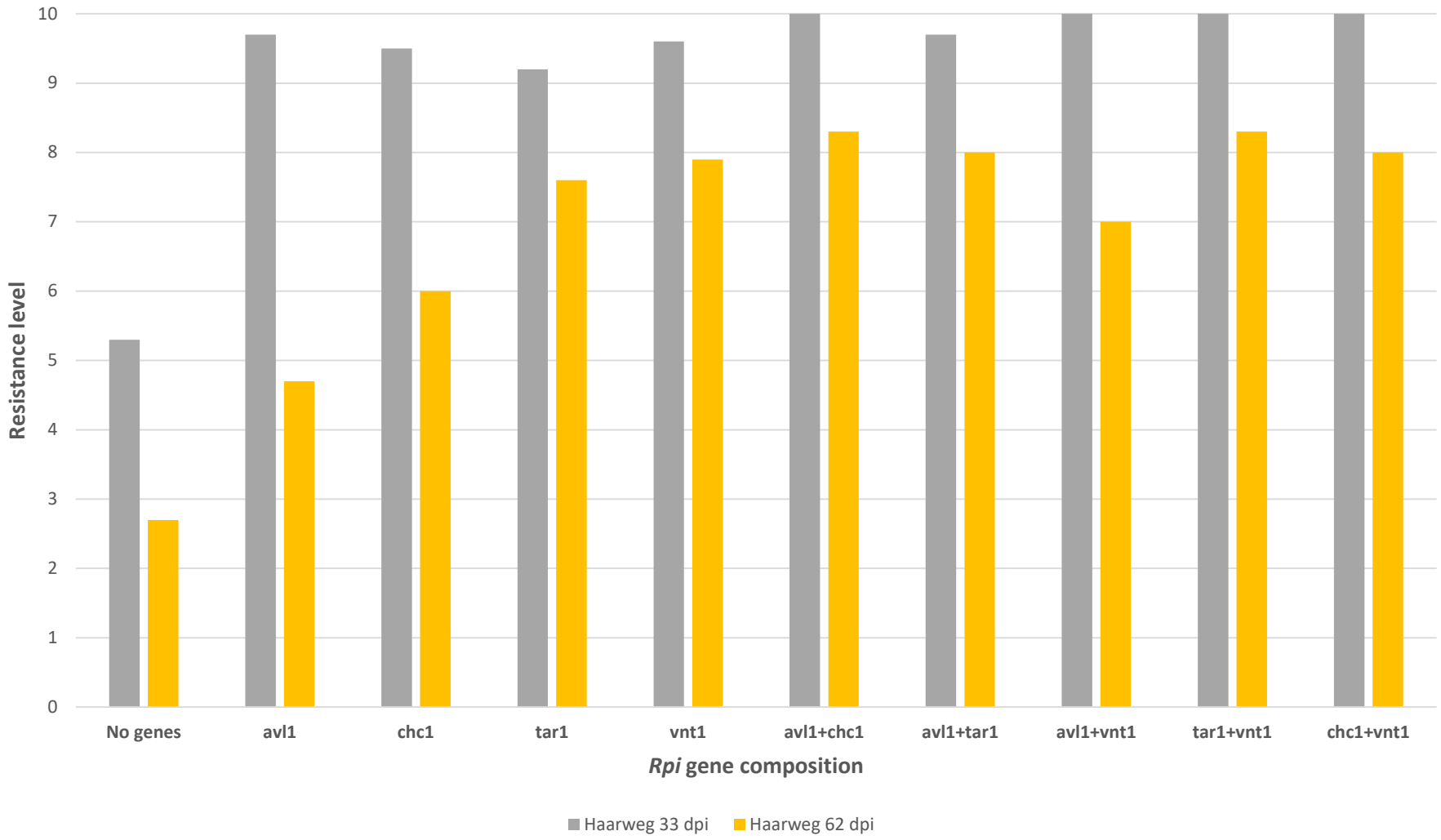
S. tarijense 852-5
Rpi-tar1, Chr10
position ~53 Mb

S. chacoense 543-5
Rpi-chc1, Chr10
position ~53 Mb

S. venturii 283-1
Rpi-vnt1, Chr9
position ~51 Mb

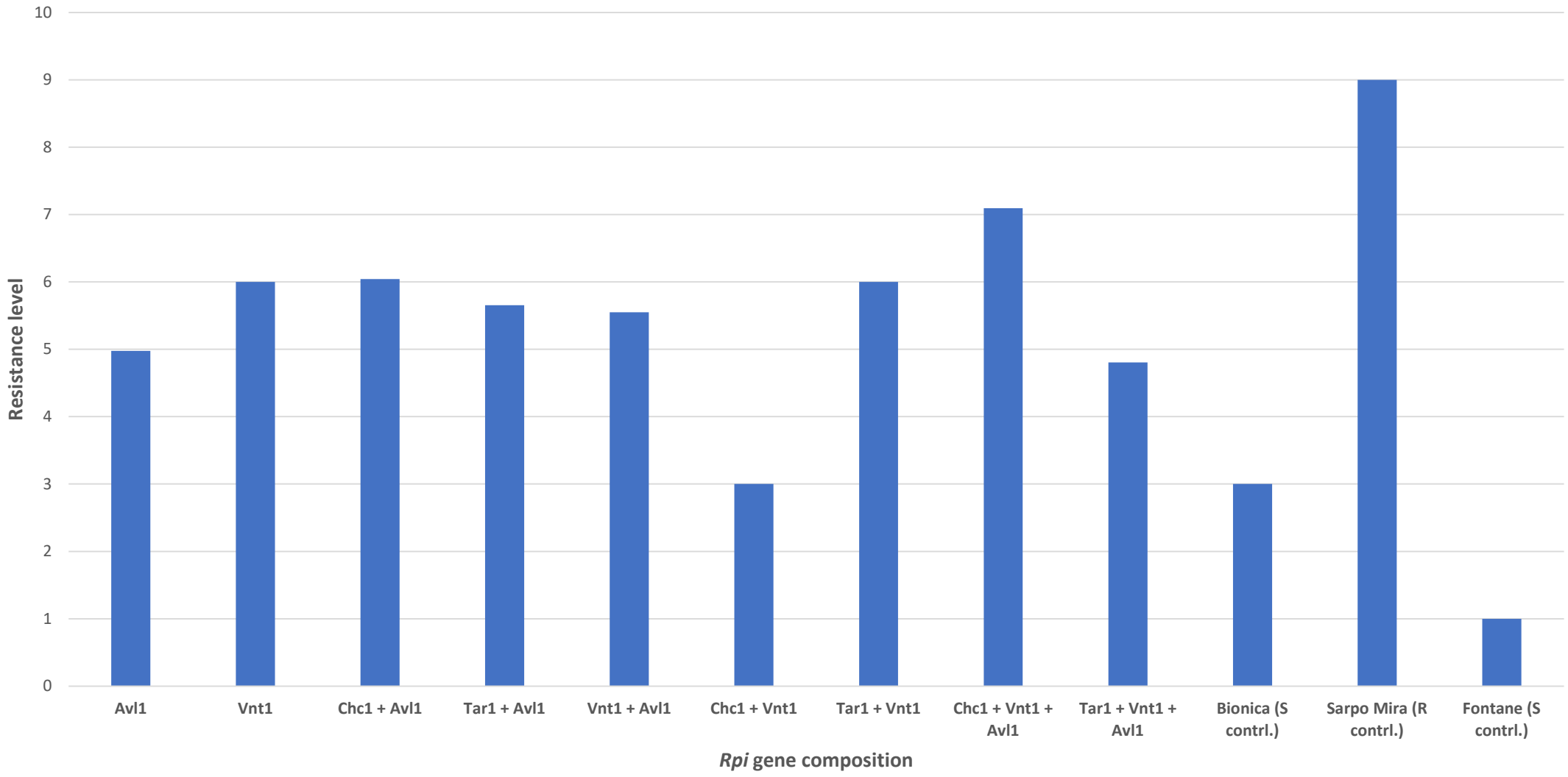

2015: susceptible hybrid x resistant source
2016: marker assisted backcrossings
2017: field trial with double stack resistant hybrid
R1
Susceptible
R1+R2
R2
DEMONSTRATION TRIAL IN 2017

2017 field trial: Diploid potato with double *Rpi* gene stack exhibited higher level of resistance to the *P. infestans* isolate IPO-C over three locations in NL



Ying *et al*. (2019)

2018 field trial: Diploid potato with double *Rpi* gene stack exhibited higher level of resistance to the *P. infestans* isolate Blue-13



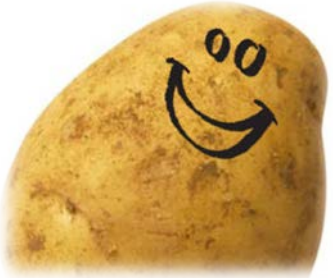
Conclusions

- There is an increased level of resistance.
- Variation of resistance conferred by different *Rpi* genes and their combinations, which may differ according to time and location.
- Additional trials over more years and locations are needed to manage resistance genes.

Future research

1. More genetic backgrounds
2. More stacks of *Rpi* gene combinations
3. Repeat field trials over multiple geographic locations

Thank You!



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