P. infestans sampling in robust potato cultivars in the Netherlands

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100years
1918 — 2018

Covenant organic potato production

- Accelerated transition to robust potato varieties:
  - 3 years: 2018 – 2020
  - Aim: 100% of robust organic potatoes in 2020.
  - Demonstration fields:
    - Resistance management

- Covenant partners:
  - Chain organization Bionext (incl. Biohuis (farmers), BioNederland (processors and traders) and the Association of Organic shops.
  - Retailers: Albert Heijn, Jumbo Supermarkets, Ekoplaza/Udea, Natudis, Estafette Odin B.V., Superunie, ALDI and Lidl
  - Organic farmers represented by: Bdeko, Biowad, Association of Bio Farmers South West, Nedato cooperative, Dutch Organic Potato Pool.
  - Organic potato breeders: Agrico, HZPC, C. Meijer B.V., Plantera B.V., Den Hartigh, Europlant, Danespo, Caithness Potatoes B.V., Fam Vos, Carel Bouma organic breeding B.V.
  - Branch association Plantum.

https://bionext.nl/thema-s/plantgezondheid/aardappel-convenant/

https://bionext.nl/application/files/1615/8936/2350/Potato_covenant_english.pdf

3 Demo fields with robust cultivars

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Activities

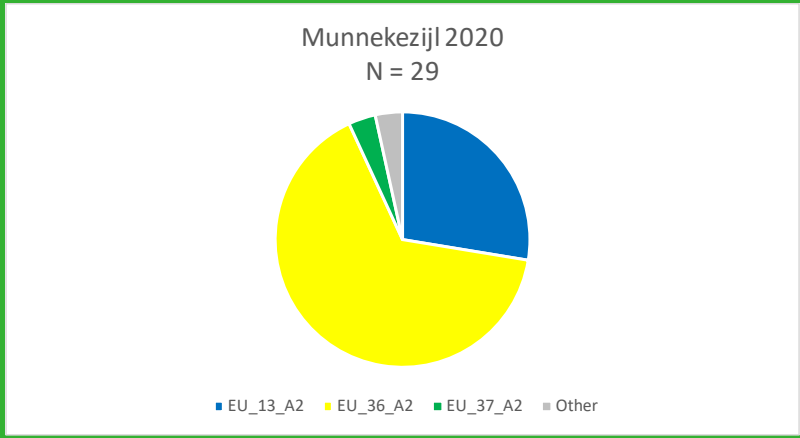
- Sampling *P. infestans* from cultivars → pure cultures + DNA samples
- Characterization of *P. infestans:*
  - Euroblight 12-plex SSR set
  - Virulence

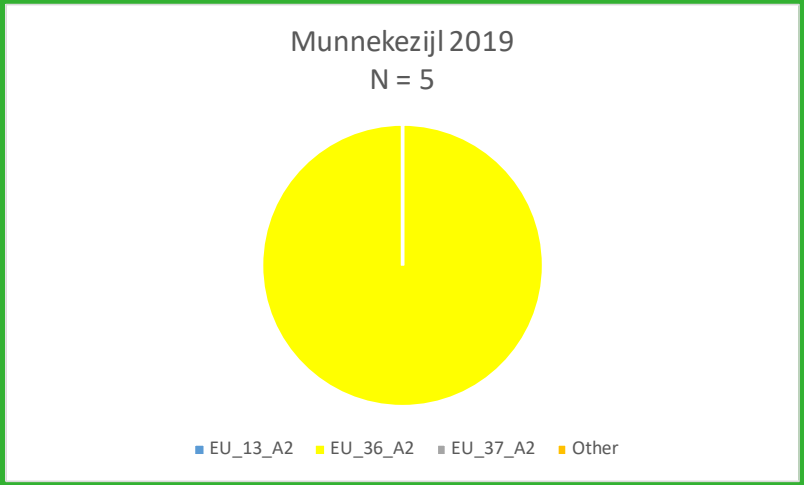
Demo fields 2020

- Zeewolde
  - 16 *P. infestans* isolates + DNA samples
- Munnekezijl
  - 29 *P. infestans* isolates + DNA samples
- Oudemolen
  - Hardly any *P. infestans*
  - Mail problem
-

SSR genotyping Munnekezijl

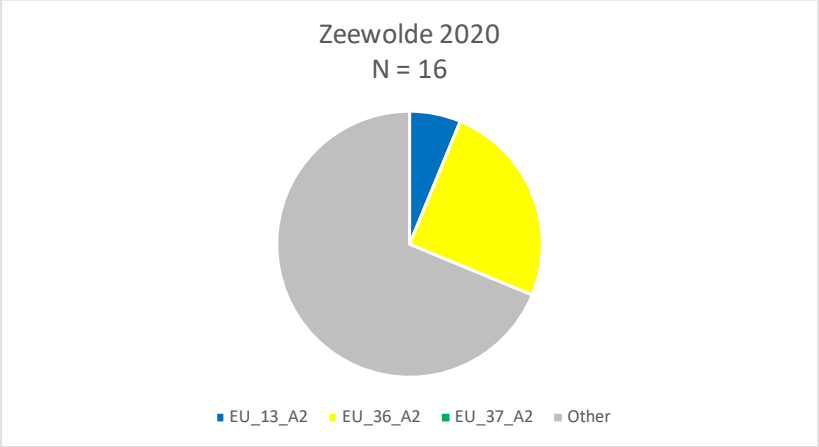
Munnekezijl	EU_13_A2	EU_36_A2	EU_37_A2	Other	Totaal
Acoustic		1			1
Alanis		1			1
Allians	1				1
Alouette		1			1
Beyonce	1				1
BIM 13-678-01	1				1
Cammeo		2			2
Connect			1		1
Glorietta		2			2
HZD 09-1496		1			1
Lady Jane		1			1
Levante		1			1
Louisa	1				1
Marabel		2			2
Muse	1				1
Nola		1			1
Otolia		1			1
Passion	1				1
Sephora		2			2
Sound		1			1
Sevilla	1				1
Tentation				1	1
Tinca		1			1
Triplo		1			1
Vitabella	1				1
Totaal	8	19	1	1	29

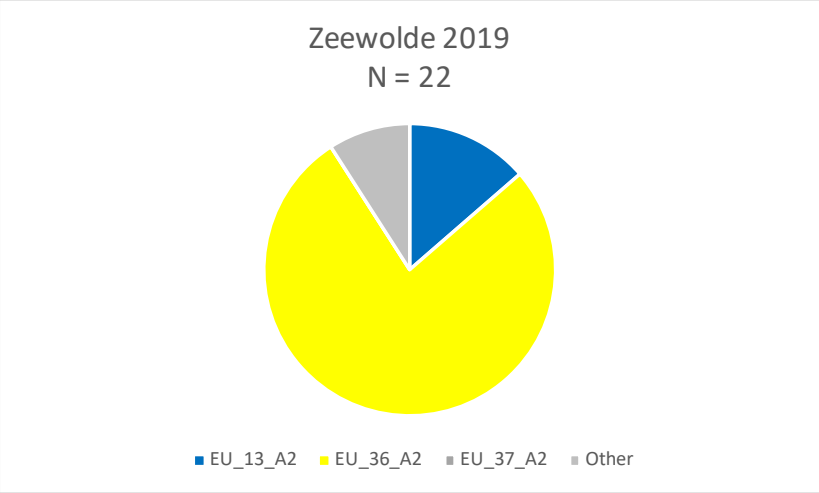




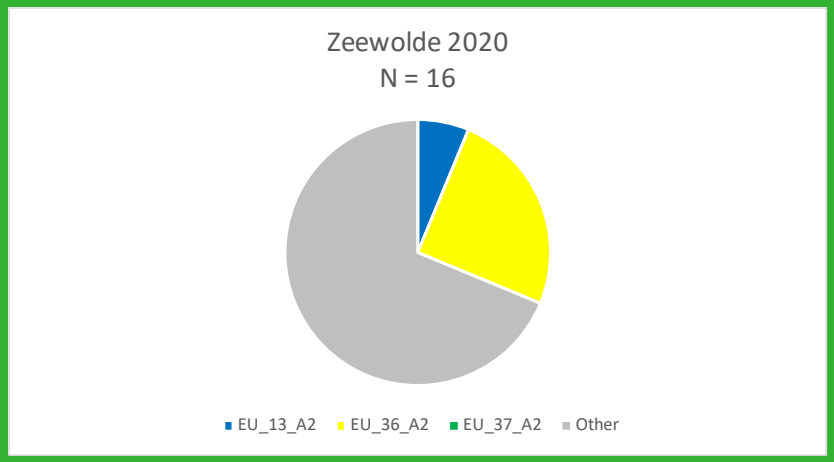
SSR genotyping Zeewolde

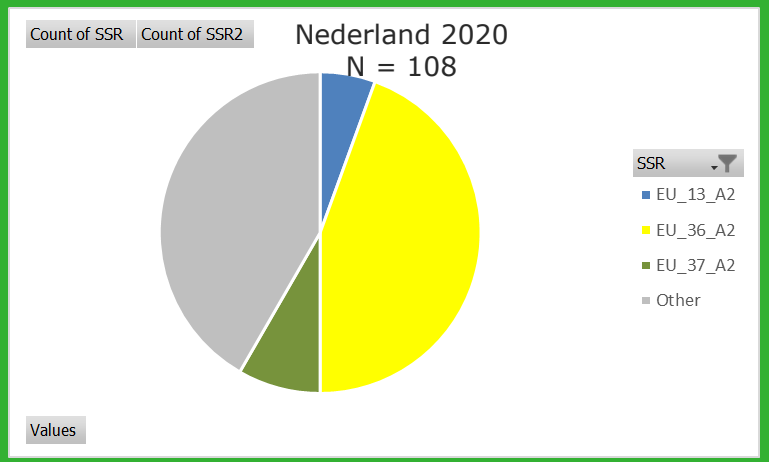
Zeewolde	EU_13_A2	EU_36_A2	EU_37_A2	Other	Totaal
Alanis		1			1
Allians				1	1
BIM 13-678-01		1			1
Cammeo				2	2
Glorietta		1			1
Lady Jane				1	1
Levante				1	1
Louisa	1				1
Marabel				2	2
Otolia				1	1
Sevilla		1			1
Sound				1	1
Tinca				1	1
Triplo				1	1
Totaal	1	4		11	16

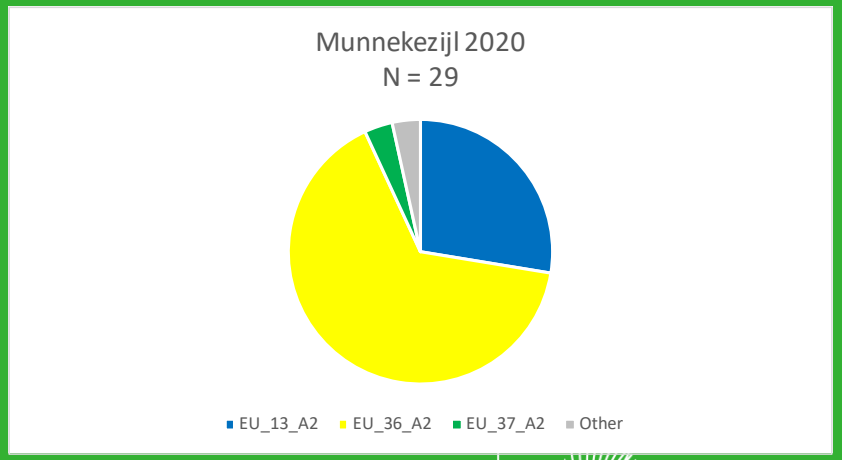




Demo fields versus NL population







Virulence bioassay 2020

- Detached leaf test (DLA)
  - Differentials:

    R0 (Desiree), Blb3(R2), R3a, R3b, R8, Edn2(R9), Sto1, Blb2, Cap1, Chc1, Vnt1,1/3, Ber1

  - 30 isolates:
    As much genetic variation as possible
  - 2 isolates did not grow

P. infestans isolates selected

Isolate	Town of origin	Variety of origin	SSR genotype
Bionext20080	Munnekezijl	Passion	EU_13_A2
Bionext20090	Munnekezijl	Vitabella	EU_13_A2
Bionext20091	Munnekezijl	BIM 13-678-01	EU_13_A2
Bionext20098	Munnekezijl	Muse	EU_13_A2
Bionext20094	Munnekezijl	Sevilla	EU_13_A2
Bionext20110	Zeewolde	Louisa	EU_13_A2
Bionext20083	Munnekezijl	Beyonce	EU_13_A2
Bionext20075	Munnekezijl	Levante	EU_36_A2
Bionext20077	Munnekezijl	Acoustic	EU_36_A2
Bionext20085	Munnekezijl	Alouette	EU_36_A2
Bionext20092	Munnekezijl	Sephora	EU_36_A2
Bionext20100	Zeewolde	Sevilla	EU_36_A2
Bionext20105	Zeewolde	Alanis	EU_36_A2
NL20036	Lelystad	Vnt1.1	EU_36_A2
Bionext20115	Zeewolde	BIM 13-678-01	EU_36_A2
NL20002	Randwijk	BIM 13-678-01	Other
NL20003	Randwijk	Lady Jane	Other
NL20004	Randwijk	BIM16-1193-12	Other
NL20005	Randwijk	BIM12-477-04	Other
Bionext20066	Zeewolde	Marabel	Other
Bionext20084	Metslawier	Muse	Other
Bionext20099	Zeewolde	Sound	Other a
Bionext20114	Zeewolde	Cammeo	Other a
Bionext20097	Munnekezijl	Tentation	Other b
Bionext20106	Zeewolde	Cammeo	Other b
Bionext20111	Zeewolde	Levante	Other b
~~Bionext20069~~	Munnekezijl	Connect	EU_37_A2
~~N3/19~~	Denemarken 2019	?	E_41_A2

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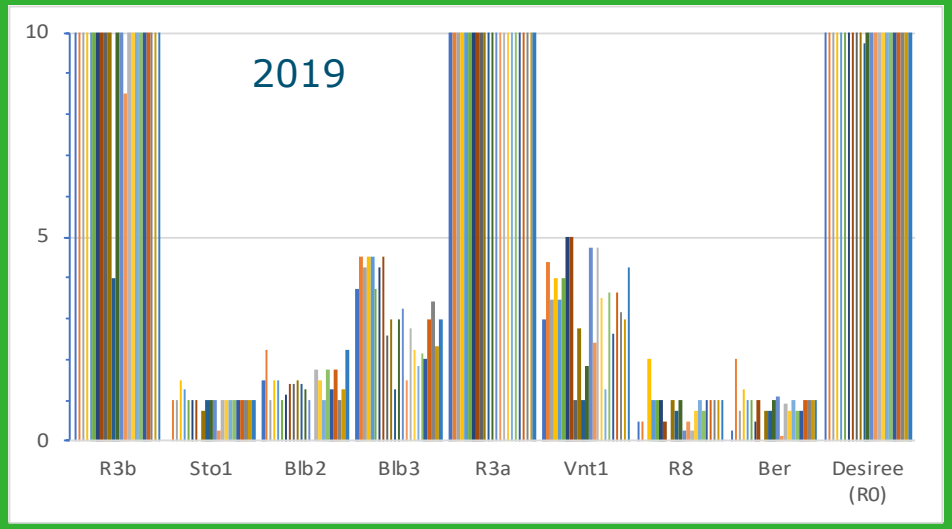
Detached leaf test

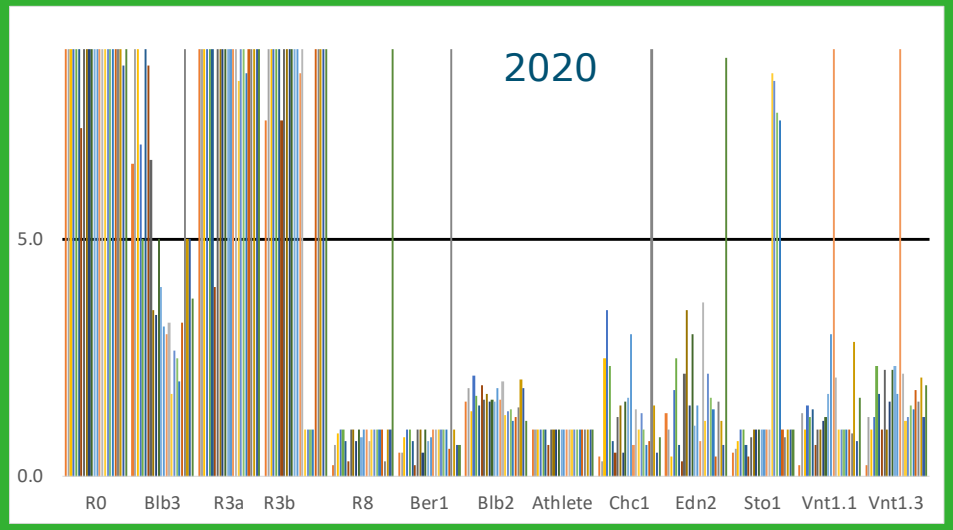
Assessment:	
0	No visible symptoms
1	HR the size of the inoculum droplet (2-4mm)
2	HR slightly bigger than the inoculum droplet (5- 8mm)
3	big HR (>8 mm), dry
4	big HR (>8 mm) + a bit of watersoaking, no sporulation
5	big watersoaked lesions (>1cm) with macroscopically invisible sporulation (under the microscope you may see some sporulation)
8	Big lesions (>1cm) with sporulation on the dark side (adaxial side because the leaves are upside don) of the leaves
10	Big lesions (>1cm) with sporulation on both sides of the leaves

Detached leaf tests 2019 & 2020

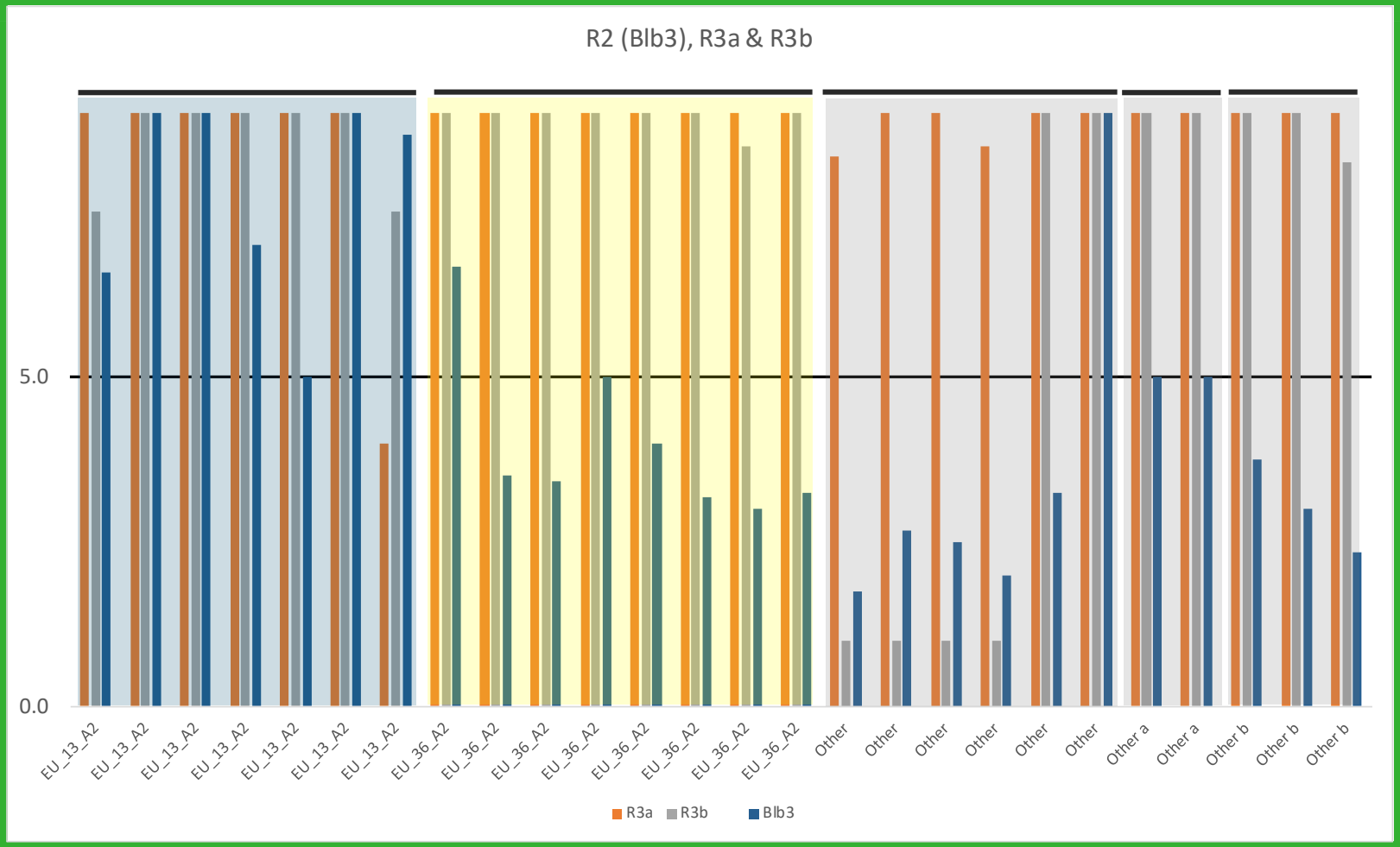


Similar effector recognition:

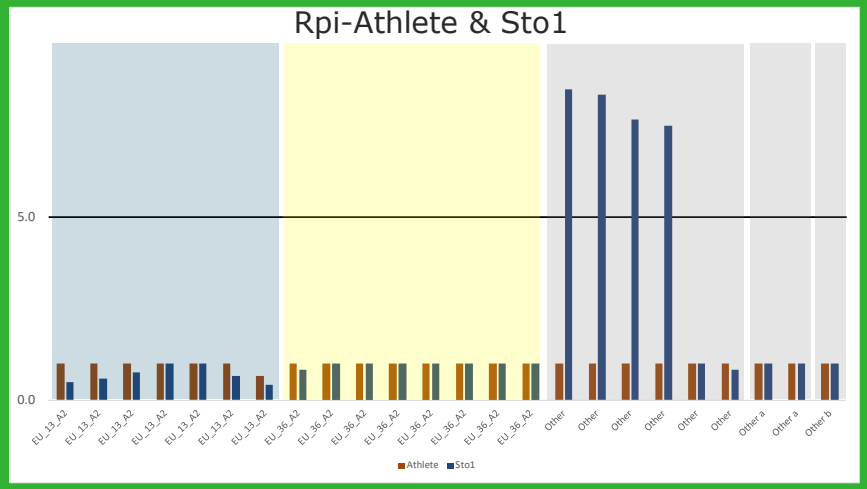
- Rpi-Ber1 & Rpi-Chc1
- Rpi-Vnt1.1 & Rpi-Vnt1.3

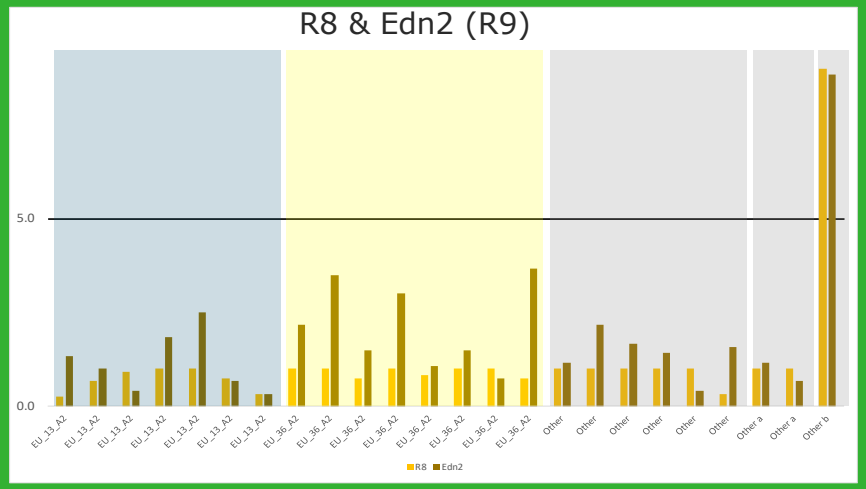


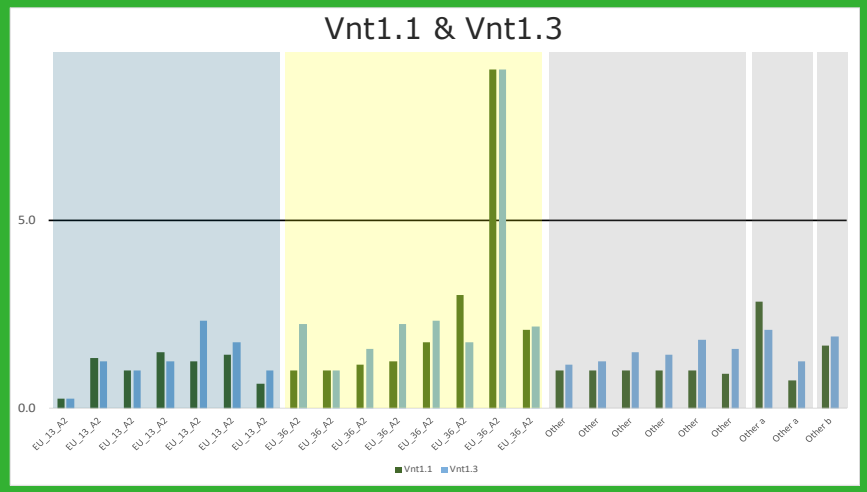
Virulence for narrow spectrum R genes Blb3 (R2), R3a en R3b

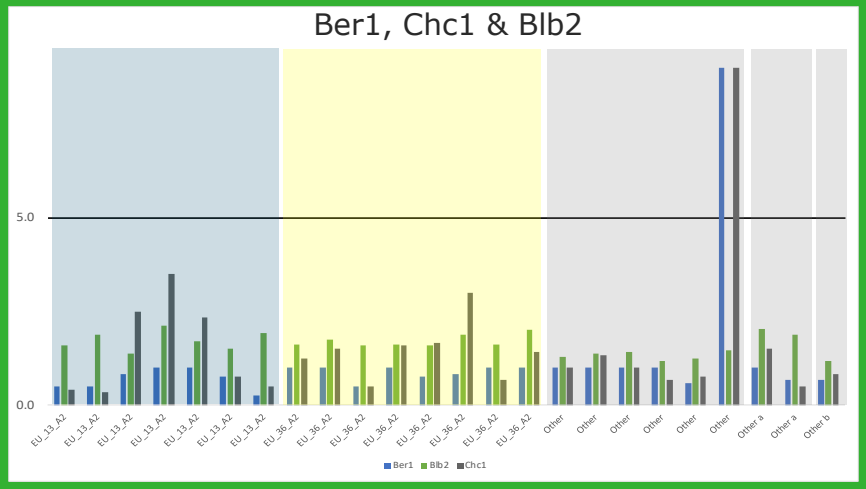


Virulentie broad spectrum R genes









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Virulence spectra *P. infestans* clonal lines

	R1	R2	R3a	R3b	R8	R9a	chc1	vnt1	blb2	sto1	Smira1
EU13	v	v	v	v	a	a	a	a	a	a	v
EU6	?	?	?	?	?	a	a	a	a	a	a
EU36	v	a	v	v	a	a	a	a	a	a	?
EU33	v	v	v	v	a	a	a	a	a	?	?

v= virulent
a= a - virulent

Conclusies

- More genetic variation *P. infestans* in demo fields in 2020 than in 2019
- Virulence for R3a & R3b is common, virulence Blb3 (R2) ~ 50% isolates
- Rare virulences primarily in “other” group:
  - Virulence for Sto1, R8, Edn2, Vnt1.1, Vnt1.3, Ber1 en Chc1
  - Stacked virulences: R8 & Edn2 (genotype “other b”)
  - One EU_36_A2 isolate virulent on Vnt1
- Mutation – selection:
  - Rare virulences still random events → Current selection pressure is limited
  - Rare (stacked) virulences demonstrate importance of resistance management!

Conclusies

- Zeldzame virulenties vooral in “other” groep P. infestans:
  - Virulentie voor Sto1, R8, Edn2, Vnt1.1, Vnt1.3, Ber en Chc1 wordt gevonden.
  - Gestapelde zeldzame virulenties:
    - R8 & Edn2 (*P. infestans* genotype “other b”)
- één EU_36_A2 isolaat wat virulent is op Vnt1
- Mutatie – selectie:
  - Zeldzame virulenties lijken nog random events, nog geen effect van selectiedruk door resistente rassen.
  - Zeldzame (gestapelde) virulenties laten wel t belang van resistentiemanagement zien.

Thank you for your attention!