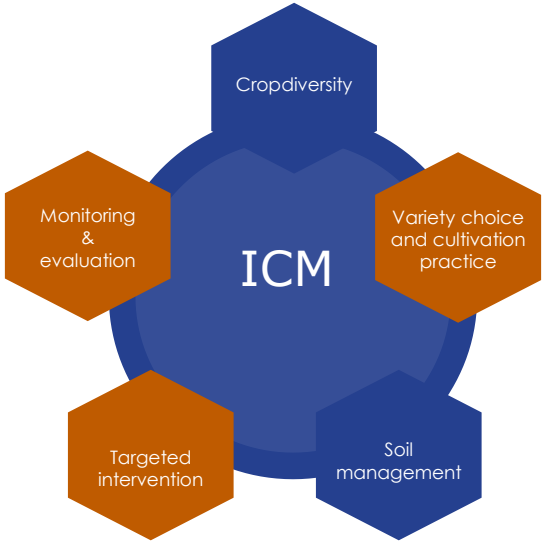
# Phytophthora resistance and virulence

Geert Kessel & Jack Vossen

Jaarlijkse convenant bijeenkomst, TPC, 21 November 2024

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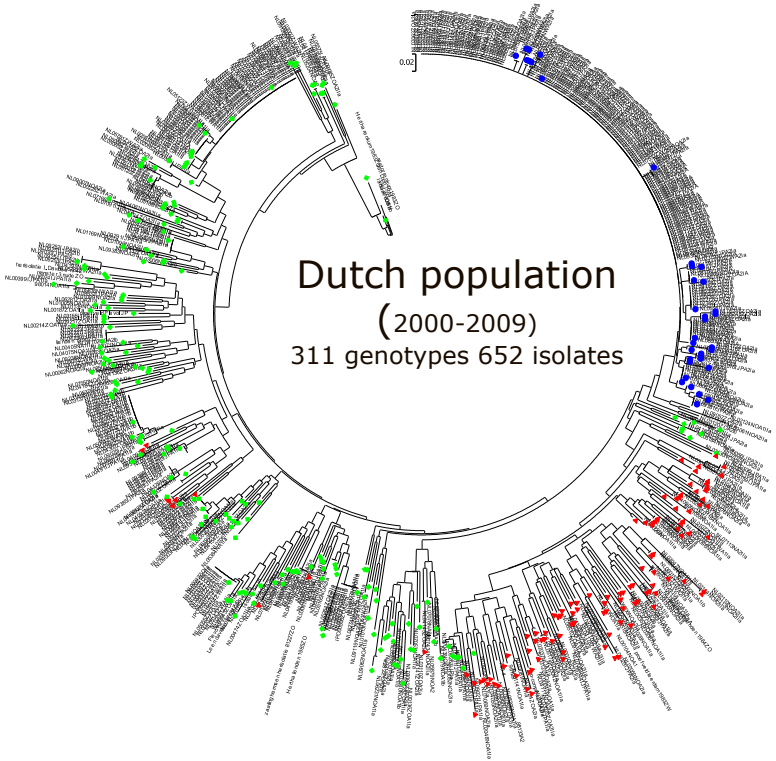
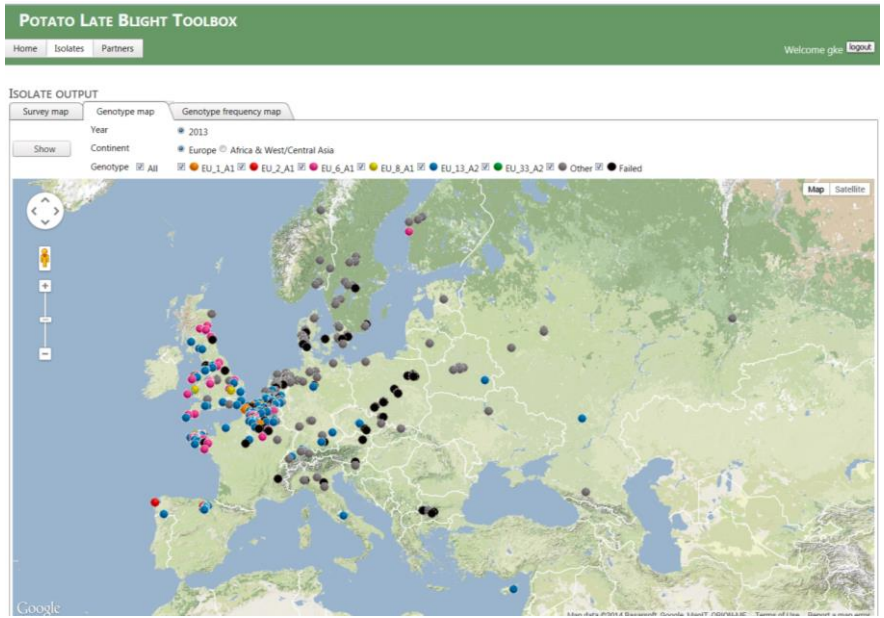
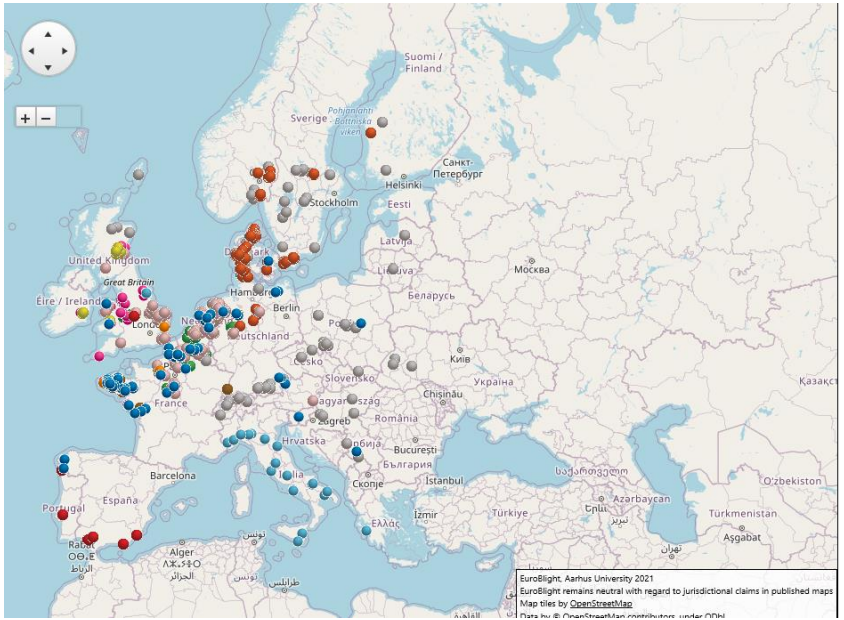
# Genetische variatie




- SSR genotypering
  - 12 neutrale merkers op niet coderend DNA
  - Geen rechtstreekse koppeling met fenotype (echte eigenschappen)
  - Bron van variatie: natuurlijke mutaties en reproductie

# EU *P. infestans* populatie 2013 versus 2020

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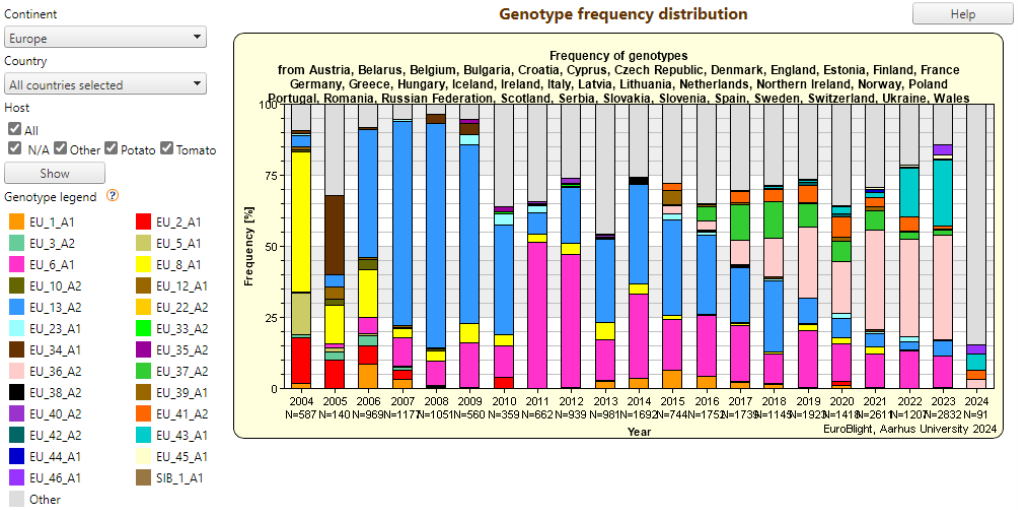
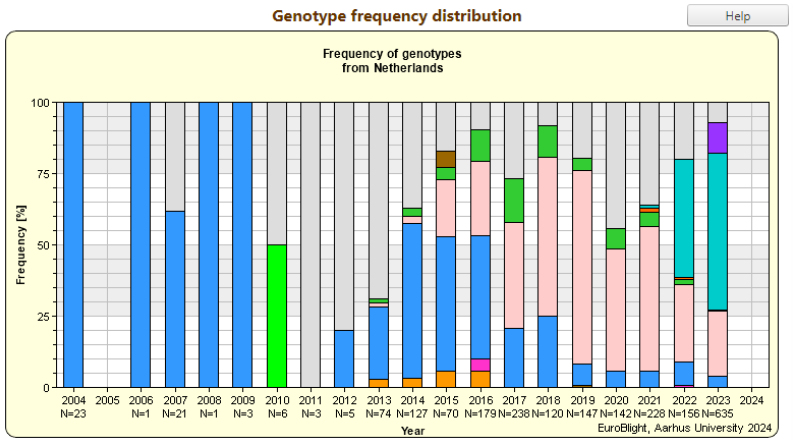
# EU & NL *P. infestans* populatie tm 2023, deels 2024

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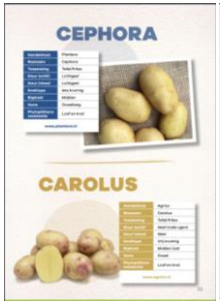
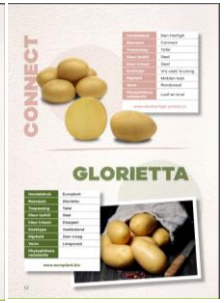
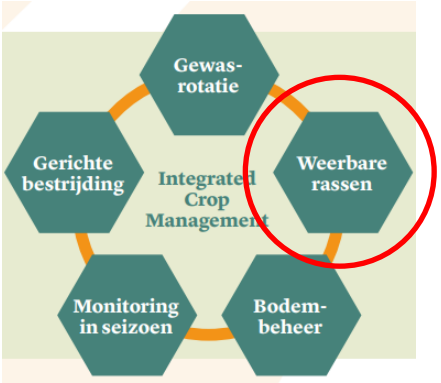
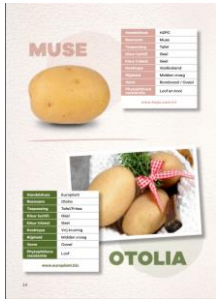
# Phytophthora ICM: resistente rassen



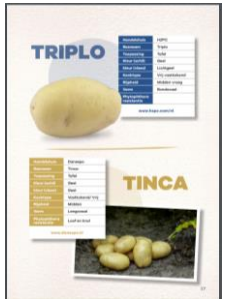



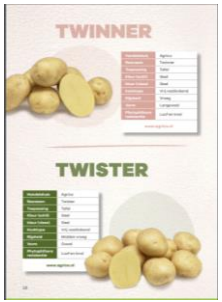



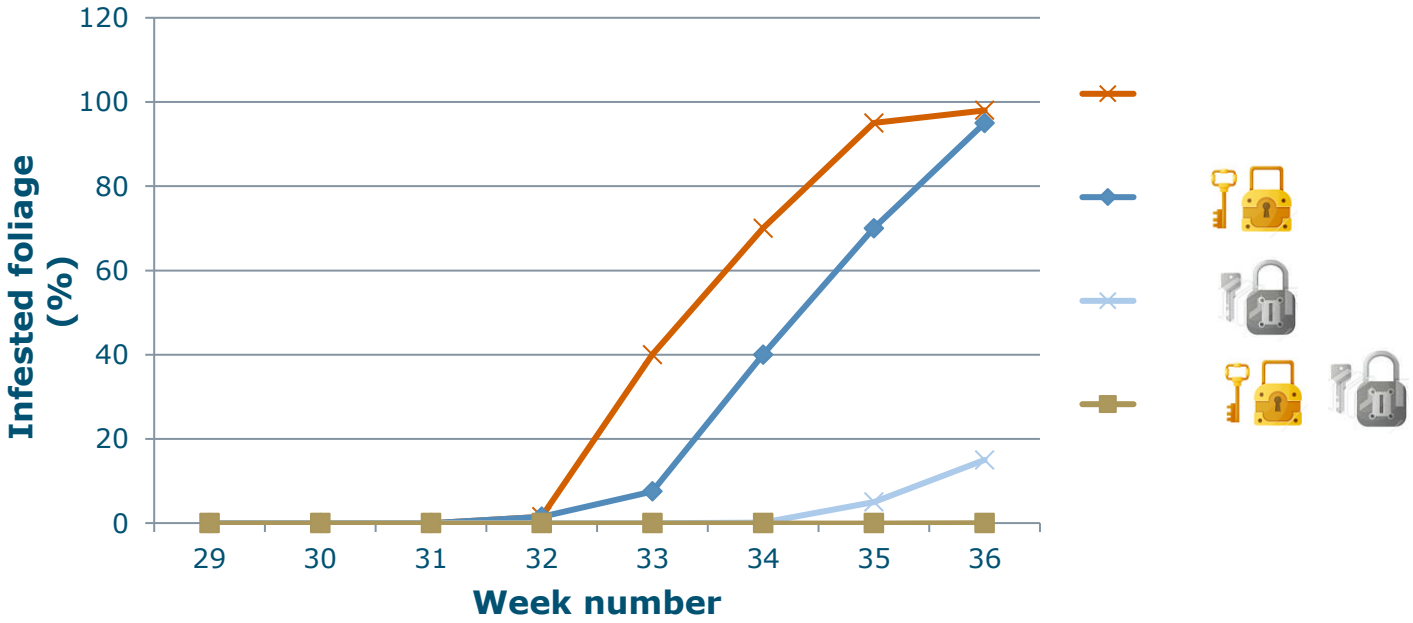



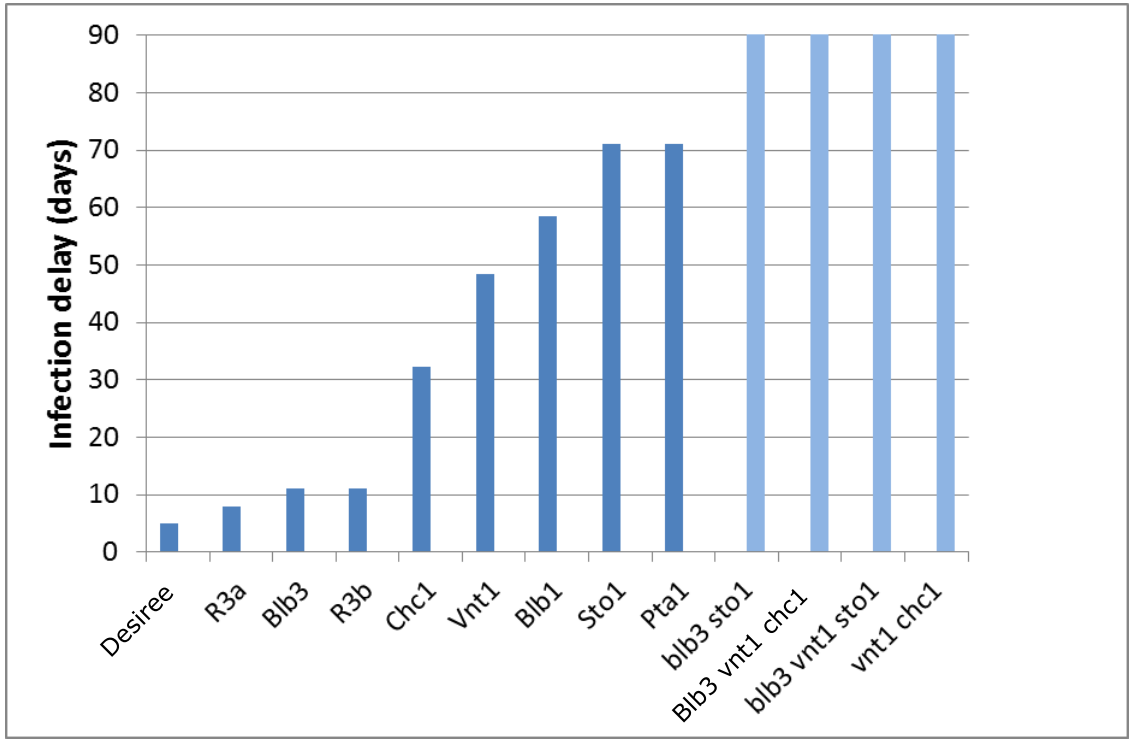




120
100
80
60
40
20
0
Infested foliage (%)
29
30
31
32
33
34
35
36
Week number

# Resistente rassen zijn effectief maar niet immuun




MOLECULAR PLANT PATHOLOGY (2008) 9(3), 385–402 DOI: 10.1111/J.1364-3703.2007.00465.X

Review

Plant diseases that changed the world

**_Phytophthora infestans_: the plant (and _R_ gene) destroyer**

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**SUMMARY**

*Phytophthora infestans* remains a problem to production agriculture. Historically there have been many controversies concerning its biology and pathogenicity, some of which remain today. Advances in molecular biology and genomics promise to reveal fascinating insight into its pathogenicity and biology. However, the plasticity of its genome as revealed in population diversity and in the abundance of putative effectors means that this oomycete remains a formidable foe.

Scholar identified 13 400 articles, with 4450 since 2002—and this search did not find all of the contributions. There are many books (e.g. Dowley *et al.*, 1995; Ingram and Williams, 1991; Lucas *et al.*, 1991), thousands of research articles and thousands of popular reports, and many historical treatments (e.g. Turner, 2005). The 'romance' occurs because many, many scientists have had high hopes that their investigations would lead to control of this dangerous pathogen. The 'controversies' (some continuing to today) develop from differences in method/interpretation—aided by ego. The vast literature creates a special challenge in writing a short overview of this organism and mandates that it be highly selective.

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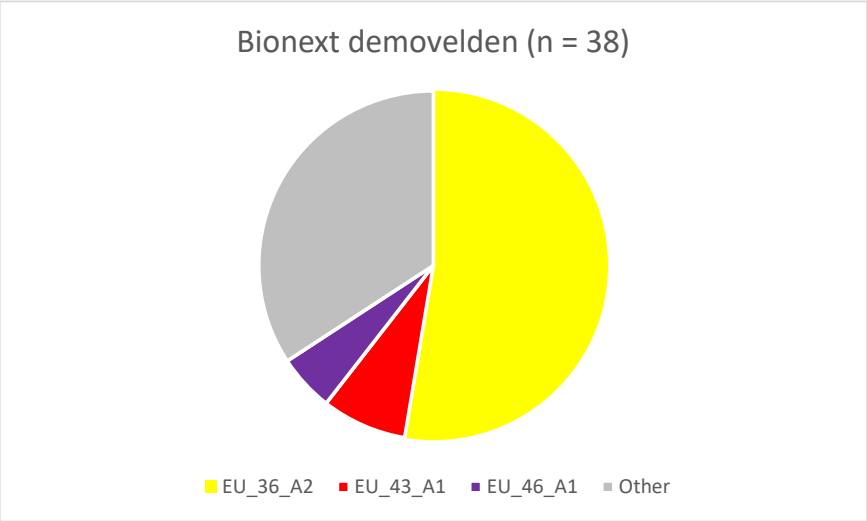
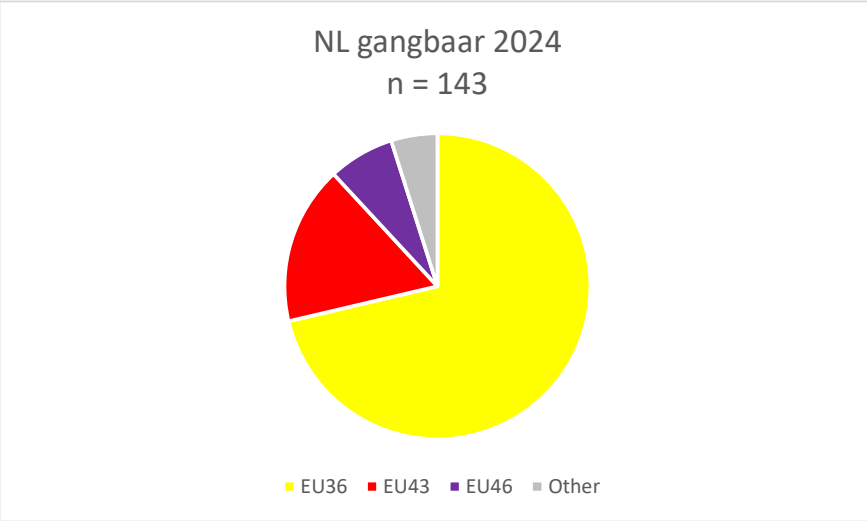
# *P. infestans* bemonstering 2024

- Totaal: 55 monsters → 39 reincultures
    - Munnekezijl:
        - 23 bladmonsters, 19 reincultures
    - Almere:
        - 18 bladmonsters, 12 reincultures
    - Langeweg:
        - 14 bladmonsters, 8 reincultures

# *P. infestans* SSR genotypes in Bionext demovelden

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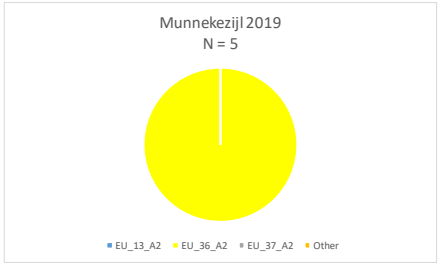
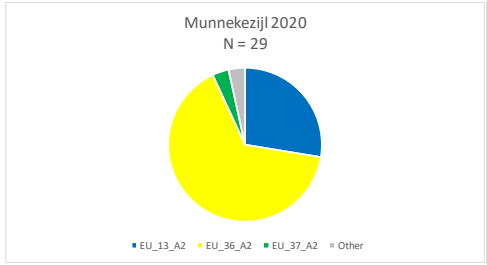
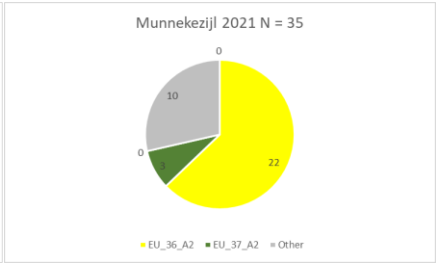
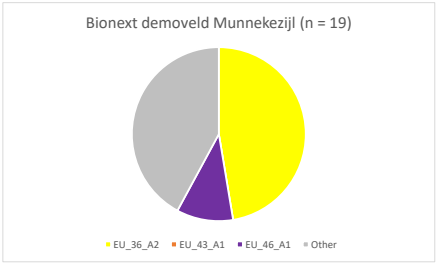
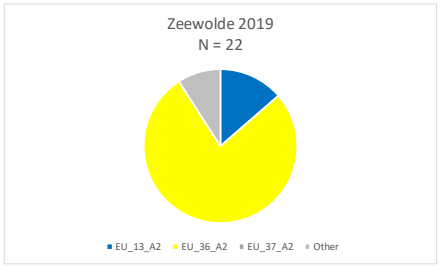
# *P. infestans* SSR genotypes in Bionext demovelden

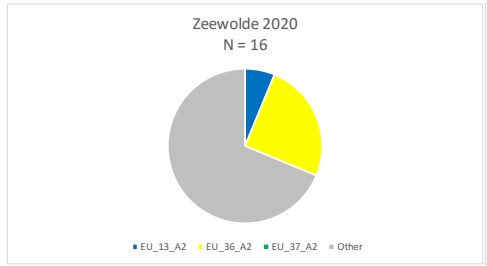


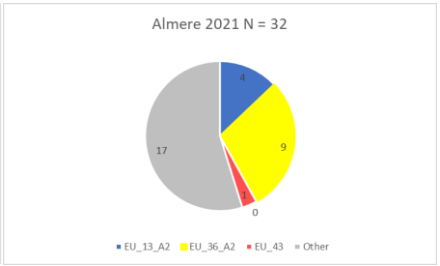



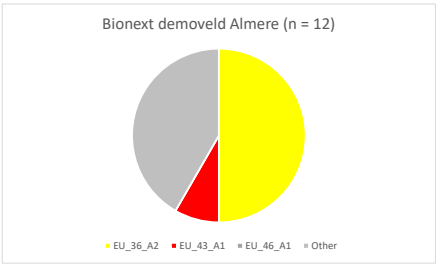



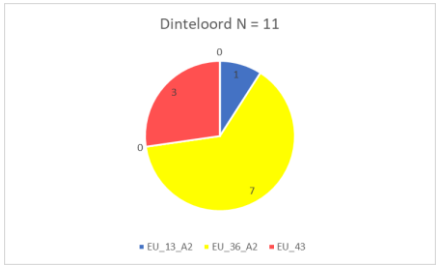



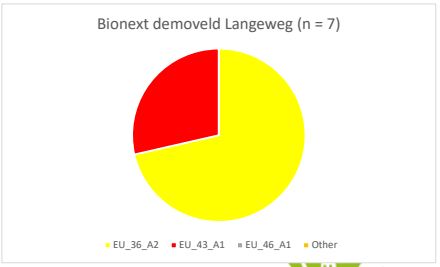

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# Virulentie toets 2024 *P. infestans* isolates

- Selectie en opkweek van isolaten
  → zoveel mogelijk genetische variatie.
  26 stuks.
- Opkweek plantmateriaal:
  Differentials met de volgende R genen:
  - R0 (Desiree & Russet burbank)
    + →

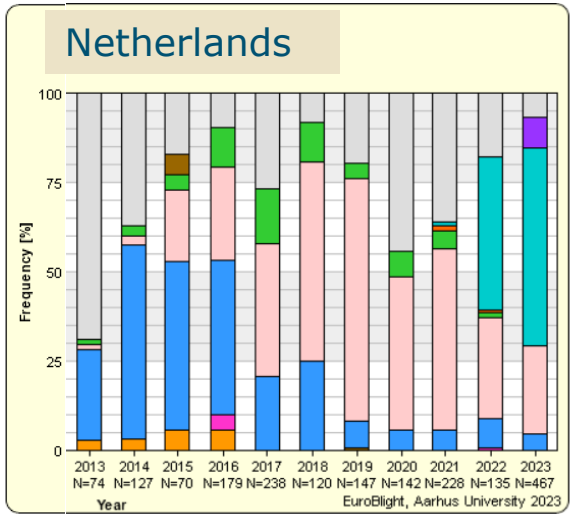
| Resistance gene<br>Functional group | Cognate Avr (family) |
|---|---|
| R1 | Avr1 |
| R3a | Avr3a |
| R3b | Avr3b |
| R2, Rpi-abpt | Avr2 family |
| R8, Rpi-smira2 | Avr8 |
| R9a, Rpi-edn2 | Avr9a family |
| Rpi-blb2 | Avrblb2 family |
| Rpi-chc1, Rpi-ber1 | Avrchc1 family |
| Rpi-vnt1, Rpi-wbr1 | Avrvnt1 |
| Rpi-cap1 | Avrcap1 |

# Virulentie biotoets 2024

Day 0

Day 5

# Algemeen virulentiespectrum van huidige klonale lijnen




| | R3a | R3b | R2 | blb2 | vnt1 | ber1 | R8 | cap1 |
|---|---|---|---|---|---|---|---|---|
| EU13 | v | v | v | a | a | a | a | a |
| EU36 | v | v | a | a | a | a | a | a |
| EU37 | v | v | v | a | a | a | a | a |
| EU41 | v | v | v | a | a | a | a | a |
| EU43 | v | v | a | a | a | a | a | a |
| EU46 | v | v | a | a | a | a | a | a |
| other | v | var | var | var | var | var | var | var |

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# Toename van enkelvoudige & meervoudige virulenties

| Group | acquired virulence | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|
| EU36 | ber1 | - | Fl | NH | Fl, Fr | NB, Fl, Fr |
| EU36 | R2 | - | - | - | - | NB |
| EU36 | vnt1 | Fl | Fr, Fl | Fr | - | Fr |
| EU36 | ber1, cap1 | - | - | - | - | Fr |
| EU36 | ber1, blb2 | - | - | - | - | Fr |
| EU36 | ber1, R9a | - | - | - | - | NB |
| EU36 | R9a, blb2 | - | - | - | - | Fl |
| EU43 | R2 | - | NB | NB | NB, Fl, Fr | NB, Fl, Fr |
| EU43 | R2, blb2 | - | - | - | NB | - |
| EU46 | R2 | - | - | - | - | Fr |
| BN23135 | R8, R9a | - | - | - | Fr, Fl | Fr, Fl |

NH: Noord Holland
Fr: Friesland
Fl: Flevoland
NB: Noord-Brabant

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# Enkele conclusies

- Virulenties:
  - Virulente varianten overleven winter en breiden virulentiespectrum uit
  - 4 nieuwe dubbele virulenties in demovelden 2024
- Resistentiemanagement
  - Naleven teeltvoorschriften, afvalhopen, opslag, aantasting
  - Pootgoed belangrijke factor,
  - BOS systemen kunnen helpen