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Moving forward from a reactive to a proactive and predictive approach in Late Blight control

Euroblight Workshop

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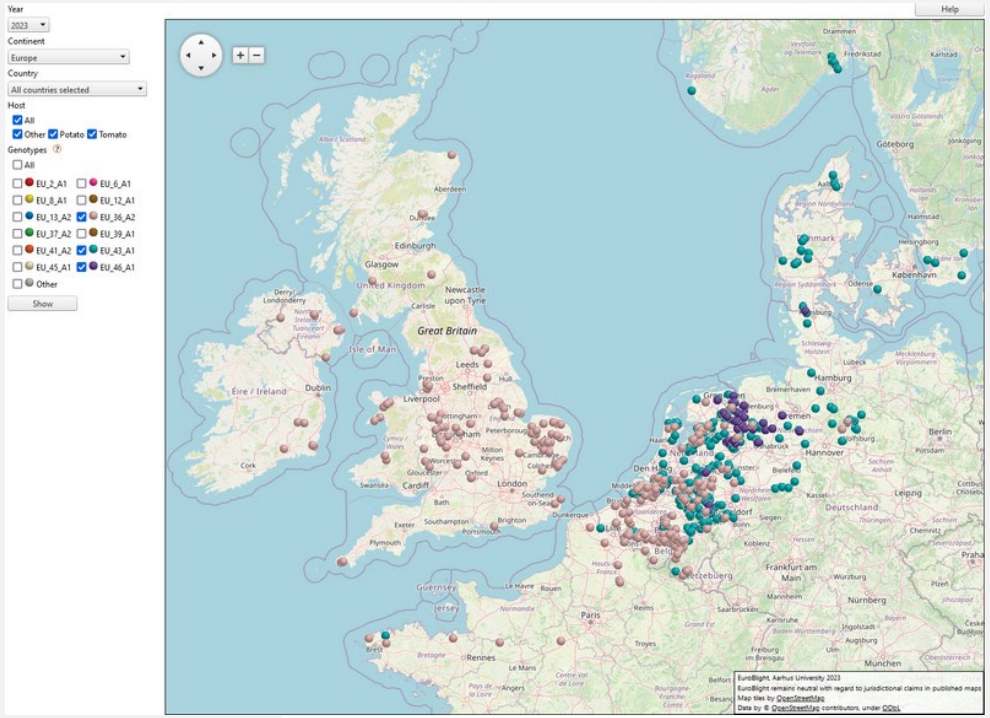
Lunteren, the Netherlands

Audrey Derumier, Gwenaël Champroux, , Ed Bingham, Pim van de Griend, Lawrence Veryser

How *Phytophthora infestans* is monitored today



EuroBlight early data release

FRAC
FUNGICIDE RESISTANCE ACTION COMMITTEE

FUNGICIDE RESISTANCE ACTION COMMITTEE

Pathogen risk

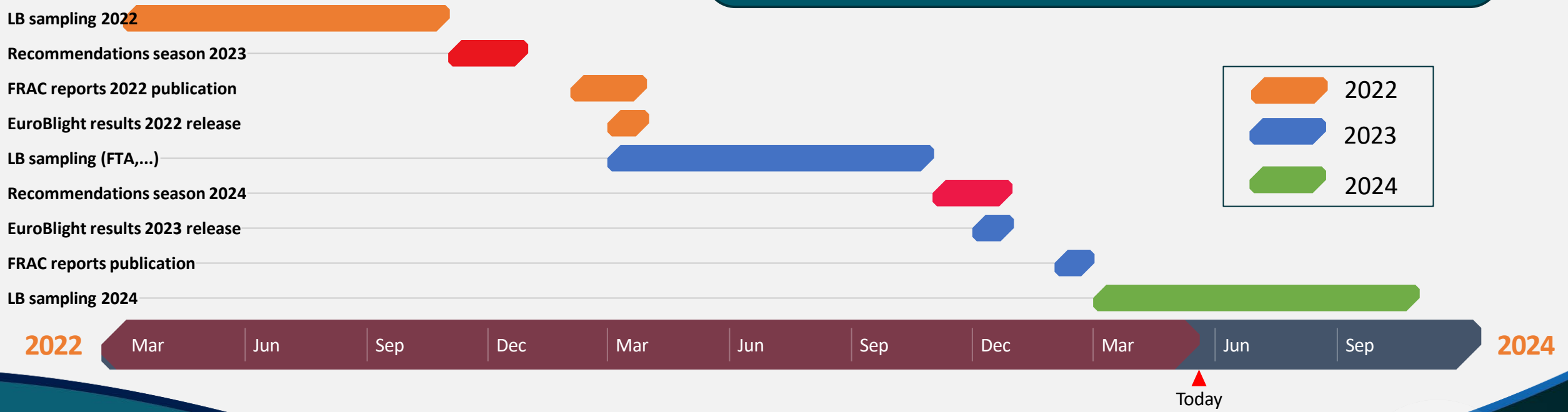
Fungicide risk

NEW RECOMMENDATIONS

Our current approach is reactive

When new recommendations (fungicide programs,…) are communicated to the distributors (and the farmers), those are not considering the information from Euroblight & FRAC of the season before, but the one again before.

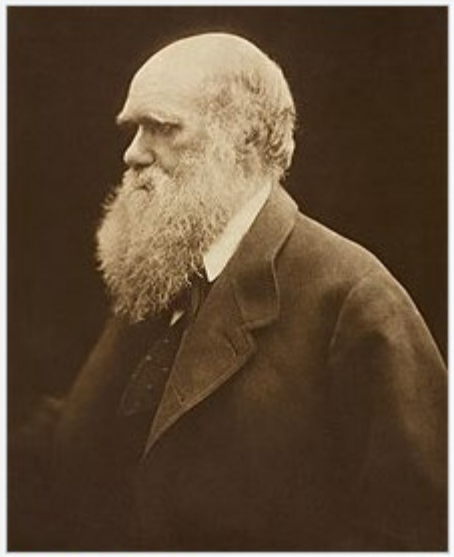
e.g.: recommendations for season 2024 consider data from 2022 season



Understanding how *P. infestans* evolves

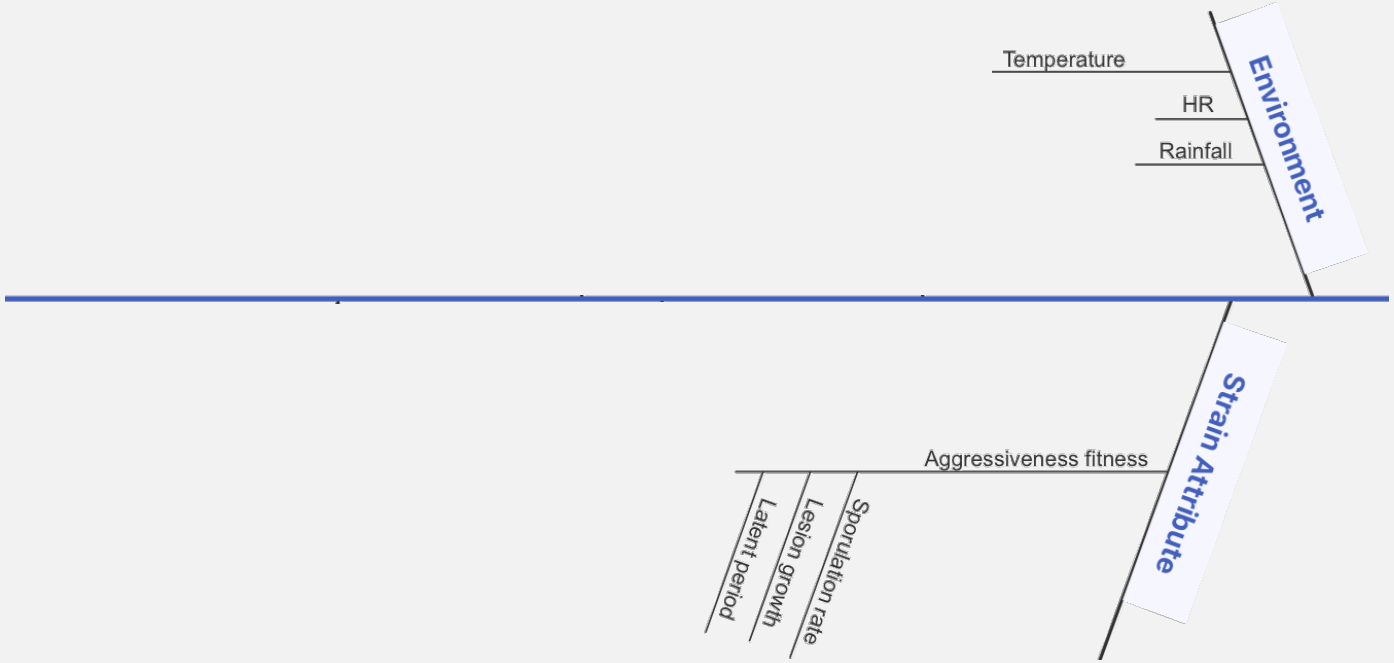
EVOLUTION

"Process of -descent with modification-. C. Darwin proposed that some organisms with a species have **trait** variants that make them **fitter** and more **likely to reproduce**. Over time, inherited modified trains become dominant in the population, and a new species may emerge. Darwin proposed natural **selection** as the mechanism for evolution"

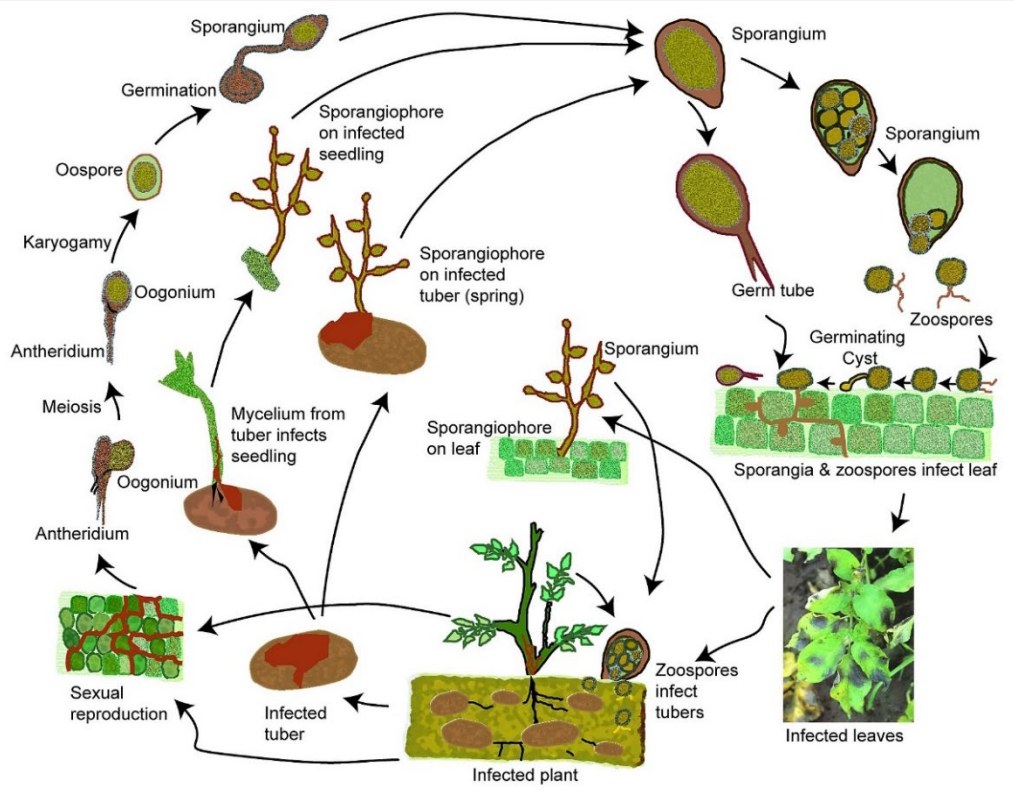


Charles Darwin in 1868

Some factors influencing late blight



Trait variants increasing fitness & reproductivity



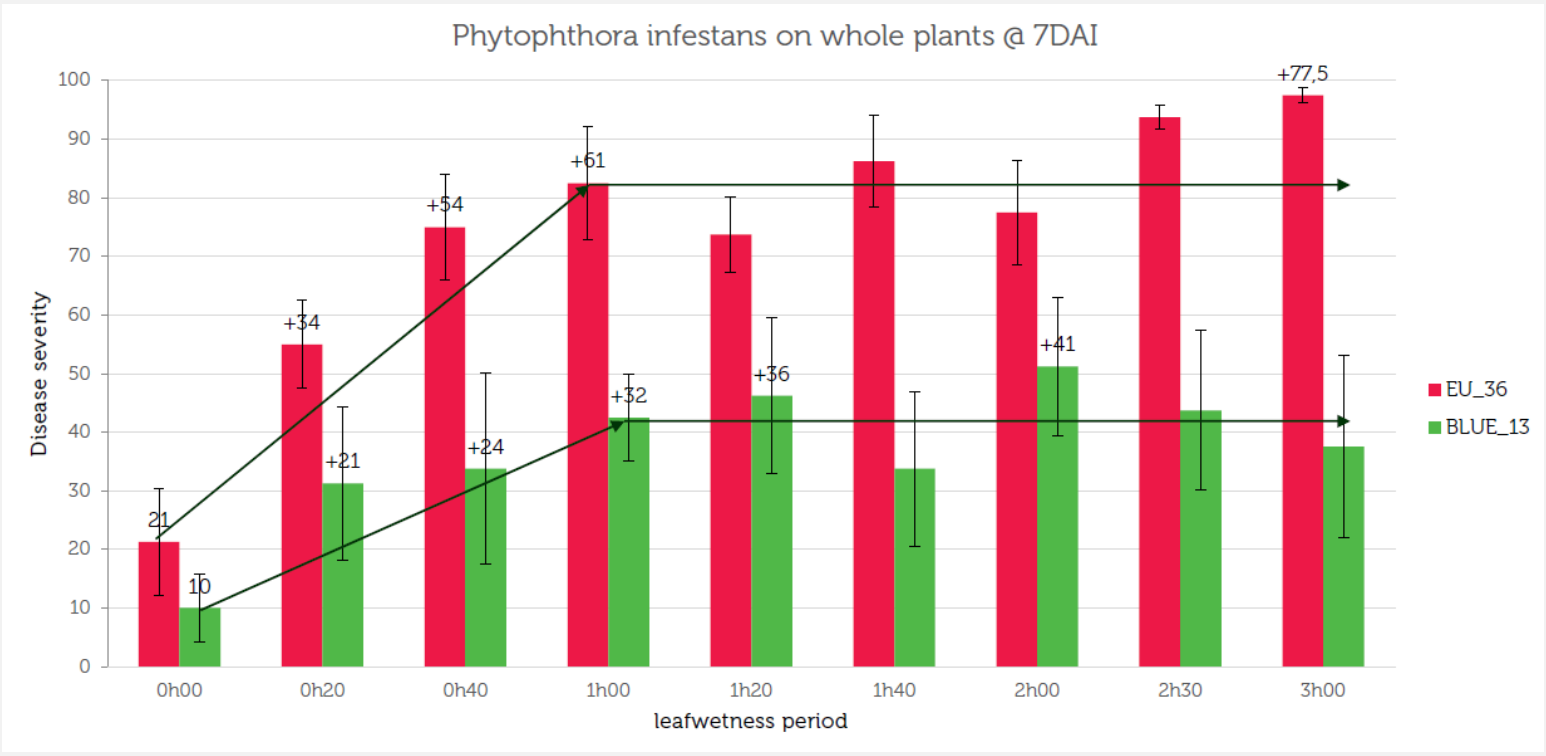
Source: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051399

Environmental factors such as T° and humidity are strongly influencing the life cycle of *P. infestans*

- Germination/infection rate
- Latent period
- Lesion growth speed
- Sporulation
- Sexual reproduction: presence of A1 & A2 mating types + optimal conditions
- Survival
- Tubers infection/spread

→ PHYTIN exhibits considerable capacity for generating, recombining, and selecting fit combinations of variants in key pathogenicity, fitness and aggressiveness traits

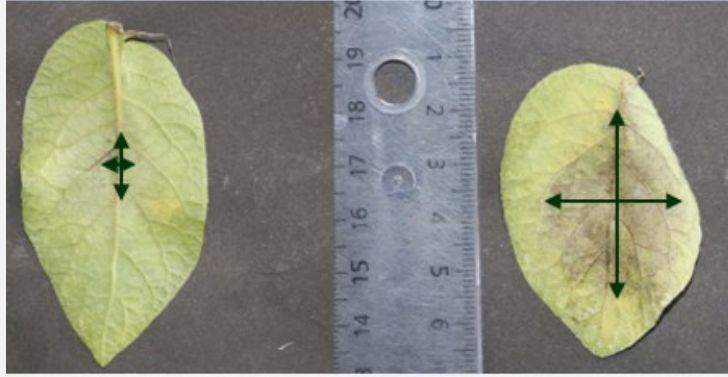
Aggressiveness tests on plants – effect of RH



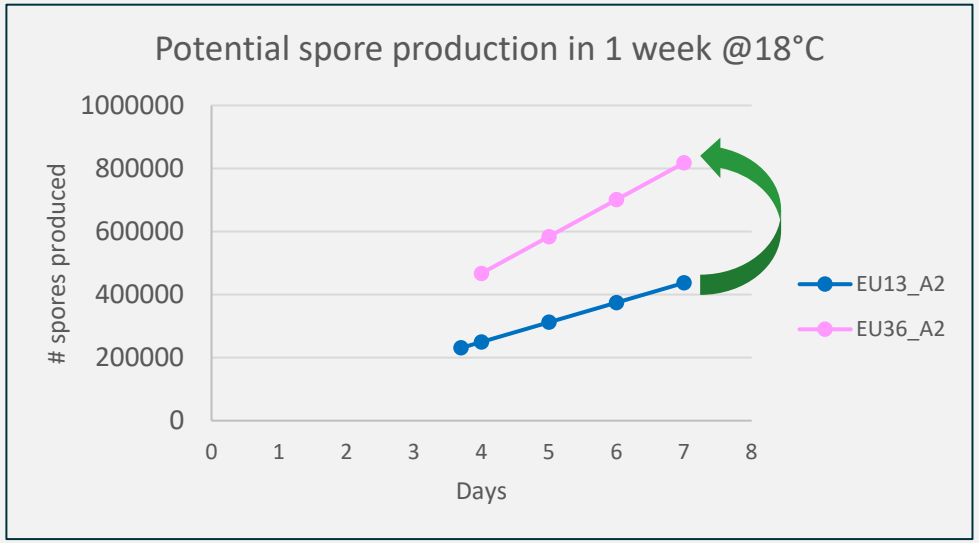
- A high RH during the first hour after infection strongly influences the level of infection
- The EU_36 genotype reaches a higher level of infection even in a short leaf wetness period: more aggressive
- The infection of the EU_36 genotype is more successful

Aggressiveness test in the lab

Update 2023 @ 18°C
Tests ongoing with EU46



Parameter	EU6_A1 (N=3)	EU13_A2 (n=34)	EU36_A2 (n=8)	EU37_A2 (n=3)	EU41_A2 (n=3)	EU43_A1 (n=7)	'Other' (n=6)
Latent period (days)	3,67	3,69	4,03	4,87	5,07	4,14	3,17
Lesion growth rate (cm^2/day)	6,55	6,42	5,80	6,35	3,90	3,59	3,94
Sporulation capacity (sp/cm^2)	10.006	9.732	20.151	8.694	35.499	27.584	21.622
Nb spores after 7 days	460k	437k	**818k**	386k	969k	**693k**	596k



→ Multiplier effect

- Biological tests are a good tool to predict how fast a new genotype can spread, and how dominant it could become in a population. But they are time consuming, difficult to repeat.
- Can we identify phenotypic markers that shape aggressiveness?
- More attention on the 'others'

‘others’

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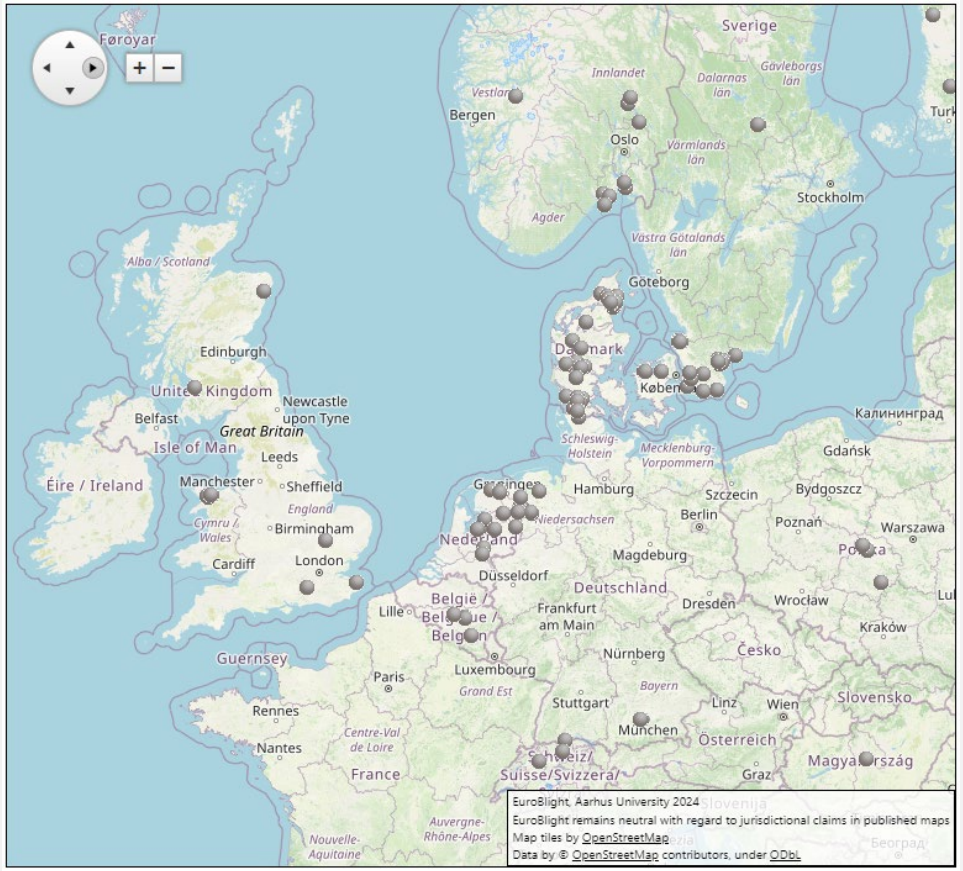
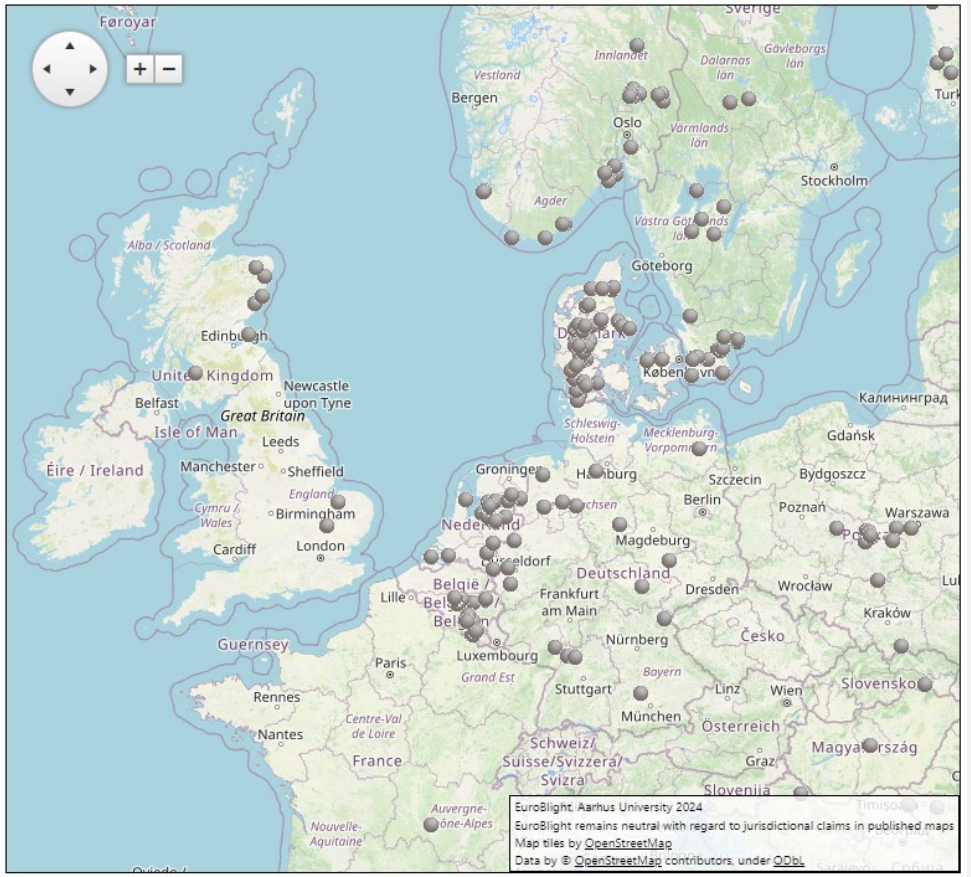
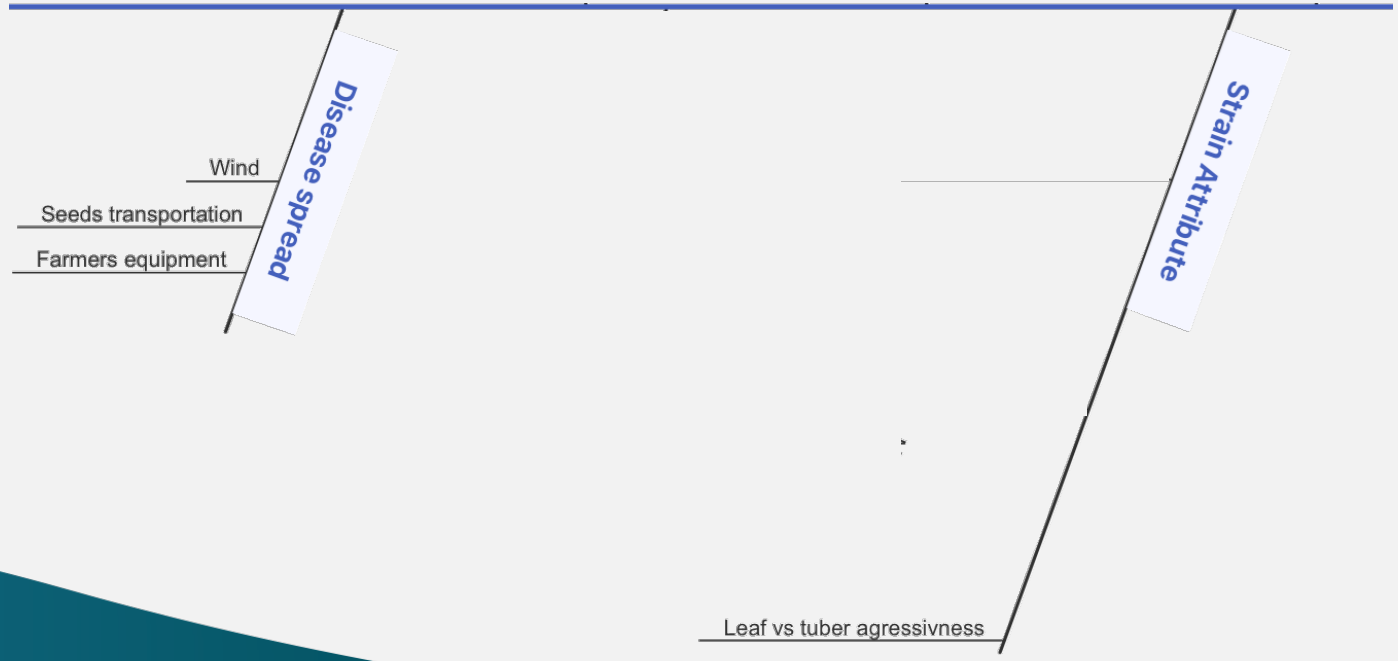
2022



2023



Some factors influencing late blight



The role of seeds export in the spread of the new genotypes

Intra-EU exports of potatoes, 2020
(EUR 1 000, 1 000 tonnes)

	Value				Volume			
	Seed potatoes	Early potatoes	Main crop potatoes	Starch potatoes	Seed potatoes	Early potatoes	Main crop potatoes	Starch potatoes
	EUR 1 000				1 000 tonnes			
EU	379 644	133 657	1 141 325	31 521	795.7	332.2	5 752.1	168.5
Belgium	36 163	8 202	135 978	394	88.4	17.2	914.0	4.1
Bulgaria	:	2	602	:	:	0.0	2.6	:
Czechia	341	658	5 137	73	0.6	1.5	11.8	0.7
Denmark	10 731	10	13 757	6	23.4	0.0	67.2	0.1
Germany	35 369	6 948	232 392	6 685	69.3	13.1	1 673.6	38.6
Estonia	0	10	839	:	0.0	0.0	5.6	:
Ireland	:	:	36	:	:	:	0.0	:
Greece	104	5 237	7 040	0	0.1	18.4	27.9	0.0
Spain	5 800	26 592	60 279	53	11.5	69.1	186.4	0.3
France	40 140	12 385	450 310	19 835	83.5	61.9	1 897.3	108.5
Croatia	64	445	1 348	:	0.1	1.3	9.2	:
Italy	449	25 945	10 577	196	0.8	49.6	18.9	0.6
Cyprus	504	20 949	6 515	:	1.0	36.8	14.1	:
Latvia	:	1 144	1 565	0	:	5.1	6.9	0.0
Lithuania	30	39	2 126	:	0.1	0.1	11.9	:
Luxembourg	2 964	209	667	1	6.7	0.6	0.5	0.0
Hungary	201	1 353	151	566	0.1	5.3	0.6	2.8
Malta	:	307	:	55	:	0.7	:	0.1
Netherlands	238 159	9 154	179 677	1 771	494.6	19.3	799.5	4.0
Austria	3 045	587	6 443	849	7.0	1.6	29.6	6.1
Poland	969	421	2 411	0	2.3	0.9	7.5	0.0
Portugal	3 942	478	11 888	536	5.0	0.7	38.6	2.3
Romania	48	731	315	2	0.0	2.2	1.1	0.0
Slovenia	50	9 965	2 415	:	0.1	24.2	5.8	:
Slovakia	:	39	5 566	:	:	0.1	14.0	:
Finland	570	2	1 606	:	1.2	0.0	5.0	:
Sweden	1	1 847	1 686	499	0.0	2.3	2.4	0.5

(:) not available
Source: Eurostat (EU trade since 1988 by HS2,4,6 and CN8 [DS-645593])

eurostat

Table 5: Intra-EU exports of potatoes, 2020

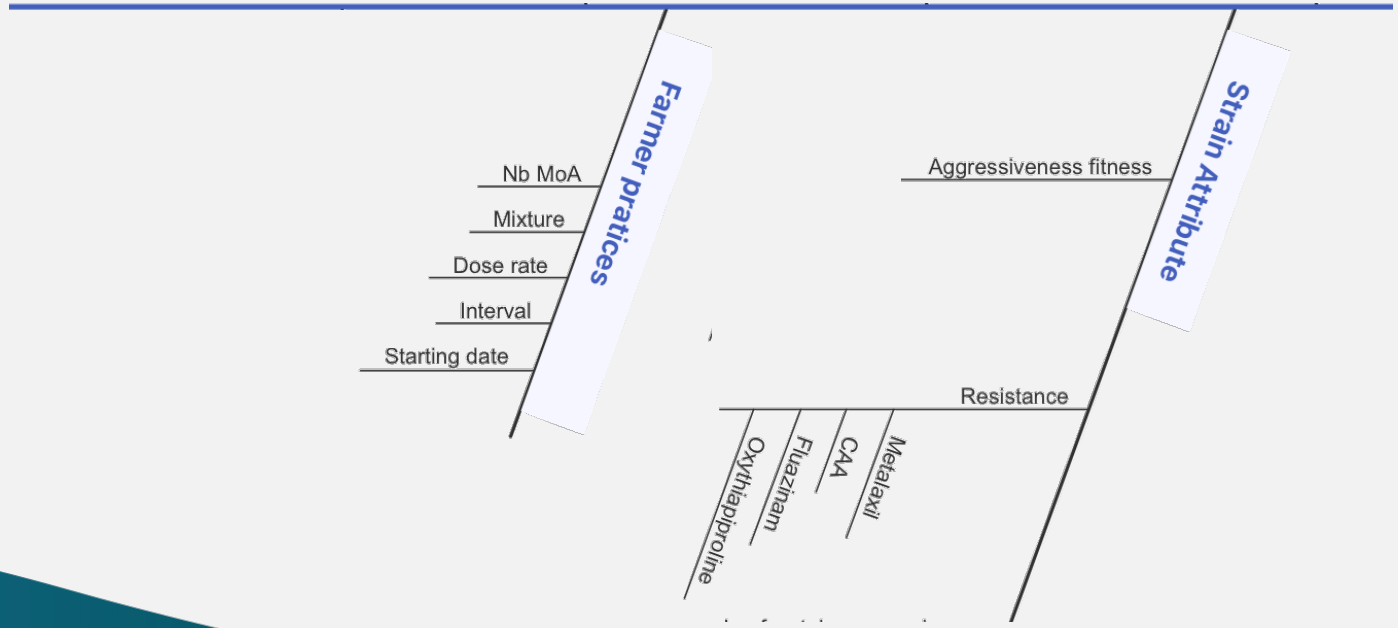
(EUR 1 000, 1 000 tonnes)

Source: Eurostat DS-016890

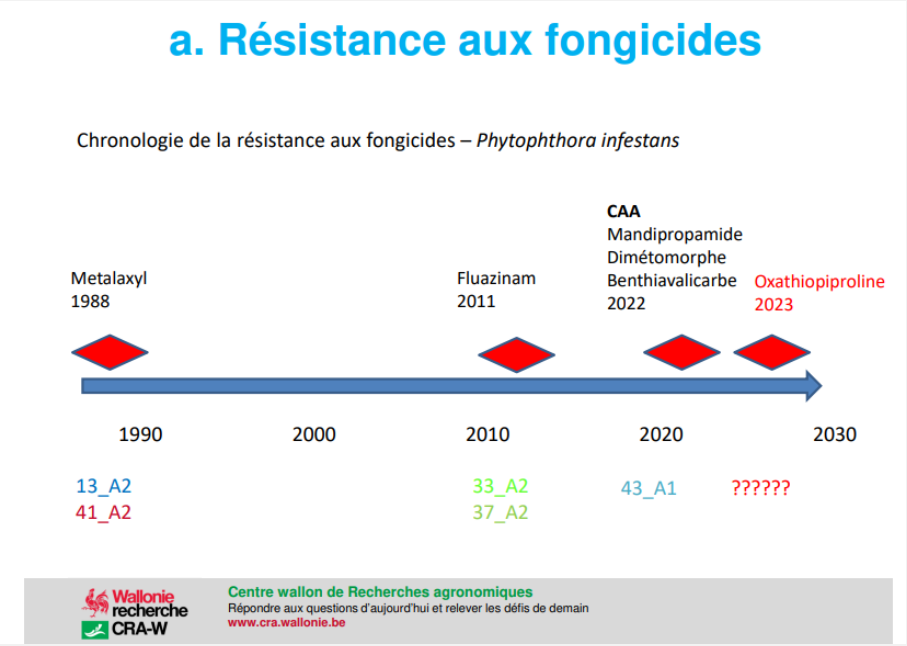
- Spread of the new genotypes is still based on assumptions
  - wind
  - farmers equipment (short distance)
  - seeds
- Spread risk via tubers
  - NL by far the biggest intra-EU exporter
  - Different aggressiveness on tuber vs lead (EU_33_A2)
  - Stop OXT in seed

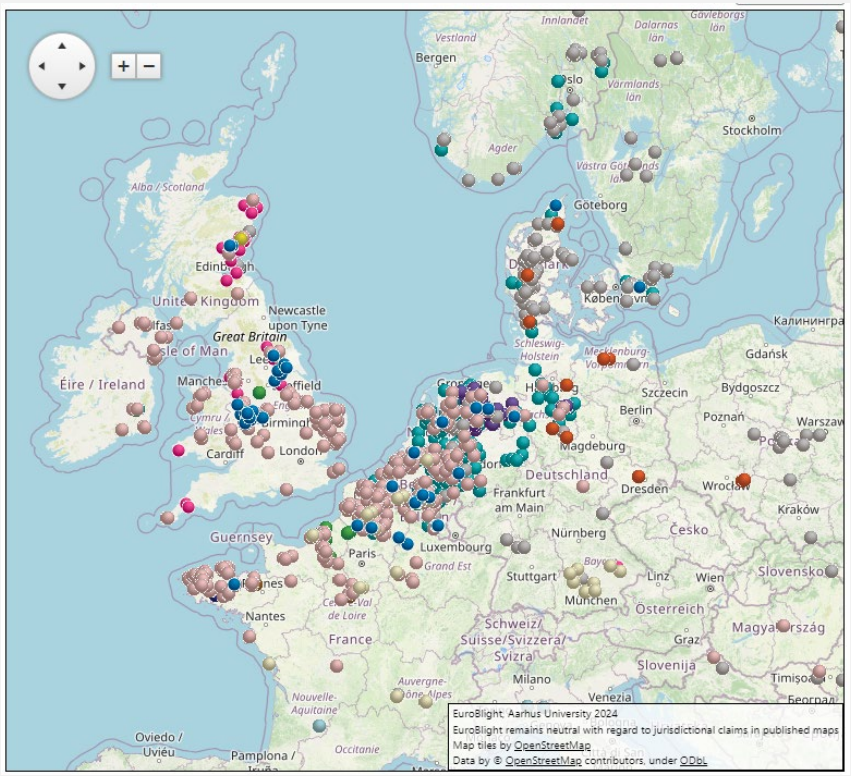
→ Tuber protection + resistance management in seed are key factors

Some factors influencing late blight



Resistance to fungicides: “boom”





- Metalaxyl: EU_13_A2, EU_41_A2, ?
- Fluazinam: EU33_A2, EU_37_A2, ?
- CAA: EU_43_A1
- OXTP: EU_43 & EU_46 ? But not all!

‘Others’: ???

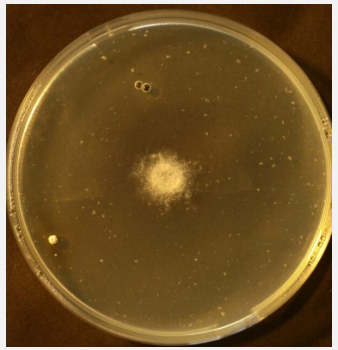
→ No strict link between genotype and fungicide resistance

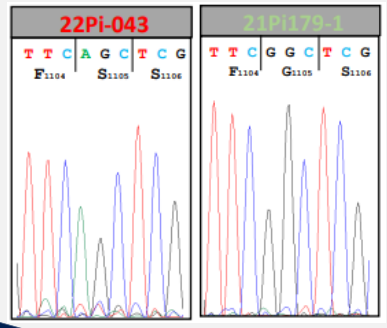
→ How can we use EuroBlight as a tool to understand and monitor resistance to fungicides?

Resistance does not disappear: Only way is to prevent, then manage

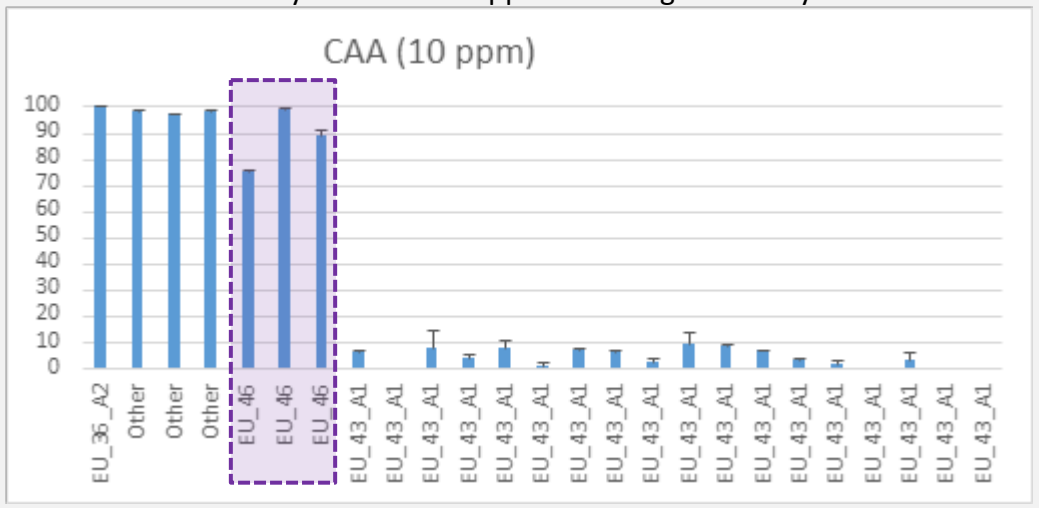
Sensitivity to CAA vs genotypes

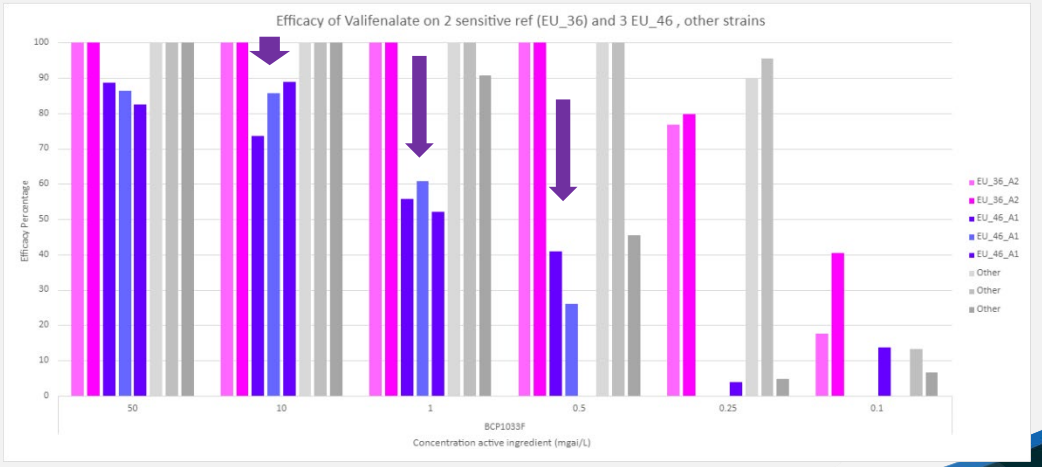
GENOTYPE	N	EC50	R profile
EU_13_A2	1	0,05-0,5	S
EU_36_A2	2	0,05-0,5	S
EU_37_A2	2	0,05-0,5	S
EU_41_A2	2	0,05-0,5	S
EU_43_A1	1	0,05-0,5	S
EU_43_A1	22	>25	R
EU_46_A1	3	0,5-1	S
Other	1	0,5-1	S
Other	2	0,05-0,5	S





Discriminatory dose rate: 10 ppm CAA fungicide in mycelium test





→ Only homozygote G1105S are CAA resistant

General recommendations 2024: if EU43 known to be present

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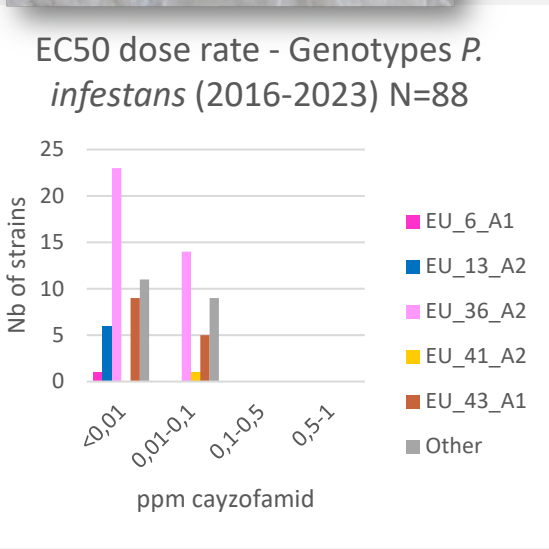
Alternation of different MoA is <u>necessary</u> when using a solo ai product.

<u>Always</u> mix ai compounds from different mode of action groups.
Recommended is not to do 2 identical mixes with same ai in row

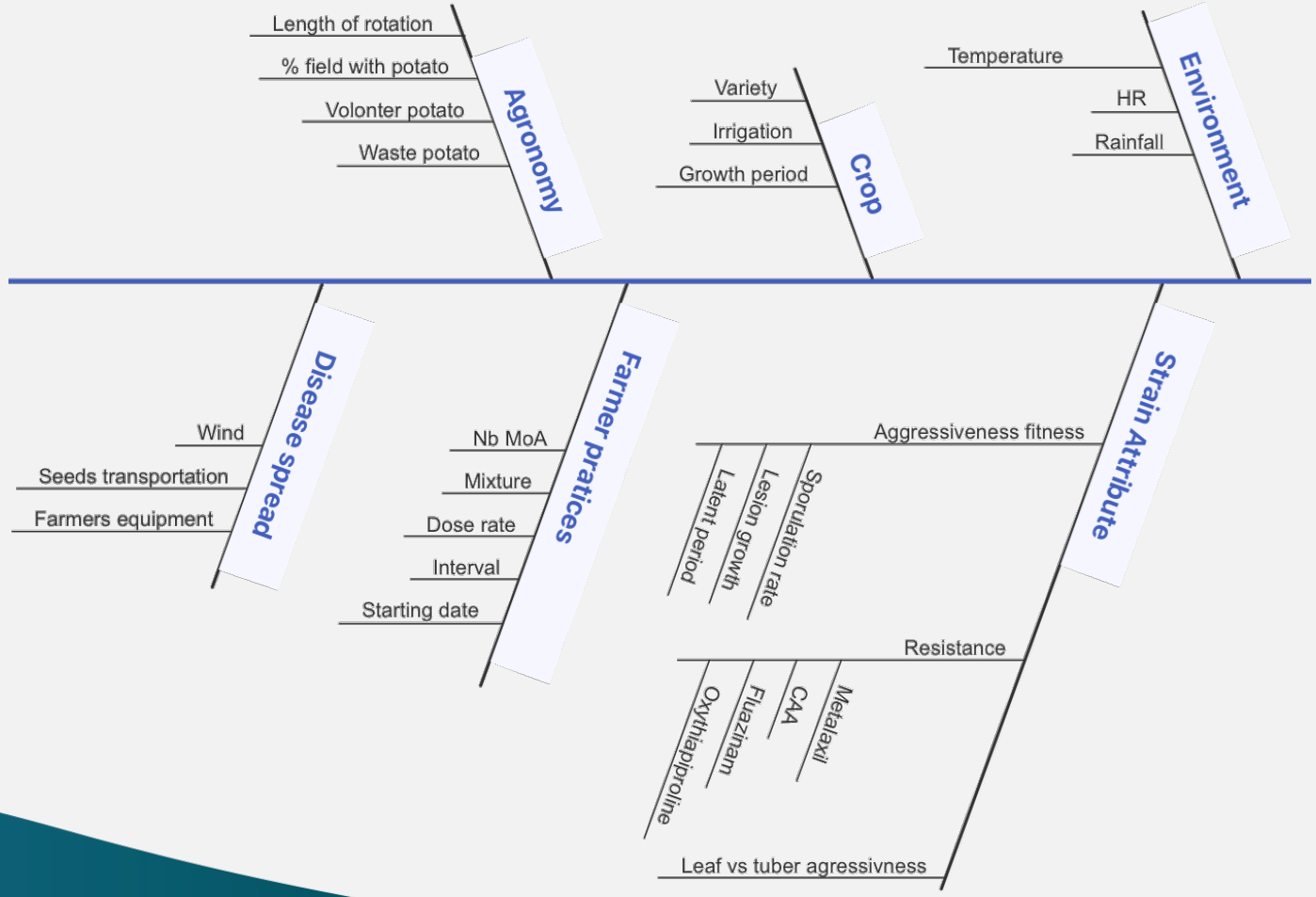
Follow up label recommendations of the fungicide products.
Maximum number of applications and <u>% use per crop cycle FRAC</u>
Use registered maximum dose rates
Apply within the intervals registered, based on late blight pressure

Observe unique FRAC recommendations for specific ai groups



→ All *P. infestans* strains tested between 2016 and 2023 show full sensitivity to **<u>Cyazofamid</u>**

Some factors influencing late blight



Take home messages

- Fast prediction models (genotype, phenotype) & Early detection of new genotypes (‘Others’)
- Getting more from the FTA cards = DNA
- Anticipate resistance management recommendations when needed. Understand what is the best strategy (mixture & dose rate)
- FRAC: transveral group for high risk diseases for recommendations of all fungicides families
- All Decision support systems (DSS) & recommendations tools need to consider the new genotypes/phenotypes

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