Late blight in Denmark

From a challenge to a problem

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PaGER 10. - 11. May 2023

STØTTET AF
Kartoffelafgiftsfonden
SEGES INNOVATION

History of poato blight

- Potatos come to Europe 1537
- Late blight comes to europe in 1840’s (A1)
  - Rapid spread in 1845-1847
- Bordeaux mixture (copper sulfate + quick lime) – late 19th century
- Fungicide – beginning 1950’s and 1960’s
- Late blight come to europe in 1979 (A2)
  - Sexual recombination - oospore

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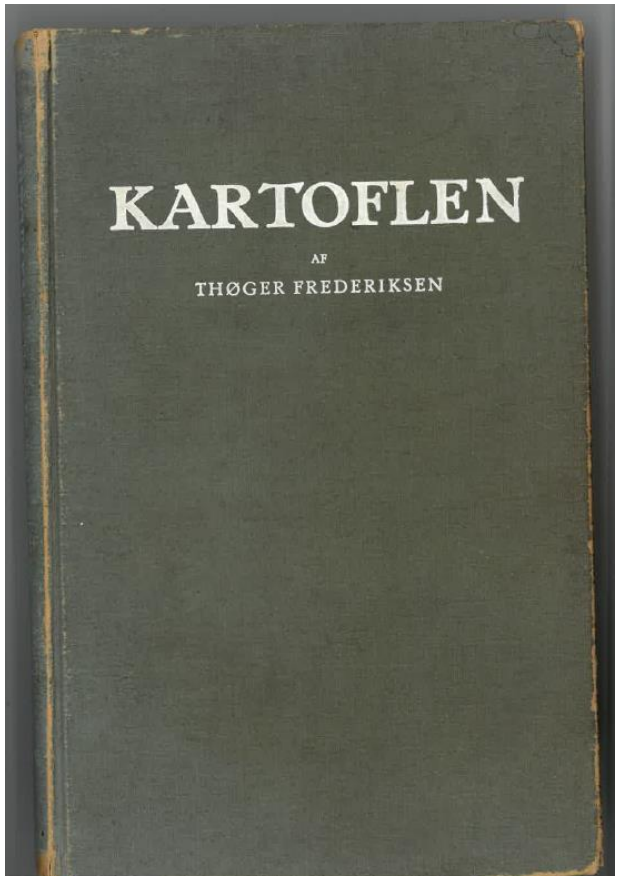
Bordeaux mixture (1944)

- *First treatment 8.-20. July*
- *Second treatment – aprox. 20 days later*



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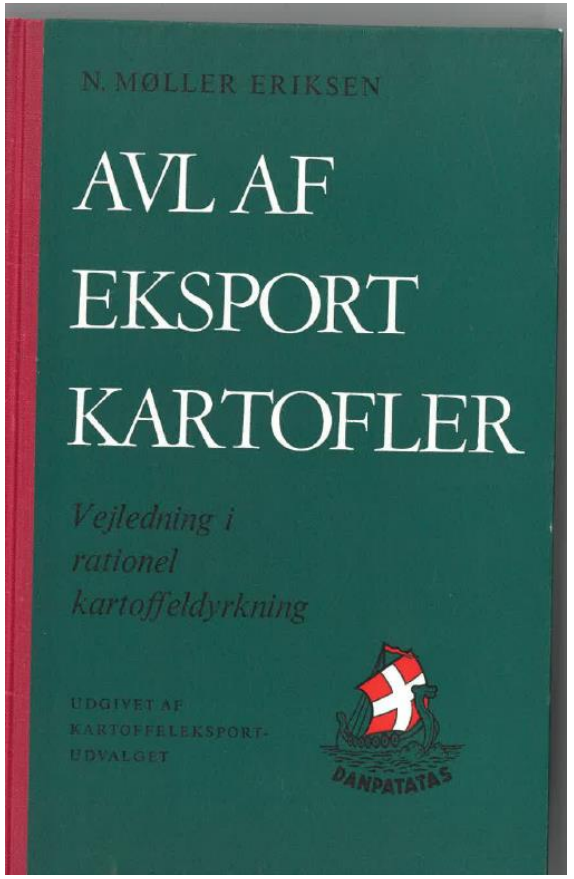
Mancozeb - multisite inhibitor (1962)

- *Two treatments will be beneficial.*
- *Timing of the second treatment is related to the precipiation after first treatment.*

Area 1962 - 90.000 ha

Beskyttende sprøjtninger mod kartoffelskimmel vil det ene år med det andet kunne betale sig.



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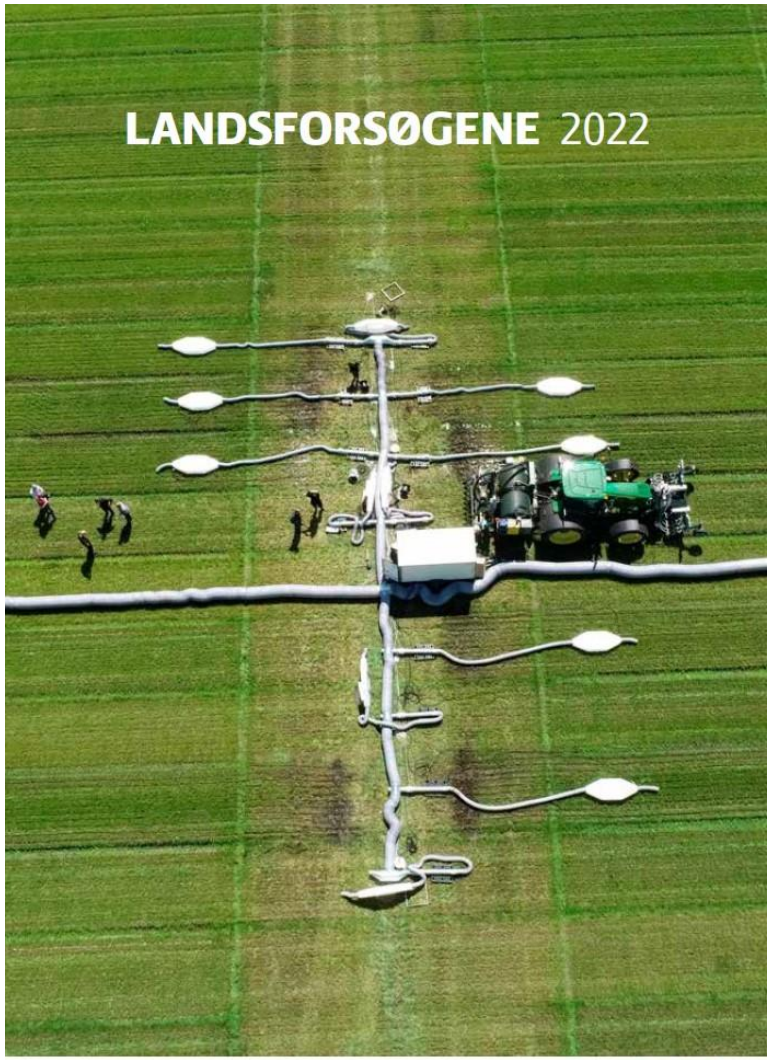
Specific fungicides 2022

- *12 - 14 treatments/season*
- *First treatment often 5.-15. juni.*
- *Net yield up to til 2.500 €/ha*



Innovationscenter for Økologisk Landbrug

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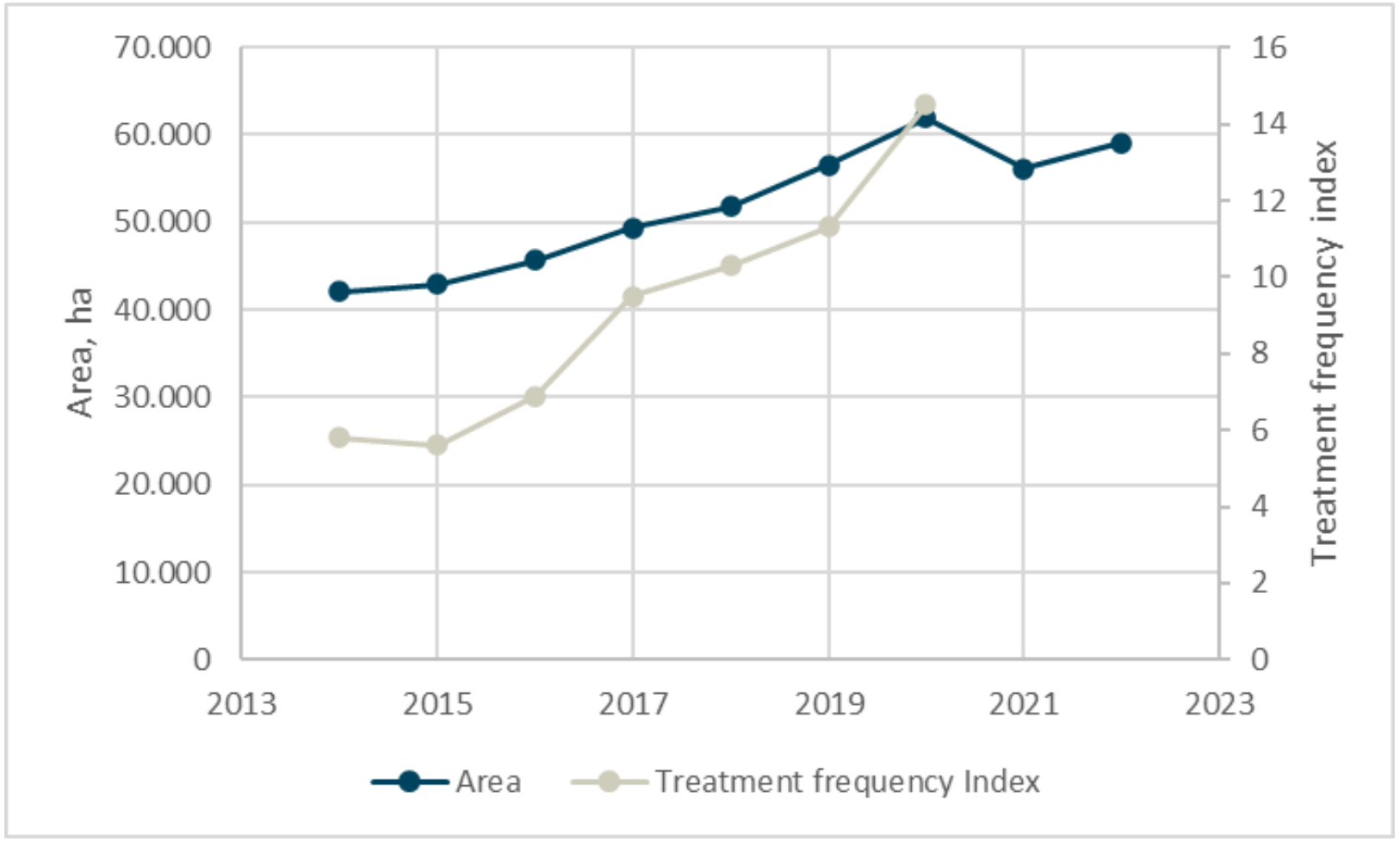
Treatment Frequency Index



(Source: Landbrugsstyrelse 2009-2022, Bekæmpelsesmiddelstatistikken 2009-2020)

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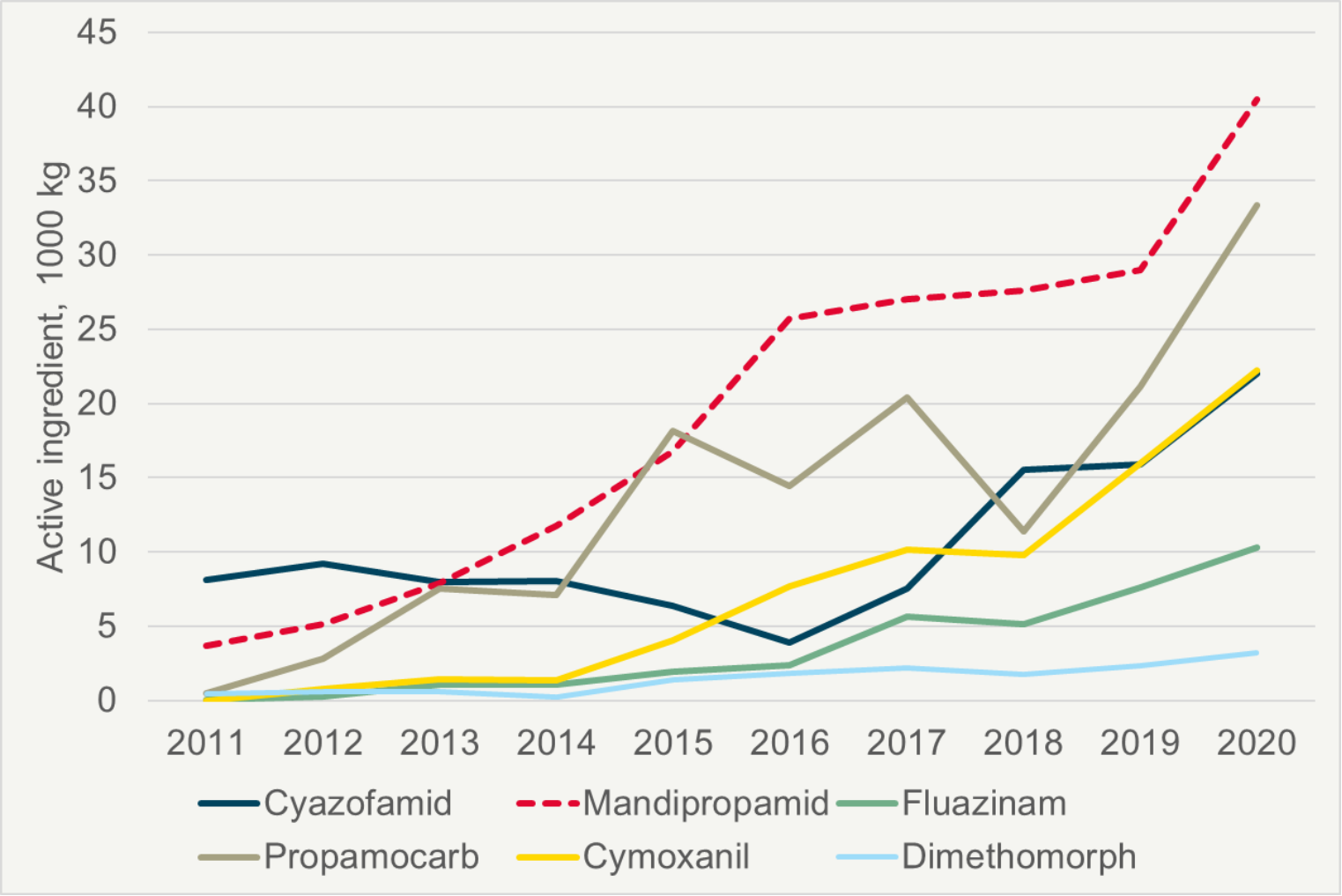
Use of fungicides in potatoes in Denmark



(Source: Bekæmpelsesmiddelstatistikken 2011-2020)

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Field trials with weekly sprays with mandipropamid
August 2022

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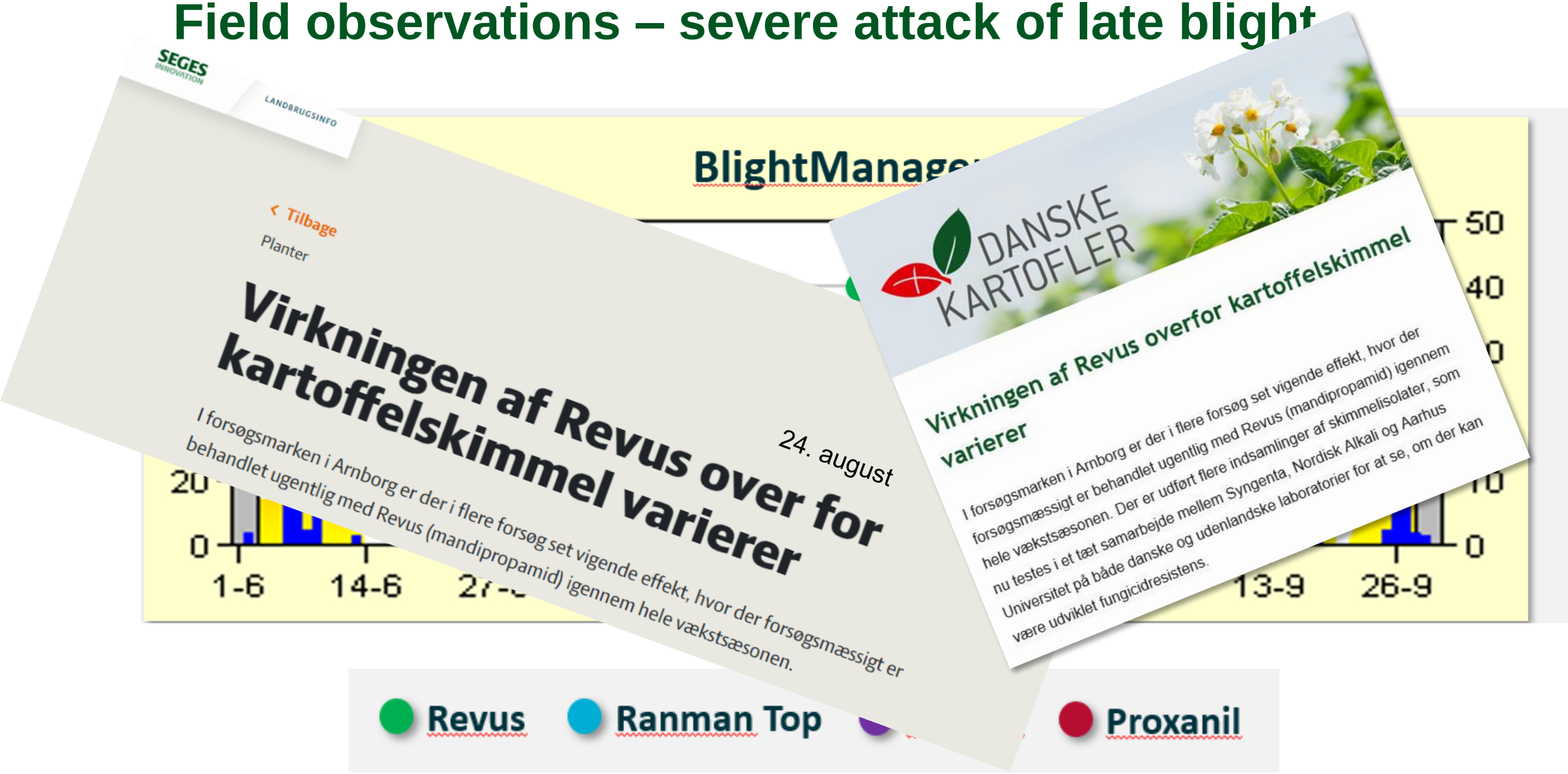
Field observations – severe attack of late blight



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Recommendation August 2022

- Precautionary principle - No sprays with mandipropamid for the rest of the season
- No sign of reduced effect of any other fungicides
- Good effect of mixing strategies

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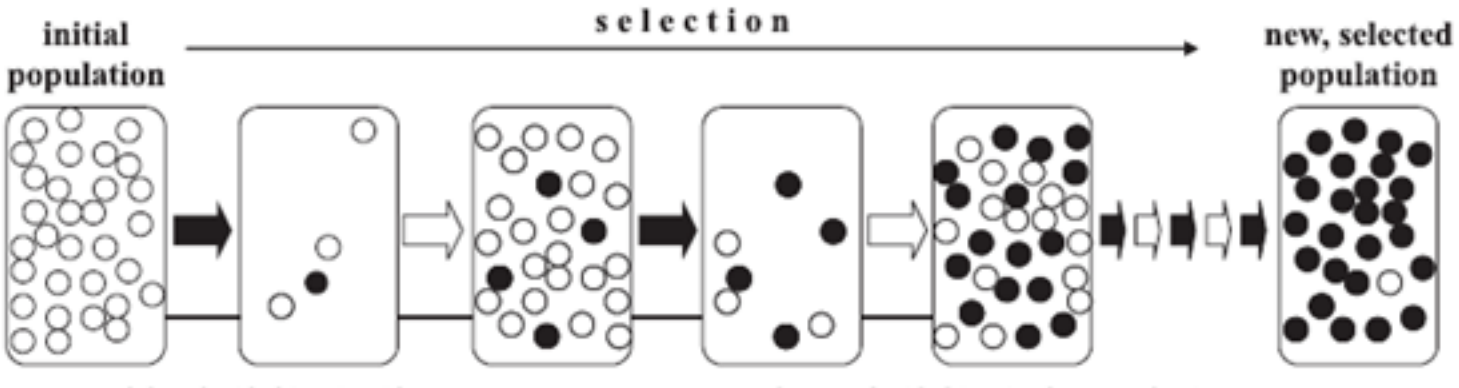
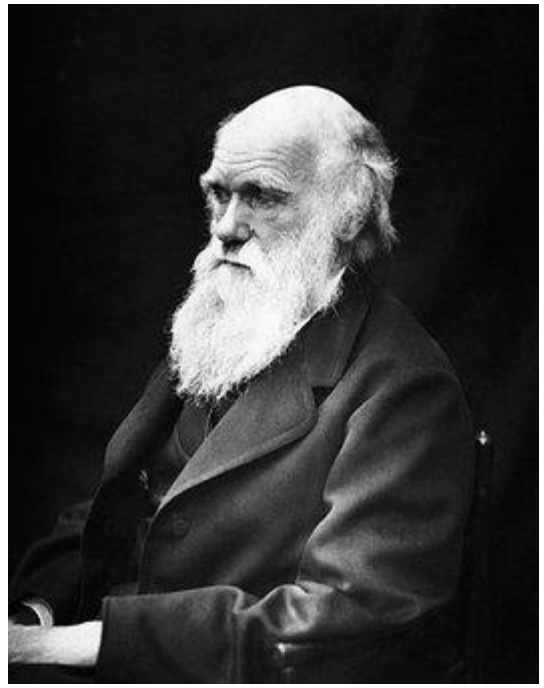
Selection for new phenotypic traits





4 x 10^{12} spores/ha

Latency period – 4-7 days

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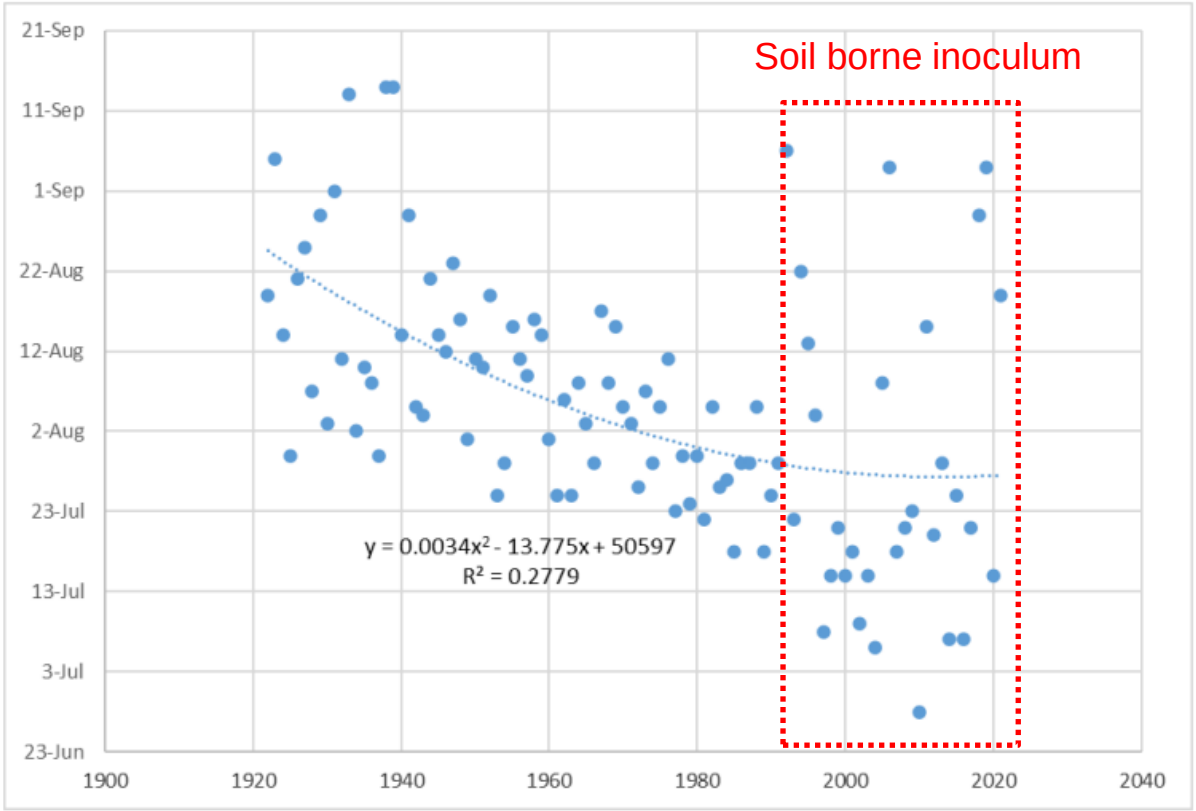
First registration of blight in Estonia Estland



(Matti Koppel, 2022)

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Withdrawel - approval of cyazofamid in 2023

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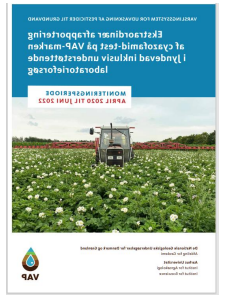
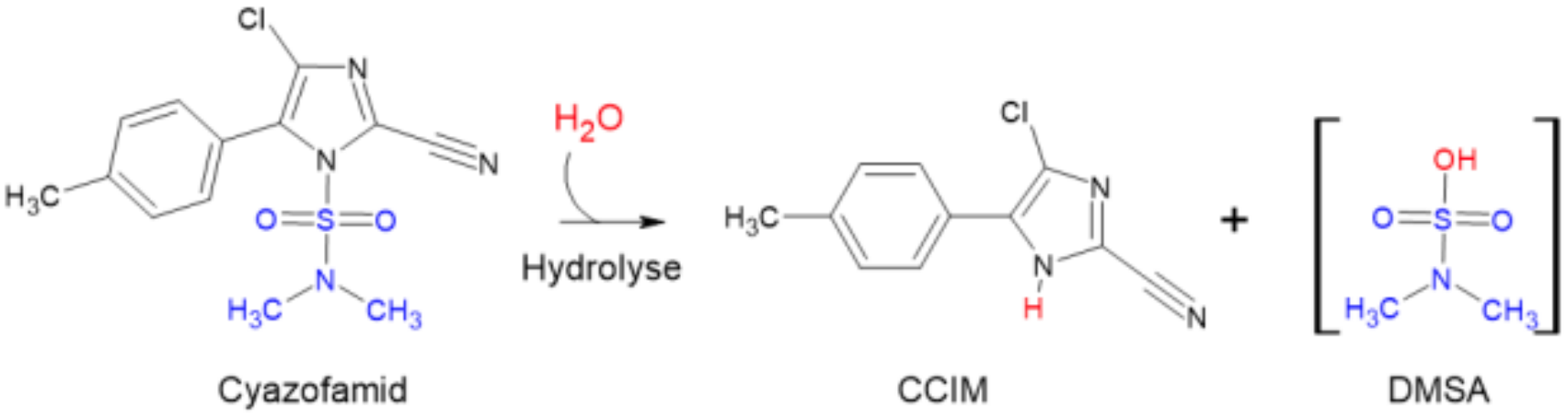
Cyazofamid og DMSA (metabolite)





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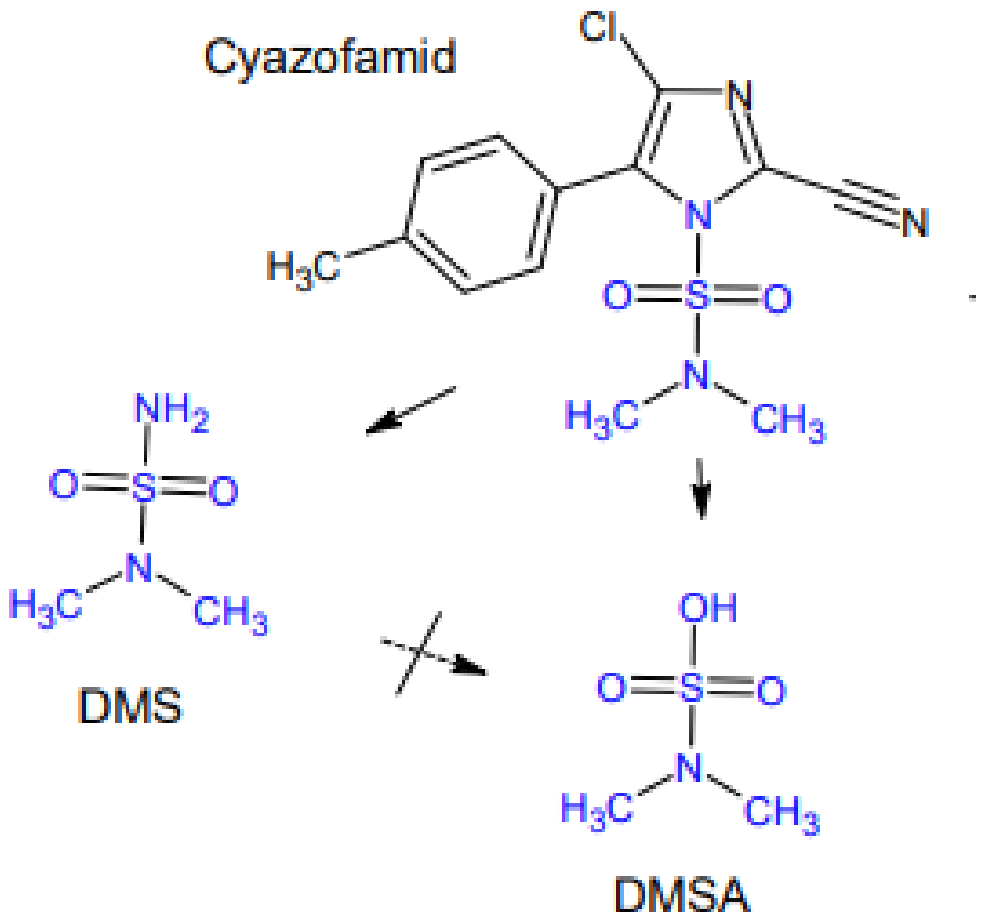
Question?



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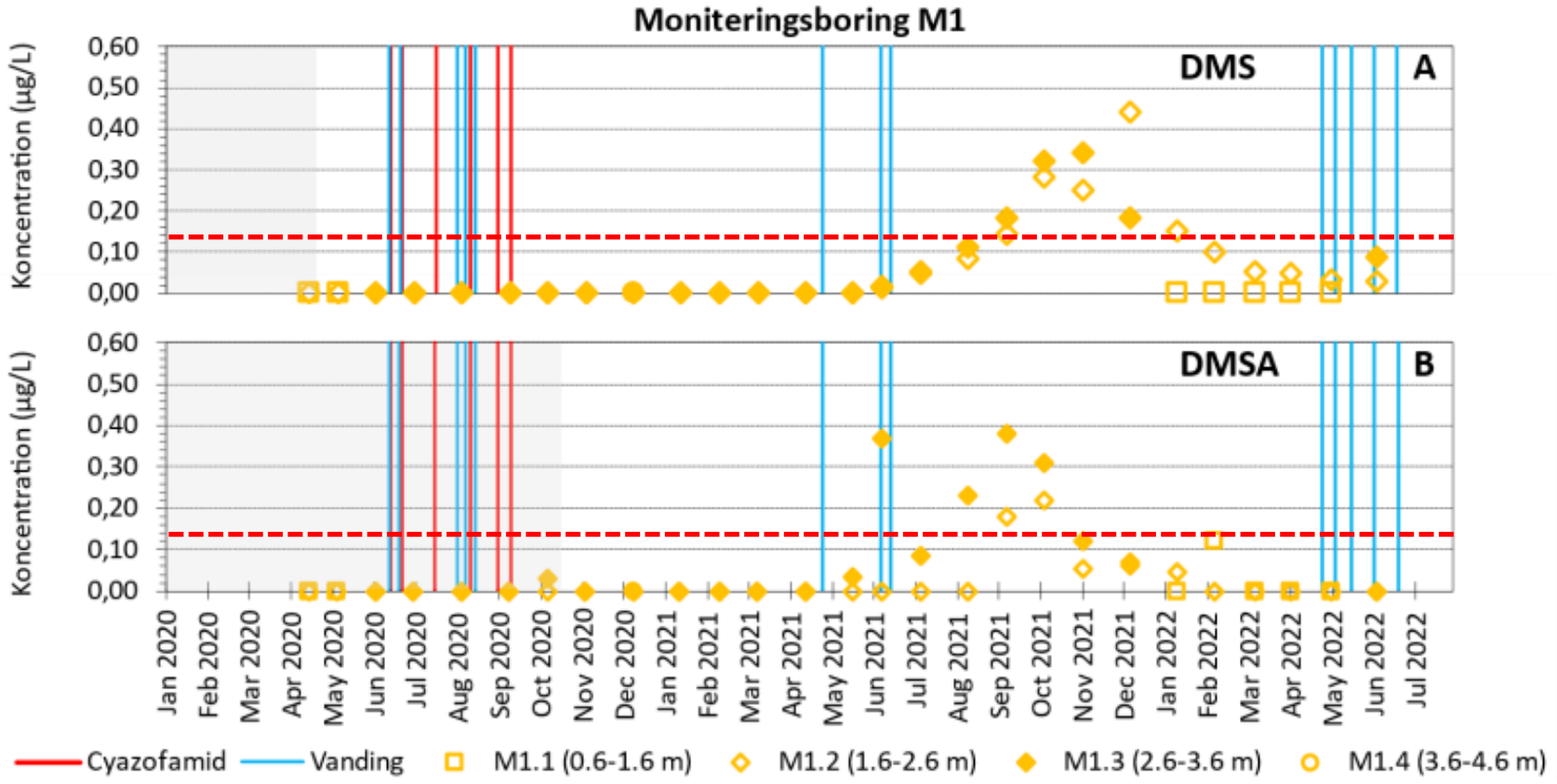
Metabolites in groundwater (DMS og DMSA)



Figur 4. DMS- og DMSA-koncentrationer målt i boring M1 på Jyndevad. A, viser målte DMS-koncentrationer og B, viser målte DMSA-koncentrationer. De gråskraverede områder viser perioder, hvor prøver har været frosset ned inden analyse. Røde lodrette streger repræsenterer sprøjtninger med cyazofamid og blå streger vanding af marken.

(source: VAP-report, GEUS & AU 2023)

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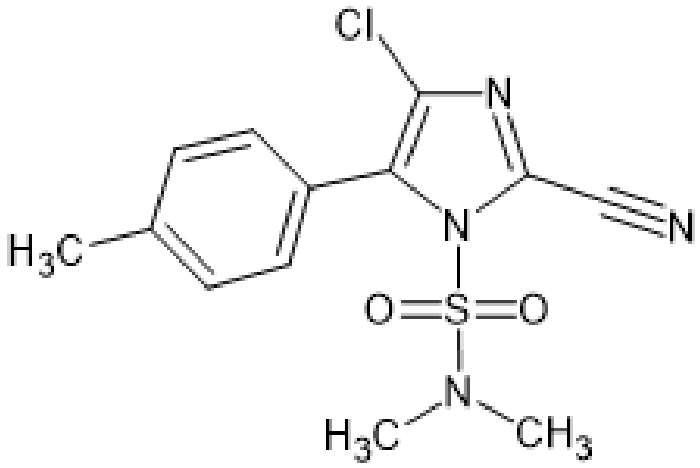
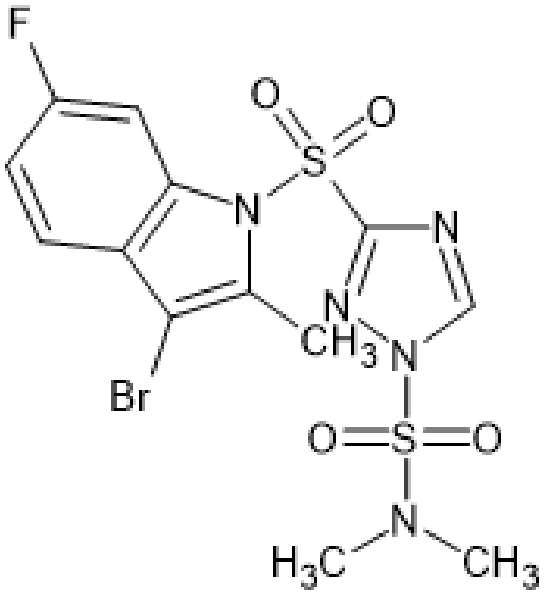
Amisulbrom and DMSA?

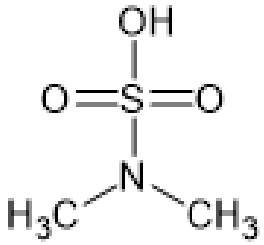
Cyazofamid



Amisulbrom



DMSA



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Euroblight

EuroBlight
A potato late blight network for Europe

	Leaf*	Tuber*	Stem	New growth	Preventive effect	Curative effect	Anti-spor. effect	Rain-fastness	Mobility
Ranman Top	3,8	3,8	●	●●	●●●	0		●●●	C
Revus	(4,0)		●◗	●●	●●●	●	●◗	●●●	C
Fluazinam	(2,9)	?	●		●●●	0		●●◗	C
Zorvec + mixing partner	4,9	(3,4-3,9)	●●◗	●●◗	●●●	●●	●●◗	●●●	S + C (T)

* Scale 1-5

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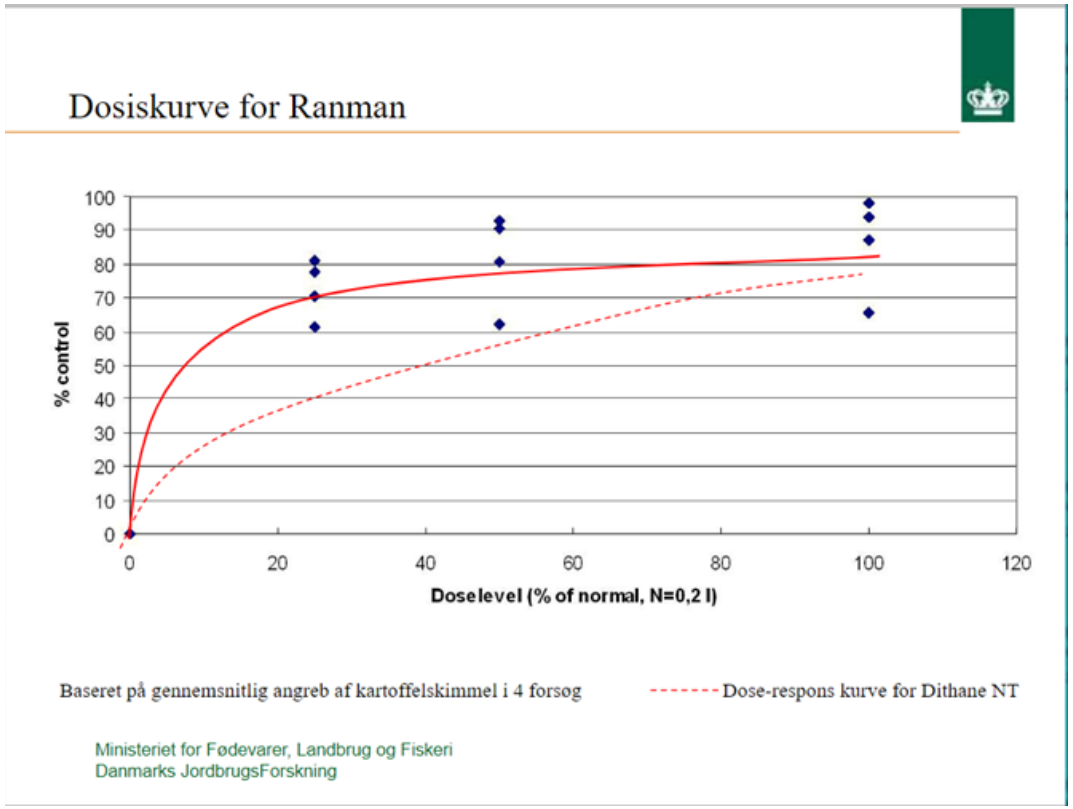
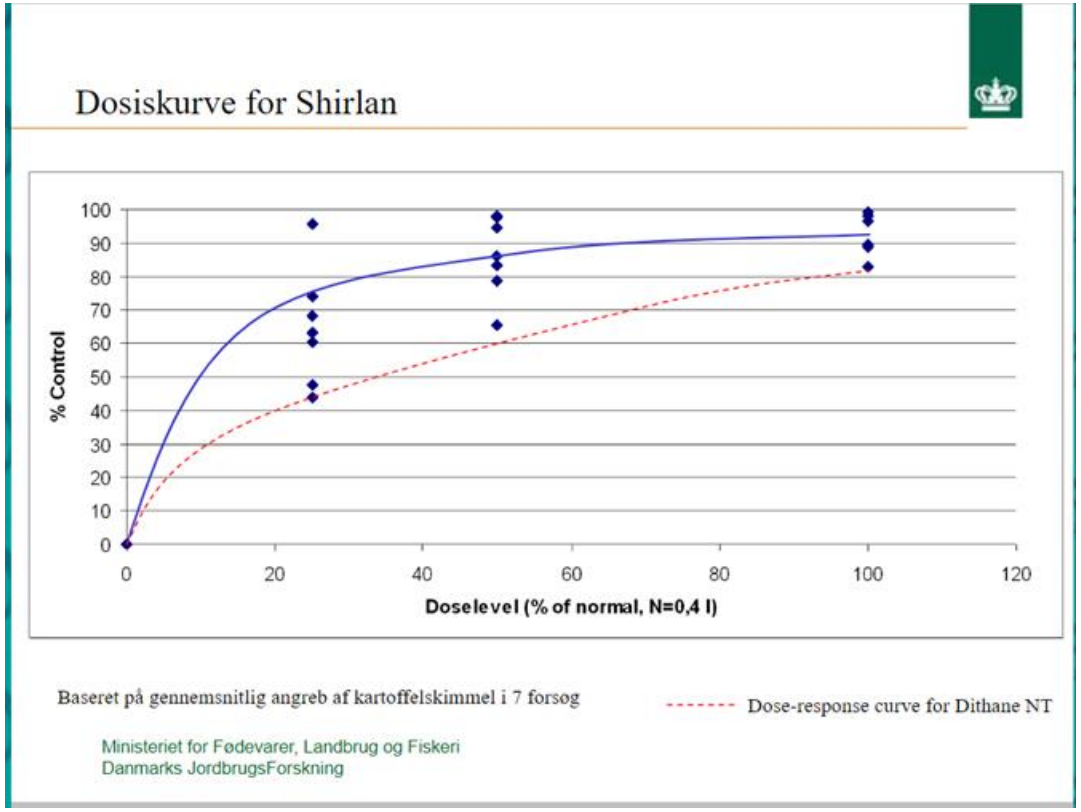
Dose/respons curve for Ranman og Shirlan





(Bent J. Nielsen AU)

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Experimental evidence: Tactics to decrease selection for fungicide resistant strains

	Increase selection	No effect	Decrease selection
Increase dose	16	1	2
Increase spray number	6	0	0
Add mixture partner	1	6	46
Alternate (replace sprays)	1	2	9
Adjust timing	3	1	2

van den Bosch et al. 2014 Governing principles can guide resistance management tactics *Annual Review Phytopathology*

**analysis included P. infestans, P. viticola, P. cubensis* and *P. aphanidermatum* (oomycetes)

Strategi 2023 – processing potatoes (Starch/chips/french fries)

No	1	2	3	4	5	6	7	8	9	10	11	12	13	No.	Volume,	Price,	Costs,	
Week	25	26	27	28	29	30	31	32	33	34	35	36	37	treatm.	l/ha	kr./kg-l	kr.-€./ha	
Date	12-jun	19-jun	26-jun	03-jul	10-jul	17-jul	24-jul	31-jul	07-aug	14-aug	21-aug	28-aug	04-sep					
Cyazofamid																		
Mandipropamid							0,6			0,6				2	1,2	325	390	
Fluazinam	0,4	0,4	0,4	0,4	0,4			0,4	0,4		0,4	0,4	0,4	10	4	528	2.112	
Oxathiapiprolin				0,15	0,15									2	0,3	1.457	437	
Propamocarb + cymoxanil		2					2			2				3	6	239	1.434	
Cymoxanil	0,25		0,25					0,25	0,25		0,25	0,25	0,25	7	1,75	280	490	
Azoxystrobin							0,5							1	0,5	235	118	
														25			**kr. 4.981**	**€. 664**
	Start block			Zorvec block			Middle block				Final blok							

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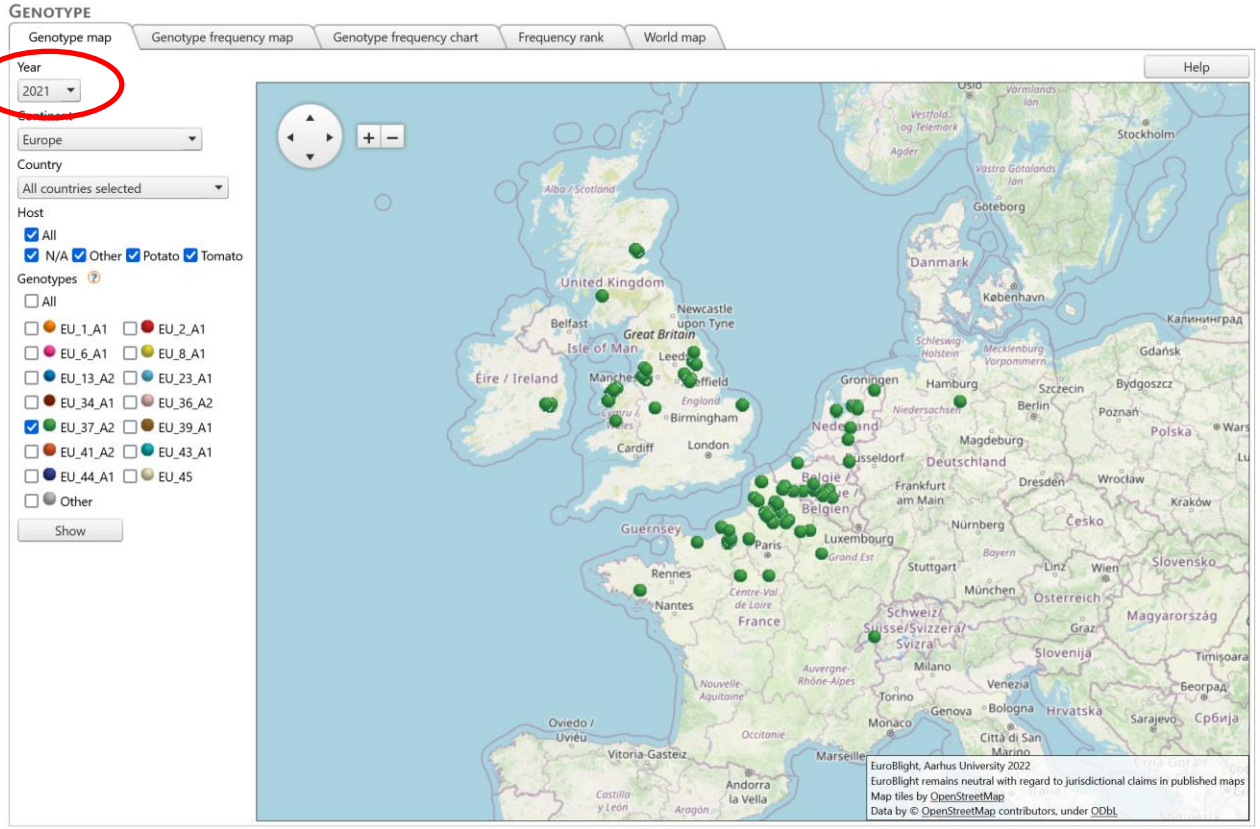
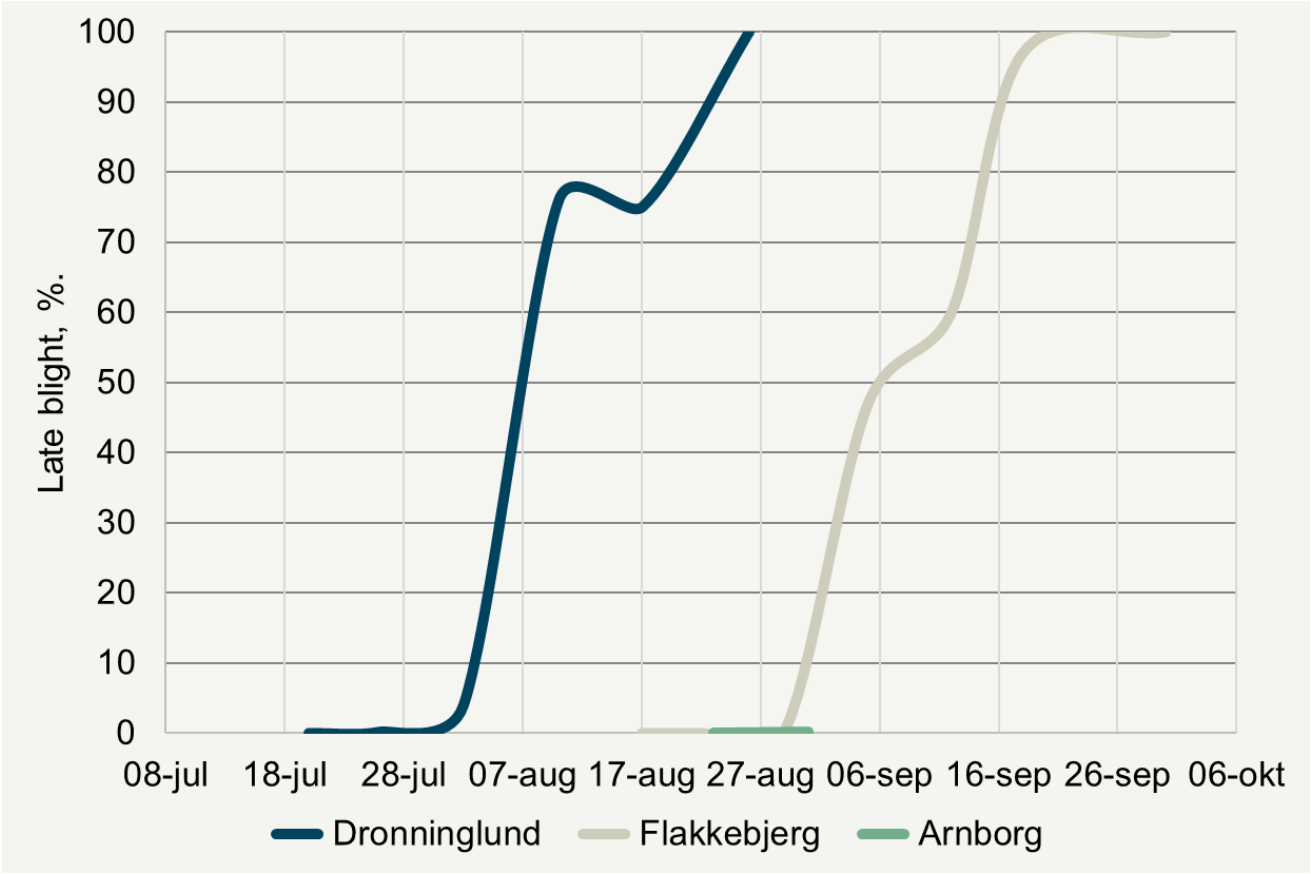
Risk for development of resistance to fluazinam and other fungicides

- Denmark 2006-2007: ?
- Holland 2011-2012: EU 33
- Holland 2017: EU-37



Risk for breakdown of variety resistance (Nofy)

EU 43 at Arnborg
EU 41 at Dronninglund



(Source: Landsforsøgene 2022)

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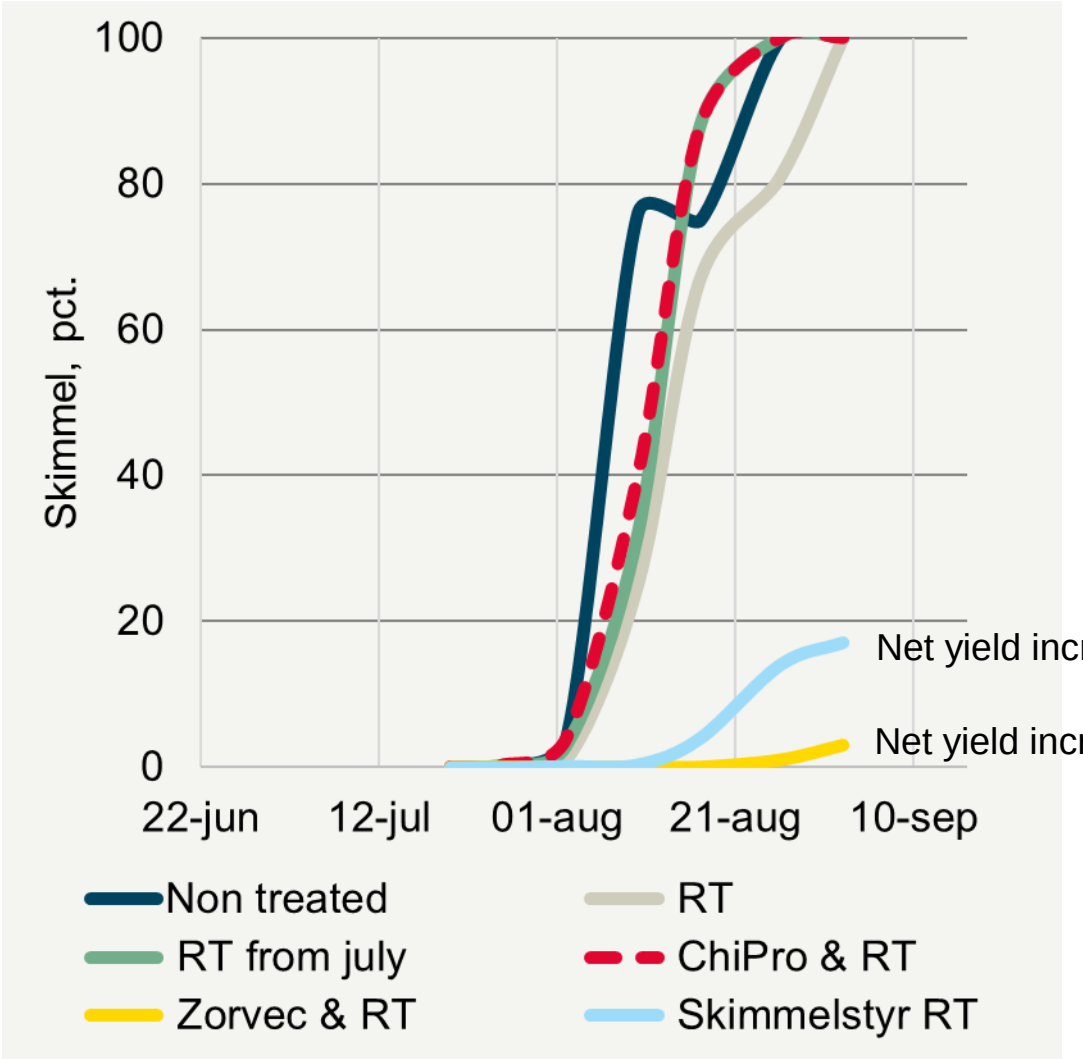
Breakdown of resistance in Nofy (EU41) (kombination of variety resistance and fungicides)



Net yield increase 2.550 €/ha

Net yield increase 2.650 €/ha

(Source: Landsforsøgene 2022)

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”Take home message”

- Possible to make 12-13 preventive treatments – just!
- High risk - development of resistance to fluazinam
- High risk - breakdown of variety resistance – need for more resistance genes
- Expected sufficent effect in 2023 and probably in 2024-2025 – after?
- Mixing strategies important
- Alternating strategies important
- Expeted increasing Treatment frenquency Index
- Approximately increasing costs - 200 €/ha
- Gradual phasing in of resistant varieties (8-10 years)
- Intensive breeding and propagation program
- It will probably work - but...!

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