

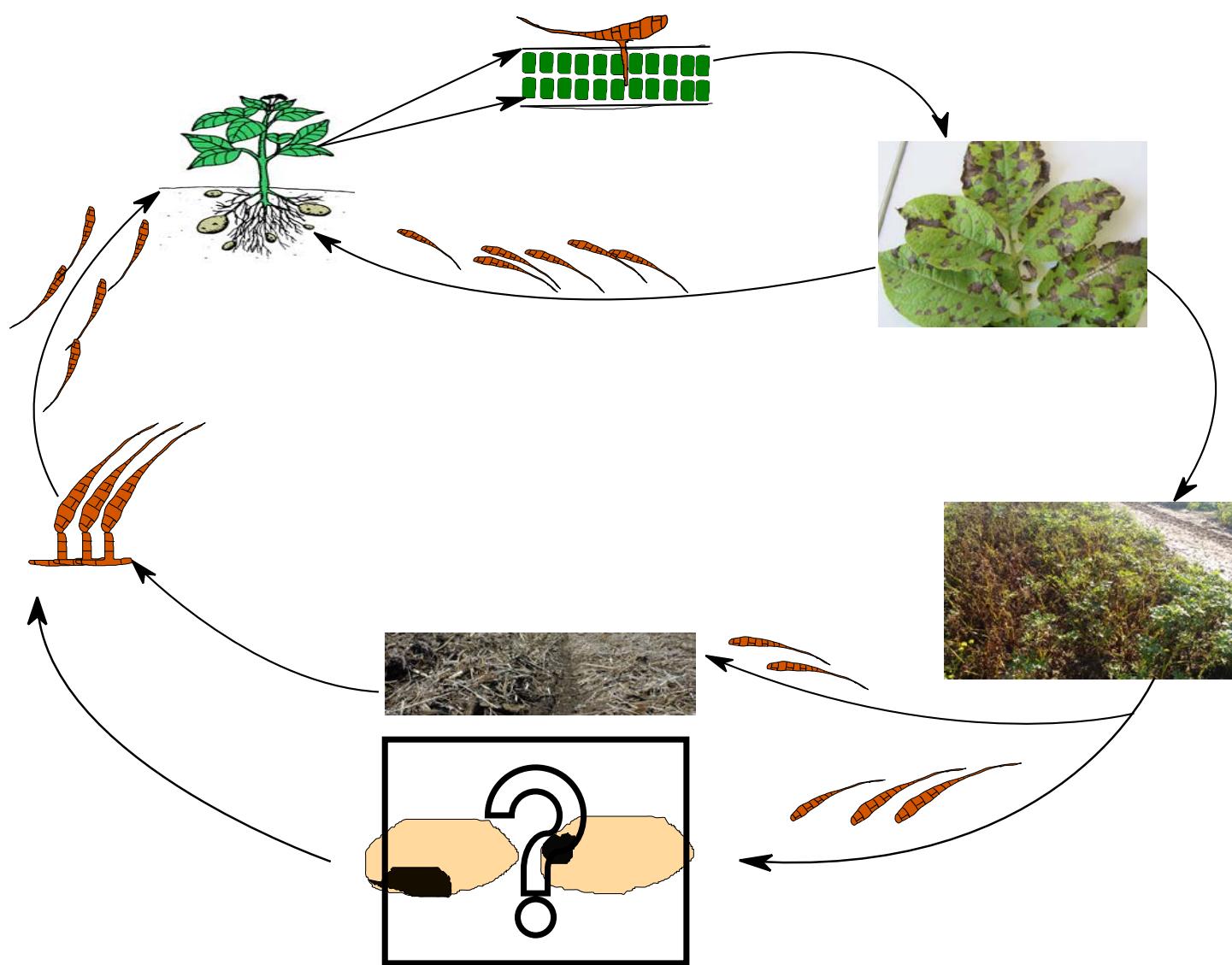
# The control of potato early blight:forecasting models and cultivar resistance



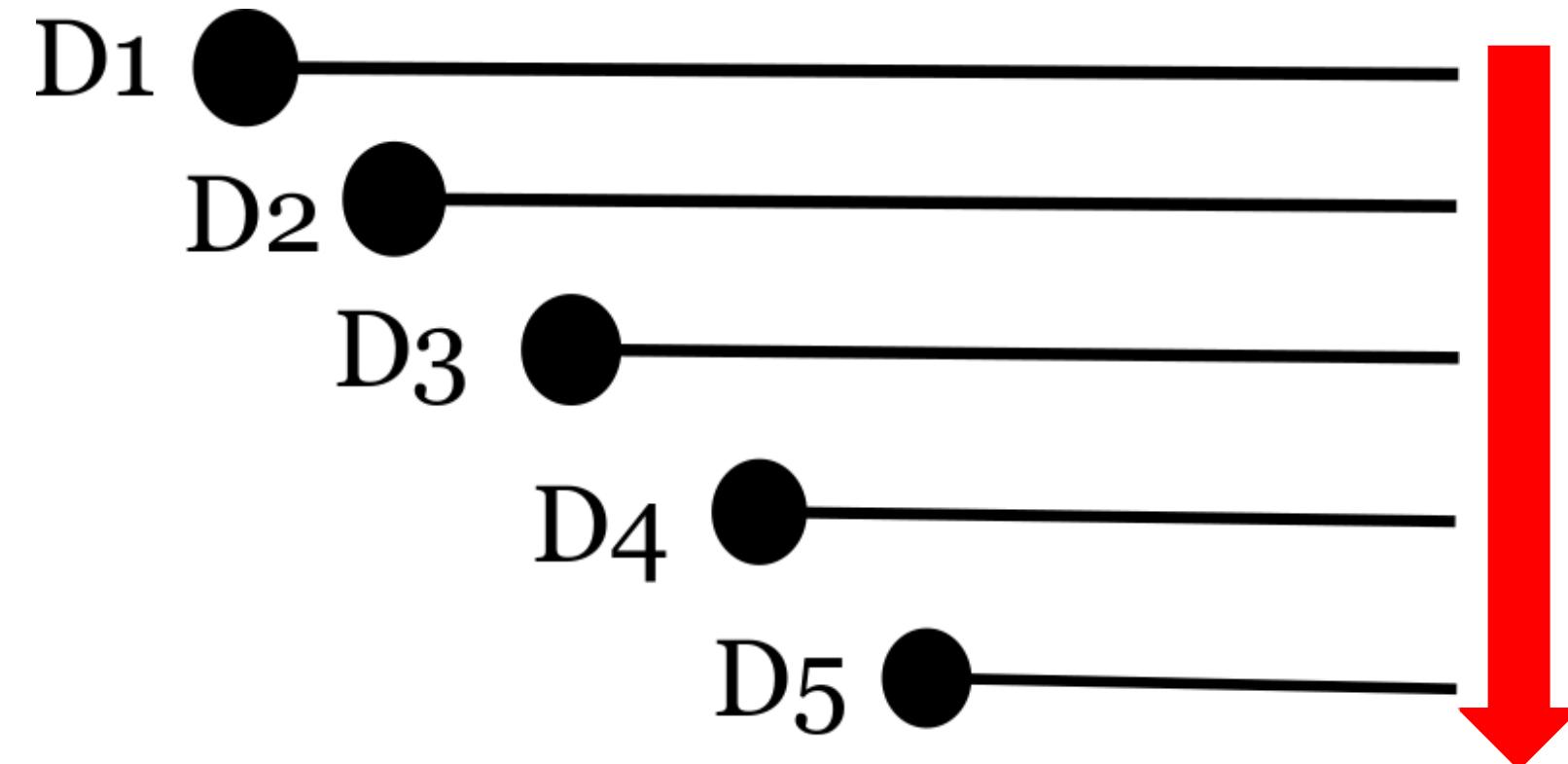
*Isaac Kwesi Abuley*

*Department of Agroecology, Aarhus University*

# What is early blight?

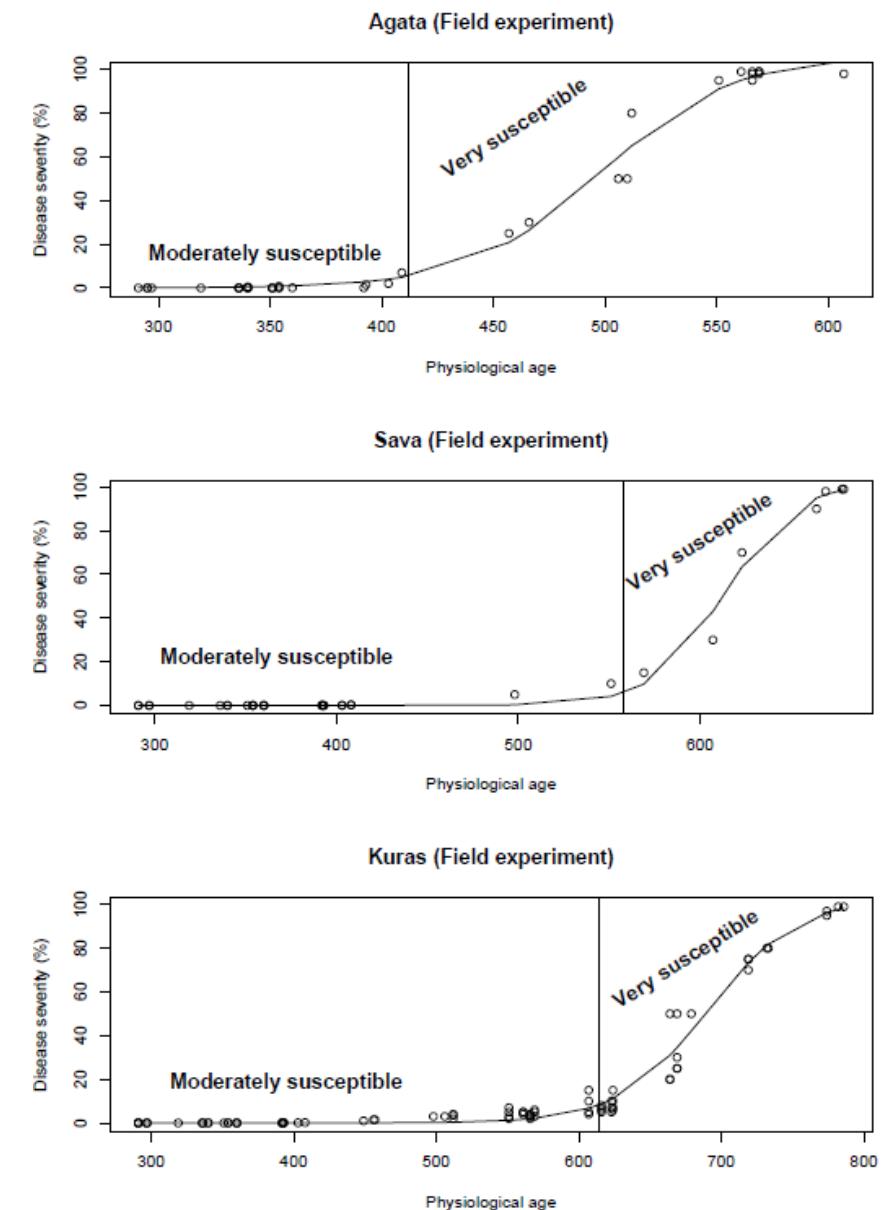
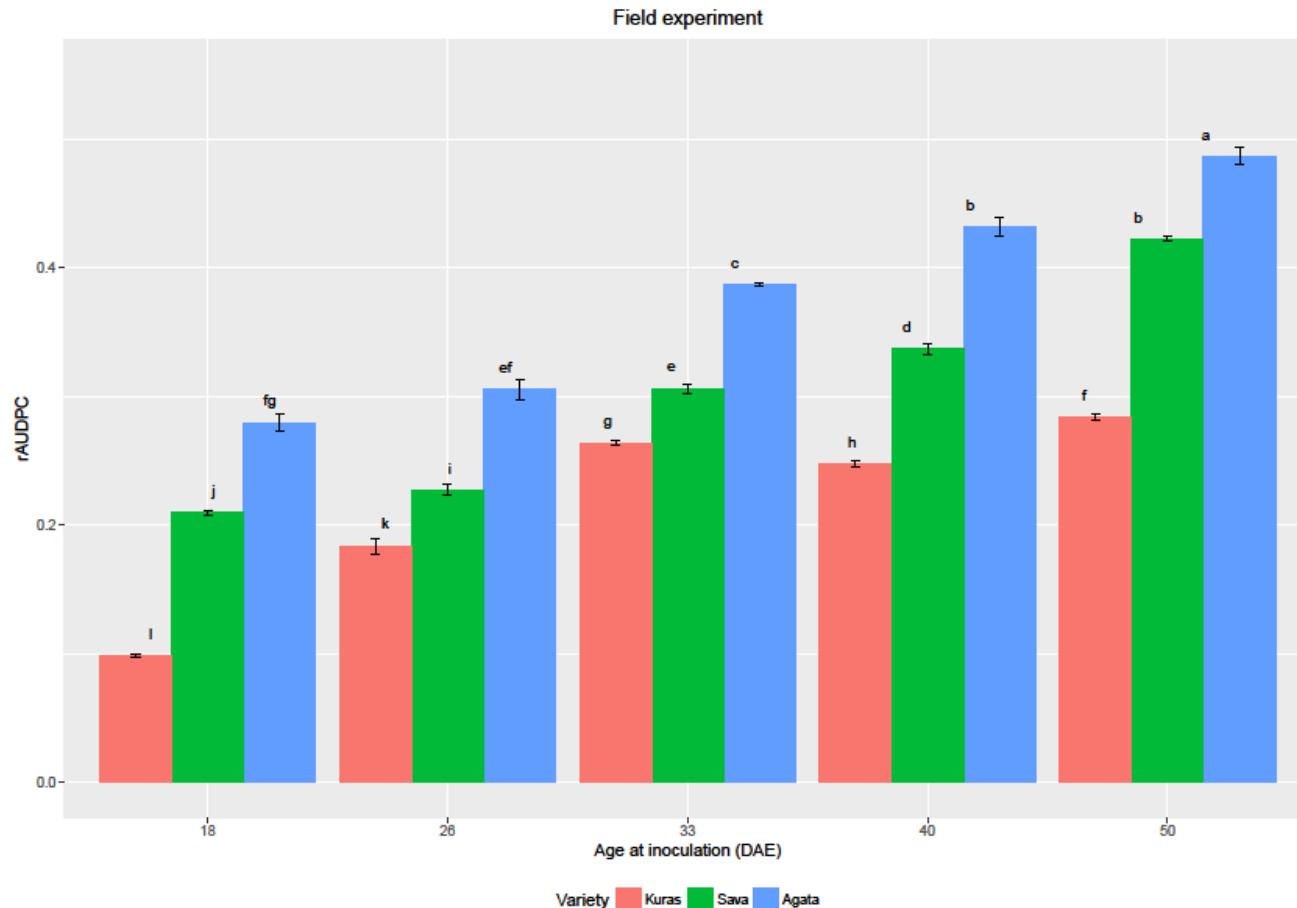


# Five planting dates and three varieties

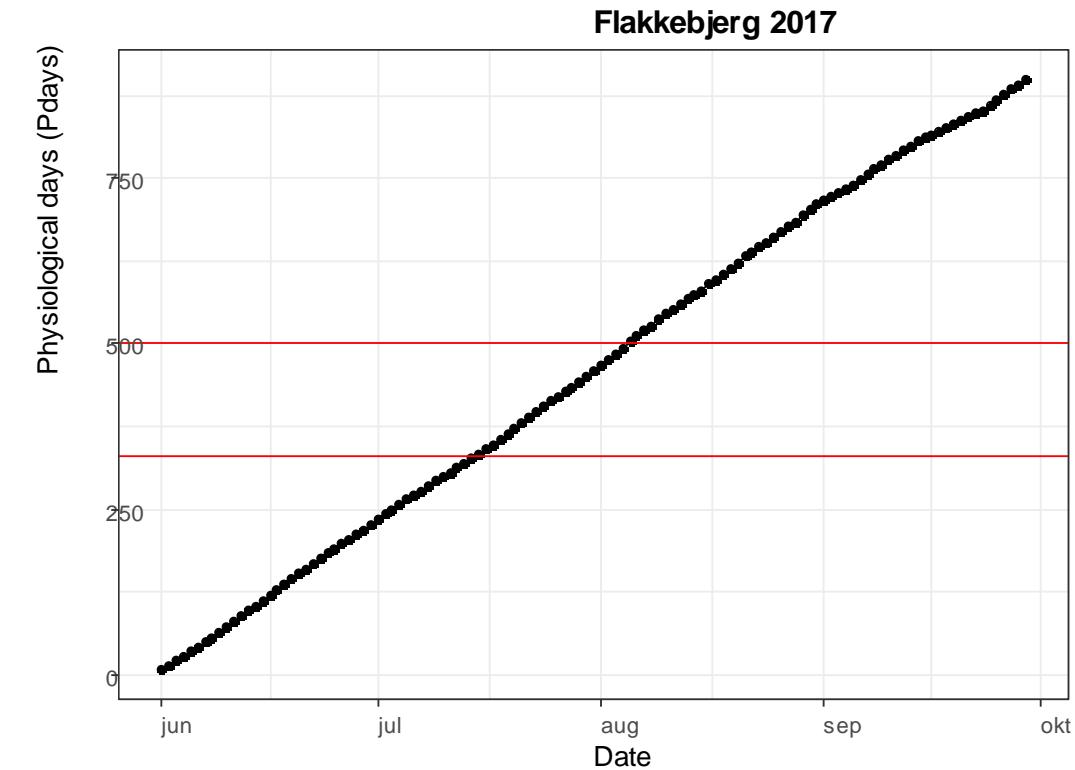
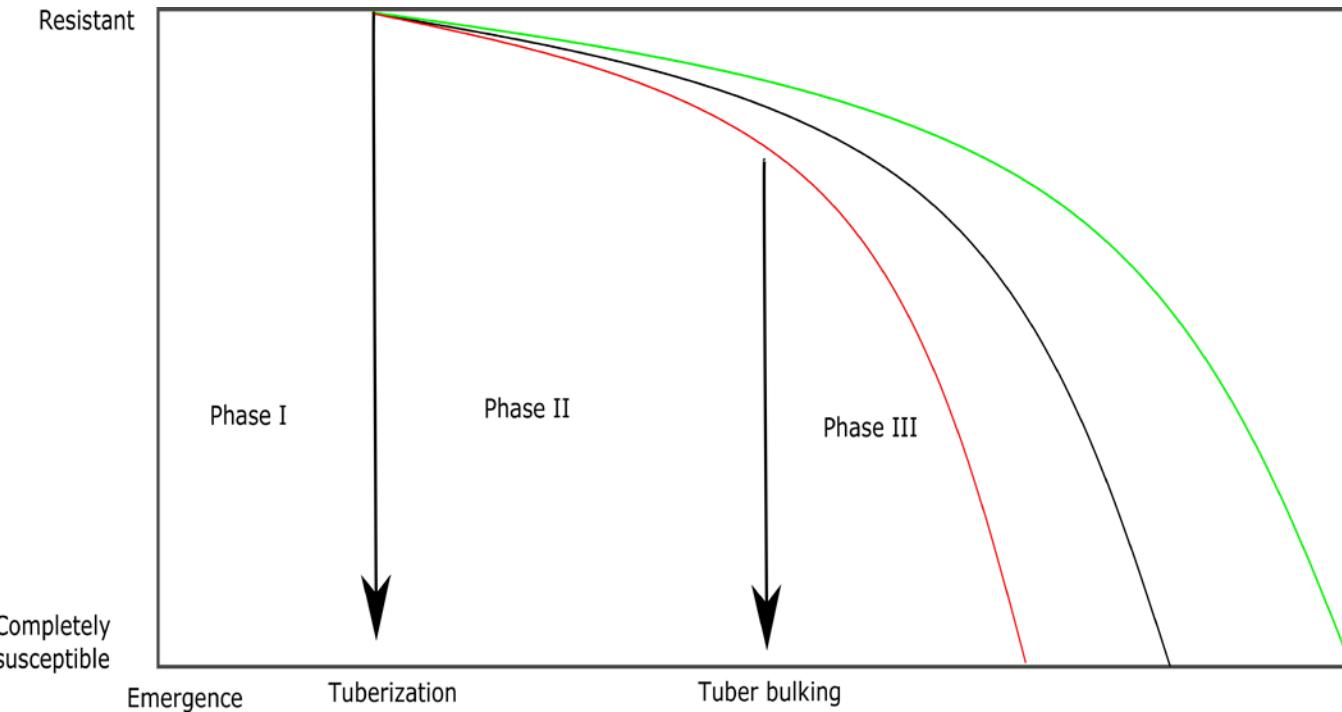


- **Agata:** Very susceptible/very early maturing.
- **Sava:** Moderately slow blighting/medium maturing
- **Kuras:** Slow blighting and late-maturing potato cultivar.

# Resistance to EB is age-dependent

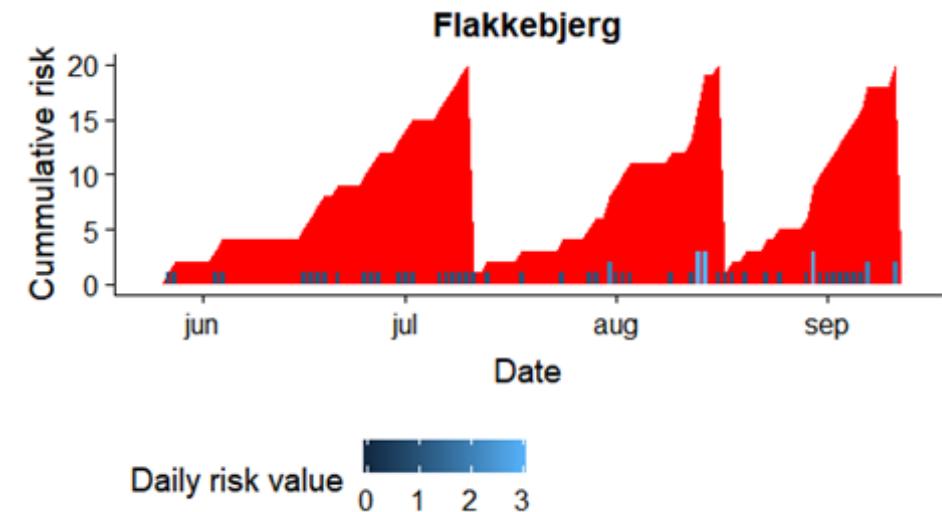


# Maturity-based model (Physiological days)



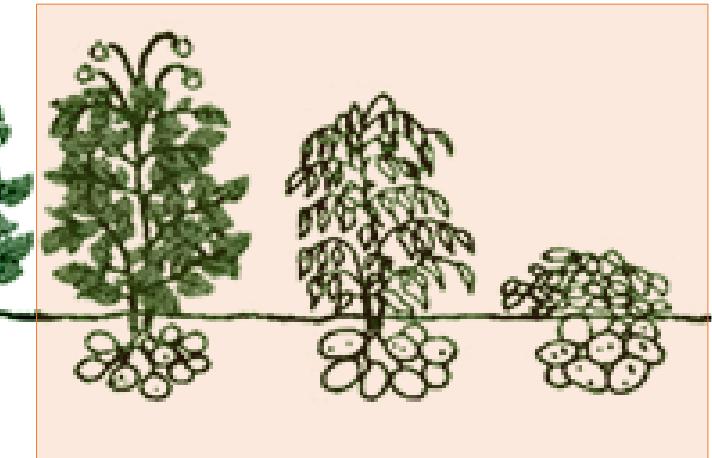
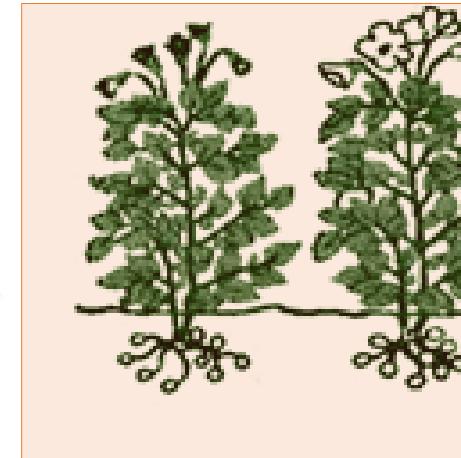
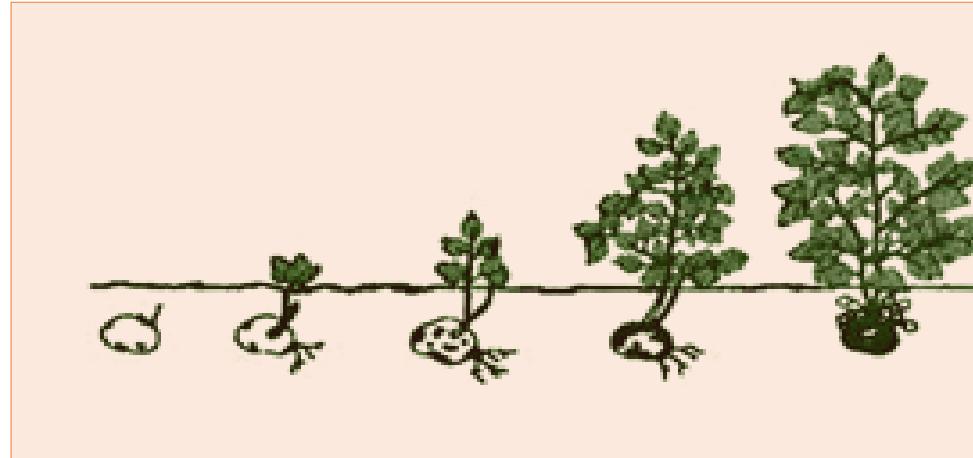
# TOMCAST model

Average temp(°C) during LW hours	Leaf Wetness per Day(h)				
	0-6	7-15	16-20	21+	
13 (10)-17					
18-20	0-3	4-8	9-15	16-22	23+
21-25	0-2	3-5	6-12	13-20	21+
26-29	0-3	4-8	9-15	16-22	23+
DSV=	0	1	2	3	4

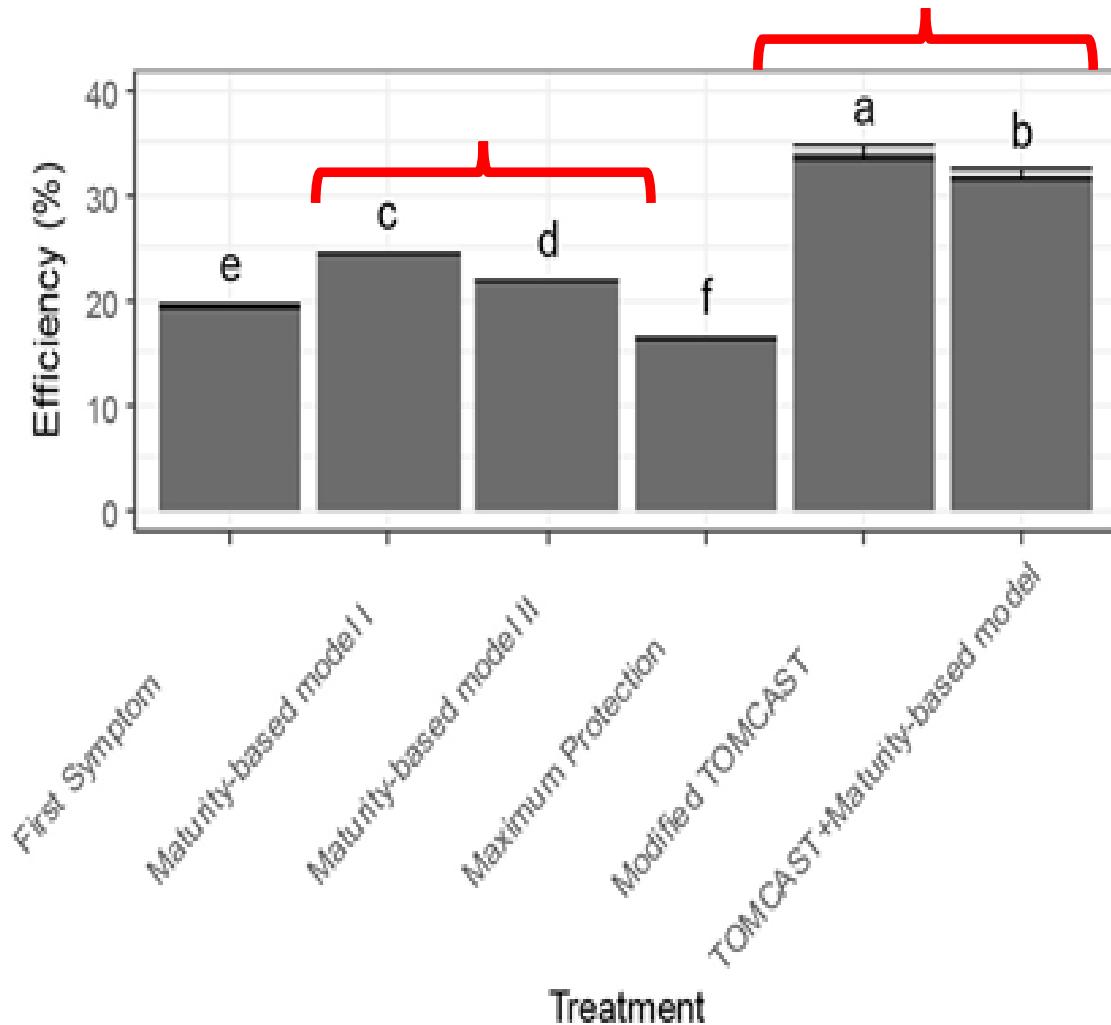
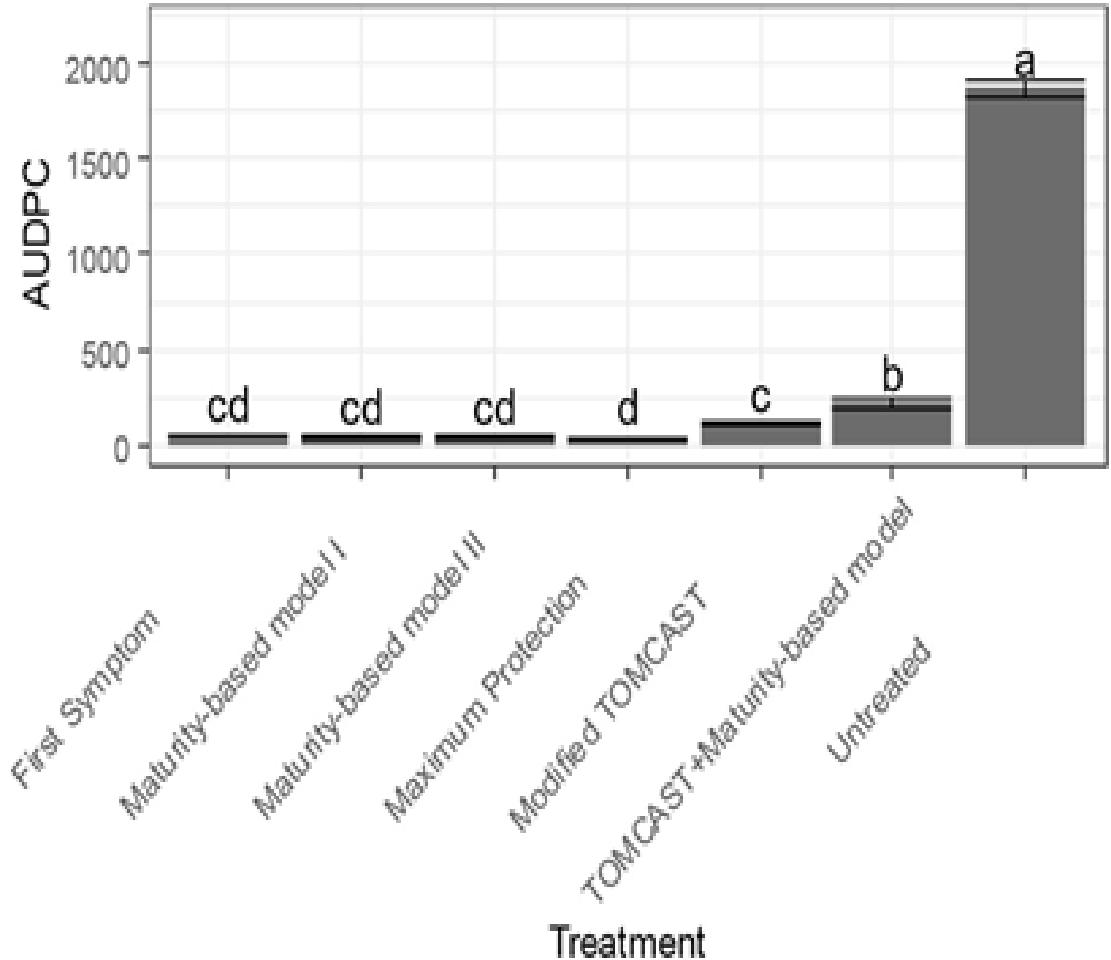


# Integrating age-dependent resistance and weather-based model

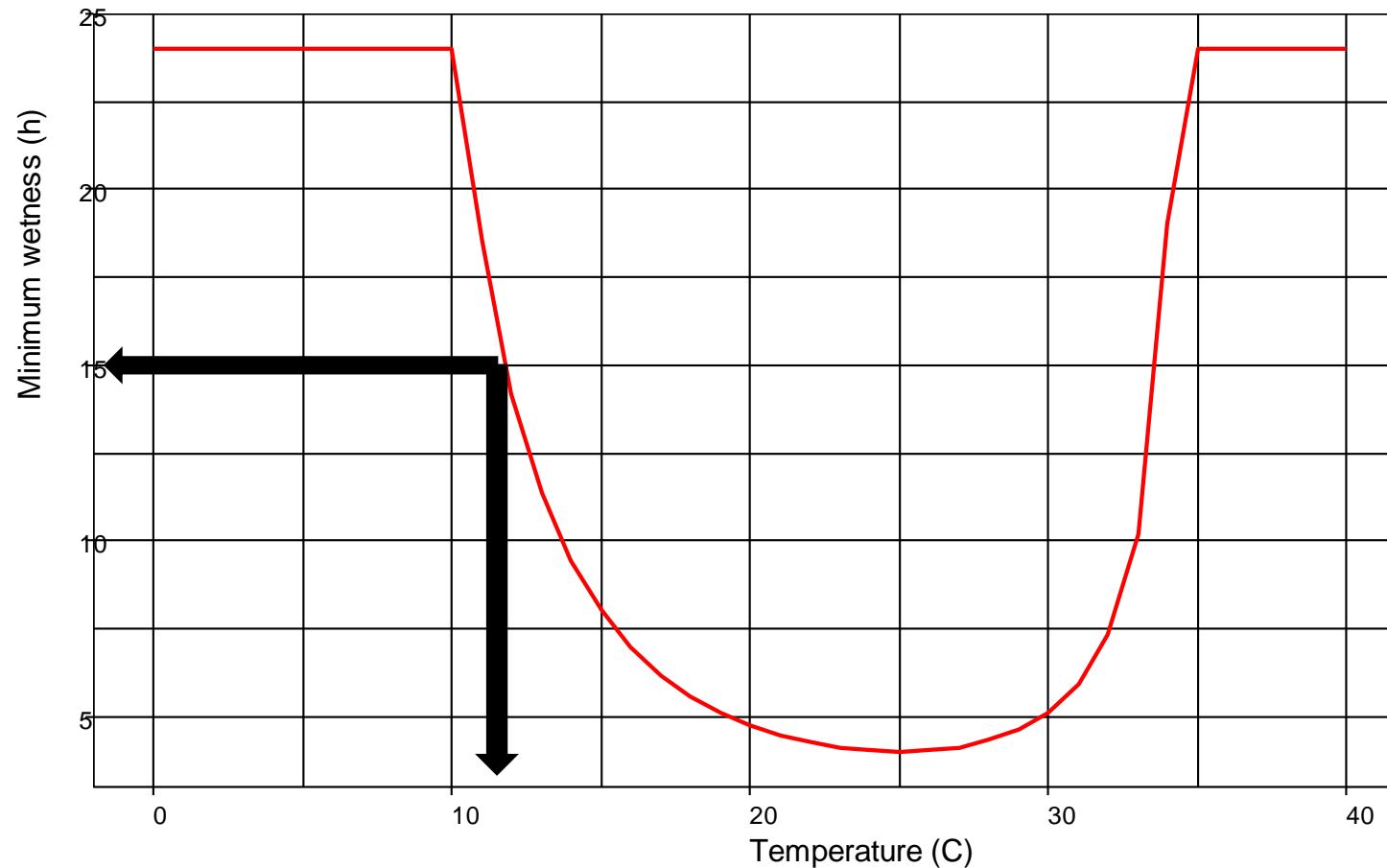
- Age < 300 Pdays
- No spray regardless of the weather
- Age 300-500 Pdays
  - Spray  $\frac{1}{2}$  or  $\frac{2}{3}$  dose:
  - 20 DSV
- Age 300-500 Pdays
  - Spray full dose:
  - 20 DSV



# Integrating age-dependent susceptibility (cv. Kardal)



# Critical days model

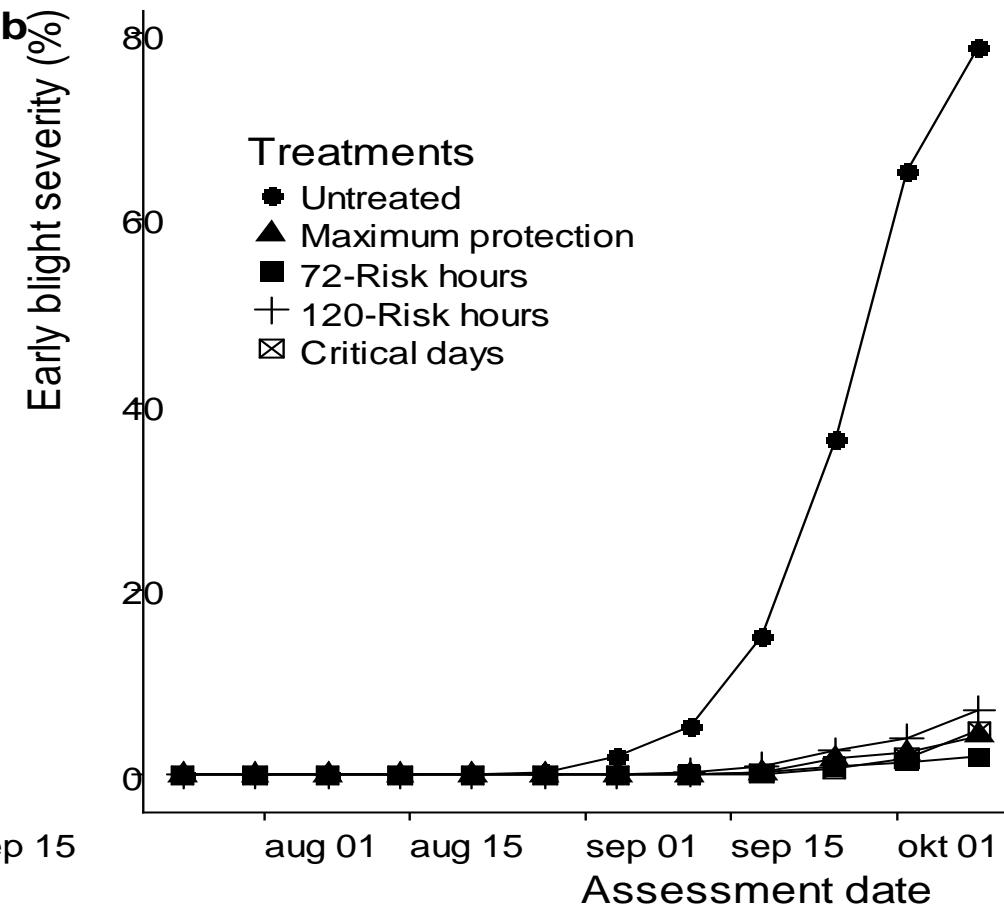
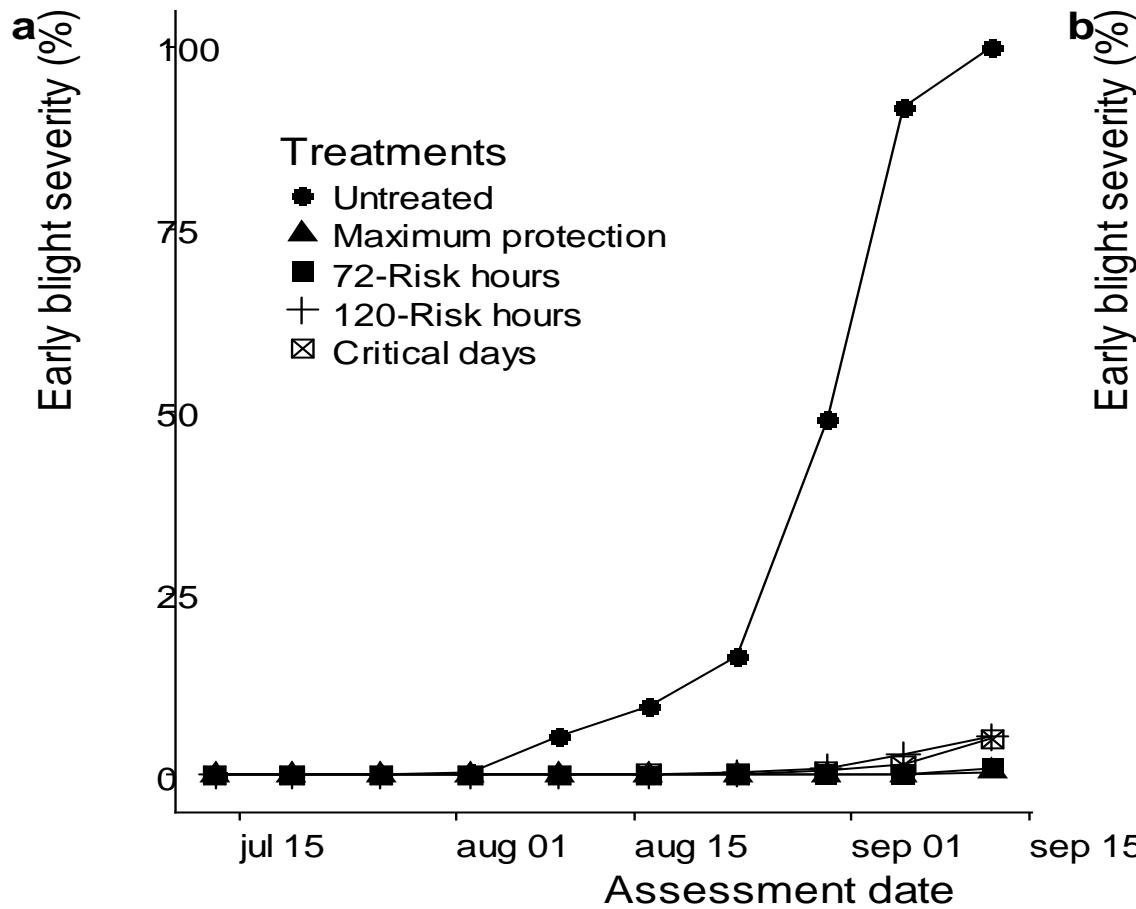


$$f(T) = \left( \frac{T_{\max} - T}{T_{\max} - T_{opt}} \right) \left( \frac{T - T_{\min}}{T_{opt} - T_{\min}} \right)^{(T_{opt} - T_{\min})/(T_{\max} - T_{opt})}$$

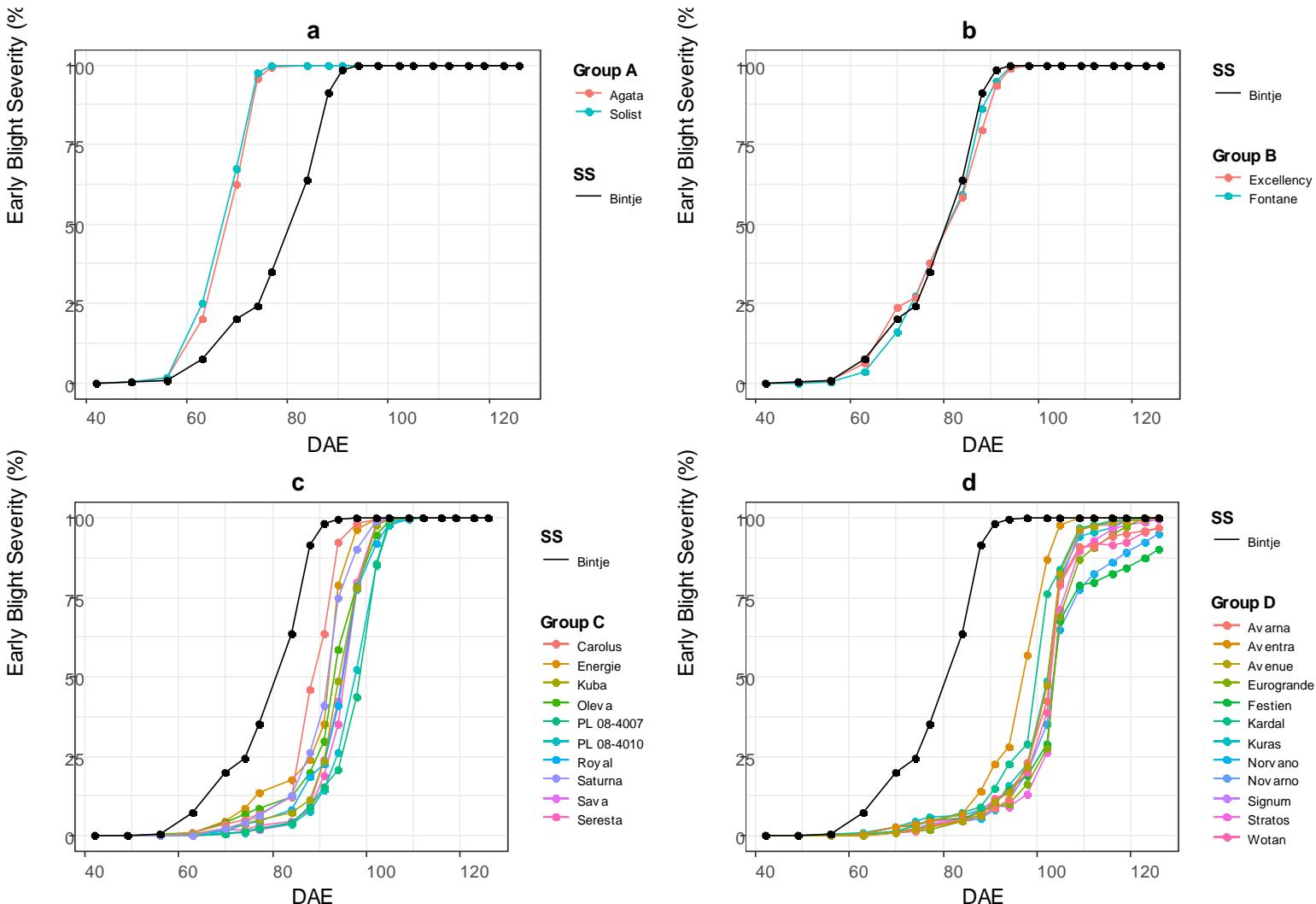
$$W_{(T)} = W_{\min} / f(T) \leq W_{\max}$$

Magarey et al. (2005) Phytopathology  
95:92-100.

# Critical days model with cv. Kuras

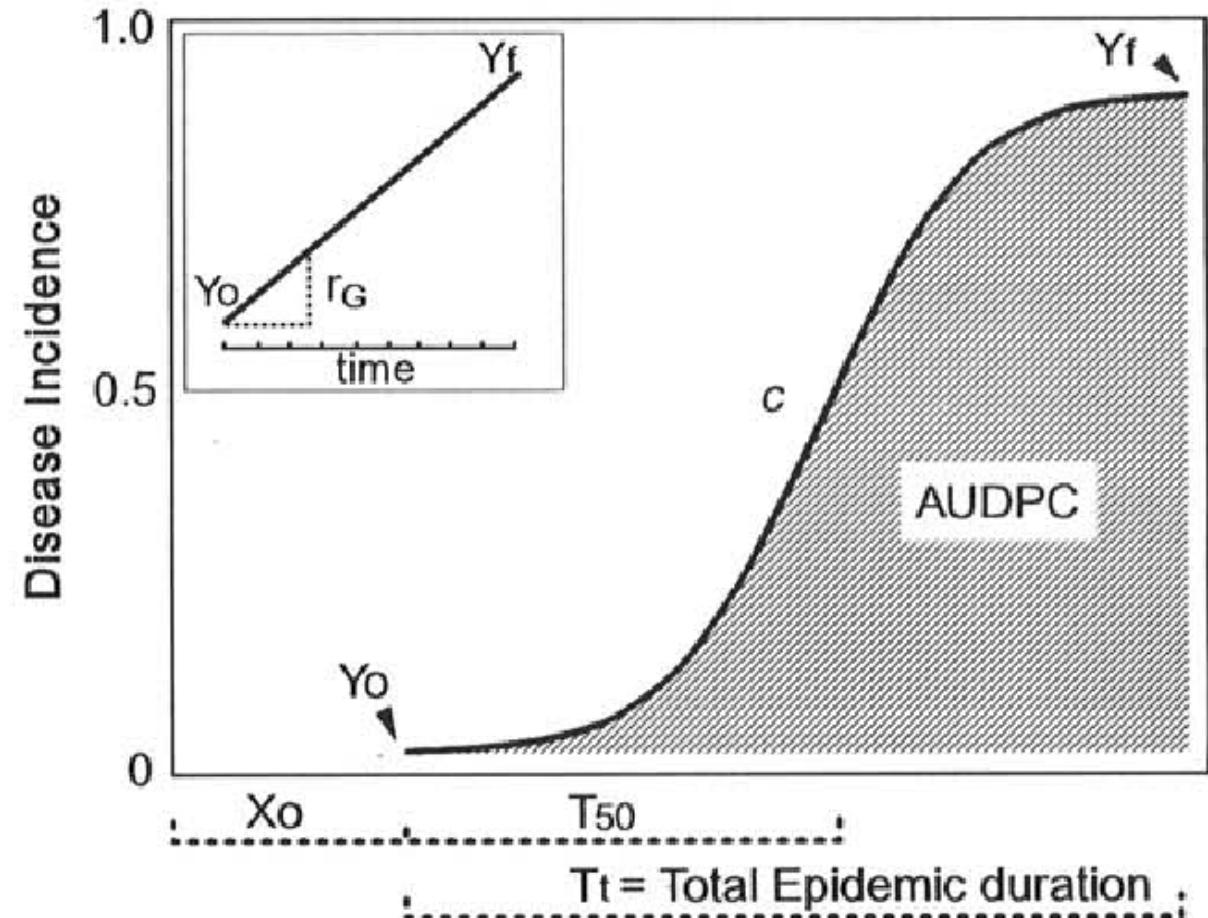


# Four groups of resistance



# Epidemiological data

- Disease assessment (0-100%)
  - Infection rate (rate).
  - The mid-time ( $T_{50}$ ).
  - Duration of epidemic ( $Y_t$ ).
  - Mid-severity ( $Y_{50}$ ).
  - rAUDPC.
  - Daily Defoliation (DD).

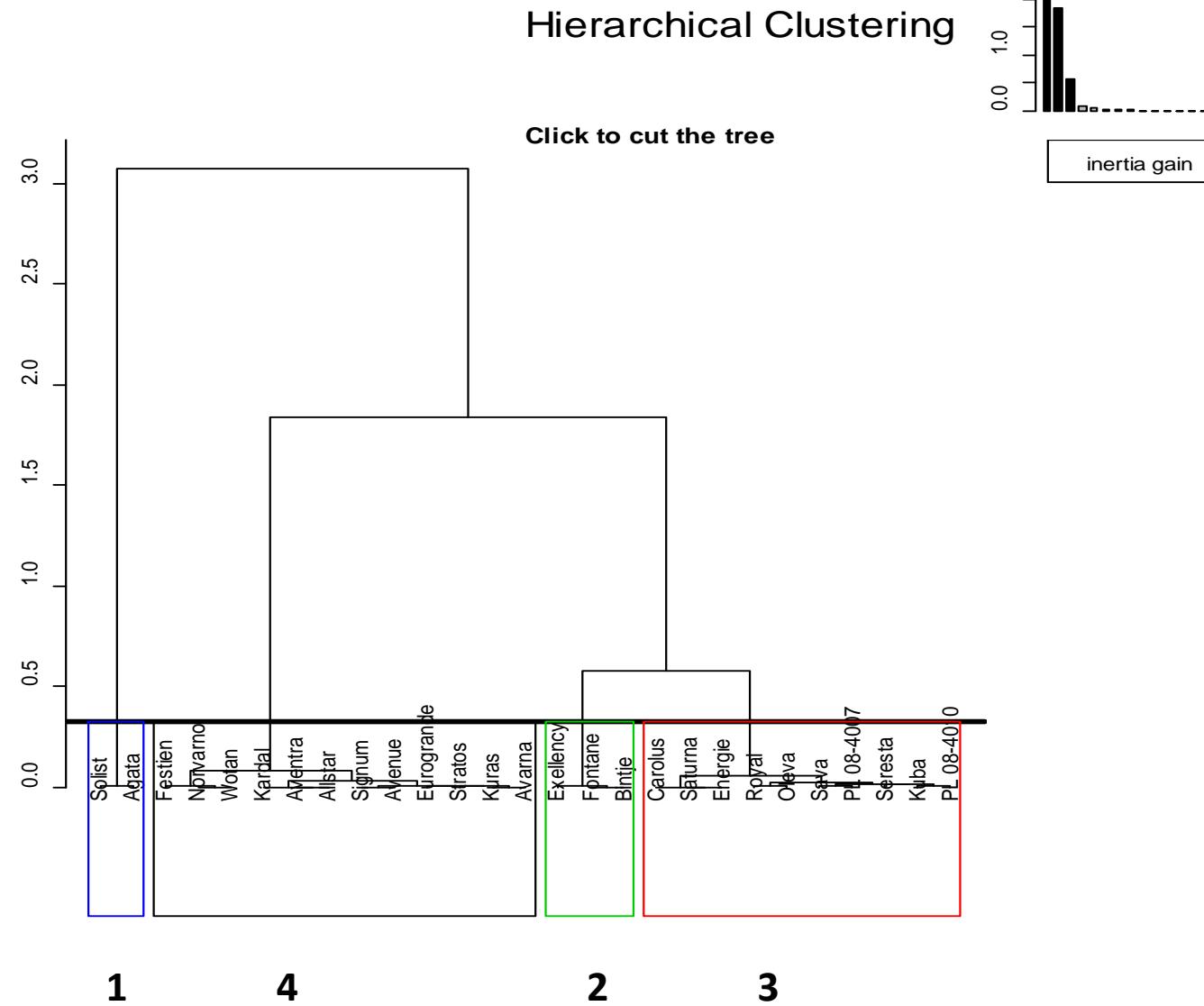


# Univariate analysis of Epidemiological parameter

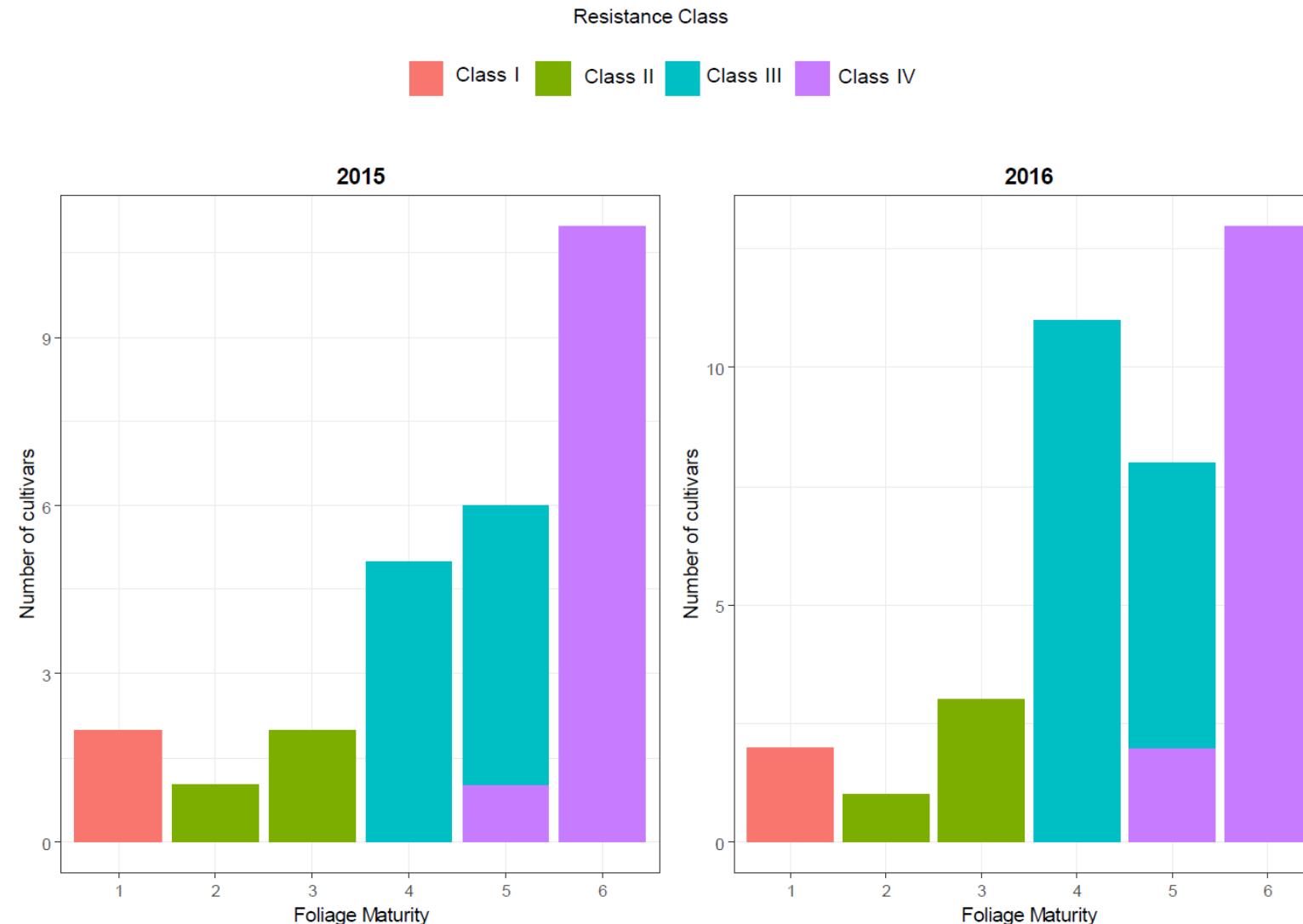
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Variety	T50 (DAS)	DD (%day <sup>-1</sup> )	Y50(%)	Yt (days)	rAUDPC	rate (day <sup>-1</sup> )
Bintje	32.08j	2.06b	63.94b	48.8g	0.36b	0.23d
Carolus	41.07hi	1.78c-f	13.15cd	57f	0.27cd	0.23d
Energie	38.93ij	1.86b-e	17.94c	56f	0.27cd	0.22de
Fontane	31.78j	2.02bc	59.58b	49.8g	0.36b	0.25c

# Cluster analysis



# Cultivar resistance to EB depends on foliage maturity

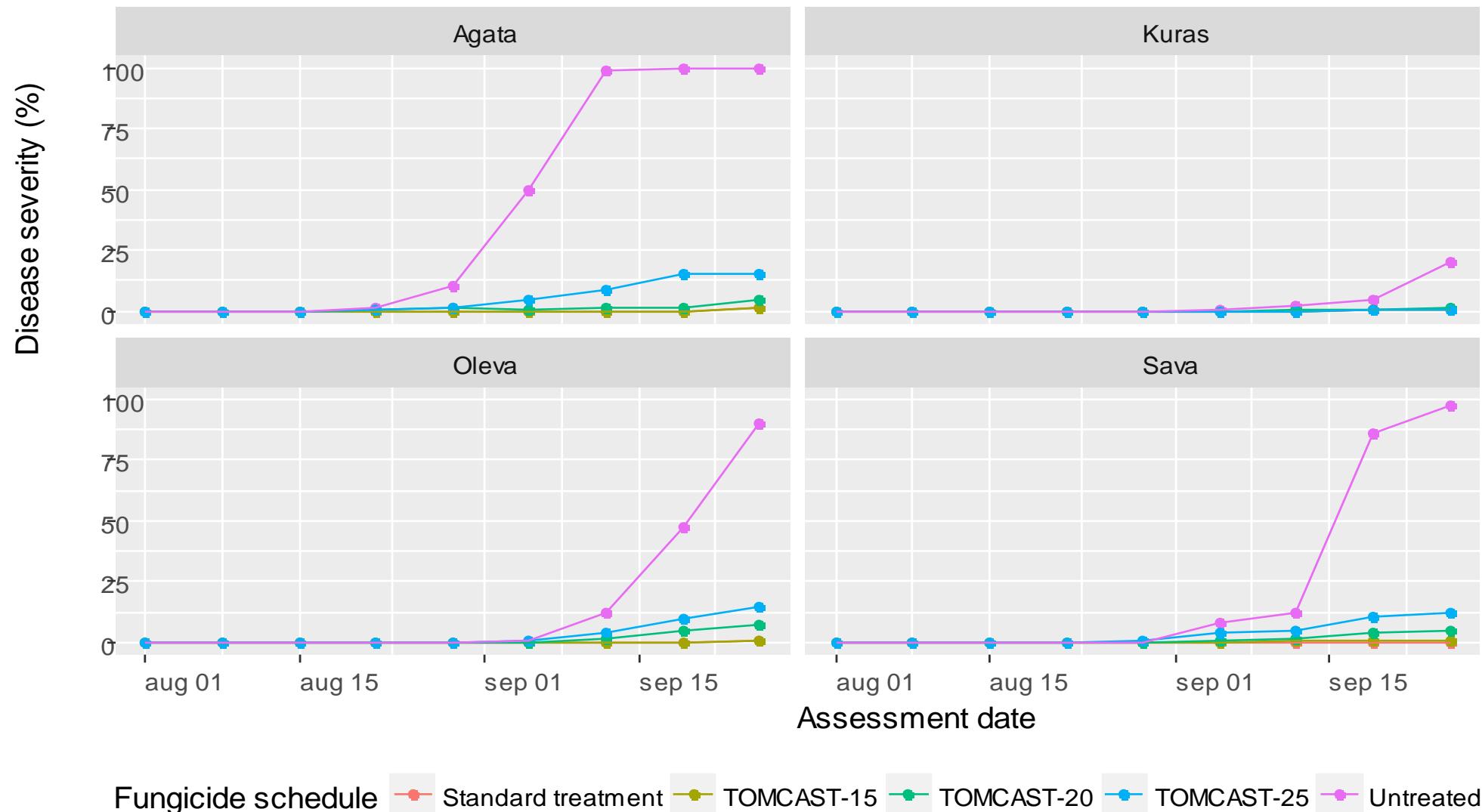


# Integrating cultivar resistance

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Cultivar	Resistance level
Agata	Very susceptible
Sava and Oleva	Moderately slow blighting
Kuras	Slow blighting
Spray schedule	Description
Untreated	No spray fungicide application
Standard spray	Fungicide application started from 50% row closure @ 14 days interval.
TOMCAST 15	1 <sup>st</sup> spray at 330 P-days and subsequent spray at 15 TOMCAST DSV
TOMCAST 20	1 <sup>st</sup> spray at 330 P-days and subsequent spray at 20 TOMCAST DSV

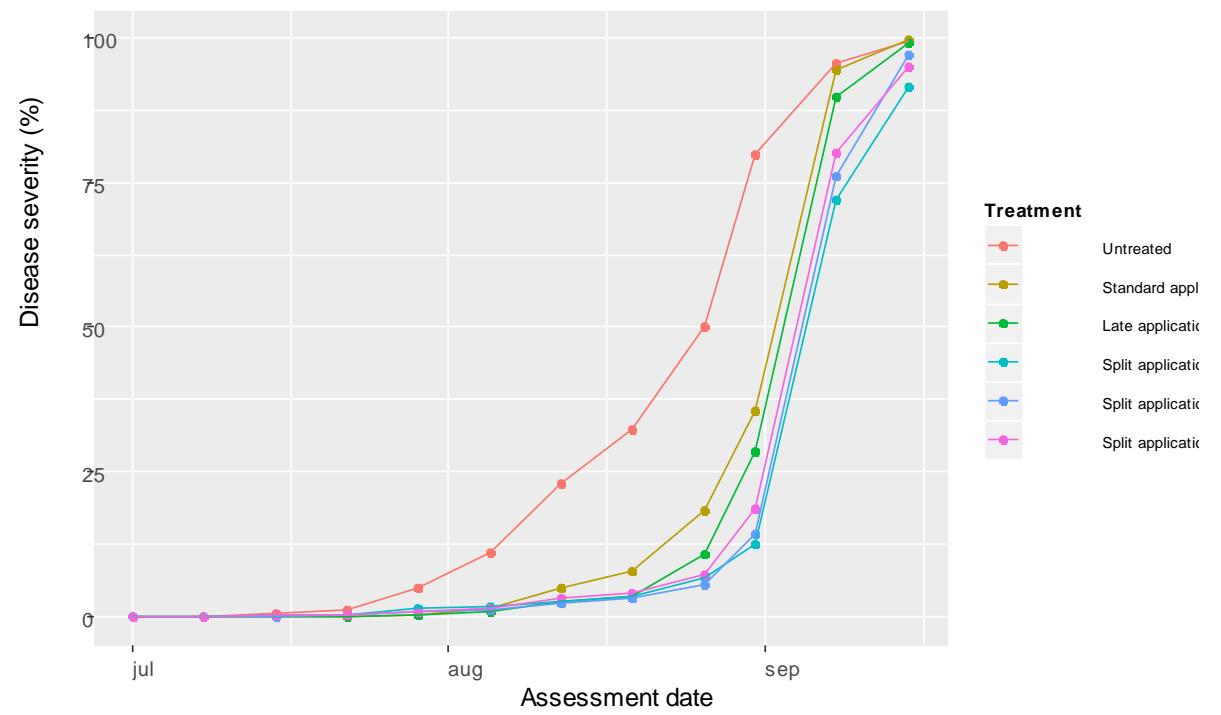
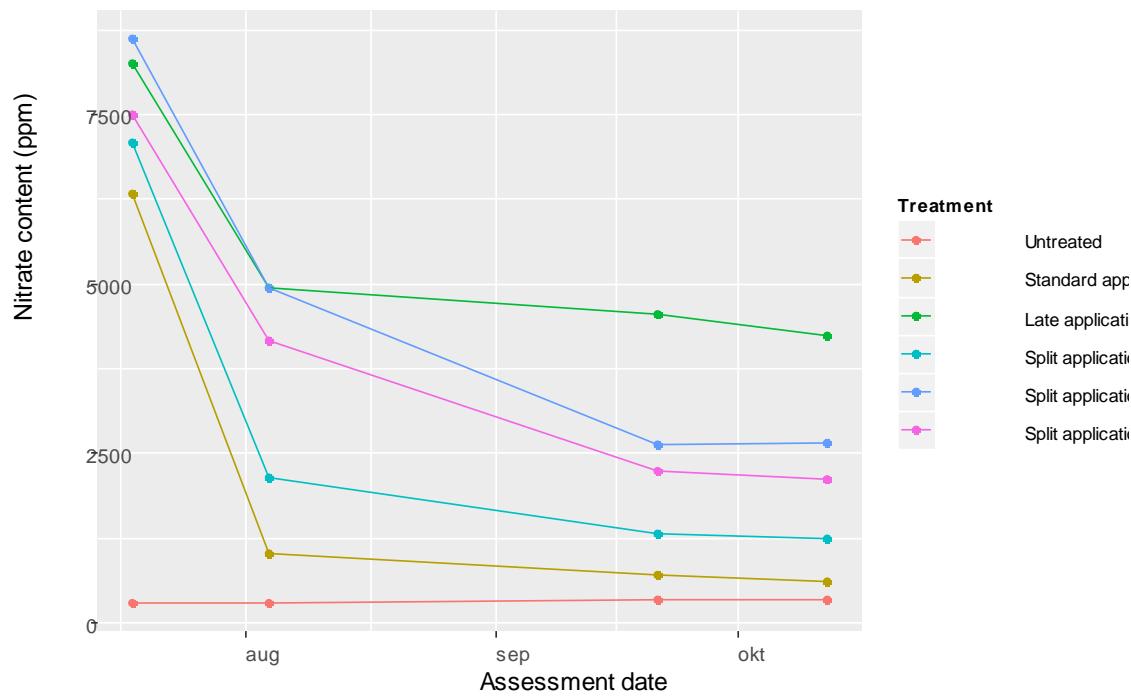
# Integrating cultivar resistance



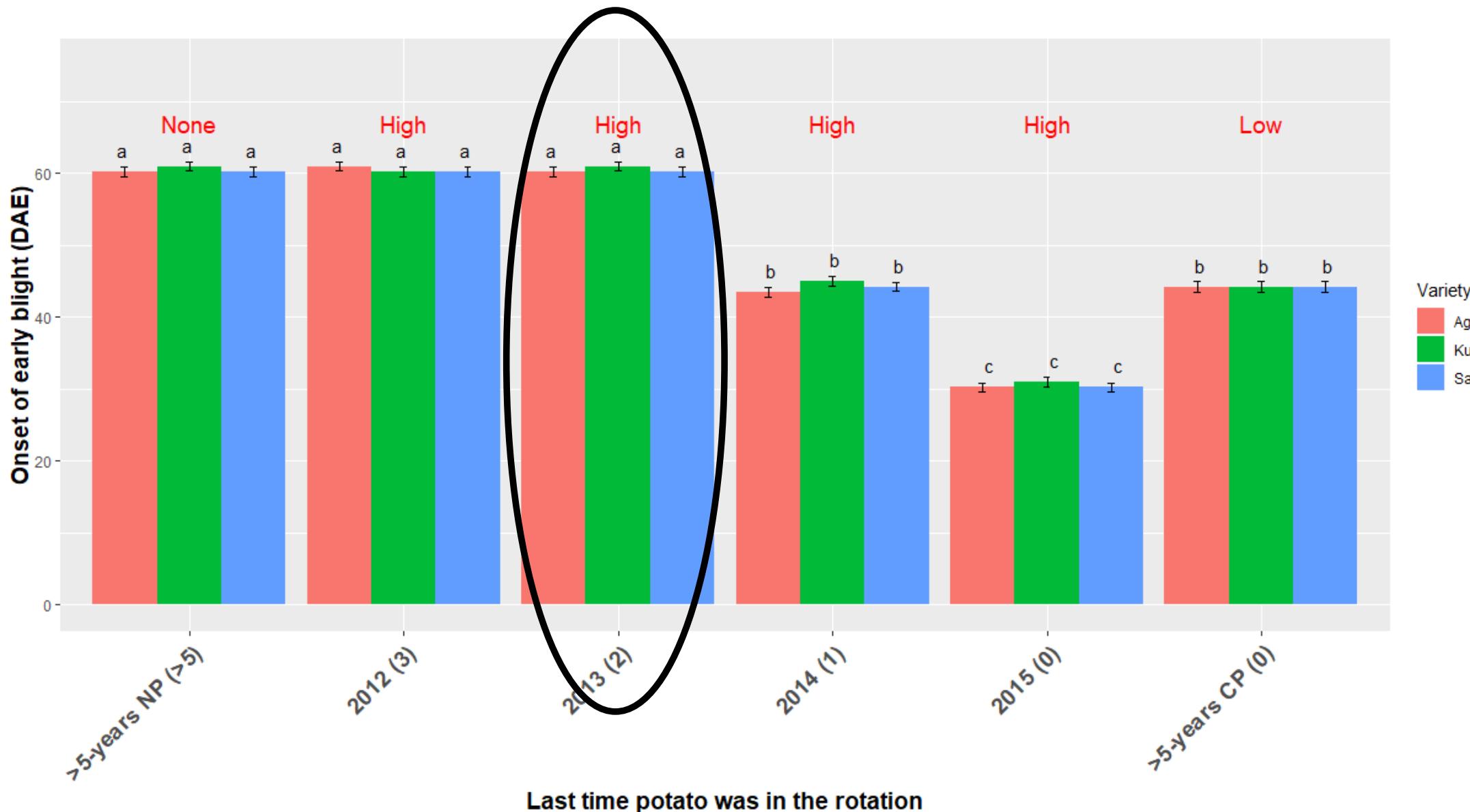
Fungicide schedule    Standard treatment    TOMCAST-15    TOMCAST-20    TOMCAST-25    Untreated

Integrating other components to control EB

# Timing N application affects early blight



# A minimum of 2 years rotation



# General conclusions

- Resistance to early blight depends on foliage maturity.
- Susceptibility of potatoes to early blight increases with plant age.
- Fungicides can be adjusted based on the plant age.
- Varietal resistance does not affect the onset of early blight.
- 2 years between subsequent potato cultivation is sufficient.
- Higher TOMCAST thresholds could be used on cultivars with higher level of resistance.
- Potatoes that receive N at emergence or as split application are less susceptible than potatoes that receive N before planting.

# Papers

- **Abuley, I.K.** & Nielsen, B.J. (2019). Integrating cultivar resistance into the TOMCAST model to control early blight, caused by *Alternaria solani*. *Crop Protection*, 117:69-96.
- Abuley I.K., Nielsen B.J. and Hansen H.H. (2019). The influence of crop rotation on the onset of early blight (*Alternaria solani*). *Journal of Phytopathology*, 167:35–40.
- **Abuley, I.K.**, Nielsen, B.J., Hansen, H.H. (2018). The influence of timing the application of nitrogen on early blight (*Alternaria solani*). *Pest Management Science*. <https://doi.org/10.1002/ps.5236>.
- **Abuley, I. K.**, Nielsen, B. J., & Labouriau, R. (2018). Resistance status of cultivated potatoes to early blight (*Alternaria solani*) in Denmark. *Plant Pathology*, 67(2), 315-326.
- **Abuley, I. K.** & Nielsen, B.J. (2017). Evaluation of models to control potato early blight (*Alternaria solani*) in Denmark. *Crop Protection* 102: 118-128.

**Thanks for your attention**