Reduced efficacy of fluazinam against some Green 33 isolates of *Phytophthora infestans* in the Netherlands

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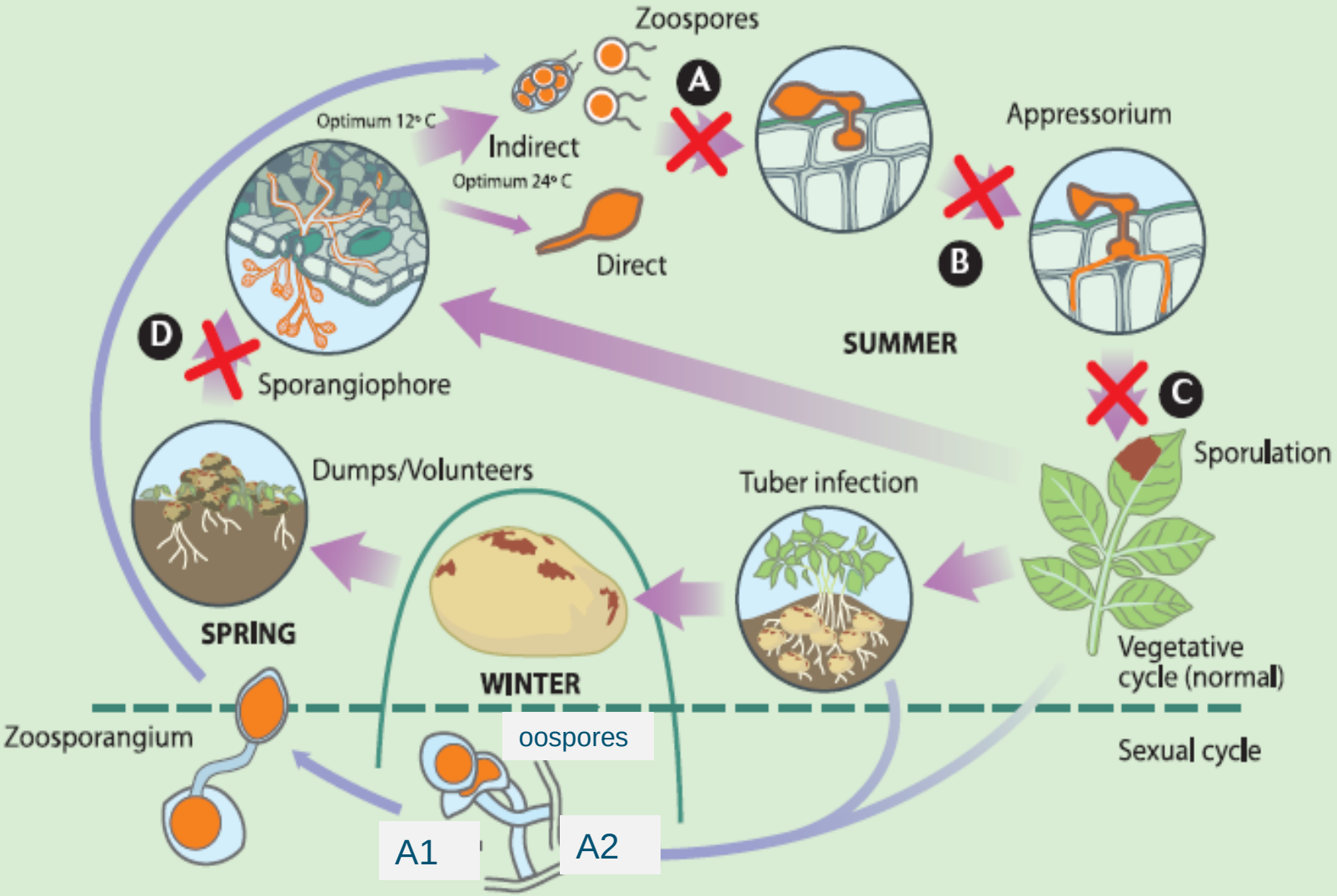
Outline of the presentation

- Introduction
  - Late Blight in NL
  - Control strategies
- Control of Green 33
  - Field trial 2011
- Population *P. infestans*
  - Clonal lineages
  - Green 33
- Conclusions

Life cycle *Phytophthora infestans*



Late Blight in The Netherlands

- Worldwide 21 million ha and € 10 billion damage
- In NL 165.000 ha with average 45 ton/ha yield
  - turnover € 750 million year
- 12-15 sprays/year
- Costs per year
  - Fungicides € 50 million
  - Spraying € 50 million
  - Damage: € 20 million
  - Total € 120 million (=15% of the turnover

EuroBlight

A potato late blight network for Europe

Fungicide comparison - Updated 25 January 2012

The effectiveness of fungicide products/co-formulations for the control of *P. infestans* based on the **highest** rate registered in Europe. These ratings are the opinion of the Fungicides Sub-Group at the St Petersburg late blight workshop, 2011 and are based on field experiments and experience of the products performance when used in commercial conditions.

Provisional ratings for the effectiveness of new fungicide products for the control of *P. infestans* in Europe, B table here

Efficacy ratings of fungicides for the control of early blight caused by *Alternaria solani* and *Alternaria alternata*. here

Hold mouse over headers to get explanation

Product (Dose rate [litre or kg/ha]) [1]	Effectiveness				Mode of action			Rainfastness	Mobility in the plant
	Leaf blight [2]	New growth	Stem blight	Tuber blight	Protectant	Curative	Anti sporulant		
copper		?	●	●	◖	0	0	●	contact
dithiocarbamates [3] (2.0)	2.0	?	●	0	●●	0	0	◖	contact
chlorothalonil		?	◖	0	●●	0	0	●◖	contact
cyazofamid (0.2)	3.8	●●	●	●●●	●●●	0	0	●●●	contact
fluazinam (0.4)	2.9	?	●	●●◖	●●●	0	0	●●◖	contact
zoxamide + **mancozeb** (1.8)	2.8	?	●[5]	●●	●●●	0	0	●●◖	contact + **contact**
famoxadone + **cymoxanil**		?	●◖	N/A	●●	●●	●	●●◖	contact + **translaminar**
mandipropamid (0.6)	4.0	●●	●◖	●●[5]	●●●	●[6]	●◖	●●●	translaminar + contact
benthiavalicarb + **mancozeb** (2.0)	3.7	?	●◖ [5]	●◖	●●●	●◖	●	●●◖	translaminar + **contact**
cymoxanil + **mancozeb**		?	●◖	0	●●	●●	●	●●	translaminar + **contact**
cymoxanil + **metiram**		?	●◖	0	●●	●●	●	●●	translaminar + **contact**
cymoxanil + **copper**		?	●◖	0	●●	●●	●	●●	translaminar + **contact**
dimethomorph + **mancozeb** (2.0)	3.0	?	●◖	●●	●●◖	●	●●	●●◖	translaminar + **contact**
fenamidone + **mancozeb** (1.5)	2.6	?	●◖ [5]	●●	●●◖	0	●◖ [5]	●●	translaminar + **contact**
benalaxyl + **mancozeb** [4]		●●	●●	N/A	●●◖	●●◖	●●◖	●●●	systemic + **contact**
metalaxyl-M + **mancozeb** [4]		●●	●●	N/A	●●◖	●●◖	●●◖	●●●	systemic + **contact**
metalaxyl-M + **fluazinam** [4]		●●	●●	N/A	●●◖	●●◖	●●◖	●●●	systemic + **contact**
propamocarb-HCl + **mancozeb**		●◖	●●	●●	●●◖	●●	●●	●●●	systemic + **contact**
propamocarb-HCl + **chlorothalonil** (2.7)	3.4	●◖	●●	●●	●●◖	●●	●●	●●●	systemic + **contact**
propamocarb-HCl + **fenamidone** (2.0)	2.5	●◖	●●	●●	●●◖	●●	●●	●●●	systemic + **translamina**
propamocarb-HCl + **fluopicolide** (1.6)	3.8	●●	●●	●●●	●●●	●●	●●◖	●●◖	systemic + **translamina**

[1] The scores of individual products are based on the label recommendation and are NOT additive for mixtures of active ingredients. Inclusion of a product in the list is NOT indicative of its registration status either in the EU or elsewhere in Europe. The dose rates mentioned between brackets are those used in the EuroBlight field trials to determine the leaf blight rating, [2] Based on EuroBlight field test in 2006-2010, [3] Includes maneb, mancozeb, propineb and metiram, [4] See proceedings for comments on phenylamide resistance, [5] Based on limited data, [6] In some trials there were indications that the rating was 1½

Ratings for leaf blight is based on results from Euroblight field trials during 2006-2010, and only compounds included in these trials are rated for leaf blight. The scale for leaf blight is a 2-5 scale (see technical report). All other ratings are 1-3 scale indicated by a combination of full (1) and half (½) orange colored dots.

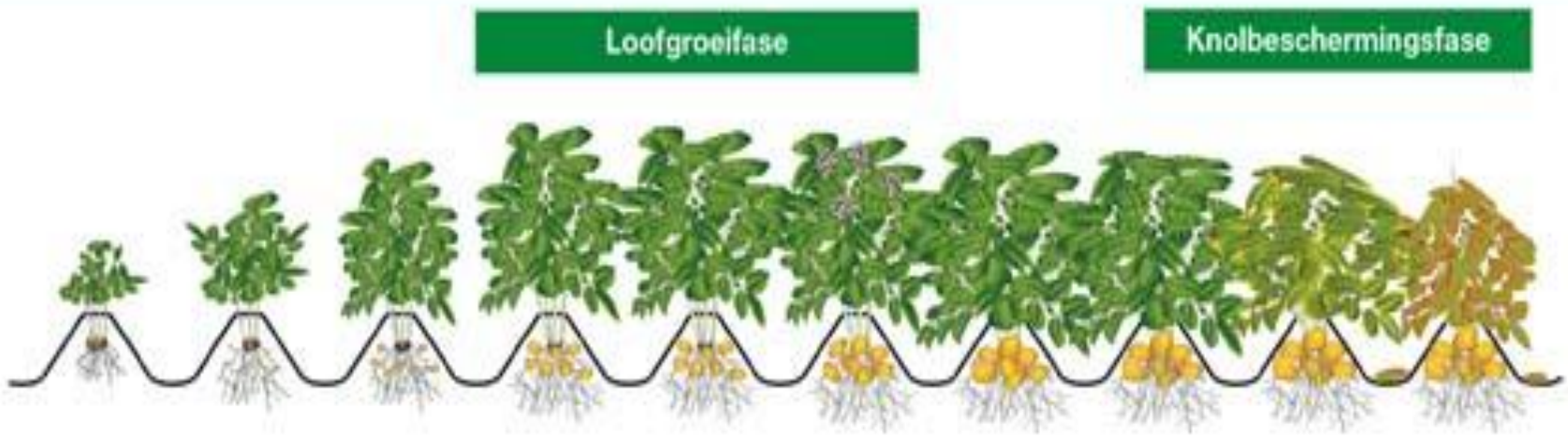
Key to ratings: 0 = no effect ; ● = reasonable effect ; ●● = good effect ; ●●● = very good effect ; N/A = not recommended for control of tuber blight; ? = no experience in trials and/or field conditions.

Whilst every effort has been made to ensure that the information is accurate, no liability can be accepted for any error or omission in the content of the tables or for any loss, damage or other accident arising from the use of the fungicides listed herein. Omission of a fungicide does not necessarily mean that it is not approved for use within one or more EU countries.

The ratings are based on the label recommendation for a particular product. Where the disease pressure is low, intervals between spray applications may be extended and, in some

Control strategies

Emergence		Fast growth	Bulking	Tuber protection
1 of 2 sprays	2 á 3 sprays	3 sprays	4 sprays	3 sprays
Curzate M		Curzate M	Shirlan	Shirlan
Shirlan		Shirlan	Shirlan	Shirlan
Revus		Revus	Shirlan	Shirlan
Revus	Fubol Gold	Revus	Shirlan	Shirlan
Revus		Revus / Infinito	Infinito / Ranman	Ranman
Valbon		Valbon	Shirlan	Ranman
Tattoo C		Tattoo C	Infinito	Ranman
Acrobat		Acrobat	Shirlan	Shirlan
Curzate M		Ranman	Unikat pro	Ranman



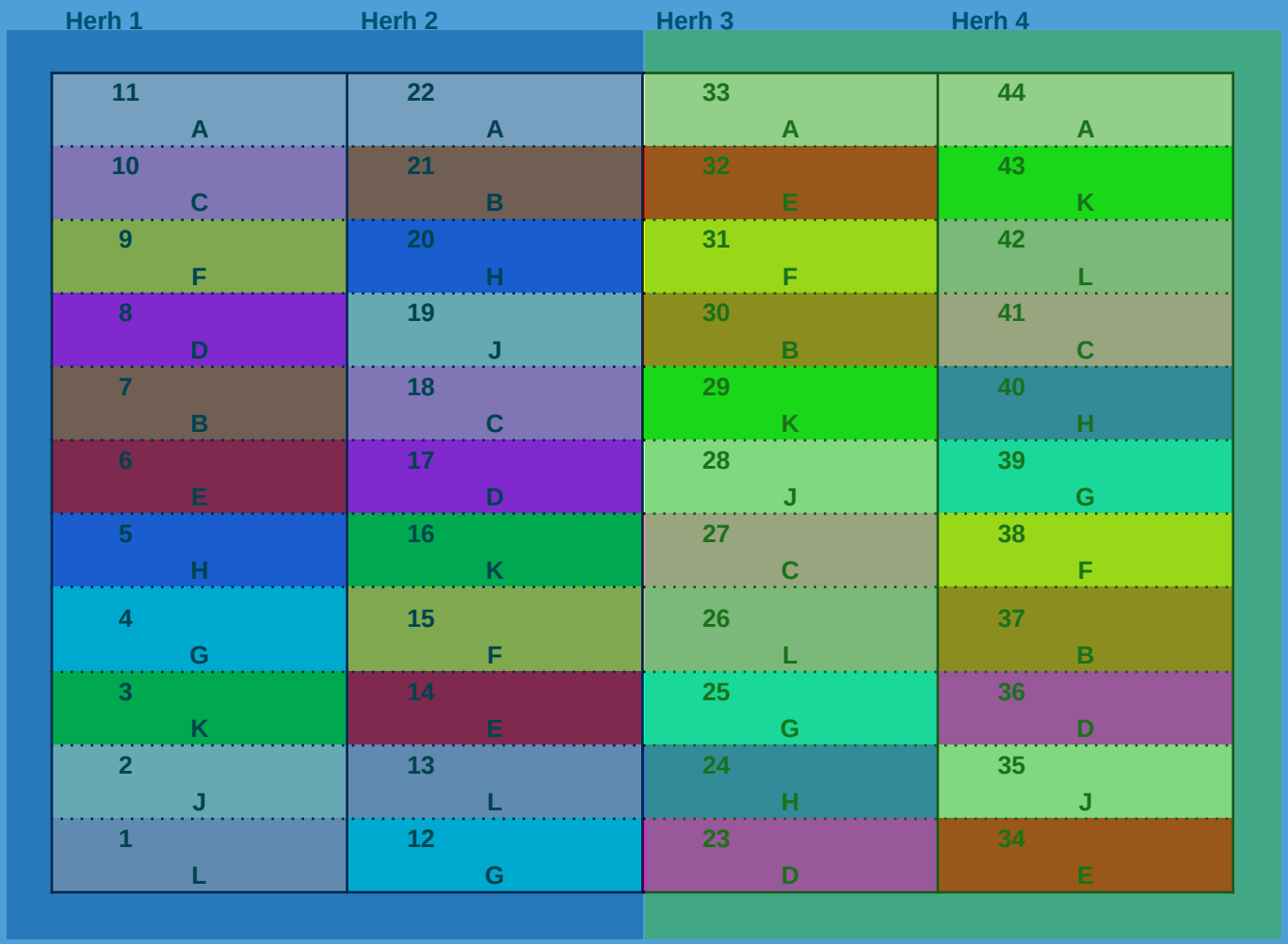
Field trial Lelystad 2011

- Cv Maritiema (2,5 leaf; 8 tuber)
- Spray 1, 2, 3: 30 June, 7 July, 15 July
- Spray 4, 5: 21 July & 26 July
- Inoculation:
    - 2 August NL07041 (Blue 13) and NL10328 (Green 33)
- Spray 6: 4 August
- Spray 7: 12 August
- Spray 8: 18 August
- Spray 9: 25 August

Field trial Lelystad 2011

Bespuiting	1, 2 & 3	4 & 5	Inoculatie		6, 7, 8 & 9
Object			Blue 13 Herhaling 1-2	Green 33 Herhaling 3-4	
1	Revus	--			--
2	Revus	Shirlan 0.4 l/ha			Shirlan 0.4 l/ha
3	Revus	Shirlan 0,3 l/ha			Shirlan 0,3 l/ha
4	Revus	Infinito 1,2 l/ha			Infinito 1,2 l/ha
5	Revus	Infinito 0,9 l/ha			Infinito 0,9 l/ha
6	Revus	Revus 0.6 l/ha			Revus 0.6 l/ha
7	Revus	Revus 0,45 l/ha			Revus 0,45 l/ha
8	Revus	Ranman 0.2 l/ha			Ranman 0.2 l/ha
9	Revus	Curzate M 2,5 kg/ha			Curzate M 2,5 kg/ha
10	Revus	Valbon 2,0 kg/ha			Valbon 2,0 kg/ha
11	Revus	Orvego 0,8 l/ha			Orvego 0,8 l/ha

Trial layout Lelystad 2011



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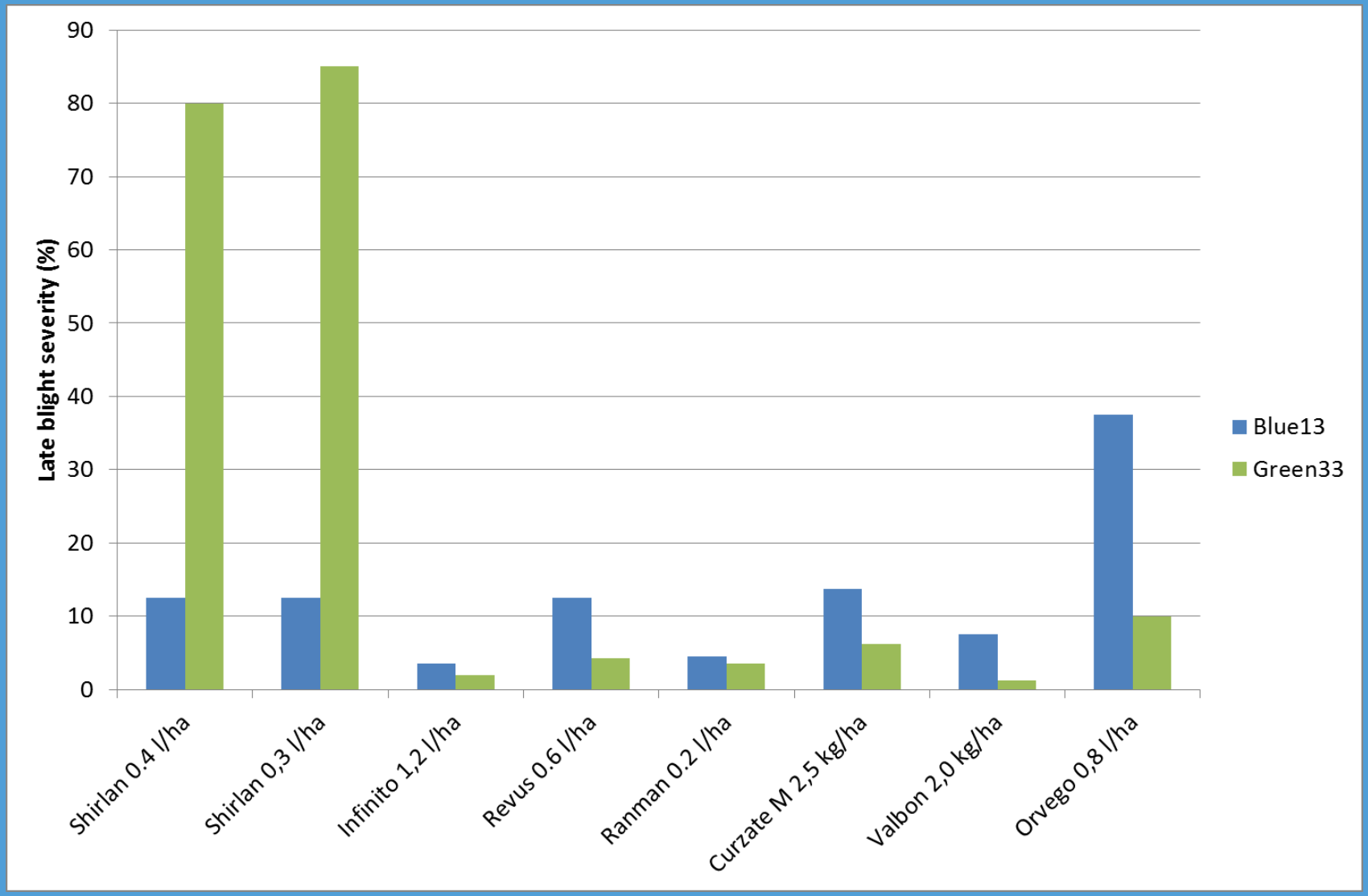
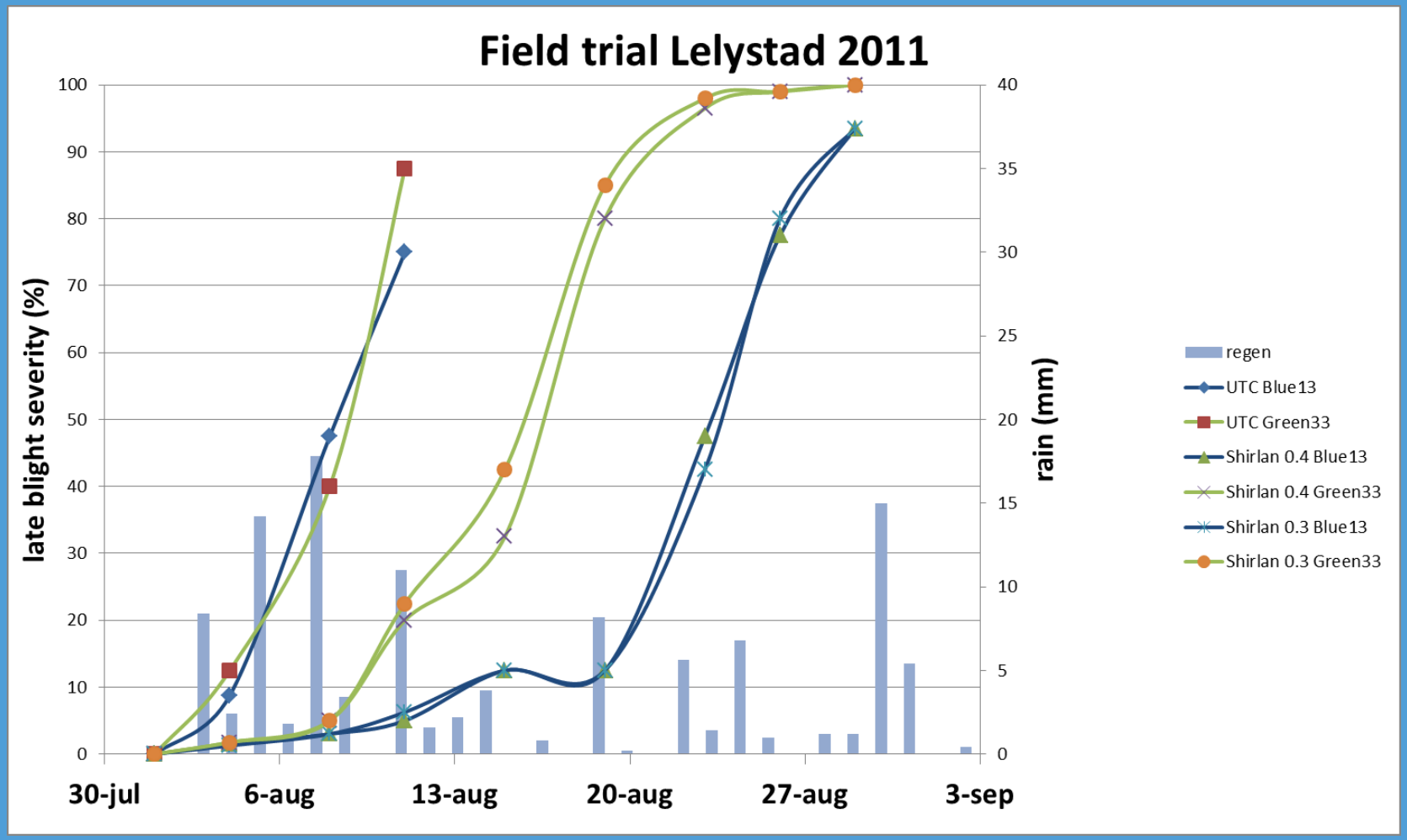
Foliar blight: 19 August 2011

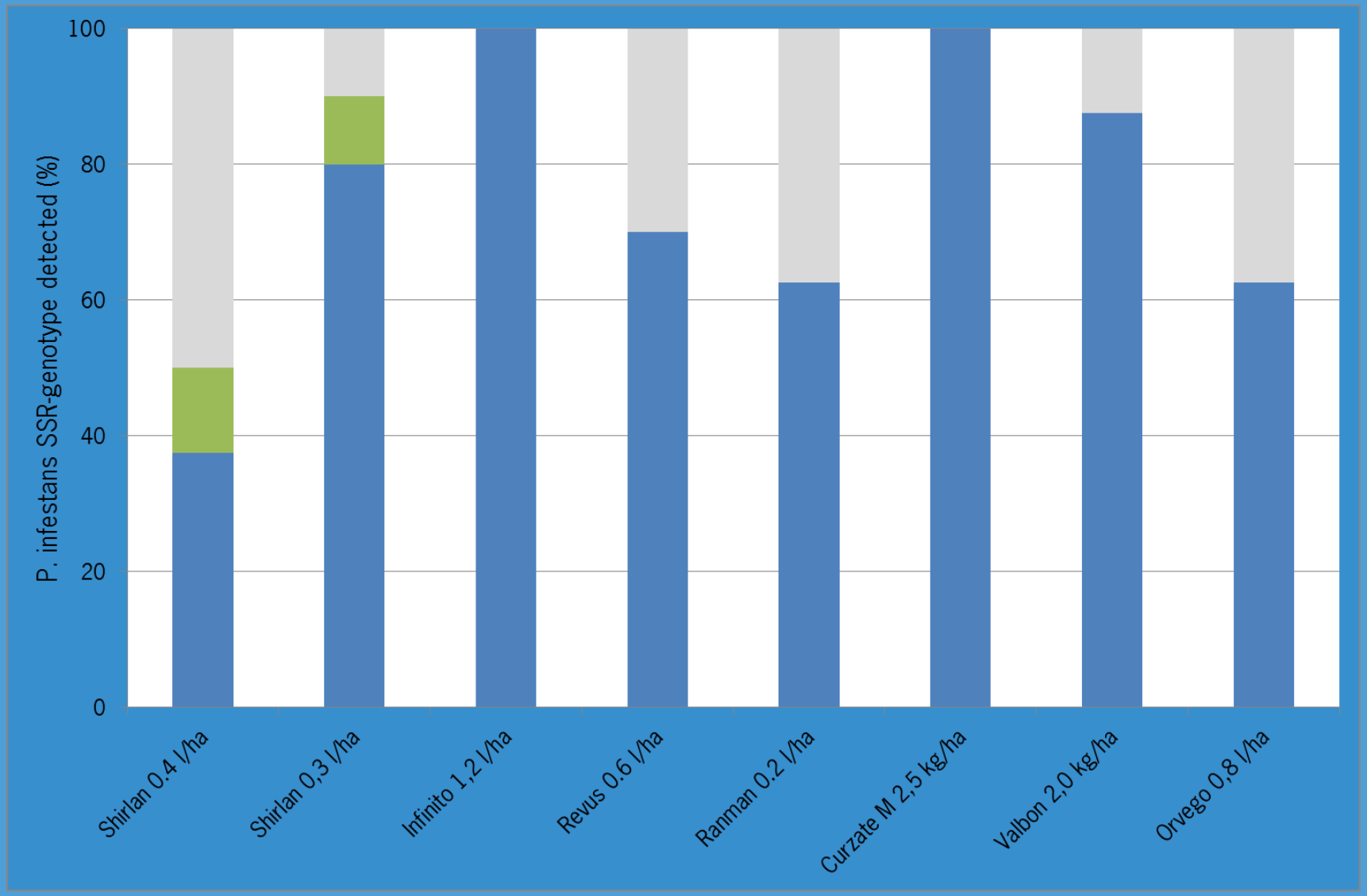


Field trial 2011: Lelystad

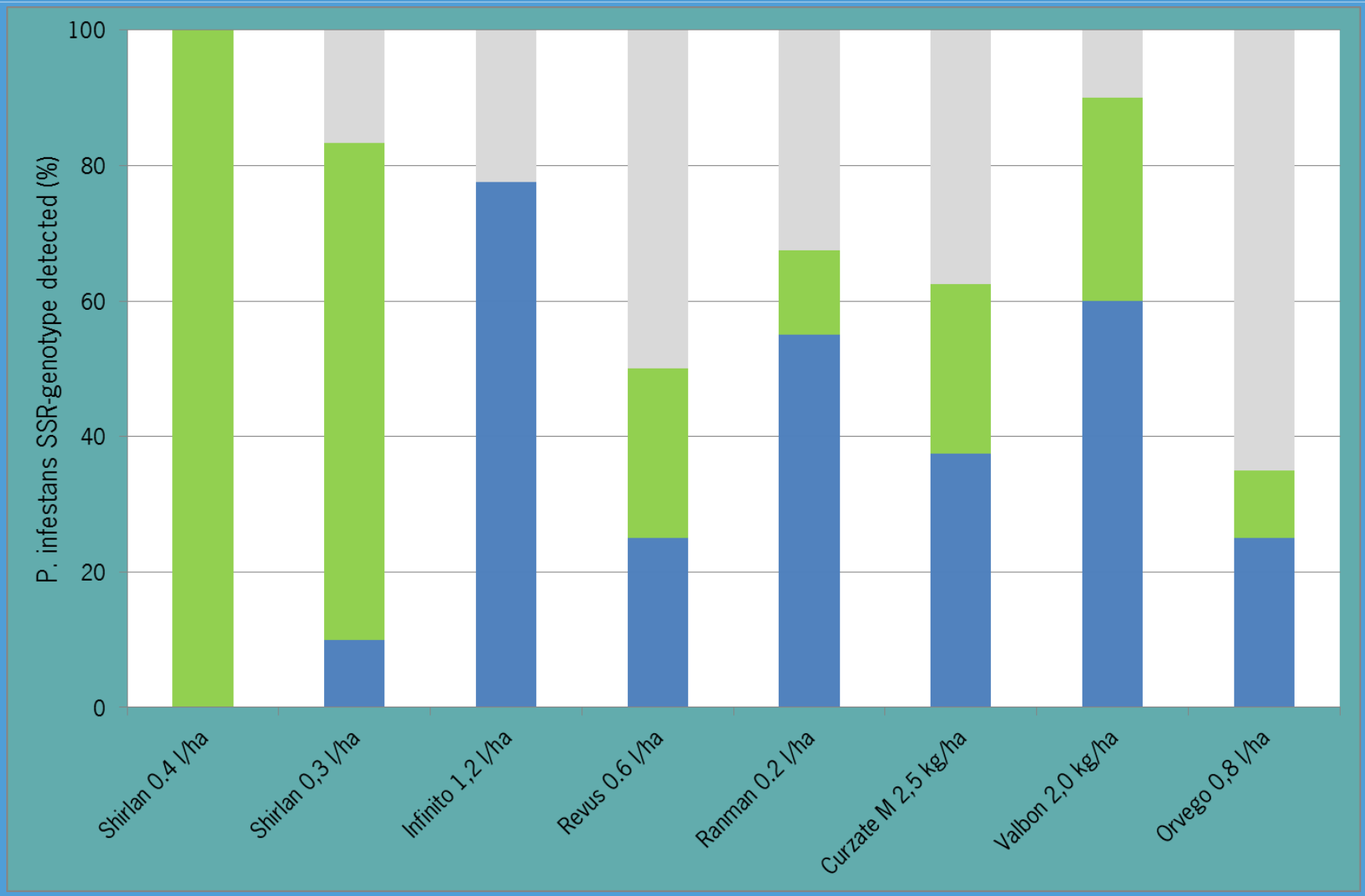
Foliar blight: Lelystad 2011



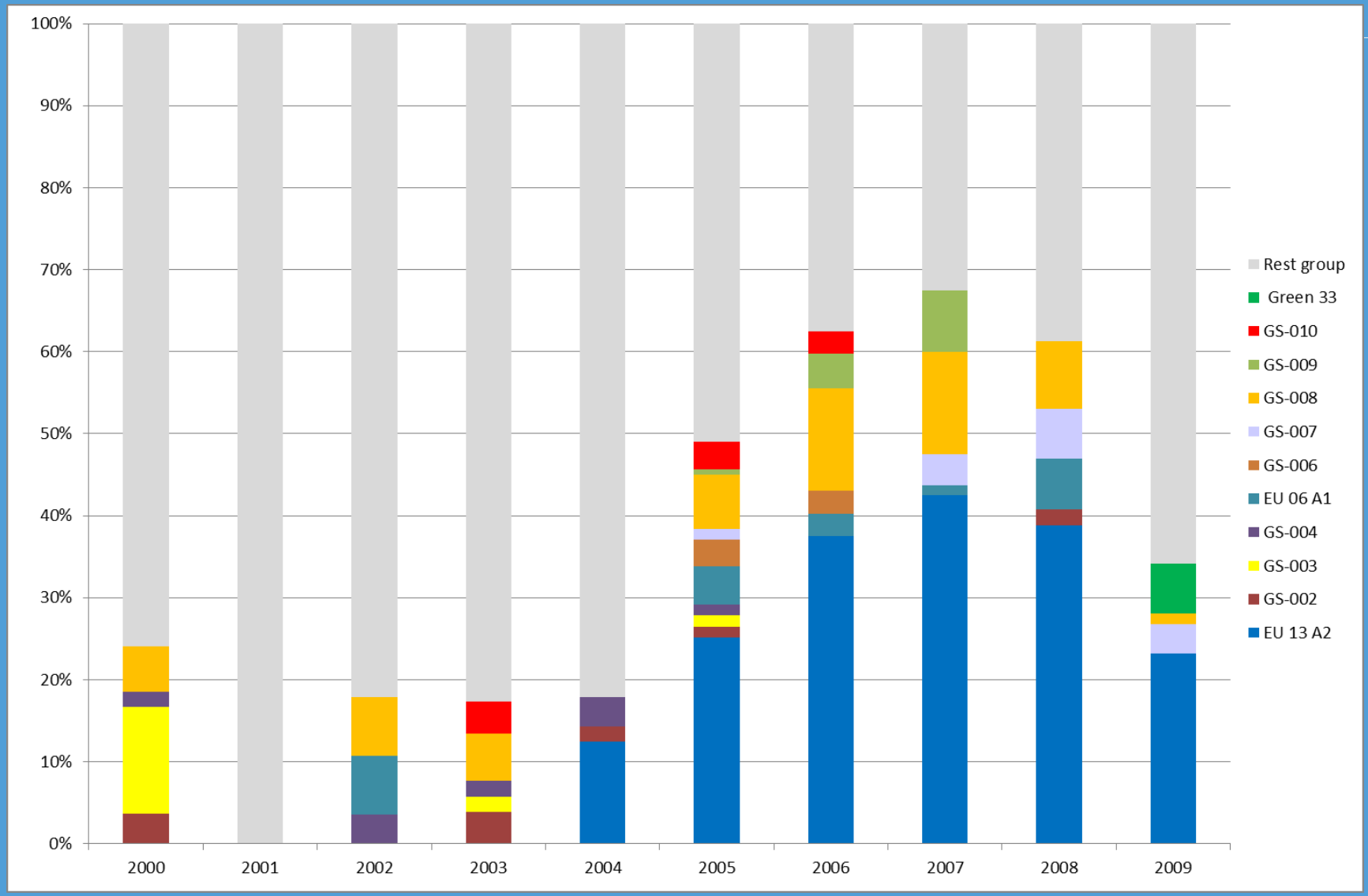
SSR genotypes in blocks inoculated with Blue13 (16 dai)



SSR genotypes in blocks inoculated with Green33 (16 dai)



Population *P. infestans*: 2000 - 2009



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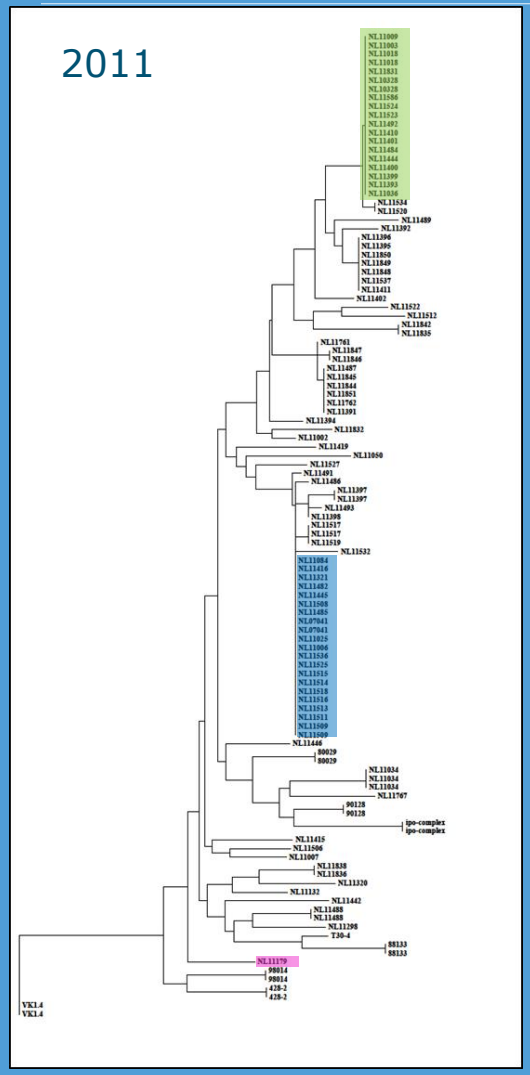
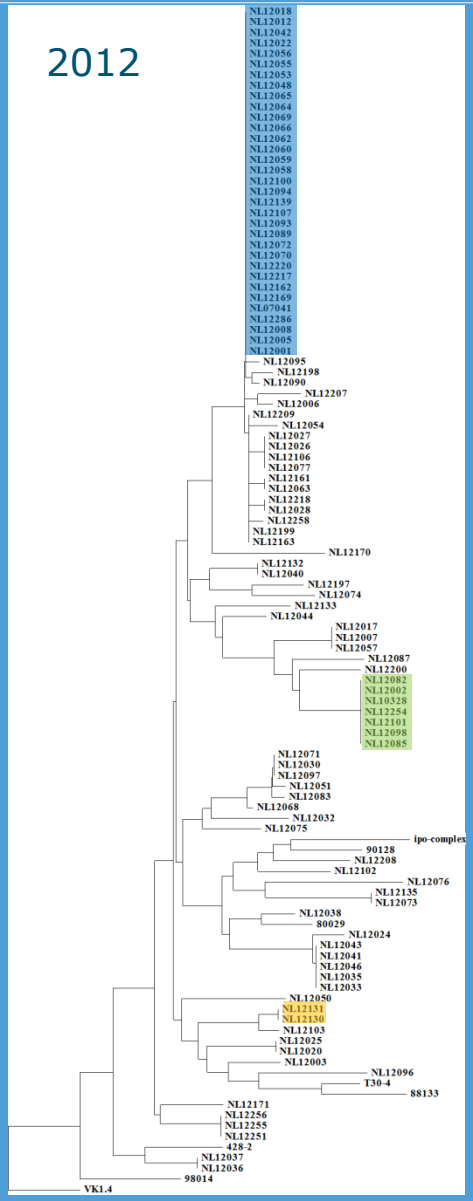
Green 33 isolates: 2011 & 2012





- 2011 (# 83)
  - 22% Blue13
  - 20 % Green33
  - 1x Pink6
  - 0 x GS008
- 2012 (# 109)
  - 31 % Blue13
  - 6 % Green33
  - 0 x Pink6
  - 2 x GS008

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Conclusions

- Dutch *P. infestans* population is very variable: mixture of clonal lineages and unique genotypes
- Green 33 is detected in NL from 2009 onwards
  - The frequency of Green 33 in NL has decreased from about 20% in 2010 & 2011 to 6% in 2012
- In field trial in 2011 in NL fluazinam did not effectively control Green33-isolates
  - Compared to other fungicides the development of Green 33 is favoured in a solo fluazinam schedule
  - Compared to other genotypes Green 33 seems less competitive
  - The correlation between sensitivity of the inoculted strains observed in the lab using different assays and fluazinam activity in the field is poor

Thank you for your attention

Acknowledgements

Caroline Strypstein
Frank Meier-Runge
Helge Sierotzki
Gabriel Scalliet

Marieke Förch
Trudy van den Bosch
Corina Topper
Geert Kessel
Bert Evenhuis

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