

# Tuber blight

## Effects of cv, spore density and isolate

A. Evenhuis, P.J. van Bekkum & G.J.T. Kessel



# Outline

- Objective
- Susceptibility of cultivars in relation to Phytophthora strains
- Tuber blight incidence in the field in relation to spore density and isolate
- General discussion & conclusions

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# Objective

- To establish relationships between inoculum density in the soil and tuber blight
  - CV's
  - Field conditions
- Improve decision rules to prevent tuber infection
  - Avoid tuber infection and tubers as primary inoculum source
  - Reduce environmental impact and possibly fungicides input



# Requirements for tuber infection (above ground)

## ■ Foliar infection

- Variety
- Weather conditions
- Spray schedule

## ■ Sporulation

- Number of sporangia produced
- Survival of sporangia

## ■ Wash down of sporangia to the ridge

- Rain duration
- Rain intensity



# Requirements for tuber infection (below ground)

- Spore density in the ridge
- Survival of spores
  - On the soil
  - In the ridge
- Infection of tubers
  - Cultivar resistance to tuber blight
  - Phytophthora strain
  - Inoculum density
  - Soil conditions





# M & M Tuber blight incidence (laboratory)

- Inoculated infection experiments on tubers:
  - During tuberization
    - 7 Cultivars
    - Phytophthora strains
      - IP098014
      - IP0428-2
      - Mixture of 15 recent strains
  - During storage 2009
    - IP098014
    - IP0428-2
    - 2 Blue 13 isolates



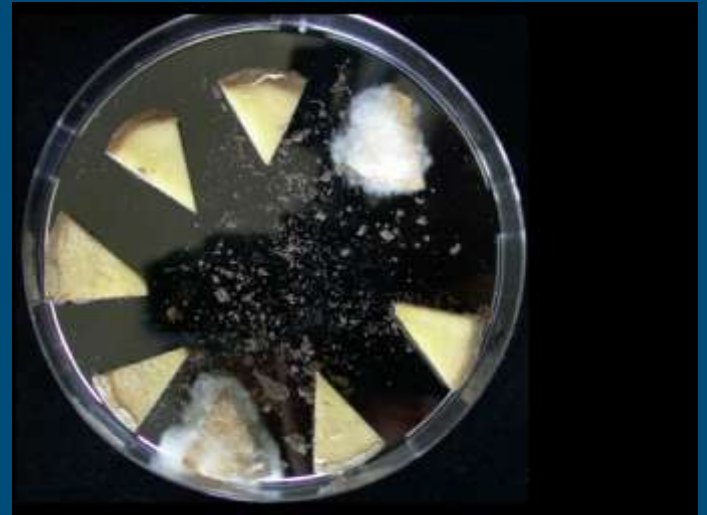
# M & M Spore density & tuber blight (field)

- Inoculation of the ridge:
  - 3 cultivars
    - Varying in tuber blight resistance
  - 2 isolates + mixture
  - 2 spore densities
    - 100 % of 'maximum' spore density washed off
    - 10 % of 'maximum' spore density washed off
  - 3 inoculation dates



# Assessments soil infectivity field

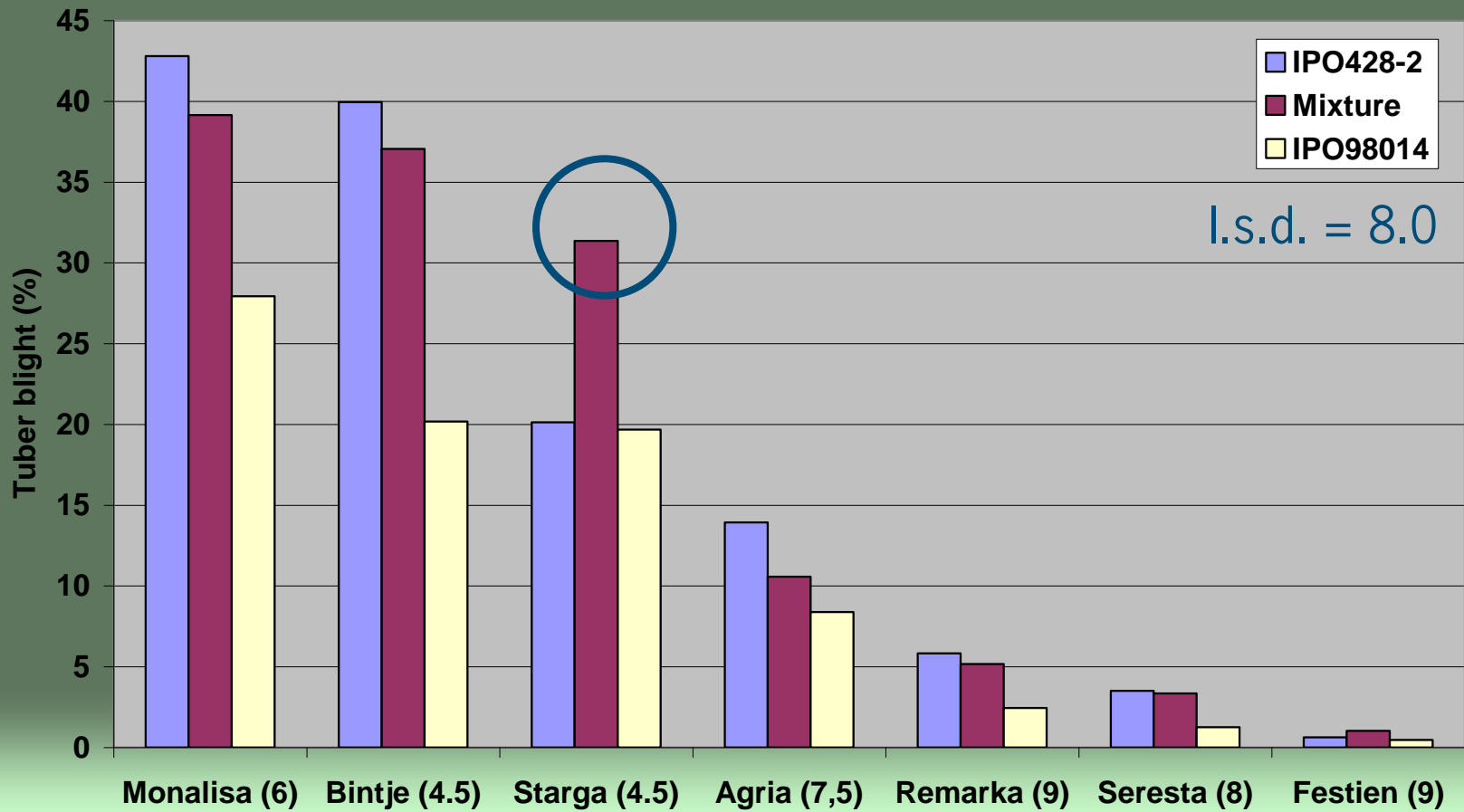
- Survival of spores in the ridge
  - Weekly soil samples
  - Lacey method
- Tuber infection:
  - Infected Tubers:
    - At harvest
    - After 3 weeks incubation



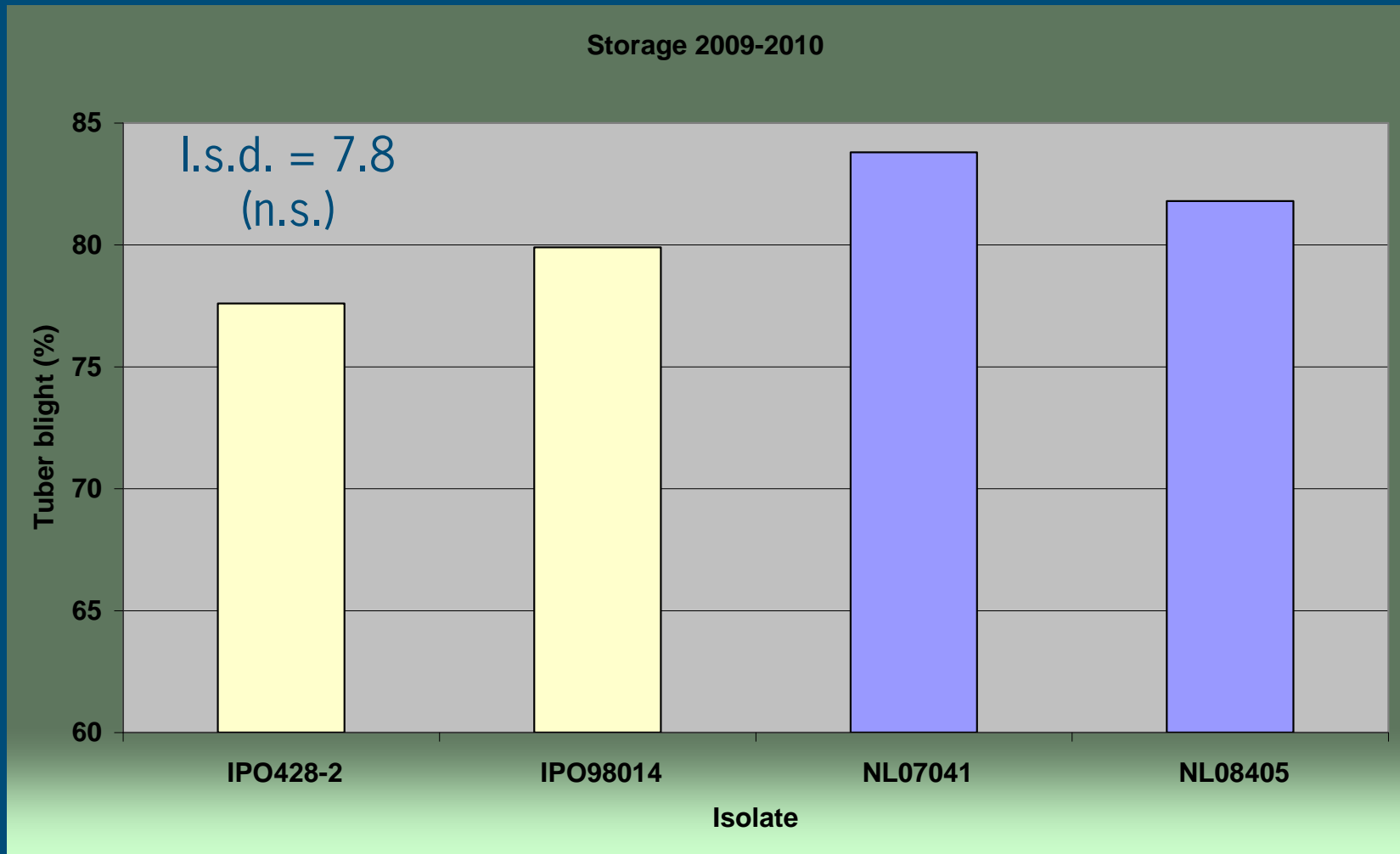


# Susceptibility of cv's to *P. infestans* isolates

Tuberization; 3 yr average

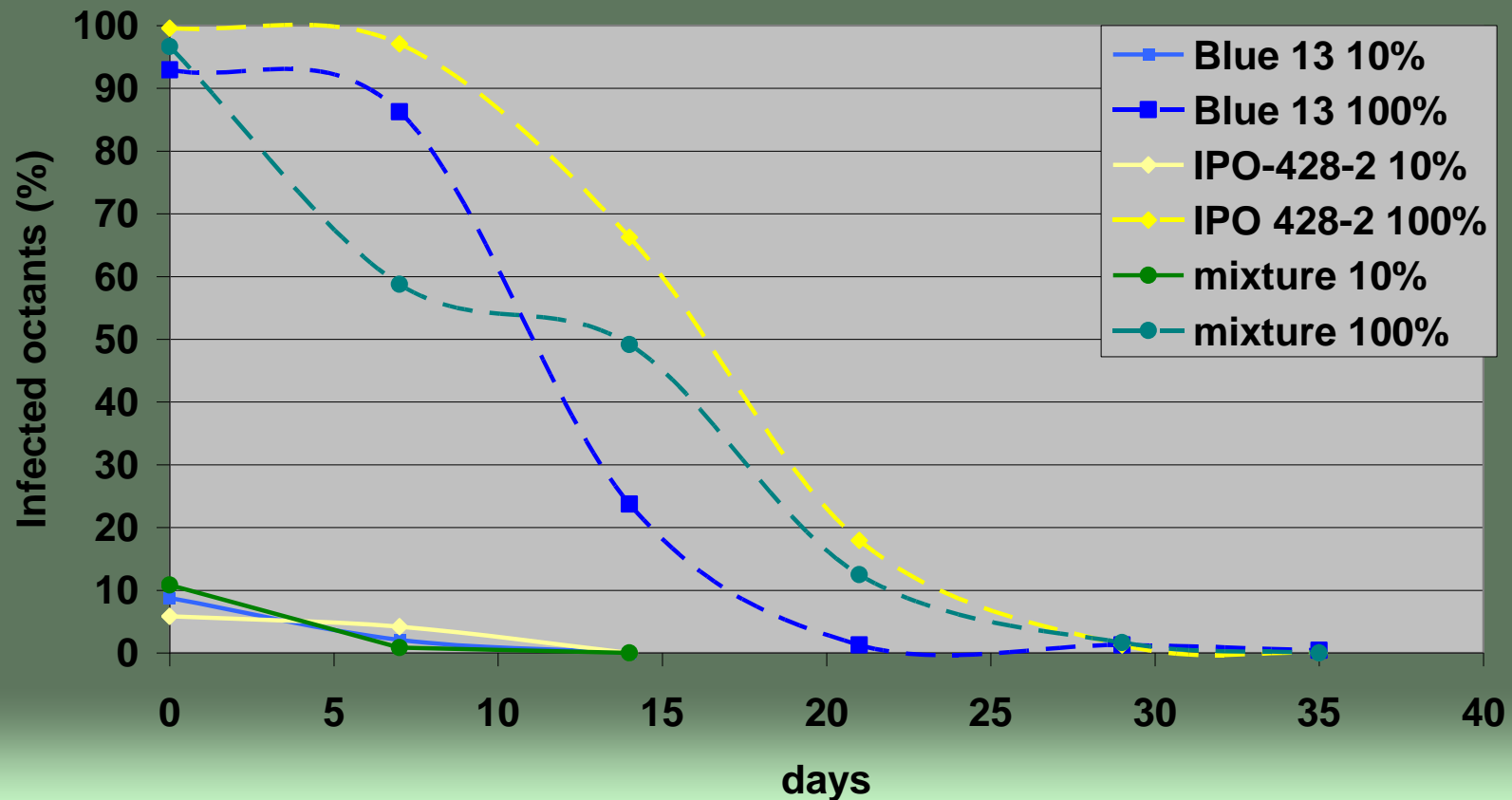


# Effect isolate on tuber blight (storage)

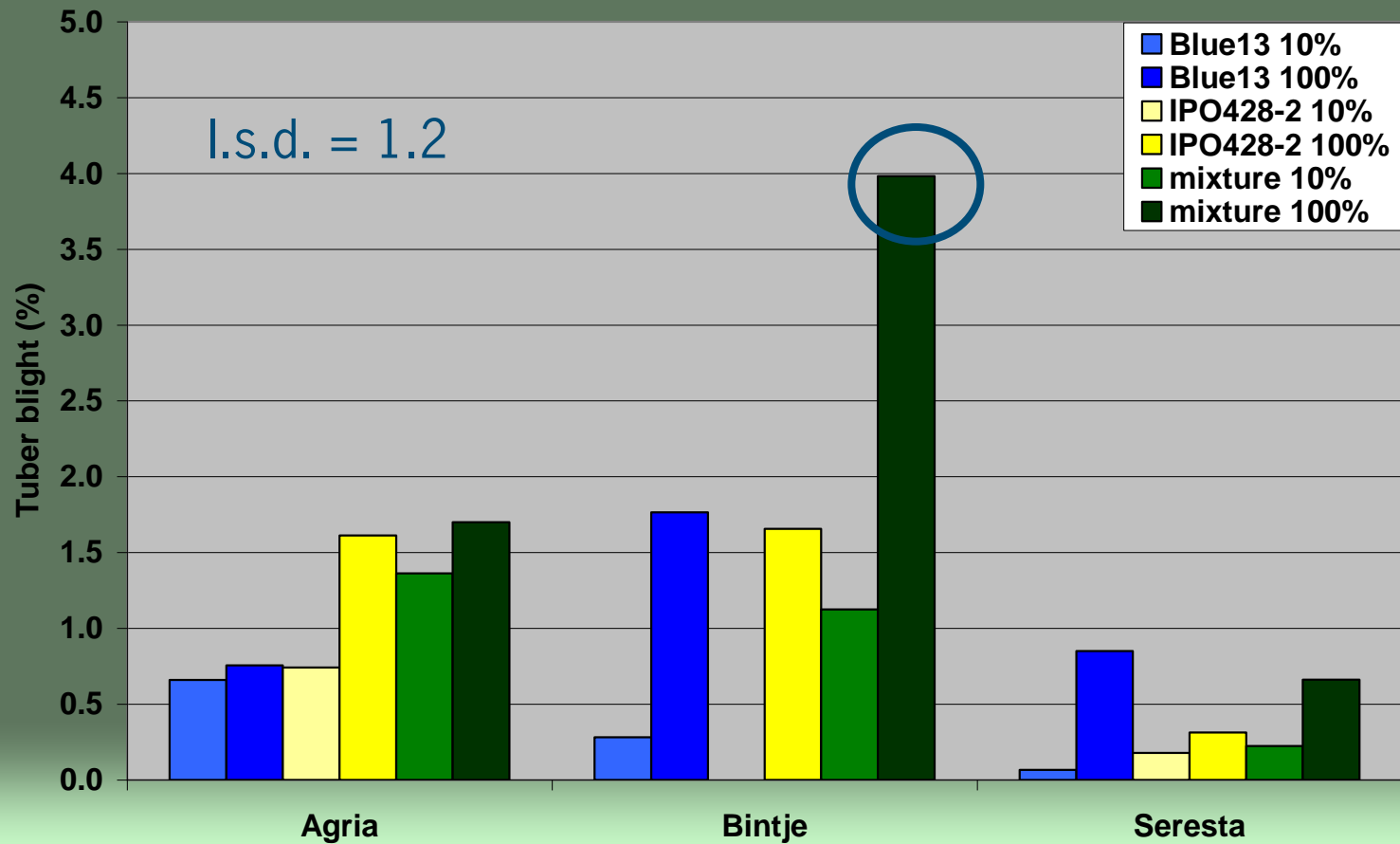


# Survival as represented by octant infection

Average of three exp.



# Tuber blight incidence






# Discussion & conclusions

- Overall: strong cultivar effect
- Also isolate effect but smaller
- IPO428-2 and mixture more aggressive than IPO98014, especially on susceptible cv's
- Blue 13 was at least as aggressive as known aggressive strains on Bintje



# Discussion & conclusions

- Overall, the mixture of 15 current isolates, including blue 13, was most aggressive towards tubers
- Survival of sporangia in soil is density dependent: longer with higher inoculum densities
- Inoculum density is related to tuber blight incidence
  - Not 1:1
- Inoculum pressure is determined above soil
  - These data help to establish the related tuber blight risk




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## Risk estimation to predict tuber blight


P.J. van Bekkum<sup>1</sup>, A. Everhuis<sup>1,2</sup> & G.J.T. Kester<sup>1</sup>

**Introduction**  
Tuber infections can result in high yield losses at harvest and / or during storage. Infected tubers also form a source of inoculum for following cropping seasons. Therefore, fungicides are applied extensively to prevent leaf and subsequently tuber blight.  
To prevent tuber infection and to reverse the fungicide input, prediction of tuber blight infection risks can help to identify critical points for tuber infection so that preventive measures can be adapted to specifically reduce this risk.  
The following key factors are important:

- Tubers must be present
- Inoculum must be present in the foliage or the soil
- Weather / soil conditions must be conducive for infection




Infected tubers resulting from a period with high inoculum pressure and favourable weather



Potato leaves severely infected with *Phytophthora infestans*

**Risk estimation**  
A risk estimation can be made based on the relative contributions of the (scored) key factors for tuber infection (Figure 1).  
A more detailed risk estimation could also include additional risk factors such as soil conditions (conducive for tuber infection), soil type, composition of top soil layer and "harvesting" (loss of sporangia into the ridges) and therefore tuber blight levels. Infection risk is also enhanced by the level of blight resistance of the cultivar and the structure of the pathogen population.



*Phytophthora infestans* sporangia which can be washed off to the soil and subsequently infection

		Tubers			
		-	+	++	+++
Inoculum <sup>1</sup>	-	-	-	-	-
	+	-	-	-	-
	++	-	-	-	-

		Tubers			
		-	+	++	+++
Weather <sup>2</sup>	-	-	-	-	-
	+	-	-	-	-
	++	-	-	-	-

		Tubers			
		-	+	++	+++
Inoculum <sup>1</sup>	-	-	-	-	-
	+	-	-	-	-
	++	-	-	-	-

**Risk category**

Low = low risk
Low - medium risk
Medium - high risk

Figure 1. Weather, inoculum and presence of tubers are key factors to estimate tuber infection risks. When all three factors are favourable tuber infection risks will be high.  
<sup>1</sup> Weather: - = No rain, + = 2 - if rain, ++ = 3 - if rain, +++ = 4 - if rain  
<sup>2</sup> Inoculum: - = No blight in crop, + = sporangia found in the crop, ++ = frequent presence of blight  
<sup>3</sup> Tubers: - = tuber infection or infection, + = early tuber blight, ++ = late tuber blight

<sup>1</sup> Plant Research International B.V.  
P.O. Box 32, 8200 AA Wageningen, The Netherlands  
Tel: +31 24 4610 111; Fax: +31 24 4610 110  
E-mail: p.j.vanbekkum@wur.nl

<sup>2</sup> Radix Plant Research  
P.O. Box 410, 8200 AA Wageningen, The Netherlands  
Tel: +31 24 4610 1234  
E-mail: van.ambroosje@wur.nl

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# Statement for discussion

- New (monogenic) resistances can be introduced without fungicide protection
- New (monogenic) resistances should be treated qs if they were susceptible