

Aggressiveness and transmission : does a correlation exist in

P. infestans ?

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Rationale

Using resistant cultivars

- useful alternative to pesticides...
- ... only if resistance is durable/ stable



which supposes that aggressiveness does not continually increase over time.

Is aggressiveness stable ?

European populations are polymorphic for aggressiveness

UK – Day & Shaw 1999; Ireland – Gillian & Cooke

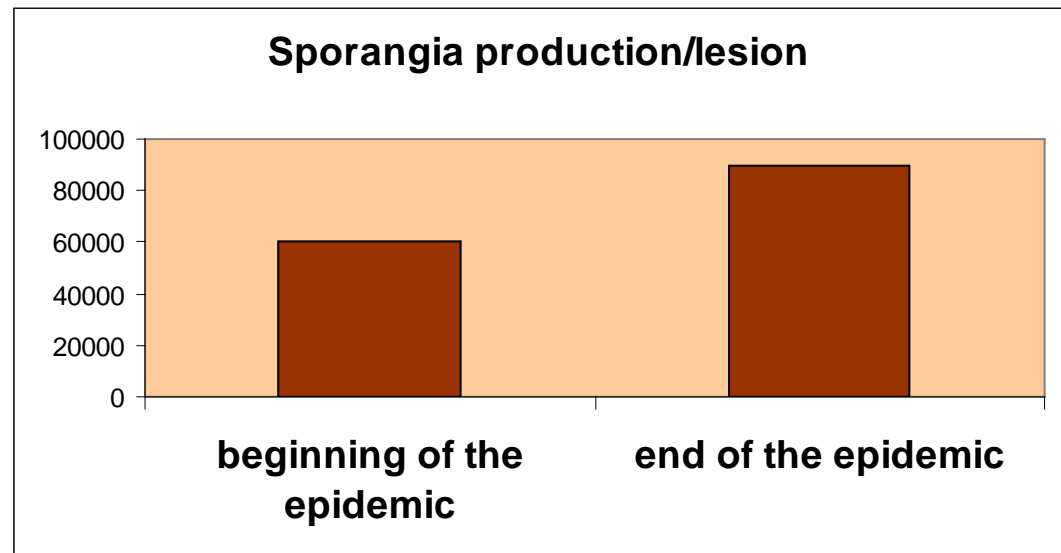
F – Lebreton *et al.* 1999; Pilet *et al.* 2003; Montarry *et al.* 2006

NL – Flier *et al.* 1999

↳ this implies that selection for higher aggressiveness is possible

Aggressiveness increases during epidemics

Andriveau et al., 2007

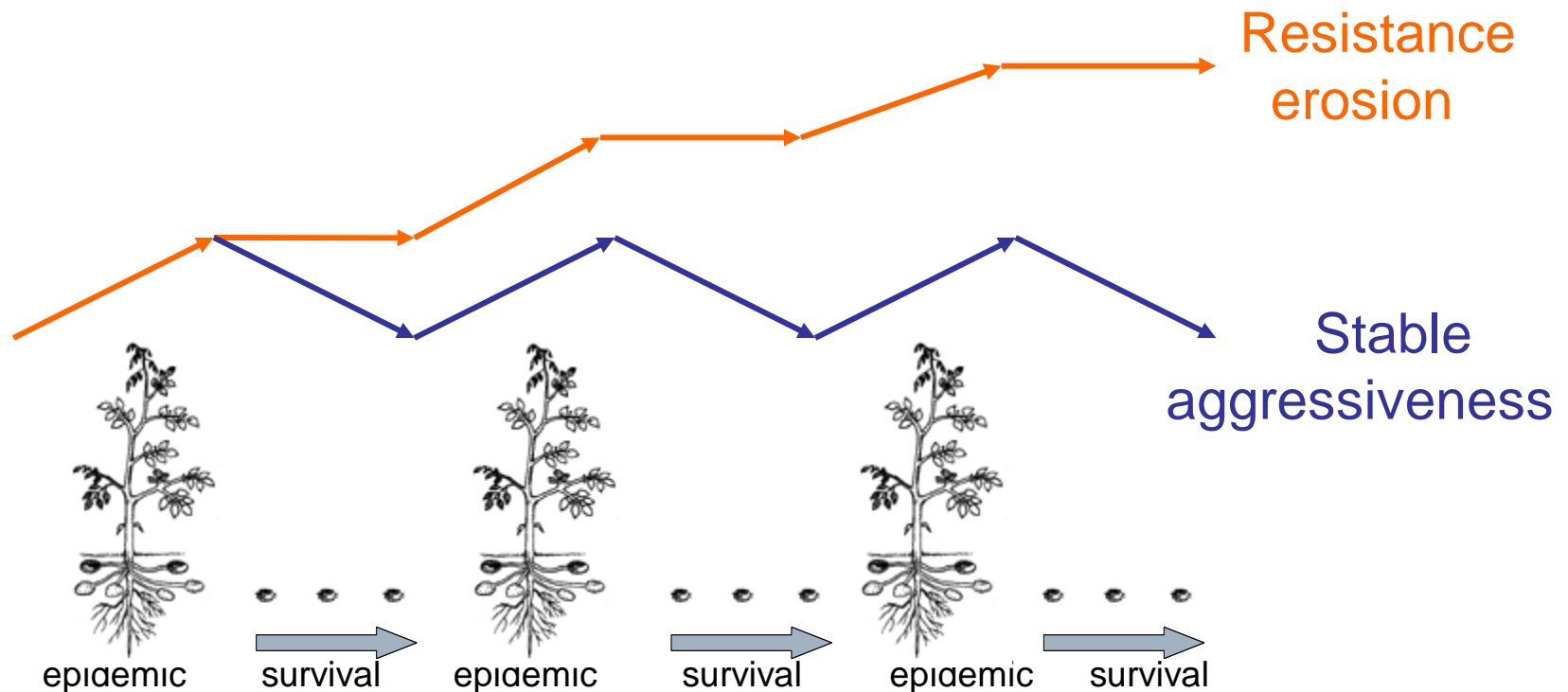


Consequences in the long run ?

Consequences : possible scenarios

If high aggressiveness does not lead to a decrease in season-to-season transmission

↳ gradual increase in mean aggressiveness over time



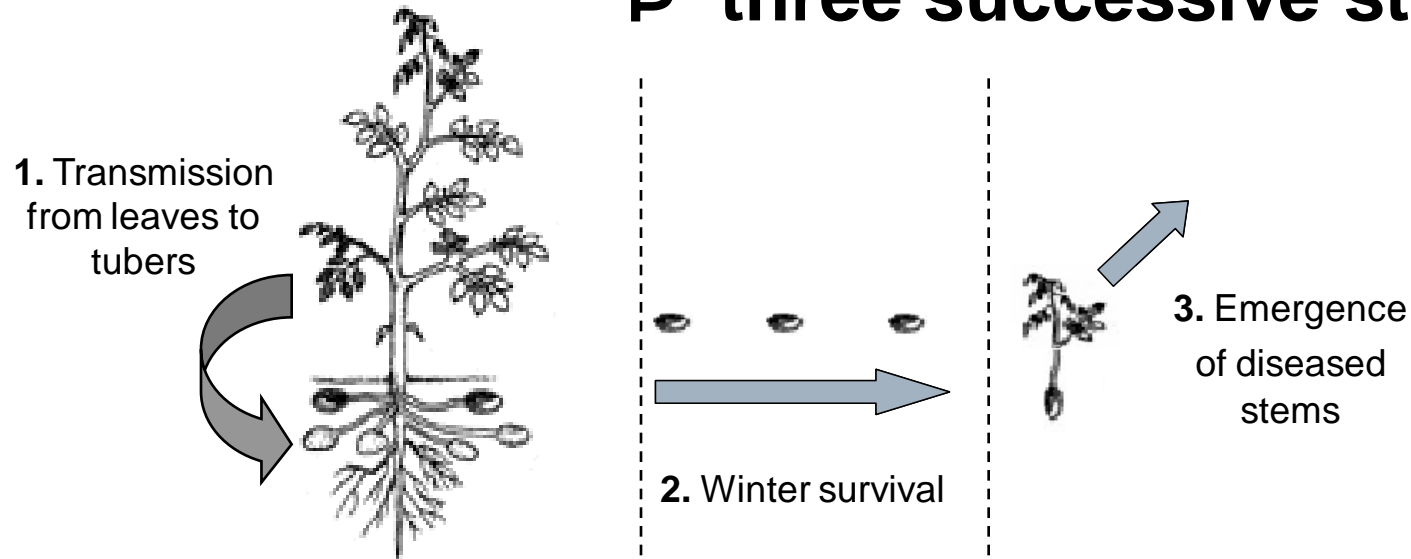
If high aggressiveness leads to a decrease of transmission

↳ Aggressiveness should remain stable

Why could there be a trade-off ?

- **Asexual transmission between seasons**

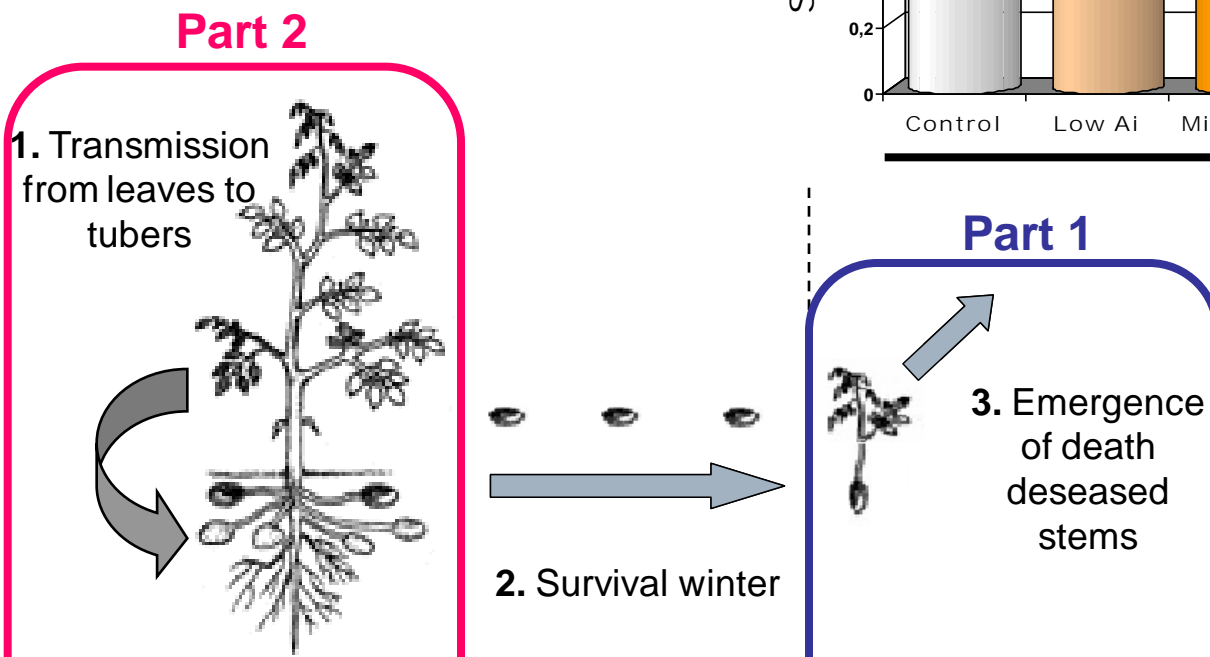
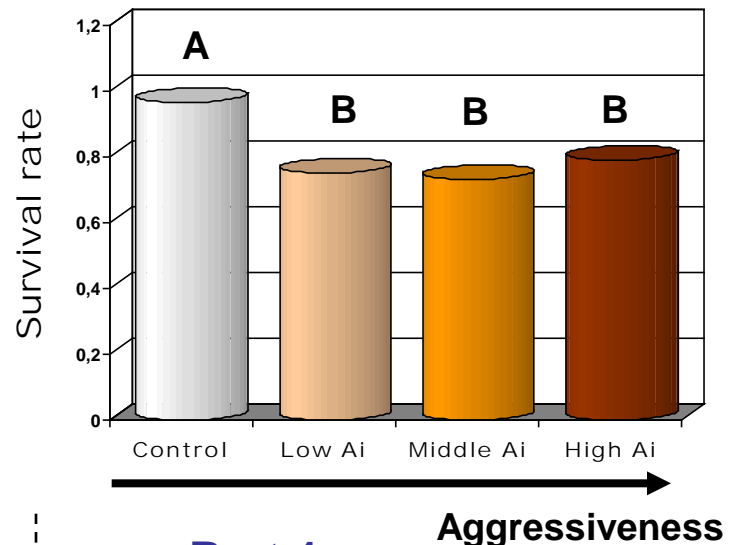
↳ three successive steps



High aggressiveness	Few and small tubers High infection	High rotting proportion	High death rate of stems	Poor transmission
Low aggressiveness	Many and big tubers Low infection	Low rotting proportion	Low death rate of stems	Good transmission

What do we know today ?

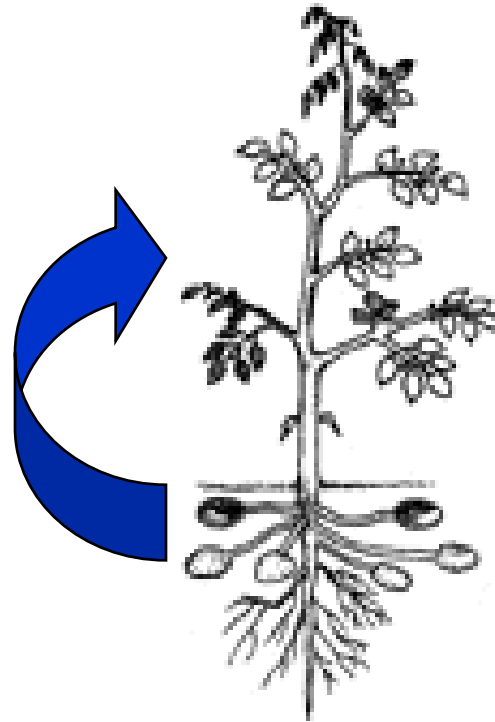
Montarry *et al.* 2007
Funct Ecol



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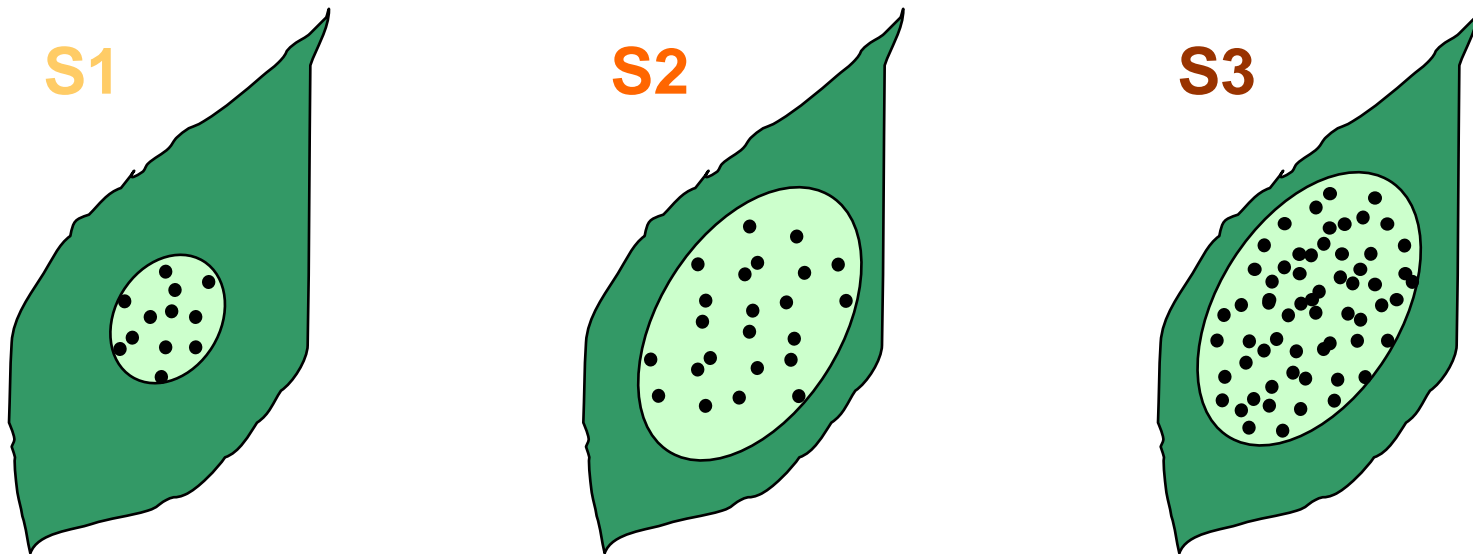
Part 1

Tubers to foliage
transmission



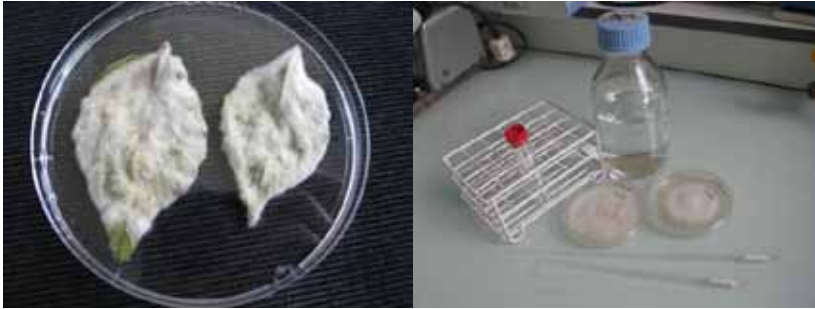
1 – Tubers to foliage transmission

- 3 isolates of *Phytophthora infestans* with \neq aggressiveness on leaflet of cultivar Bintje



- Tubers
 - One susceptible cultivar : **Bintje**
 - **100** tubers per isolate (repetition)
 - water control (sterile water)

Inoculation method



Sporangia suspension is produced on detached leaflets



tubers were placed in humid chamber for 3 days at 18°C
Opening lenticels



Spray inoculation : 5×10^4 sporangia/tuber



Tubers were kept in humid chamber for 4 days



Planting in compost

Emergence notation : one month after planting



100 %



51 %

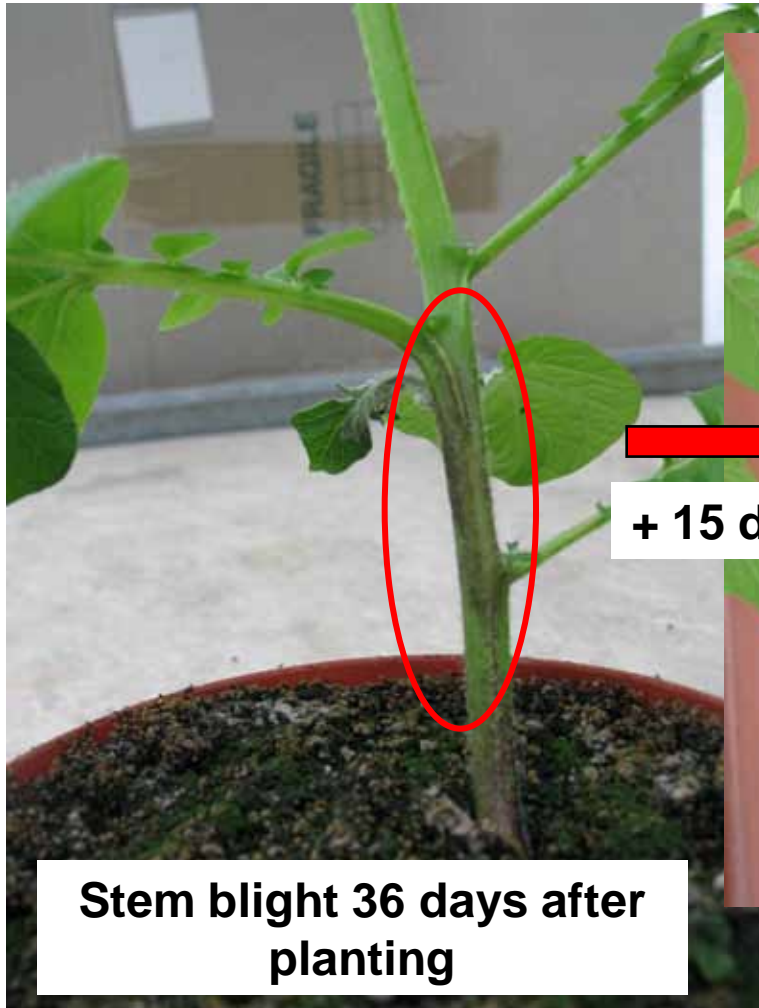


67 %



Lowest emergence rate : 18 %

Some symptoms of stem blight



+ 15 days



Some other symptoms observed



aerial tubers



very premature stem death

Scorings

-% Emergence

-Stem number per plant

- Number of diseased stems per plant

Two years : 2007 & 2008

Results

Higher aggressiveness results in:

- ▷ fewer emerged plants,
- ▷ fewer stems per plant,

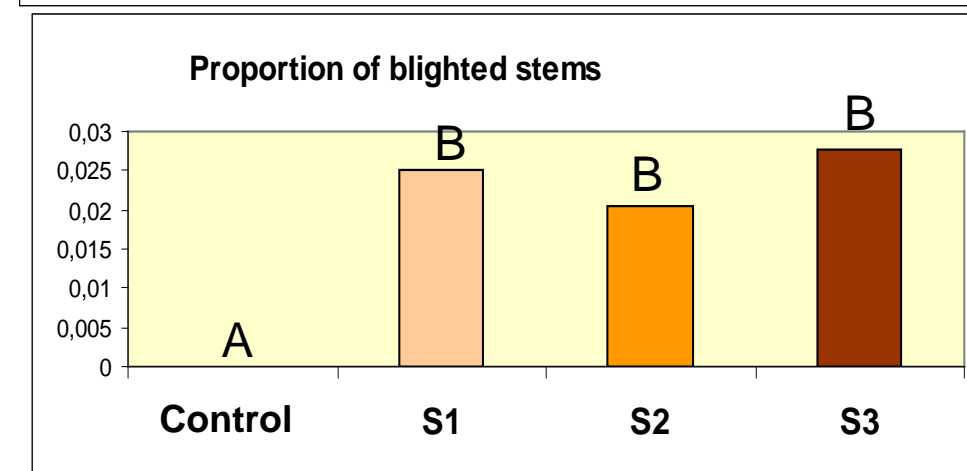
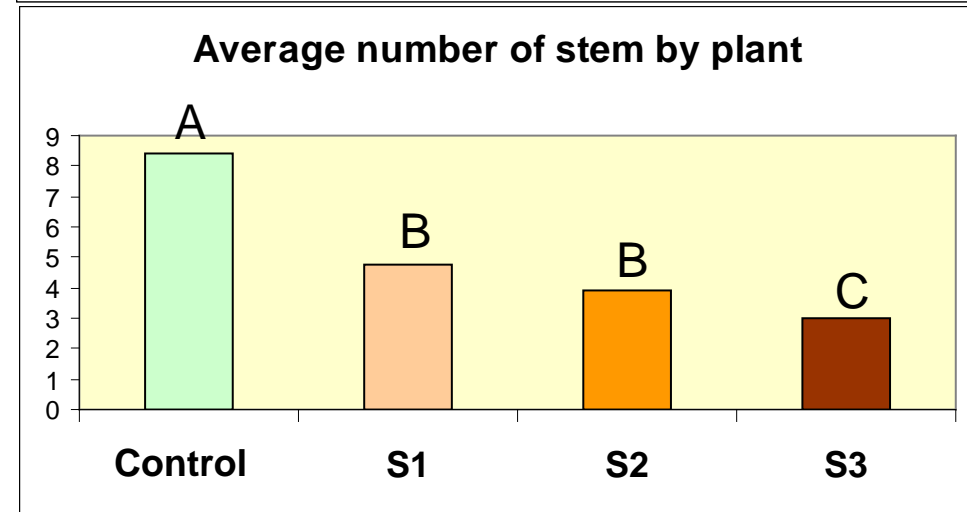
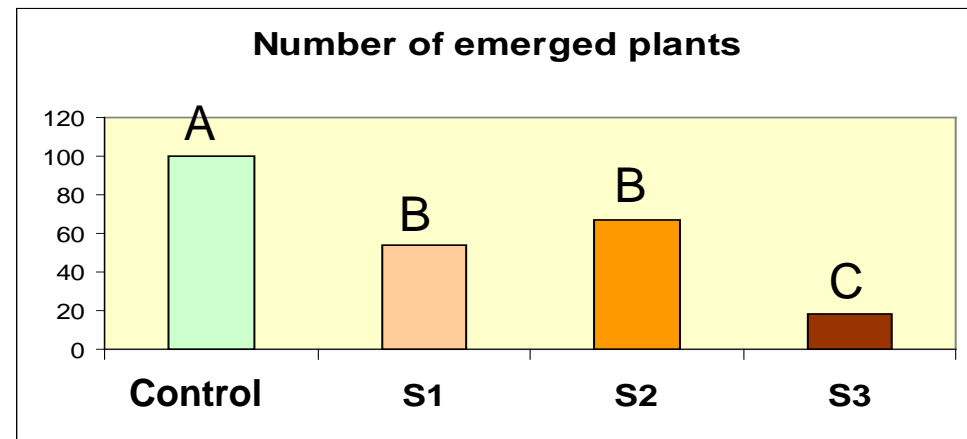
but

- ▷ no differences in the proportion of blighted stems among those emerged

Overall :

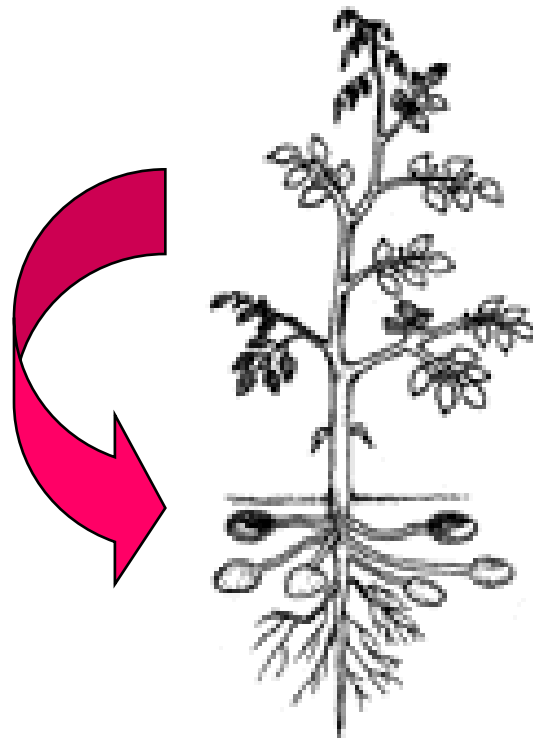
transmission of the most aggressive isolate is less efficient

Trade-off between aggressiveness and transmission



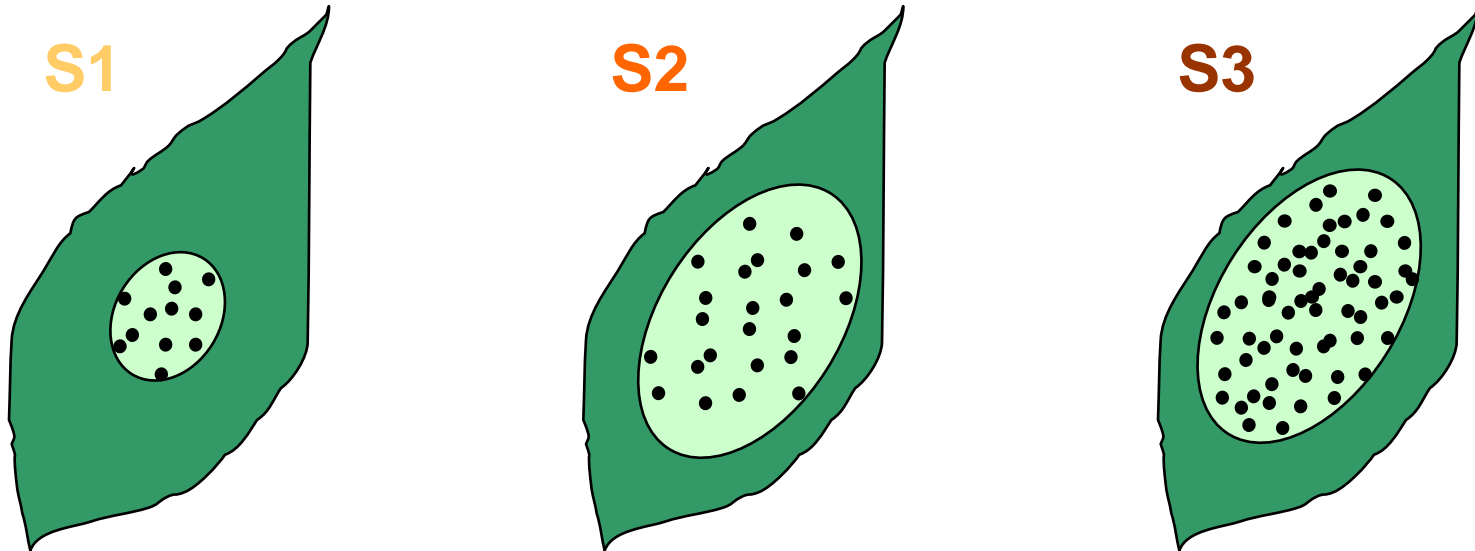
Part 2

Foliage to tubers
transmission



Method

- 3 *Phytophthora infestans* isolates with \neq aggressiveness on cultivar Bintje foliage



- One susceptible cultivar : **Bintje**
- Plants at different stages of their growth D1 D2 D3
- **10** plants per isolate and per date
- water as a control

Method

Plants were grown in greenhouse 15-20°C, 16 hours of day : 3 planting dates



1 chapel per isolate, with

-10 plants Date 1 (72 days)

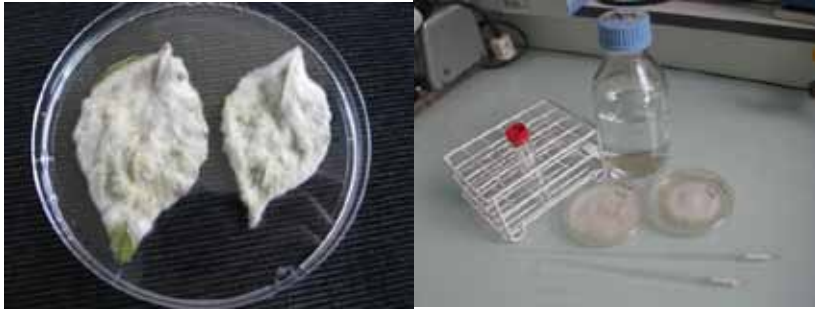
-10 plants Date 2 (56 days)

- 10 plants Date 3 (42 days)

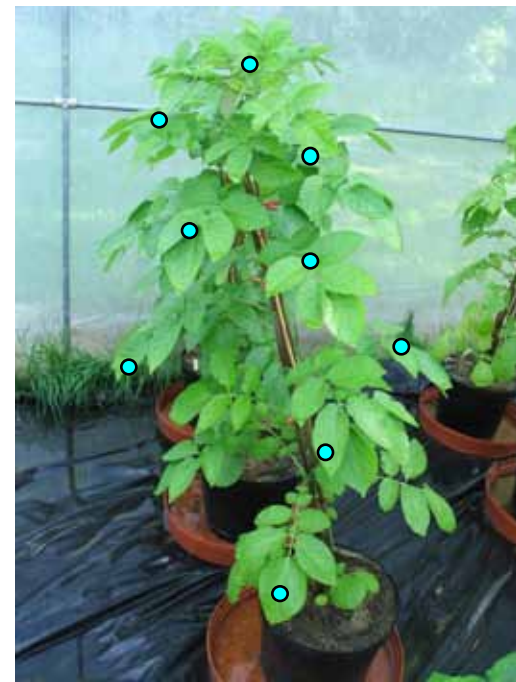
▷ Early to late epidemics



Inoculation method



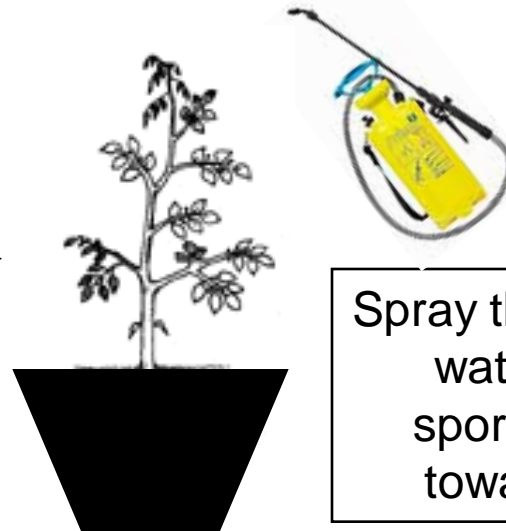
Sporangia suspension is produced from infected detached leaflets



Inoculation : Distribute uniformly 20 drops of 20 μ l by plant.

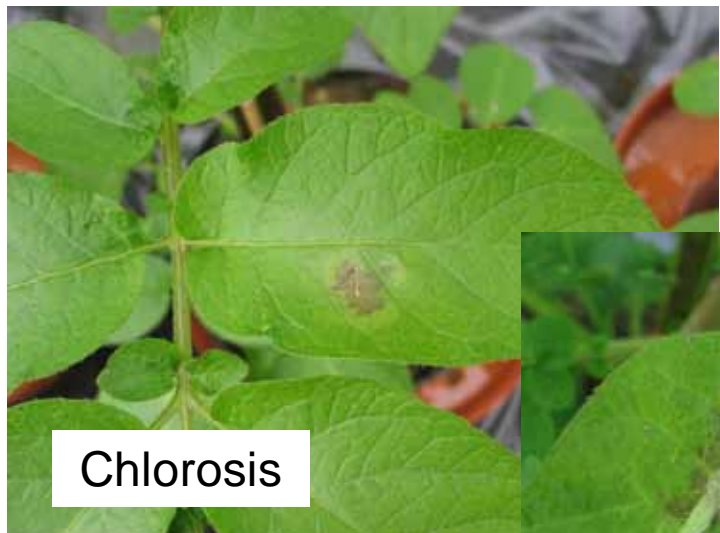


Let the symptoms develop on the foliage



Spray the foliage with water to wash sporangia down towards tubers

Symptoms observed during the vegetation



Chlorosis



necrosis on petiole



necroses at the plant top



Splashing on the leaves by rain

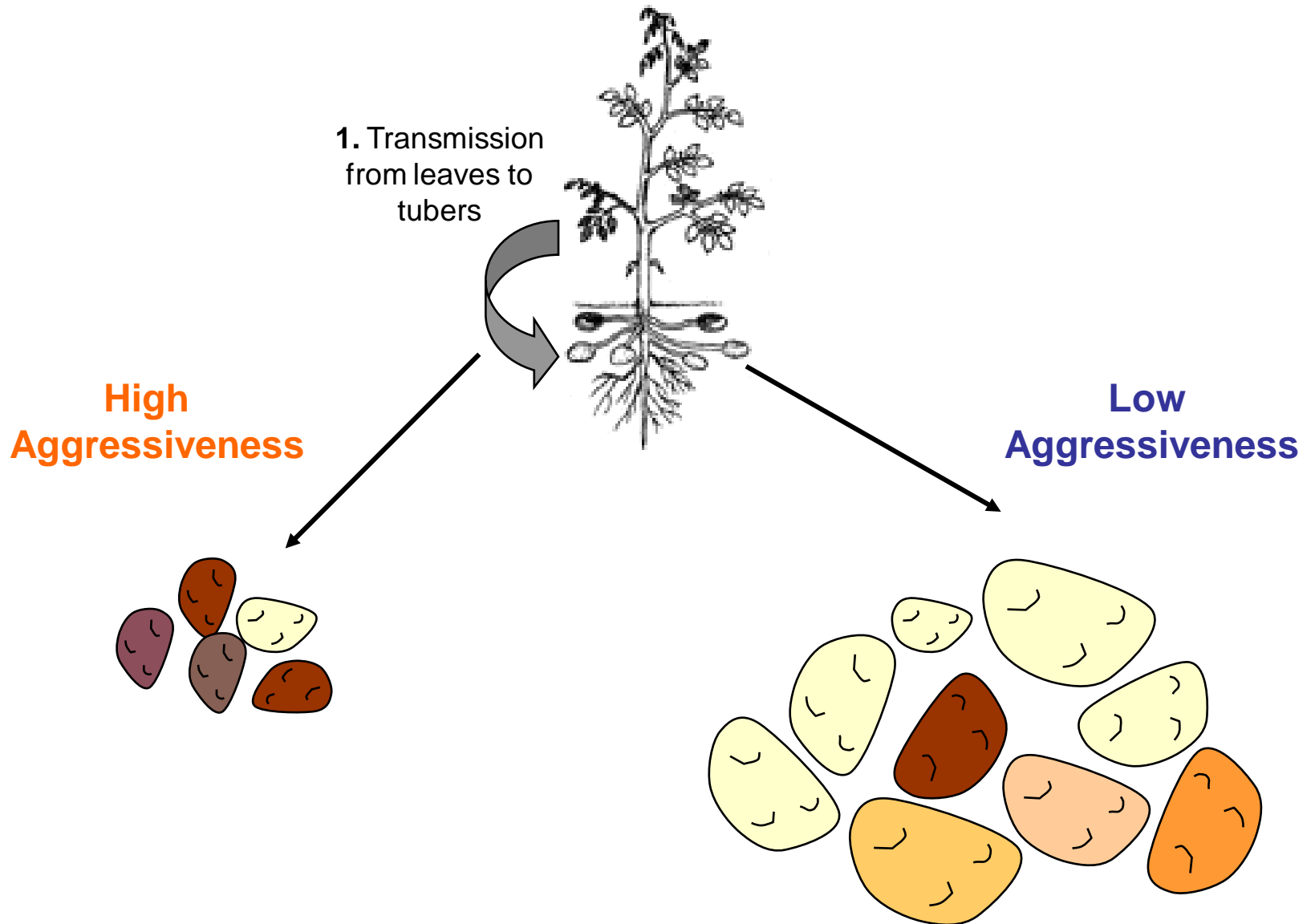


Symptom at the end of the leaflet



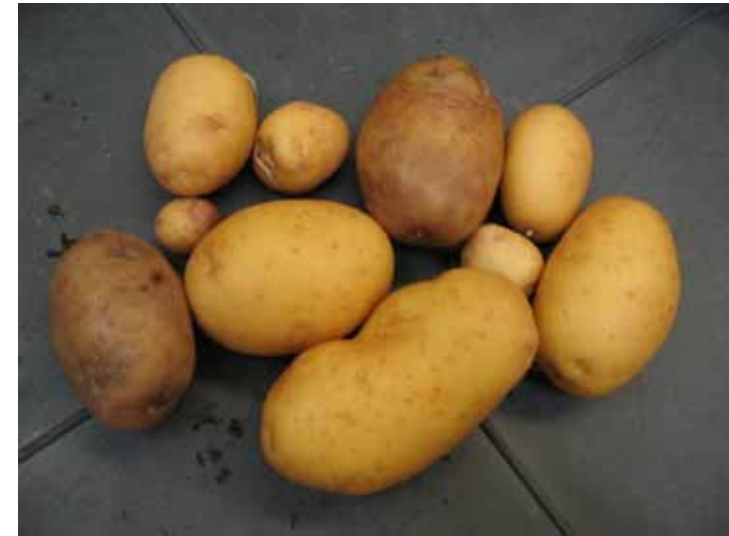
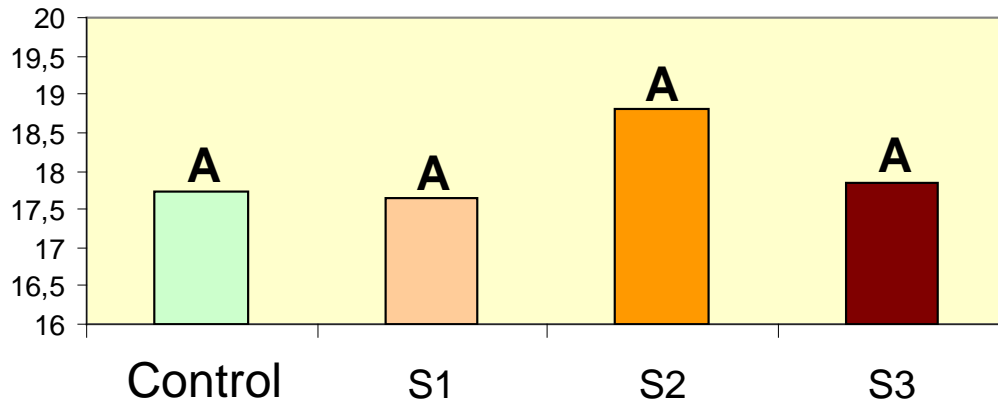
**Plants from Date 1 (72 days)
18 days after inoculation.**

What do we expect ?

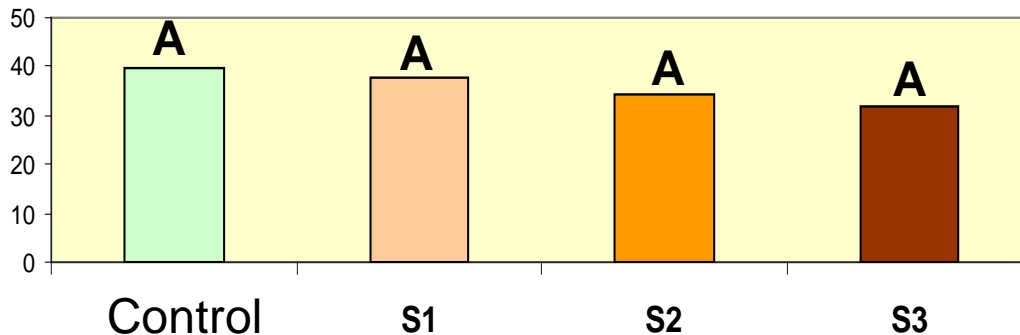


Number and weight of tubers

Mean number of tubers per plant



Mean weight of tubers per plant

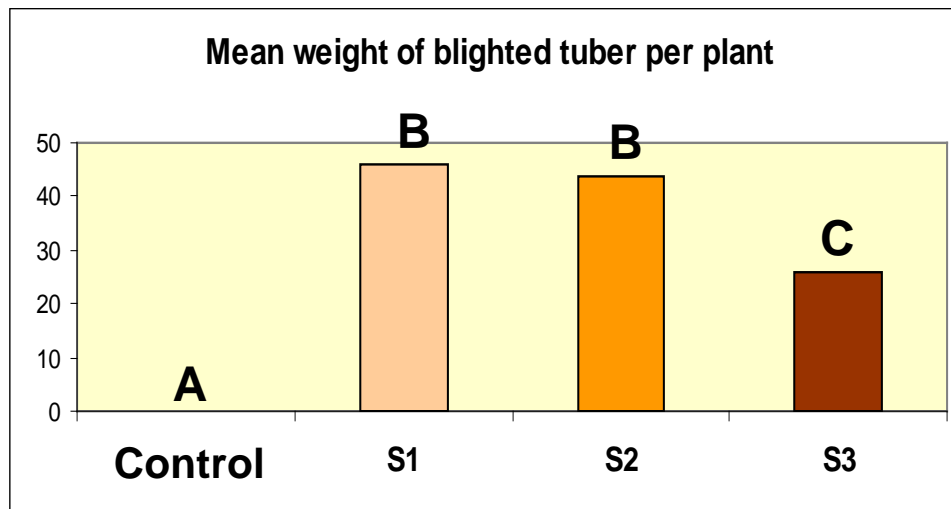
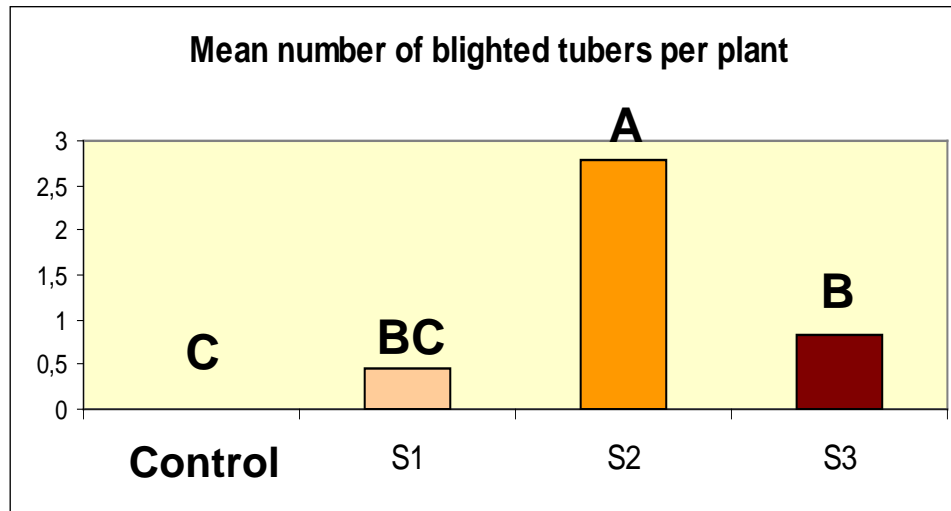


Isolates aggressiveness did not influence

the mean number of tubers per plant.

their average weight.

Number and weight of blighted tubers

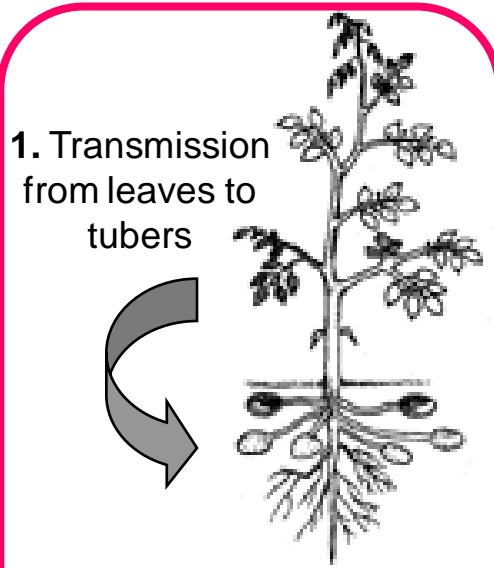


Isolates aggressiveness influence:

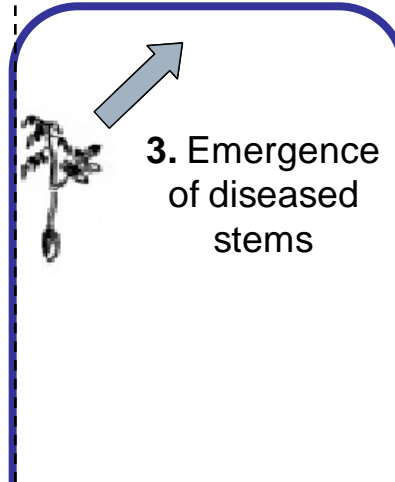
- the mean number of blighted tubers per plant
- their average weight.

To conclude

Part 2



Part 1



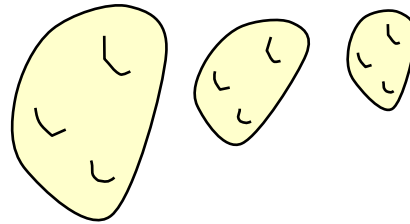
High Aggressiveness	<p>Many small diseased tubers</p> <p>High infection/ severity</p>	<p>High rotting proportion</p>	<p>High death rate of stems</p>	<p>Poor transmission</p>
Low Aggressiveness	<p>Fewer, bigger diseased tubers</p> <p>Low infection</p>	<p>Low rotting proportion</p>	<p>Low death rate of stems</p>	<p>Good transmission</p>

▷ A trade-off seems to exist between aggressiveness and transmission !

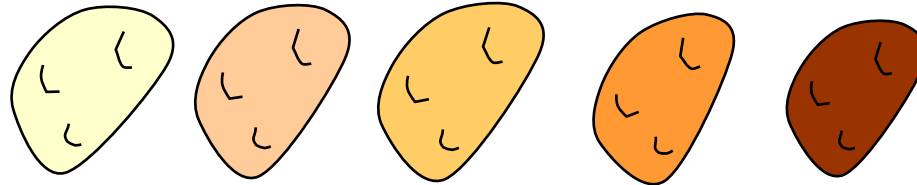
Where to now ?

- Check survival with tubers

- of different sizes



- with different initial severity of blight



- Check the effect of tuber resistance



Thanks to

- **Roselyne Corbière** for the supply of isolates,
- **Bruno Marquer, Hervé Douchy and Christian Guérin** for their technical support,
- **Didier Andrivon and Hélène Magalon** to have helped me analyze these results and build this slide show.

Isolates aggressiveness tested on Bintje leaflets

Isolates	Mean size lesion	Sporangia number /cm ²	Sporangia number per lesion
S1	11.78	39051	463000
S2	14.39	41986	610766
S3	14.51	67329	977983

Part 1 : Harvest, 50 days after planting



Notation at harvest : per plant

- Number of tubers,
- Weight of tubers