



Instituut voor Landbouw- en Visserijonderzoek

Pathways of spread of *Phytophthora ramorum* in a simulated nursery setting: an update

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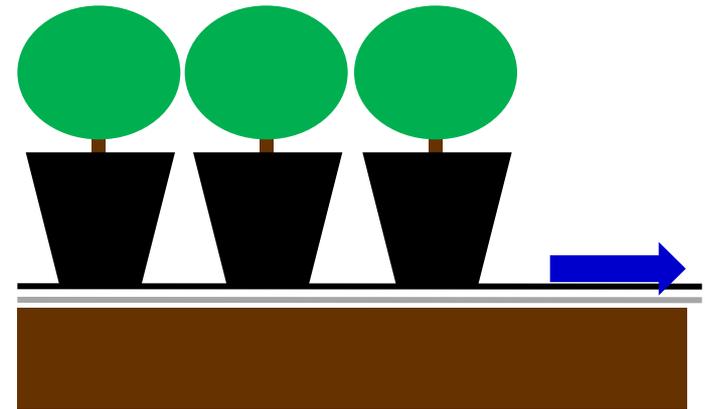
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Agriculture and Fisheries Policy Area

Rhododendron nursery



Rhododendron culture



Main objective

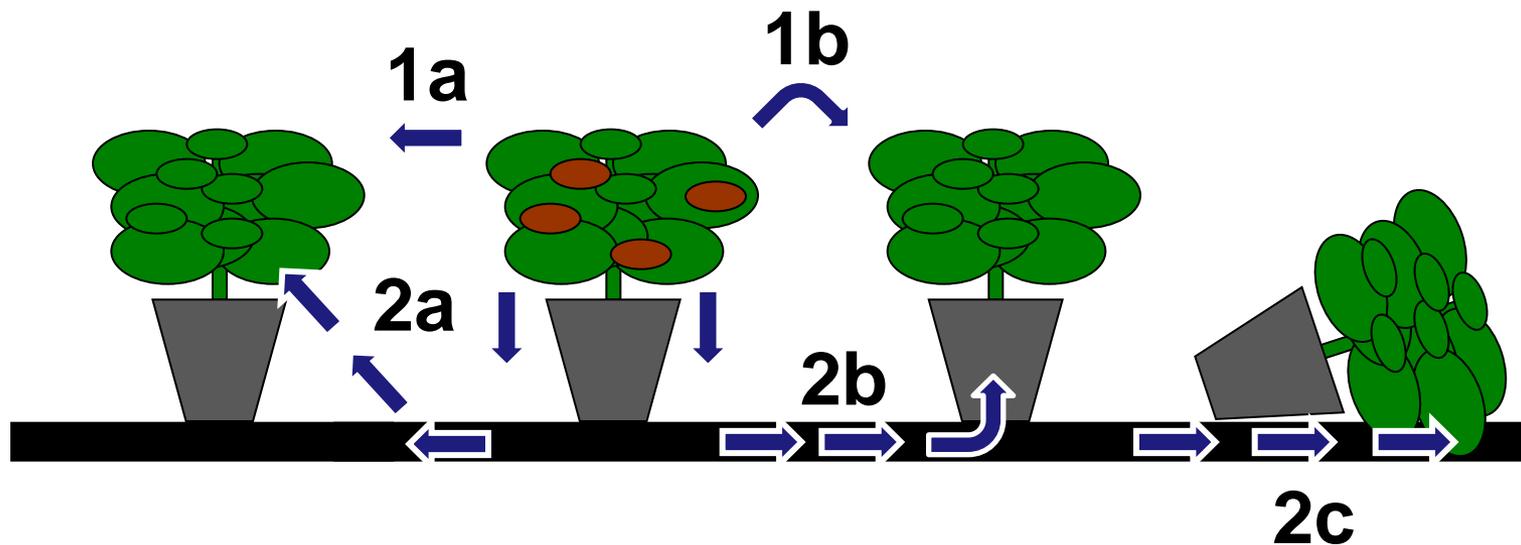
determine the pathways of spread

1. Via air

- a. directly
- b. leaf-to-leaf splashing

2. Via water film

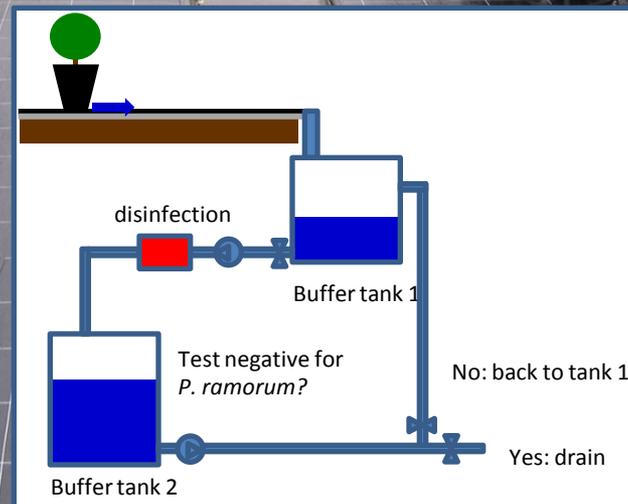
- a. Splashing from water film to leaves
- b. Water film to root ball
- c. Water film to leaves of tipped over plants



Simulated nursery setting



ring
experiments



Summarized results 2009

1) ring experiments: % symptomatic plants (n=4)

Experiment 1

Contact: $25 \pm 18 \%$

5 cm space: $6 \pm 13 \%$

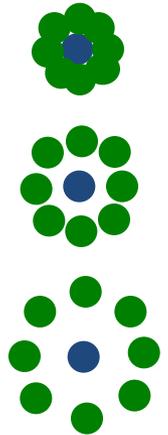
20 cm space: $0 \pm 0 \%$

Experiment 2

Contact: $69 \pm 31 \%$

5 cm space: $6 \pm 7 \%$ (or $0 \pm 0 \%$)

20 cm space: $0 \pm 0 \%$



2) Environmental samples

Air samples: all negative

Water samples: all positive



3) Water film and tipping over of plants = risk factor

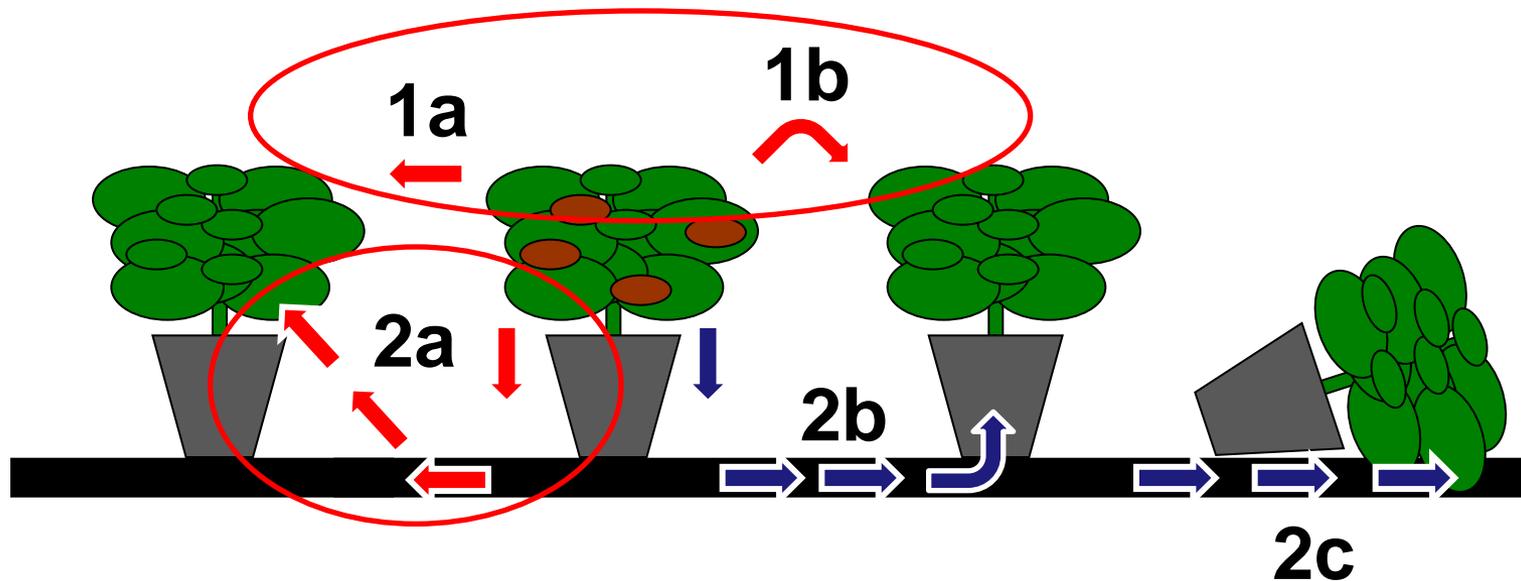
- Seconds in water + moist conditions = infection
- 6 to 20 hrs in water film = pathogen inside



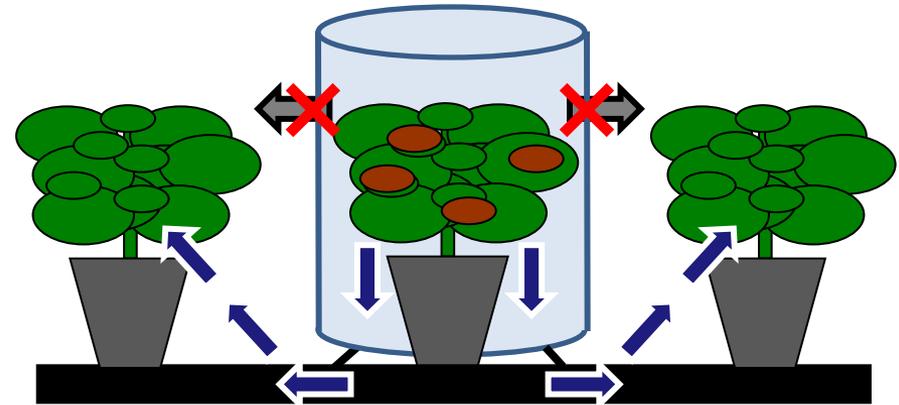
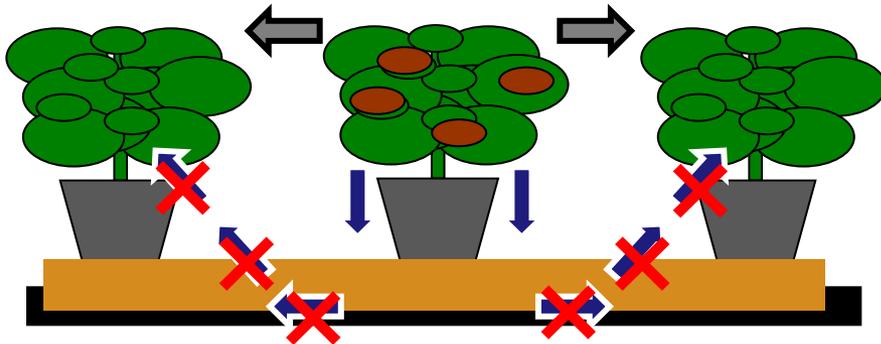
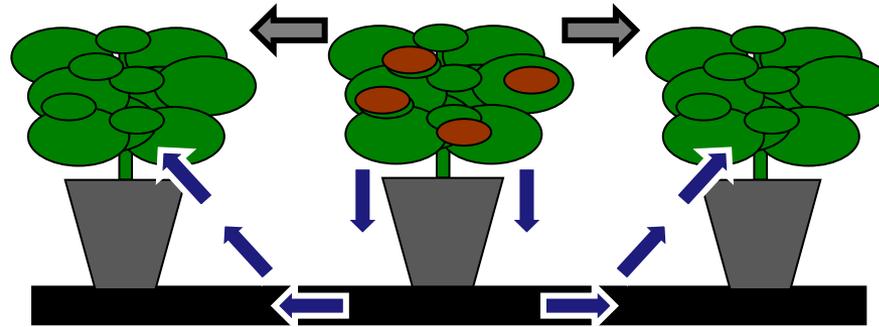
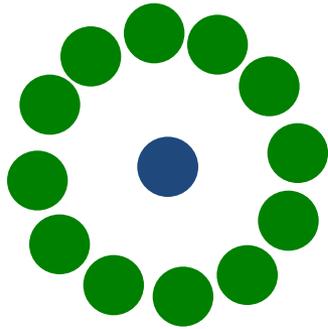
Objective 1

Observation: heavy rain/wind events → also spread to 20-40 cm

Question: is spread direct (via air = 1a or 1b)...
...or indirect (via water film = 2a) ?



Direct (via air) or indirect (via water film)?

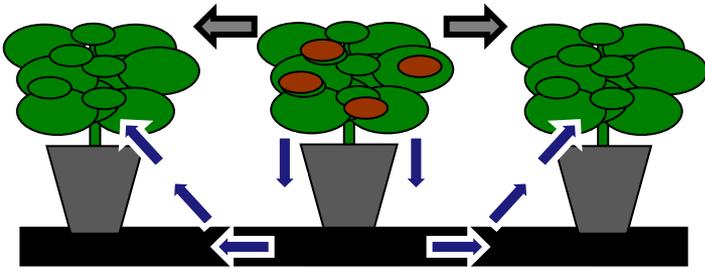


- Two experiments
- 3 replicate circles per treatment
- 12 plants per circle

Direct (via air) or indirect (via water film)?



Direct (via air) or indirect (via water film)?

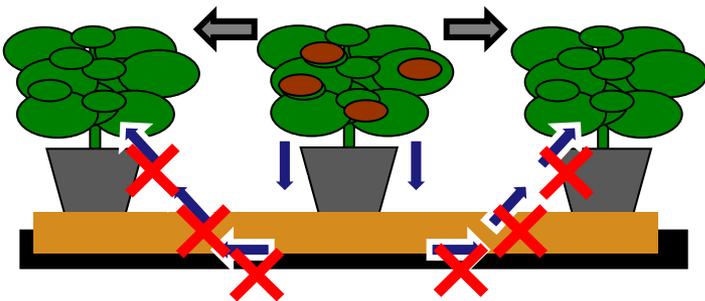


Expt. 1

69±13%

Expt. 2

55±26%

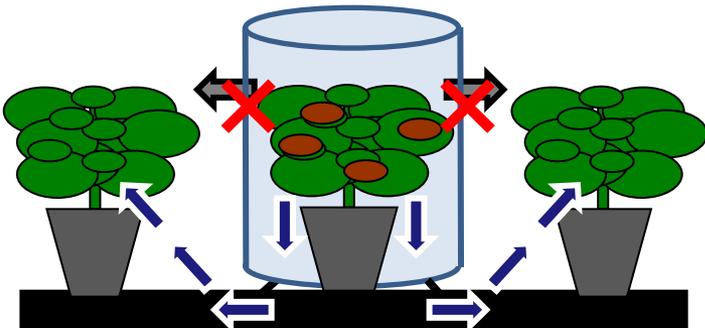


14±17%

9±1%

53%

36%



39±33%

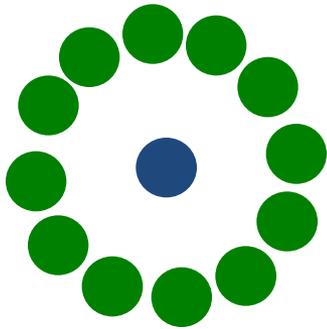
27±28%

Direct (via air) or indirect (via water film)?

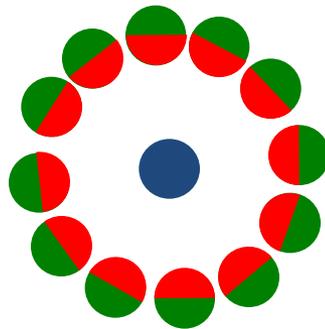
What part of the plant are the lesions on?

Inside?

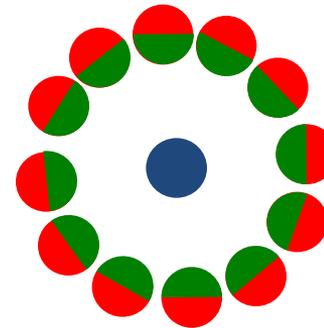
Outside?



Entire plant

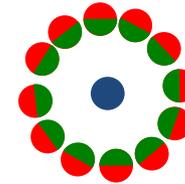
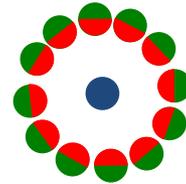


Lesions on
inside part



Lesions on
outside part

Direct (via air) or indirect (via water film)?



Expt. 1

	Entire plant	inside	outside
reference	103 (100%)	71 (69%)	32 (31%)
straw	21 (100%)	21 (100%)	0 (0%)
column	51 (100%)	28 (55%)	23 (45%)

Expt. 2

	Entire plant	inside	outside
reference	52 (100%)	31 (60%)	21 (40%)
straw	5 (100%)	5 (100%)	0 (0%)
column	18 (100%)	12 (67%)	6 (33%)

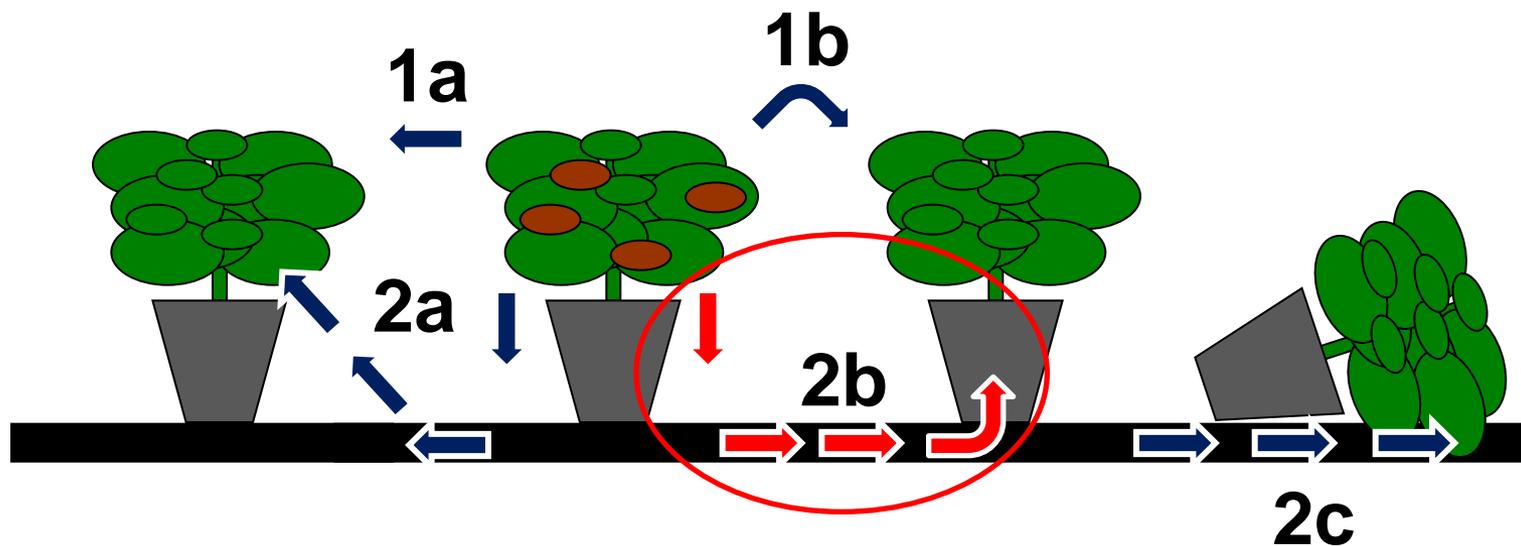
Conclusion: in case of heavy rain...

- ground-to-leaf splash dispersal most important
- limited direct leaf-to-leaf spread. Also splash dispersal?

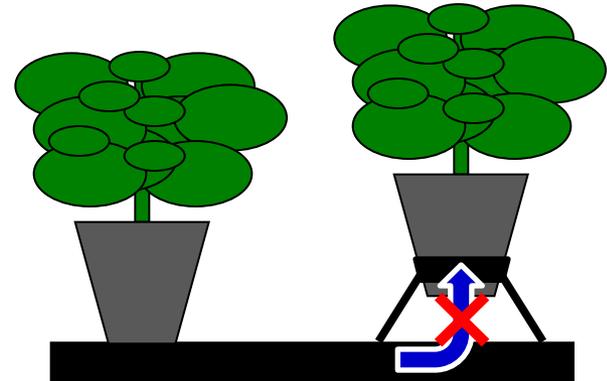
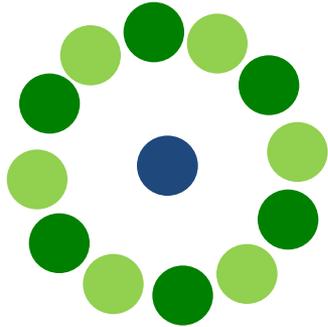
Objective 2

continue to determine the pathways of spread

Risk of spread via the water film to the pot ?



Spread from water film to pot?



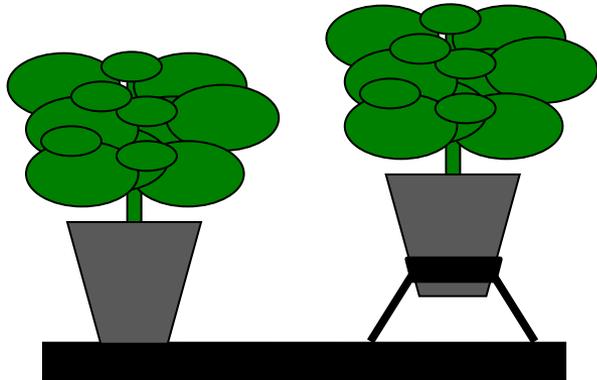
After 1 week:
individual baiting of root balls

Plants pre-checked and
negative (+ unique
genotype)

3 experiments

Water film always positive

Spread from water film to pot?



Experiment 1:

- 6 double circles
- 144 plants
- 30/144 plants tipped during intense rainstorm (not included)

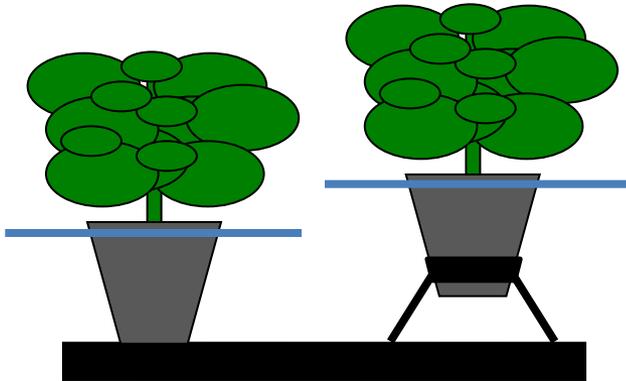
P. ramorum baiting :

in the water film: 11/55 positive

off the surface: 2/59 positive

Question: 2/59 positive = entered upper part via splashing?

Spread from water film to pot?



Experiment 2:

- 8 single circles
- 96 plants
- splash shields in 6 replicates
- tip prevention with bars
(2/96 still tipped – intense rain)

Spread from water film to pot?



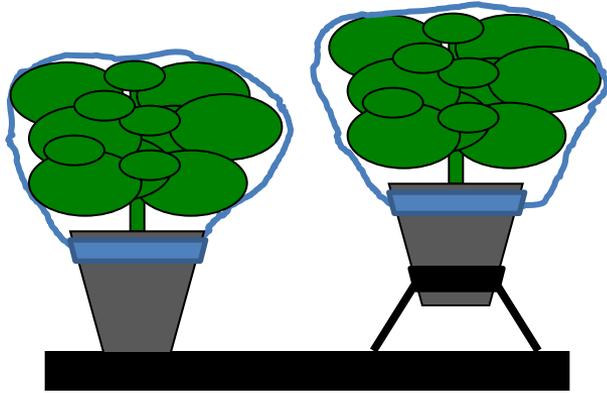
P. ramorum baiting of root balls:

in the water film: 20/47 positive

off the surface: 8/47 positive (5/8 with no splash shields)

Still insufficient prevention of splash dispersal?

Spread from water film to pot?



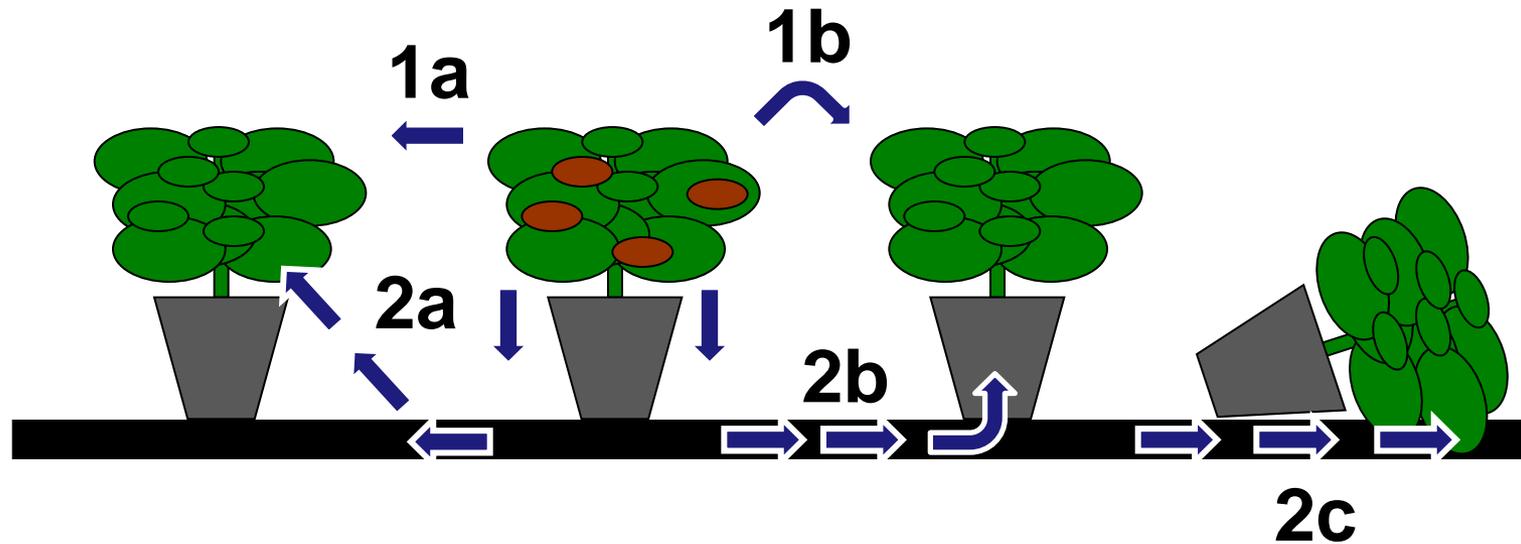
Experiment 3:

- 8 single circles
- 96 plants
- Plastic bags in 6 replicate circles
- tip prevention with bars



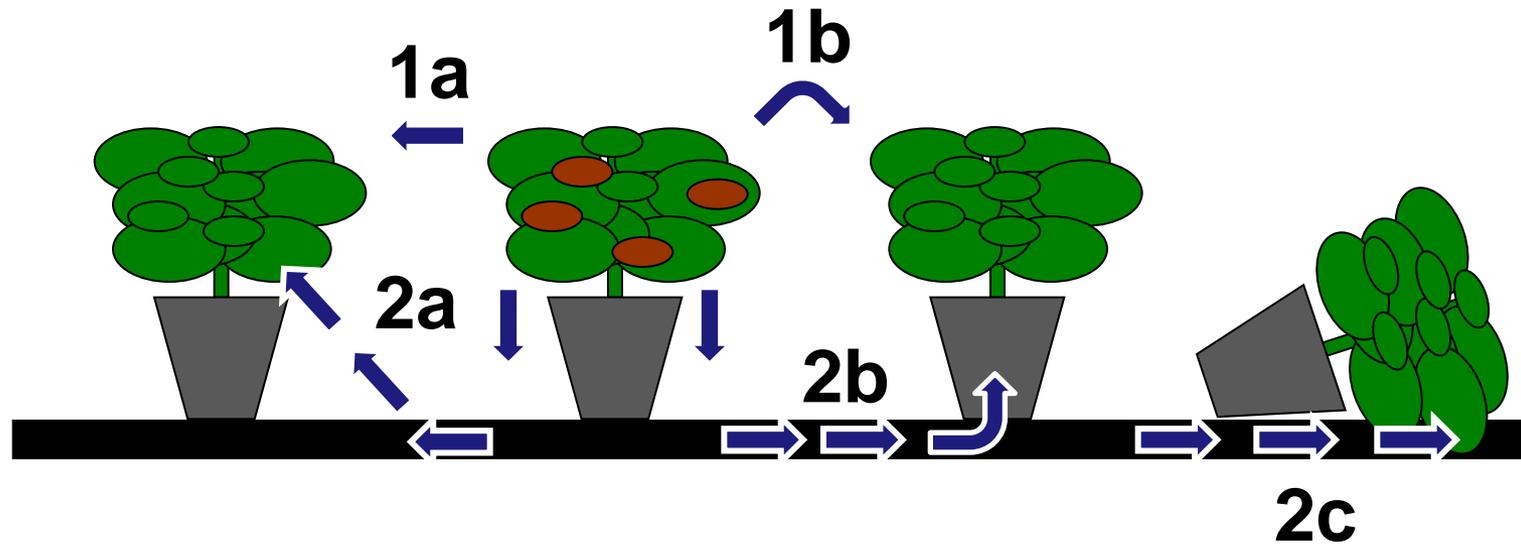
P. ramorum baiting of root balls:
in the water film: 20/48 positive
off the surface: 0/48 positive

Conclusions



- Direct aerial spread: limited in distance, mostly splash dispersal
- Spread via water film = more important
- Spread to root balls = demonstrated + could be longer distance + risk for root infection and shipping of latently infected plants !

Acknowledgements



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