Cherry rootstock sensitivity to waterlogging

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Objectives

- **Many new rootstocks**
  - Gisela: 6, 12
  - Krymsk: 5, 6, 7
  - Piku: 1, 3, 4
  - PHL-A
  - Weiroot 158
- **Knowledge about new rootstocks**
  - Flooding is a case of abiotic stress that can affect plant growth, yield and fruit quality of cherry trees
  - Cherry tree decline due to root asphyxia quite common
- **New orchards more intensive**
  - More expensive
  - Need for complete and reliable information

Objectives

* Develop a reliable method easy to implement
  * Micropropagated plants
  * Controls
    * Sensitives
    * Tolerants
* First trials carried out in 2013 to develop an experimental design for the upcoming years

Materials and methods

- Three rootstocks tested
  - Two controls:
    - Maxma 14: as a quite tolerant roostock
    - SL 64: as a sensitive rootstock
    - Weiroot 158: we suspect it to be sensitive
- Characteristics of the plants
  - Plants are micropropagated
  - Acclimatised in a greenhouse for 4 weeks
  - Each plant in plastic pots (9 cm x 9 cm x 9.5 cm)
    - Soil: 70:30 mix of white peat:brown peat

Materials and methods: first trial

- First trial: 22 July/23 September
  - Experimental designs
    - 3 rootstocks: Maxma 14, SL 64, Weiroot 158
    - Modalities:
      - Control (no waterlogging)
      - Complete soil submersion for 1 day
      - Complete soil submersion for 3 days
      - Complete soil submersion for 7 days
    - Replications: 10 plants per rootstock and per modality
    - Soil completely submerged (1 cm above the soil surface)
  - Observations
    - Plant length
    - Diameter growth (at the base of the plant)
    - Chlorophyll content in the leaves
    - Outbreak of foliar necrosis

Materials and methods: first trial

- Plant management
  - Irrigation
    - Control plants were irrigated regularly by sub-irrigation
      - Every 2 or 3 days depending on the climate
    - Submerged plants
      - After waterlogging and drainage
  - Lighting
    - Natural lighting because the trial took place in Summer
    - In Autumn or Spring, it might be necessary to use artificial lighting

Materials and methods: first trial

General overview

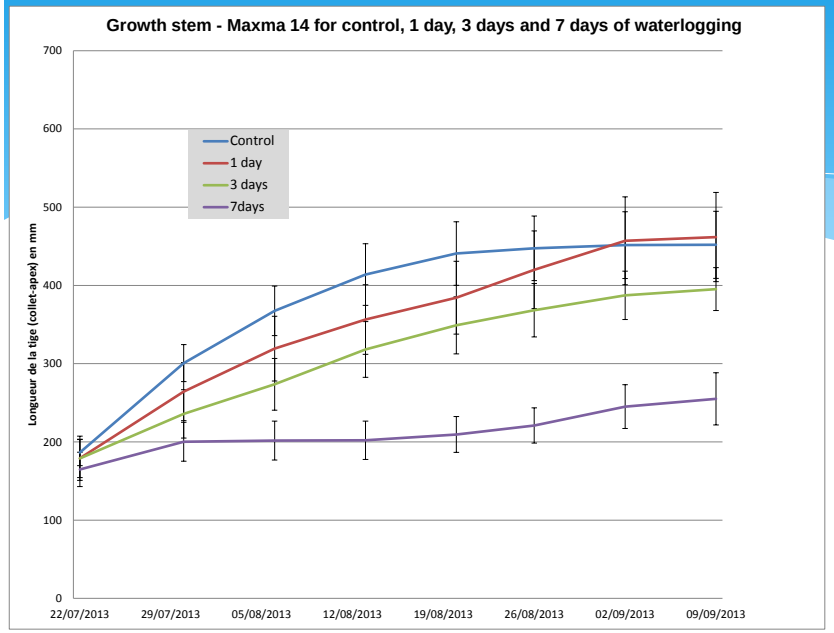
Control plants

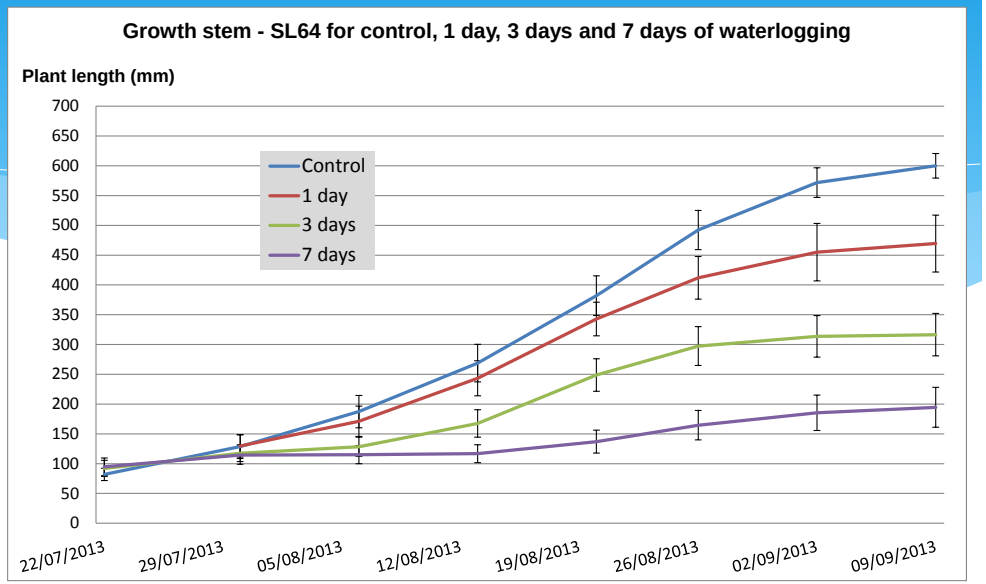
SL 64

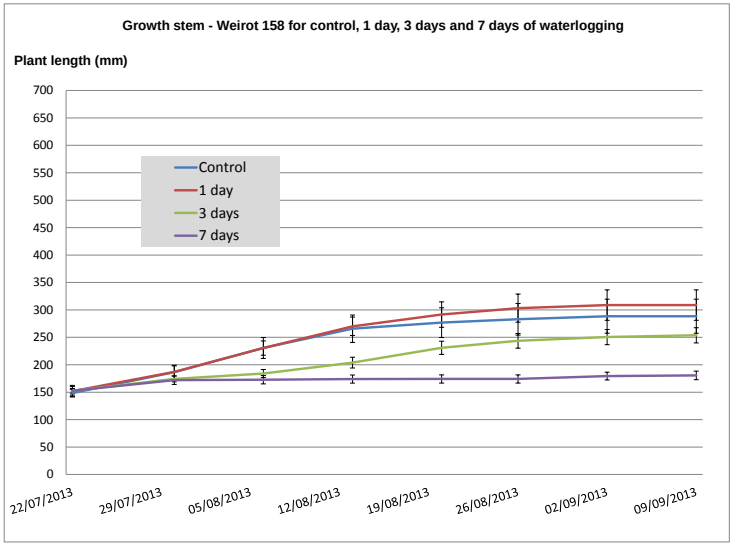
Maxma 14

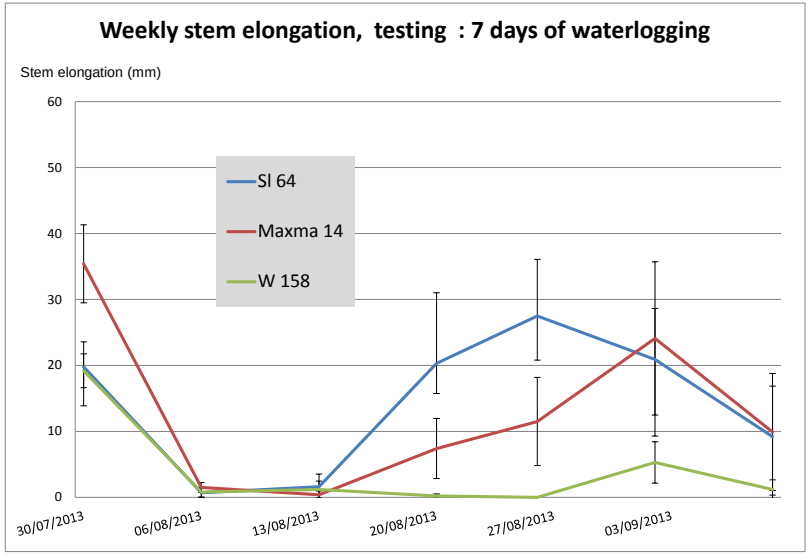
Weiroot 158

Results first trial: plant growth









Results first trial : length growth

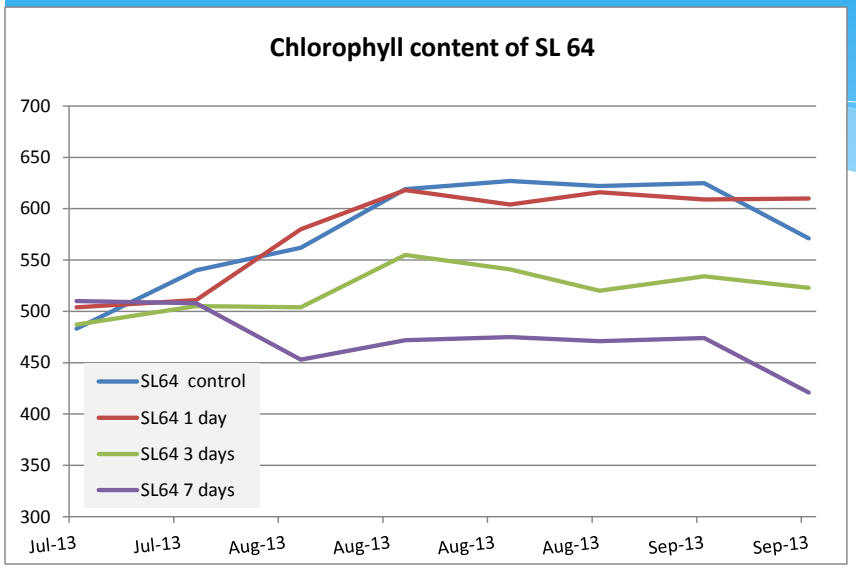
- Length growth
  - 1 day: not sufficient to limit growth
  - Waterlogging for 3 or 7 days affects the growth of the 3 rootstocks
  - It's difficult to compare the 3 rootstocks because they do not have the same vigour and the plants were not homogeneous enough
    - Observations in the field:
      - SL 64: vigourous
      - Maxma 14: semi-vigorous
      - Weiroot 158: semi-vigourous but less than Maxma 14
  - One control for each class of vigour? (dwarf, semi-vigourous, vigourous)
  - Standard deviation
    - Quite large
    - Plants should be more homogeneous
    - More than 10 replications?

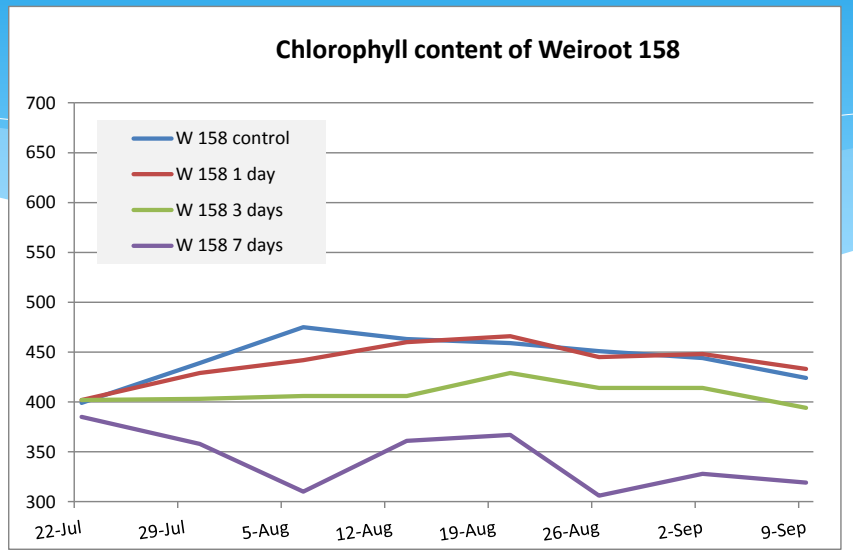
Results first trial : chlorophyll content in the leaves

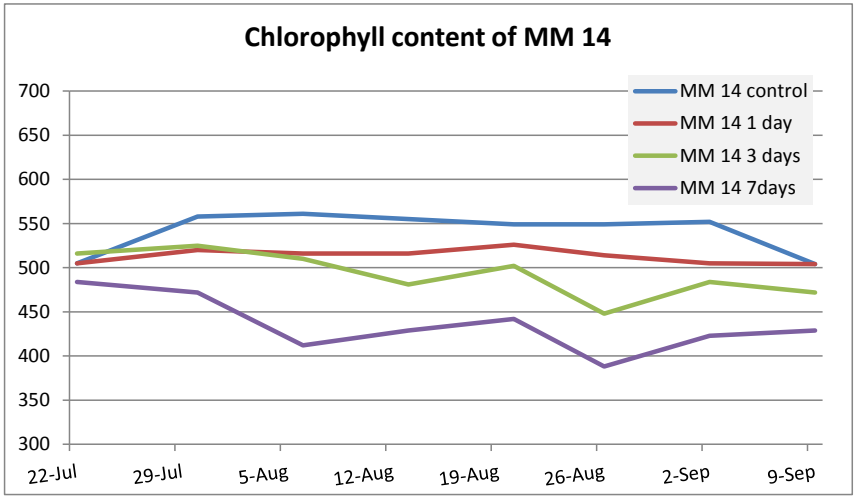
- Use of N-tester
  - Every week
  - 3 measurements per plant on the 5th or 6th leaf (from the upper part of the plant)
  - 30 measurements per rootstock

- Chlorophyll contents vary depending on rootstocks
- The data are stable for a modality
- May be sufficient to do one measurement at the beginning

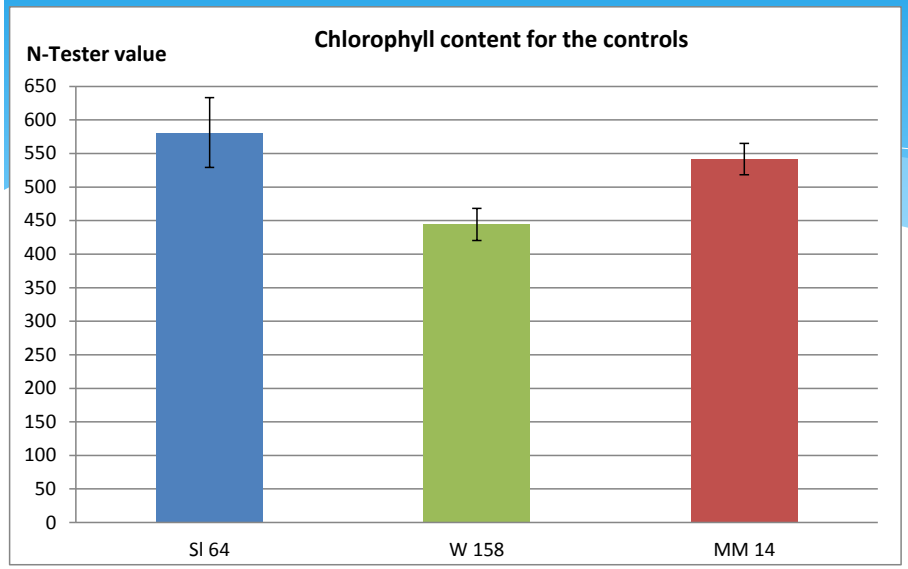
Results first trial : chlorophyll content in the leaves

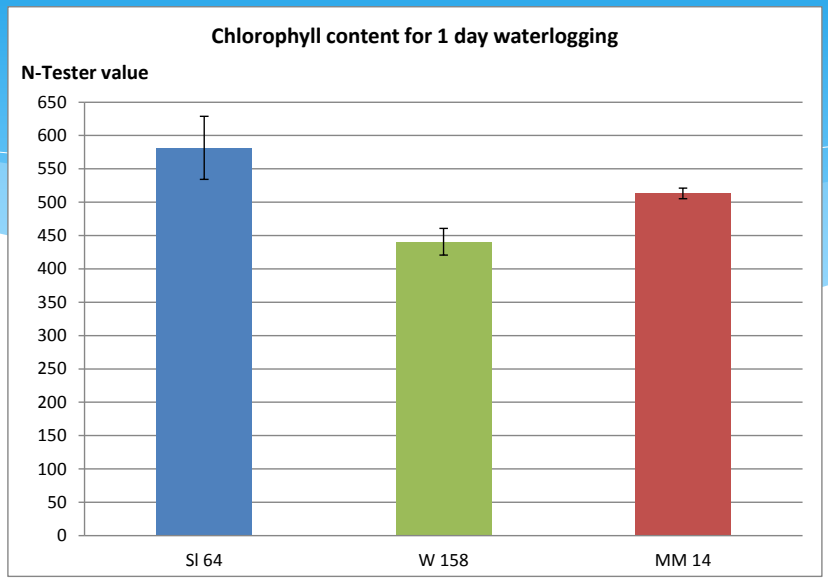


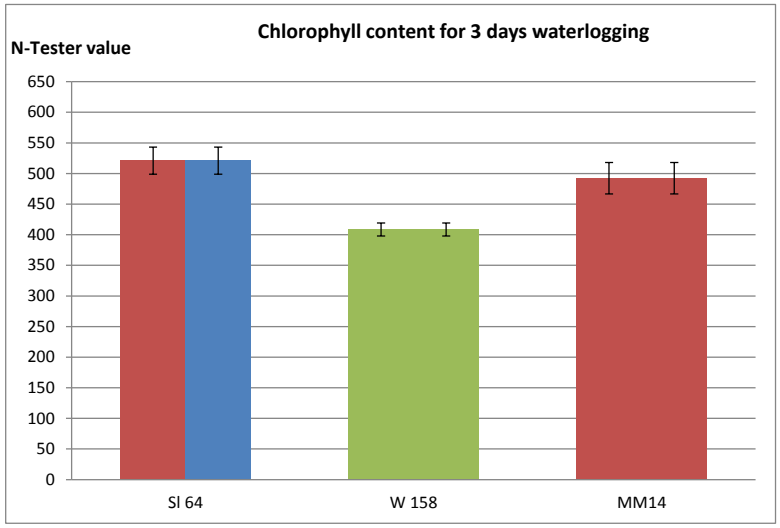


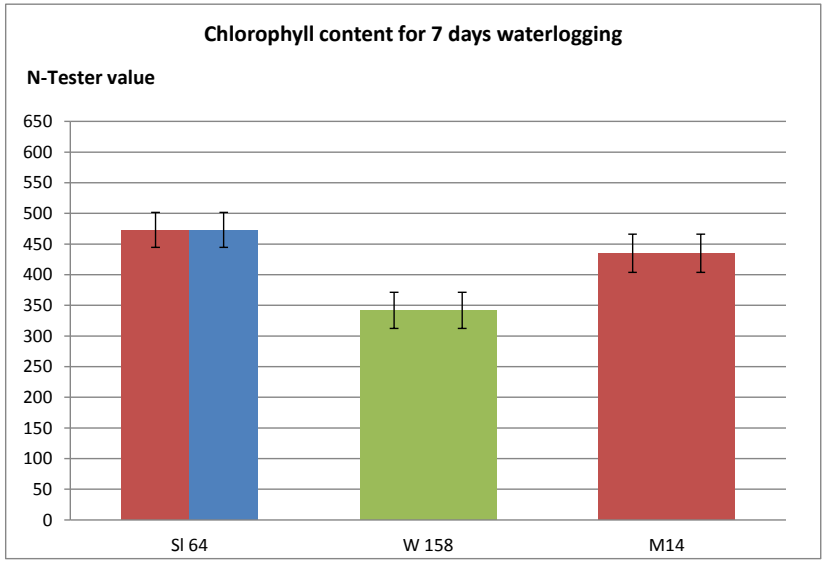


Results first trial: Chlorophyll content in the leaves



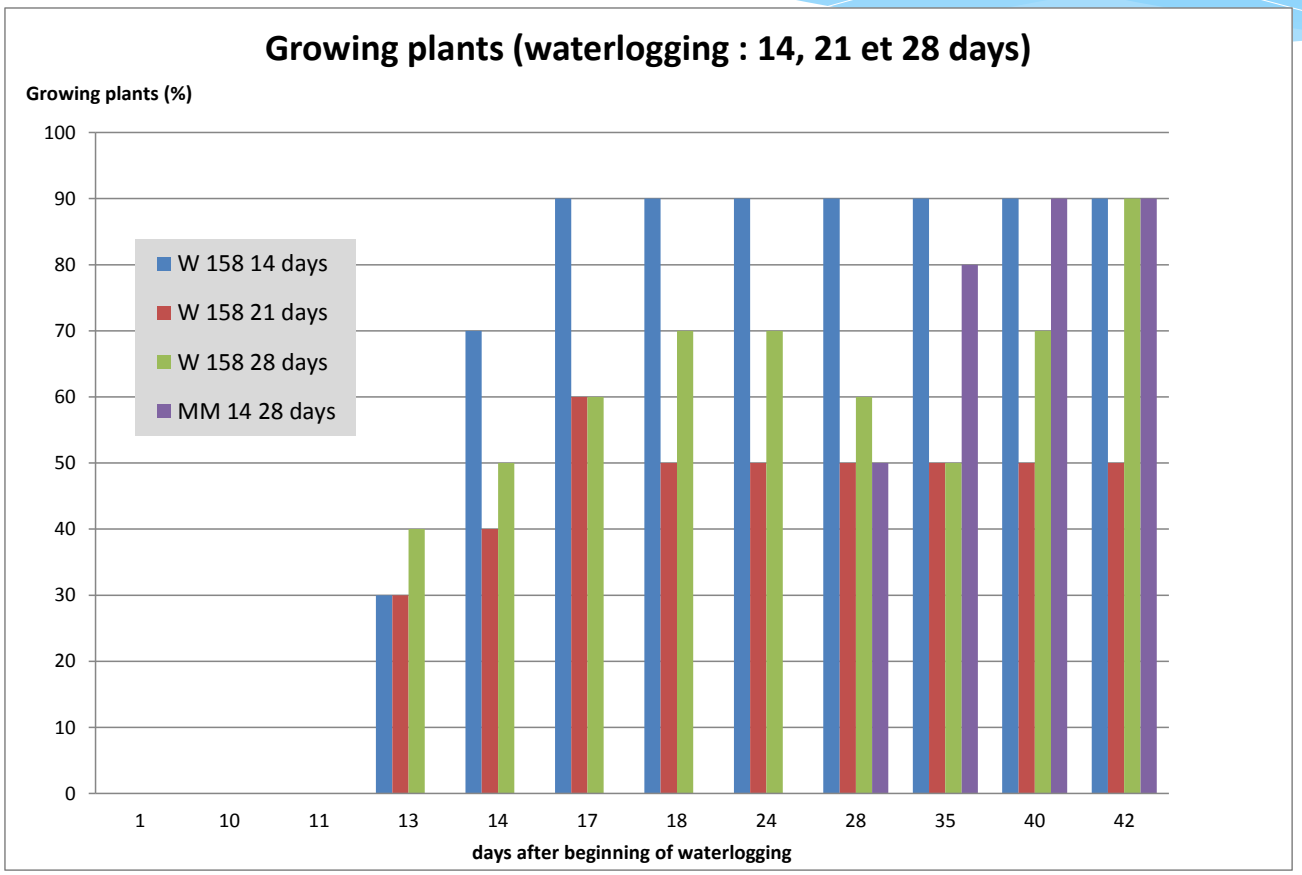






Results first trial

- Growing plants
  - % of plants which are growing or start growing after the end of waterlogging



Materials and methods: second trial

* Observations
  * Plant length
  * Outbreak of foliar necrosis
  * Outbreak of dead plants
  * Regrowing plants after waterlogging
  * Appearance of new superficial roots

Results second trial: outbreak of foliar necrosis

Foliar aspect after 21 days of waterlogging

MM 14

Weiroot 158

Results second trial: outbreak of foliar necrosis

* Foliar symptoms

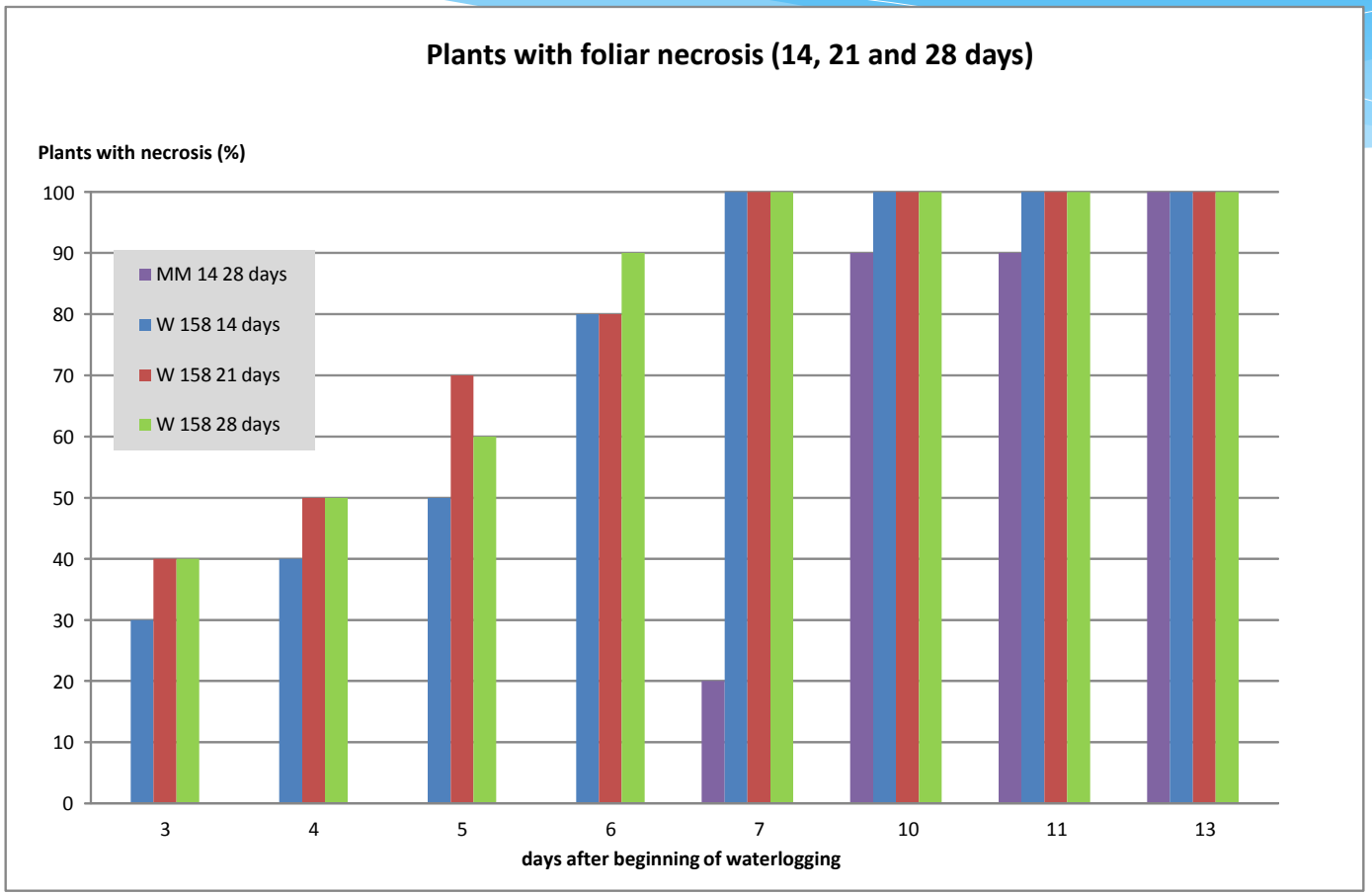
W 158: 7 days of waterlogging

W 158: 14 days of waterlogging

MM 14: 7 days of waterlogging

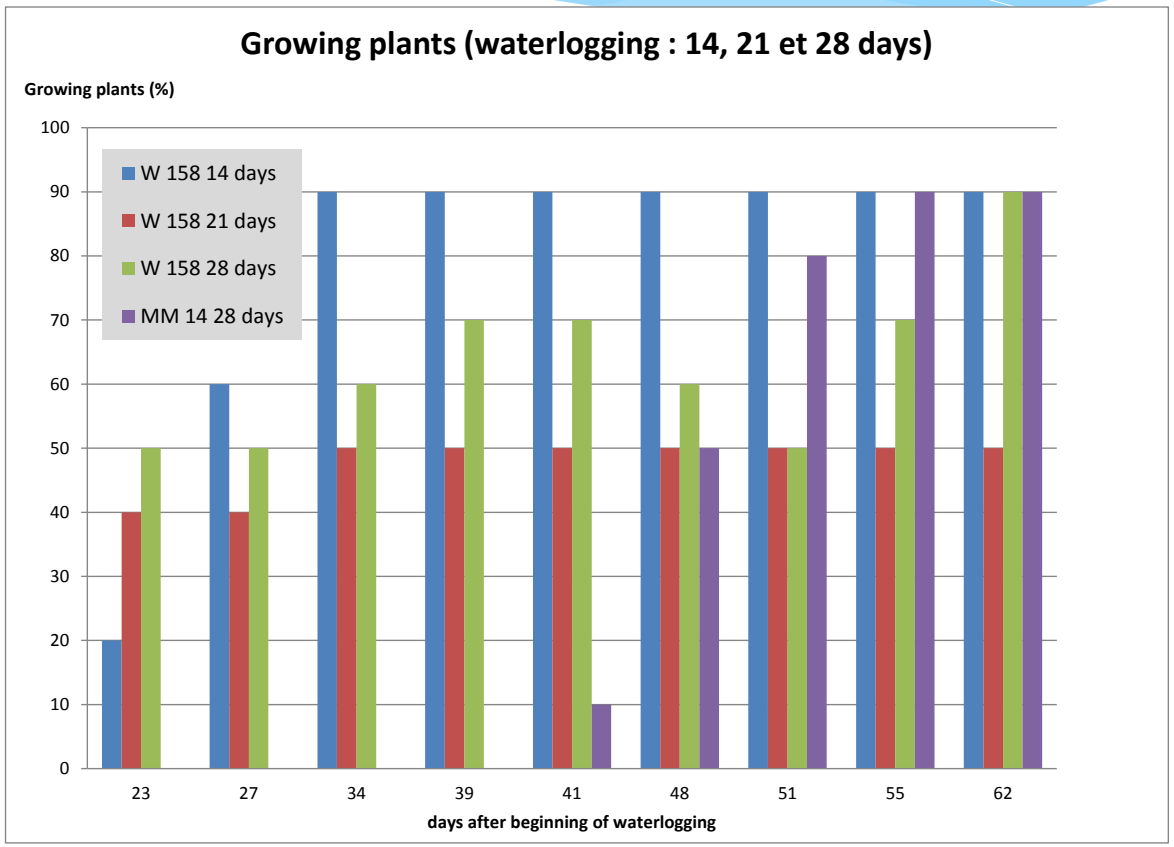
Results second trial

* Outbreaks of foliar necrosis



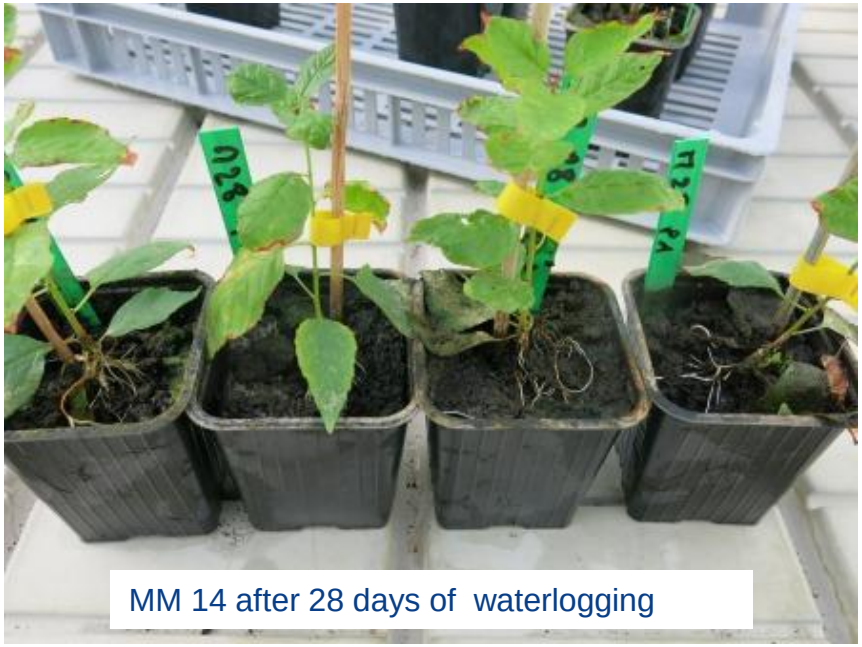
Results second trial

- Growing plants
  - % of plants which start growing after the end of waterlogging

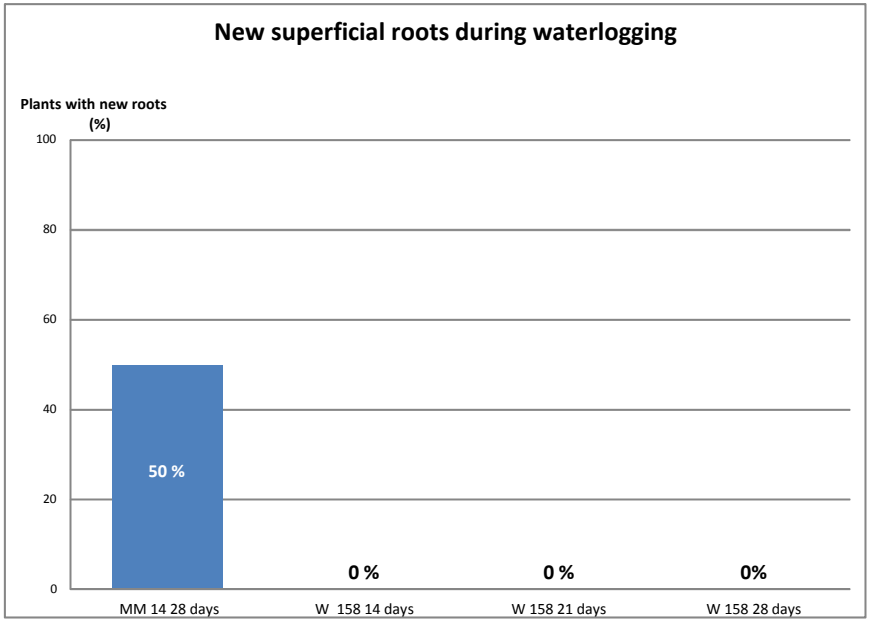


Results second trial

* Appearance of new superficial roots during waterlogging
  * One way for the rootstocks to survive is to form superficial roots during waterlogging

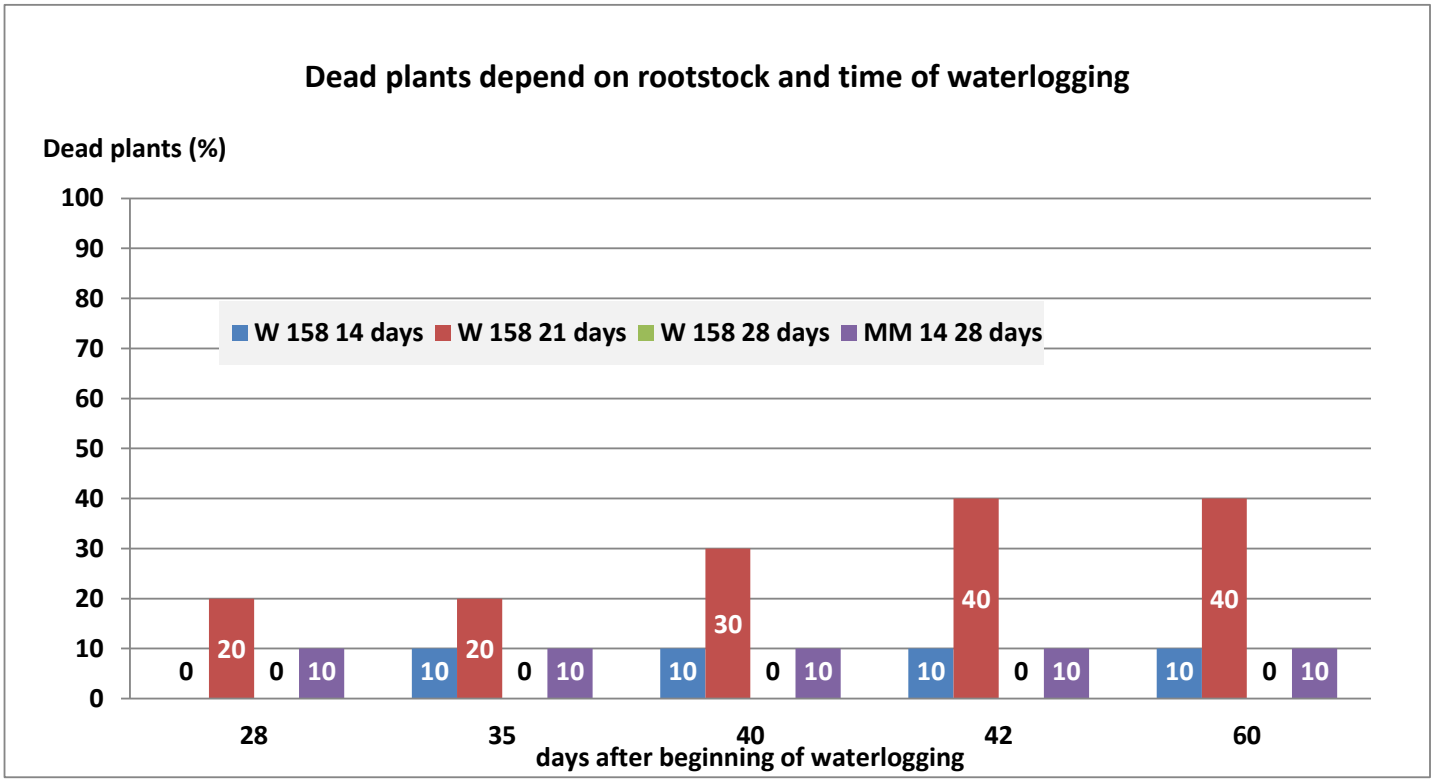


MM 14 after 28 days of waterlogging



Results second trial: dead plants

* Results are not always related to the rootstocks
  * Many more trials required to determine why the results are different



Rootstock sensivity to root asphyxia: conclusion

- Repeat trials to note the repeatability of the results
  - Observations to carry out:
    - Growth length
    - Outbreak of foliar necrosis
    - Outbreak of dead plants
    - Outbreak of new superficial roots
    - Regrowth after waterlogging
  - Plant homogeneity:
    - Growing plant or dormant plant
    - Age and size of the plant
    - Weight of the substrate used
  - Observation of the roots after waterlogging

Rootstock sensivity to root asphyxia: conclusion

* This year, the rootstocks were not grafted
* We might graft the rootstocks with a variety which accentuates the asphyxia symptoms
  * In the field, we observe that the variety Ferdouce(cov) increases the decline of trees due to flooding.