Water Stress in Raspberry

Future-proofing berryfruit
ClimaFruit

The Interreg IVB
North Sea Region
Programme

Malmo 13.09.2012

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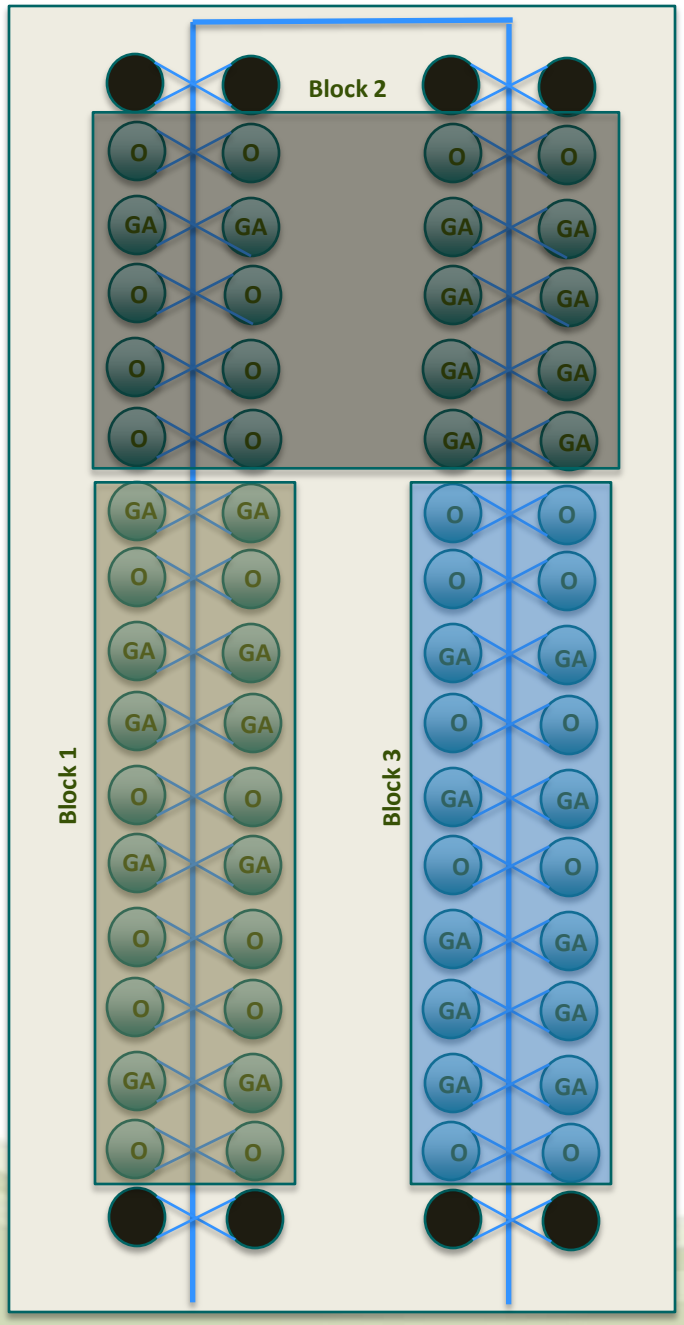
Water stress in raspberry at Scotland

- **Short-term drought stress in one-year old canes grown in pots in a tunnel:**
    - Determining the mechanisms of stress tolerance/avoidance used by raspberry to cope with water limitation (2011 and 2012)

Water limitation 2011

- 4 L pots (2 irrigation drips)
- Irrigation twice daily (2 x 330ml)
- 5 different treatments
- 3 Blocks
- 2 biological replicates (1 sampled at t0 and the other after 1 week recovery)



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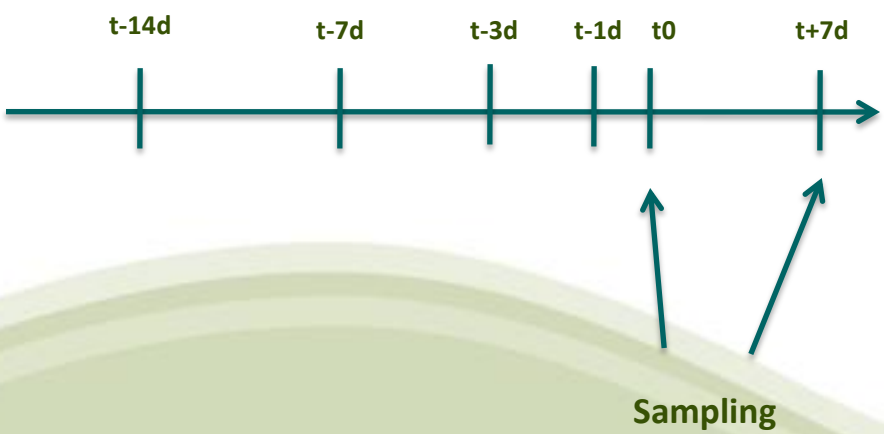
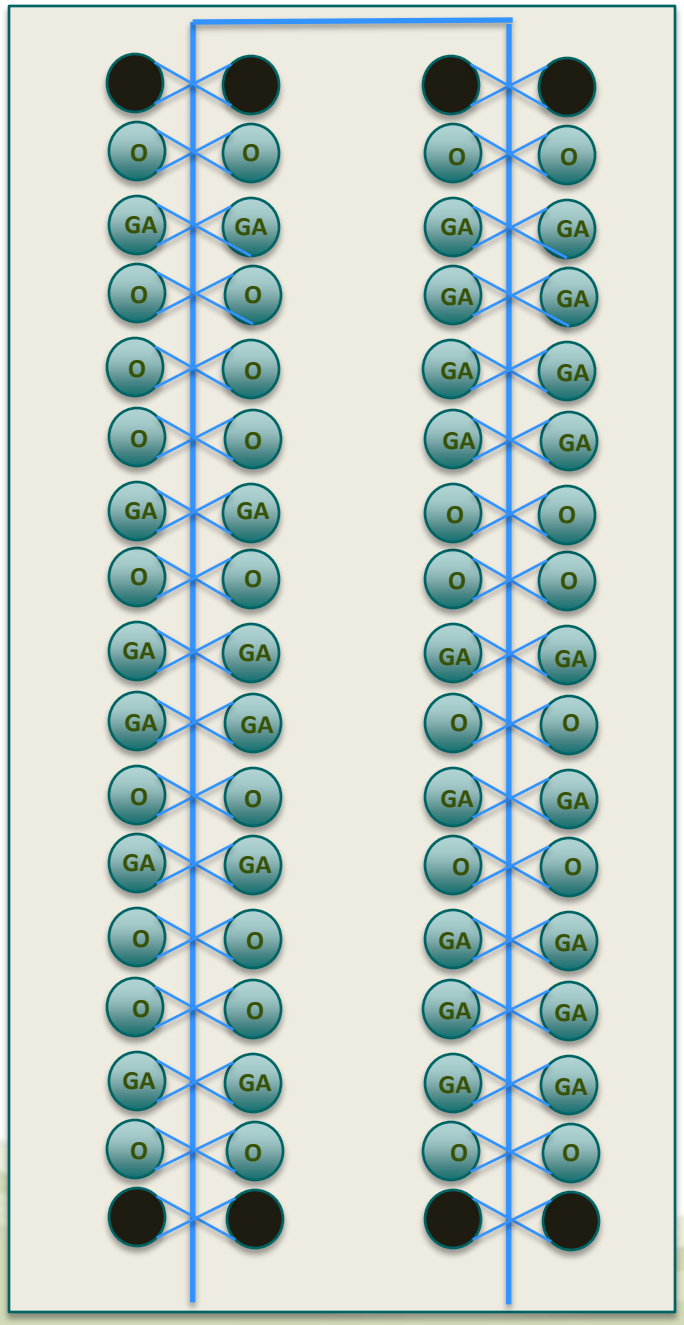
Water limitation

Drip irrigation was removed from some of the plants at different time points before sampling:





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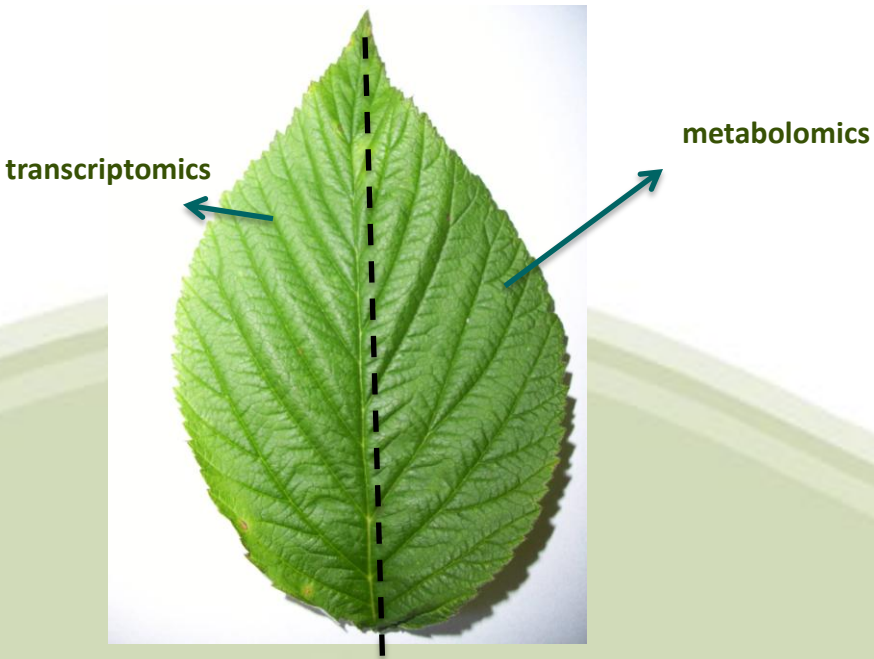
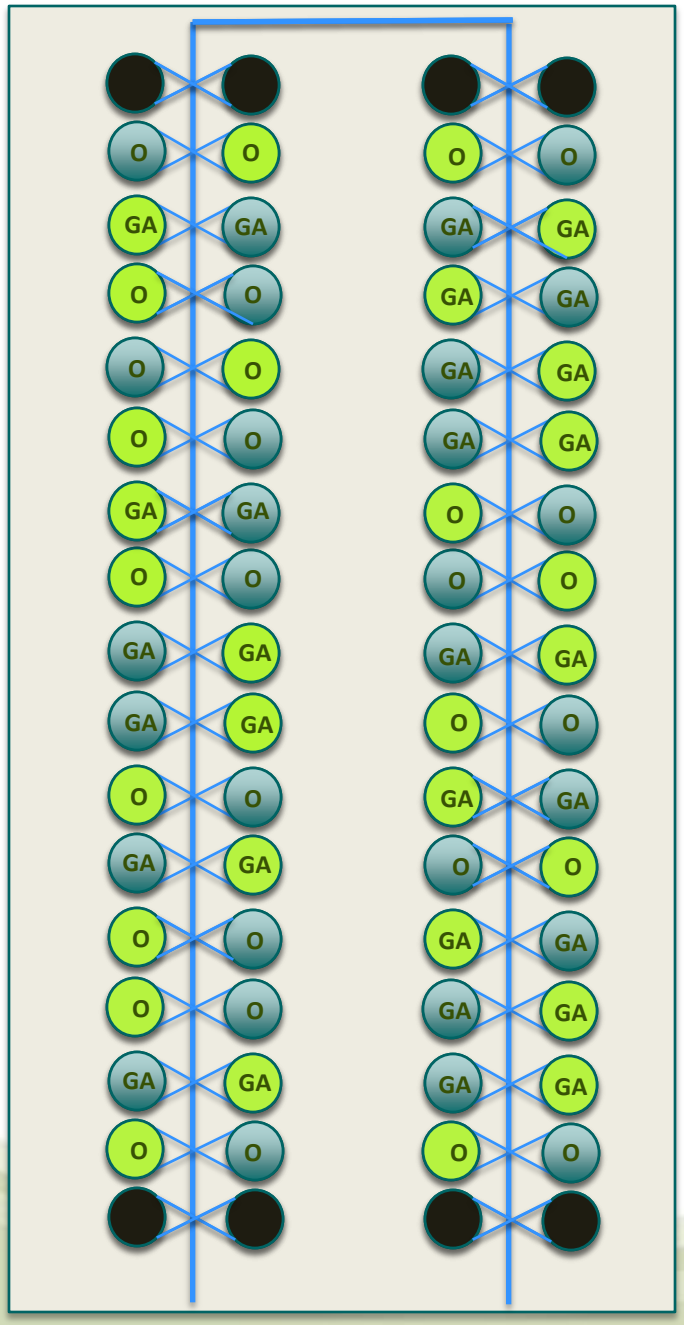
Water Limitation

- Irrigation was restored and after one week the remaining plants were sampled.
- Sampled terminal leaf from 7th youngest node





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Water limitation

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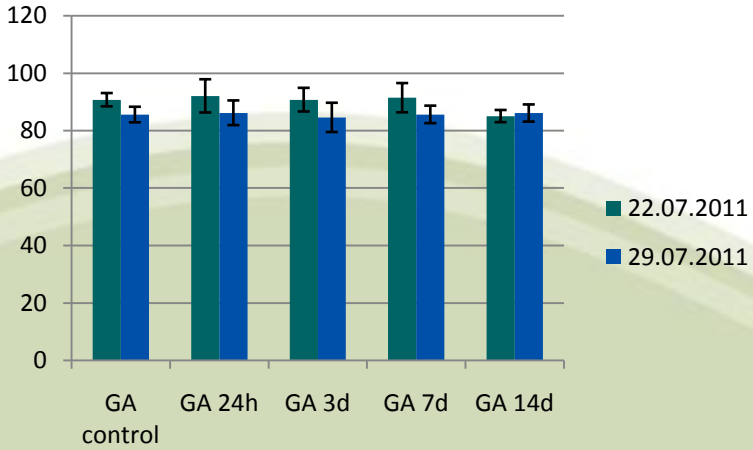
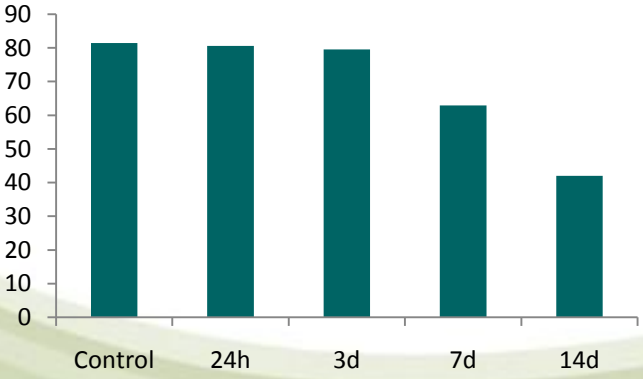
Glen Ample

control | 24h | 3d | 7d | 14d

Relative water content (leaf)



Soil water content (3-7cm)



Water limitation

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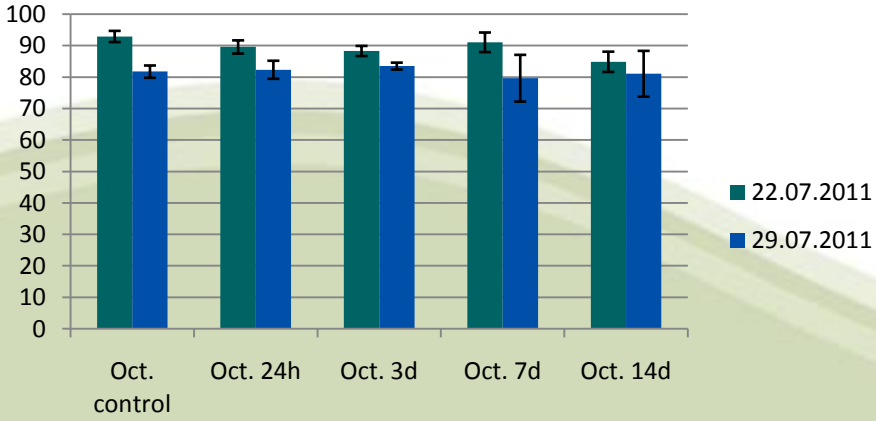
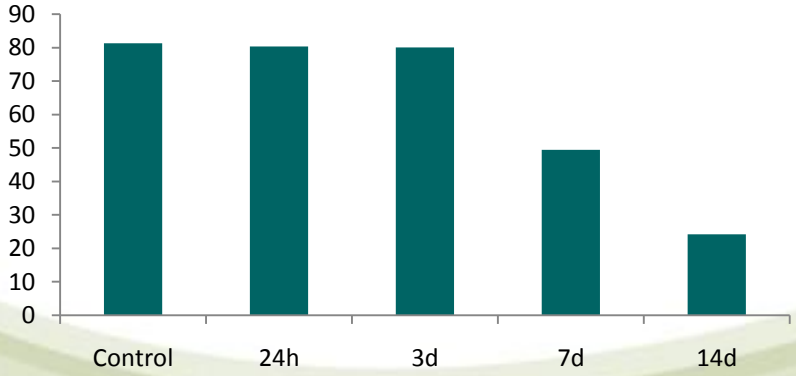
Octavia

control 24h 3d 7d 14d

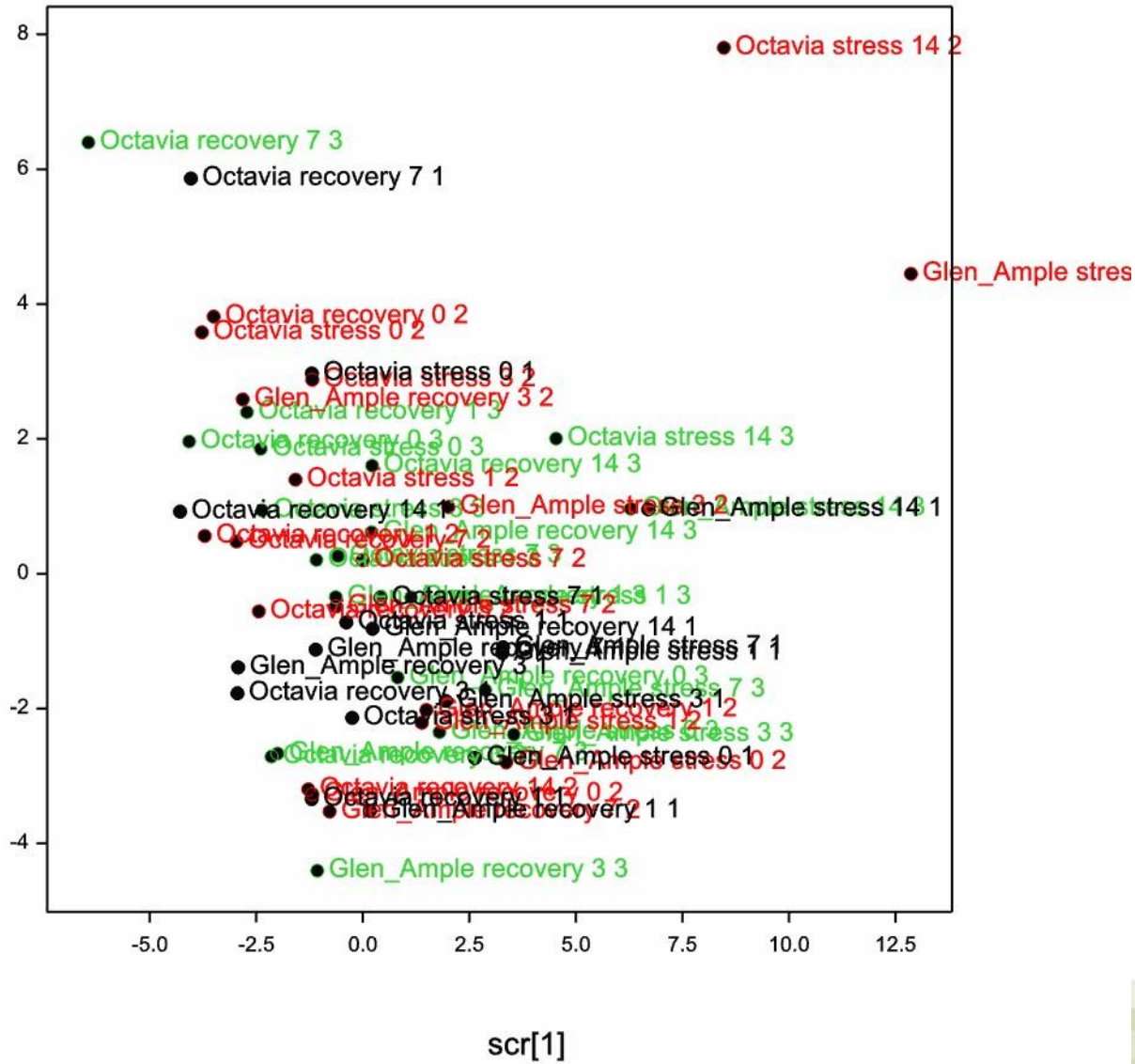
Relative water content



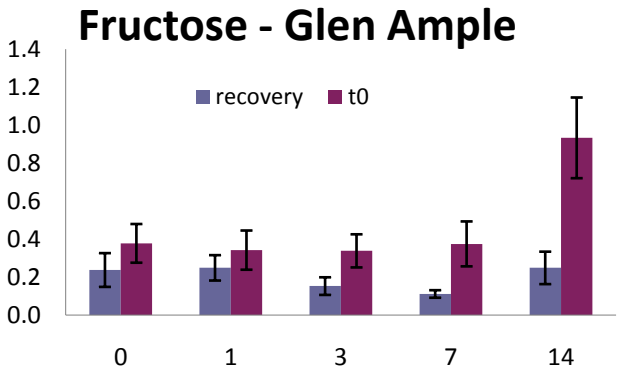
Soil water content (3-7cm)

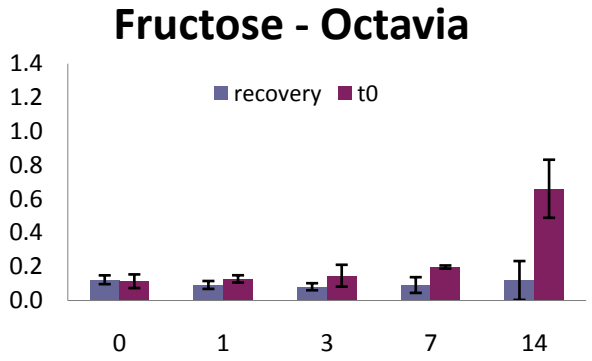


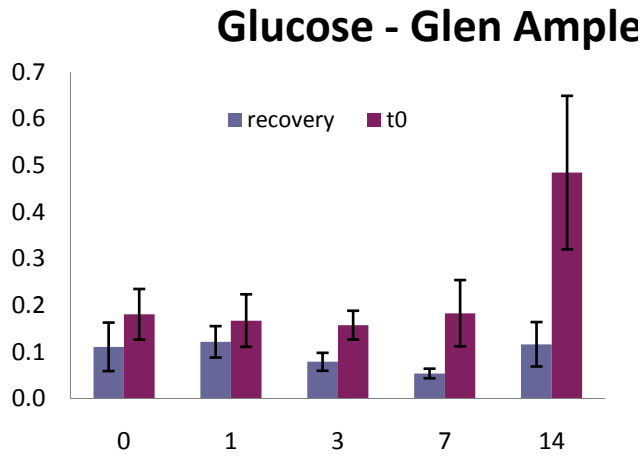
Principal component analysis

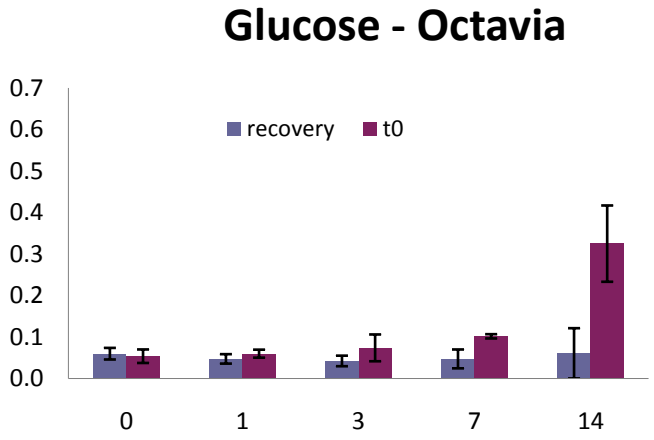


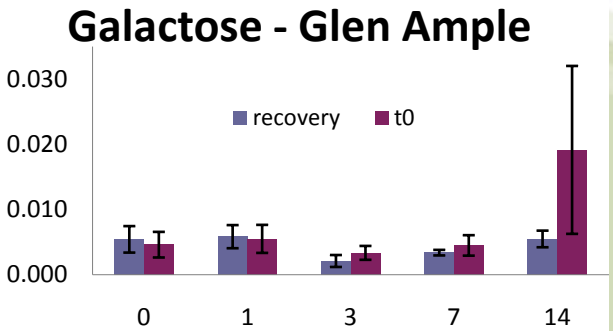
Metabolomics

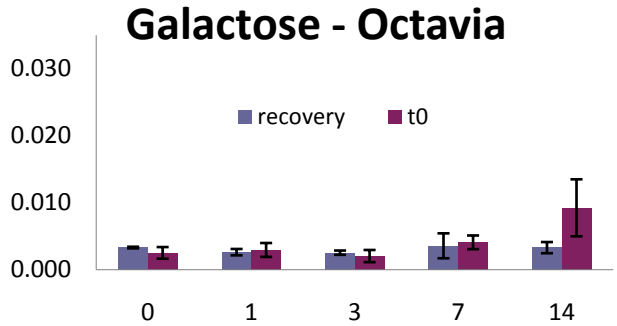












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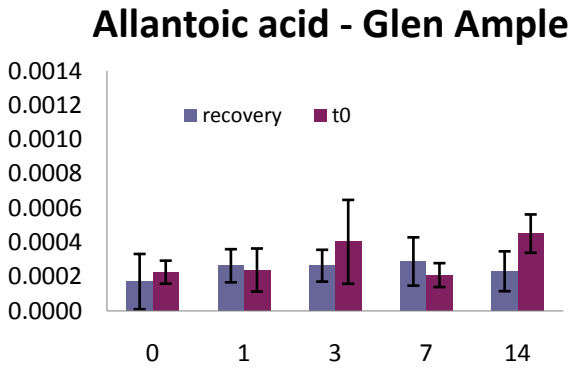

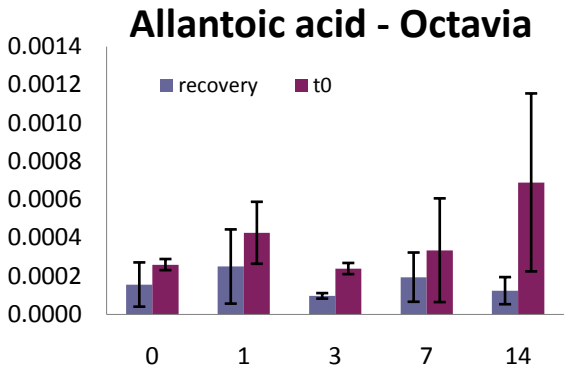

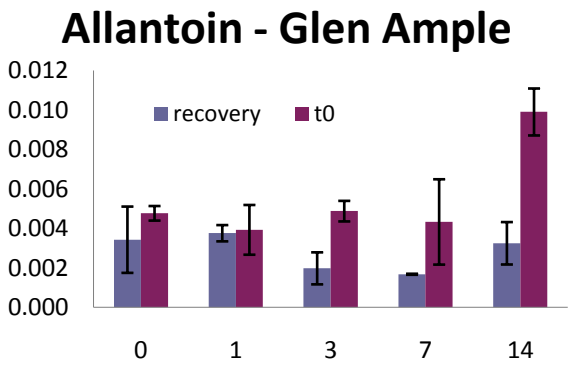

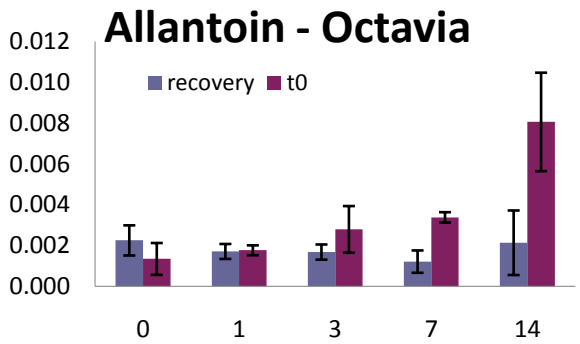

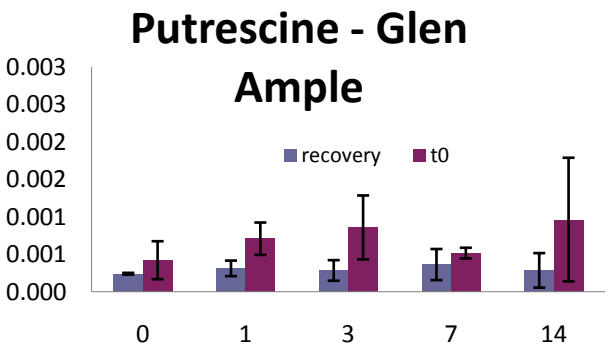

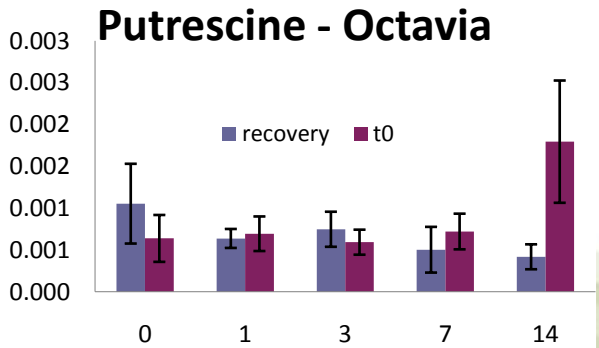

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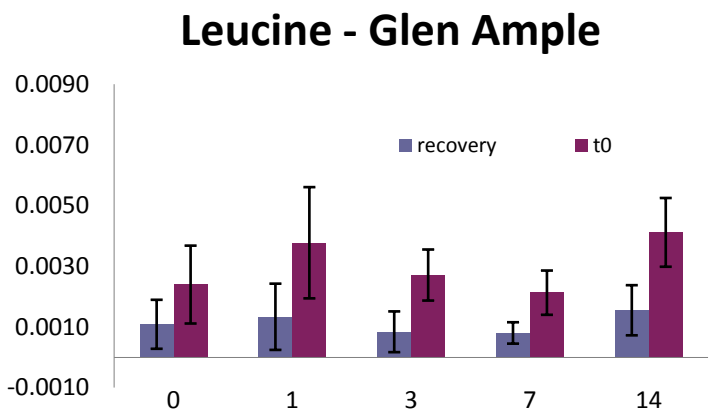
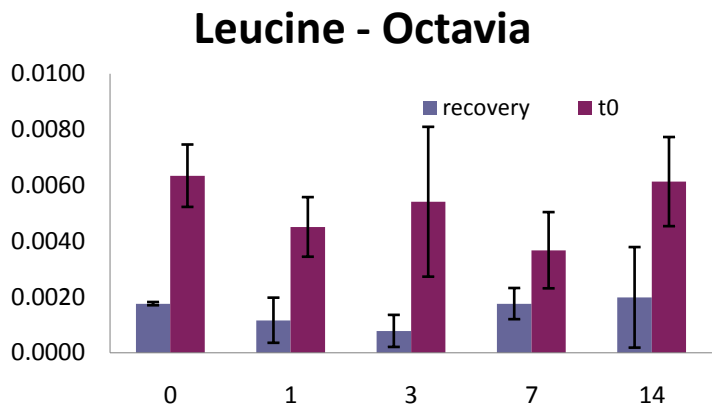
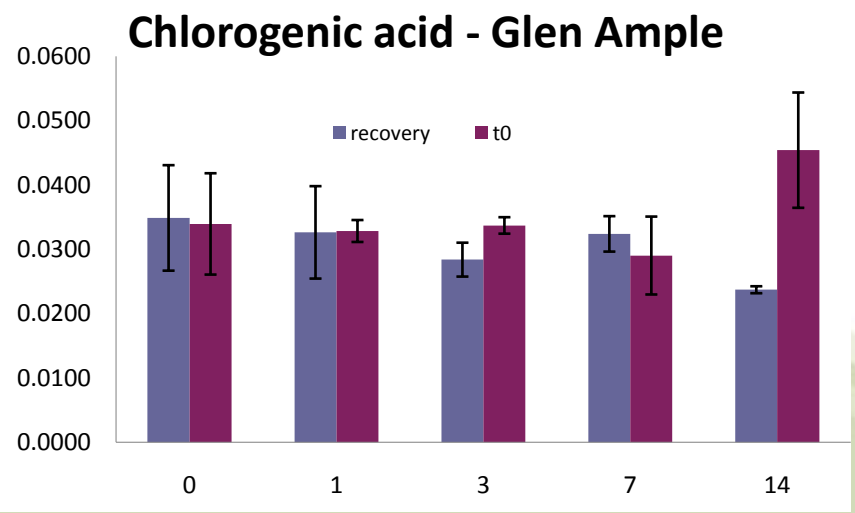
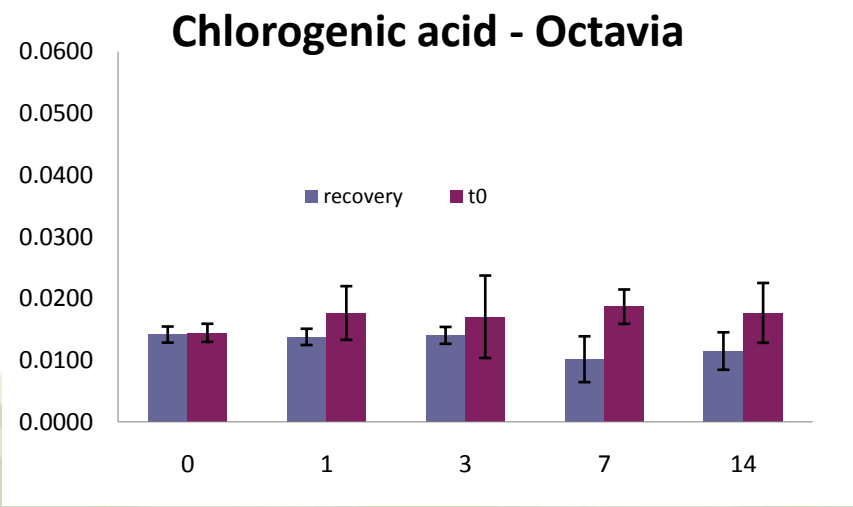






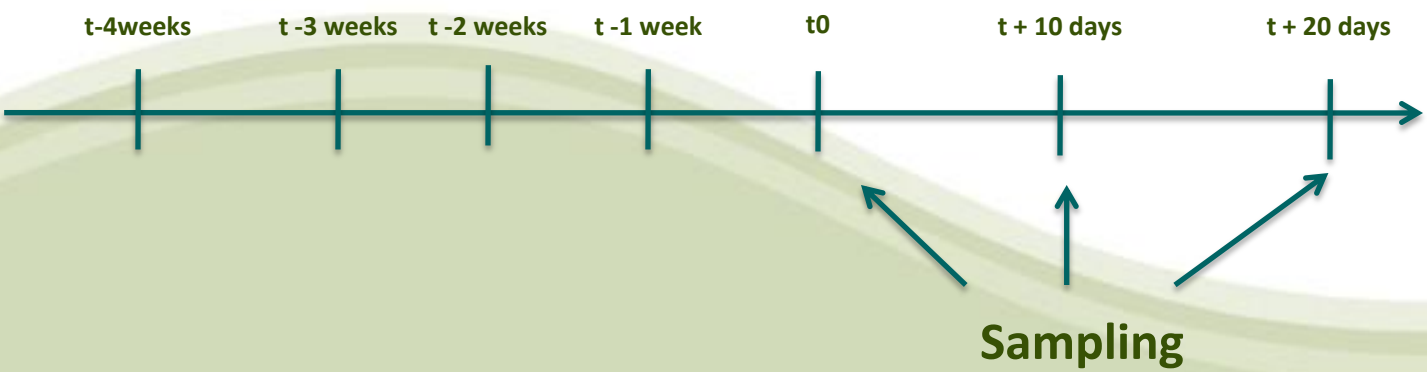


Conclusions

- There were no differences in tolerance to drought between cultivars
- Stress treatments did not elicit a significant decrease in relative water content and chlorophyll content
- The levels of glucose, fructose and galactose appear to increase when plants are exposed to drought
- The levels of putrescine, allantoin allantoic acid also increase in response to stress
- After 1 week of recovery these metabolite levels return to levels similar to control plants

Drought stress 2012

- Minimization of phenotypic plasticity
- Different irrigation protocol
- Monitoring growth and development
- Longer timescale



Experimental design

Glen Ample_4week	Glen Ample_3week	
Octavia_3week	Octavia_control	
Octavia_4week	Octavia_1week	
Octavia_2week	Glen Ample_1week	
Glen Ample_Control	Glen Ample_2week	Block 1
Glen Ample_Control	Octavia_1week	
Octavia_3week	Octavia_4week	
Glen Ample_2week	Glen Ample_3week	
Octavia_2week	Glen Ample_4week	
Glen Ample_1week	Octavia_control	Block 2
Octavia_4week	Glen Ample_3week	
Octavia_control	Octavia_2week	
Glen Ample_4week	Glen Ample_Control	
Octavia_3week	Glen Ample_1week	
Octavia_1week	Glen Ample_2week	Block 3
Glen Ample_Control	Octavia_4week	
Octavia_1week	Glen Ample_4week	
Octavia_3week	Octavia_control	
Glen Ample_1week	Glen Ample_2week	
Octavia_2week	Glen Ample_3week	Block 4
Glen Ample_4week	Glen Ample_2week	
Octavia_1week	Octavia_control	
Glen Ample_3week	Octavia_4week	
Glen Ample_Control	Glen Ample_1week	
Octavia_3week	Octavia_2week	Block 5
Octavia_1week	Glen Ample_1week	
Octavia_3week	Glen Ample_3week	
Octavia_control	Octavia_2week	
Octavia_4week	Glen Ample_2week	
Glen Ample_4week	Glen Ample_Control	Block 6

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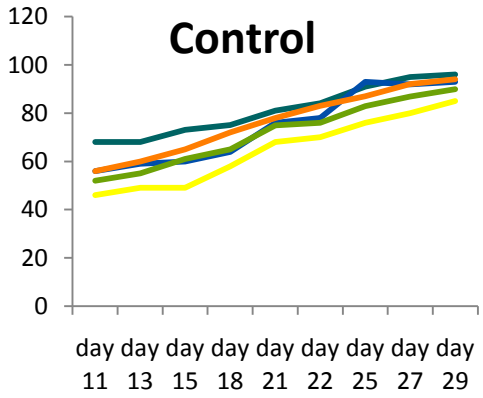
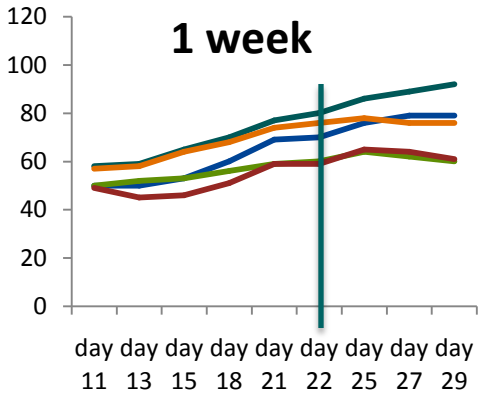
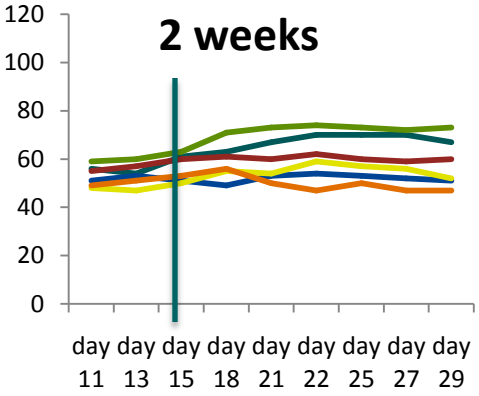
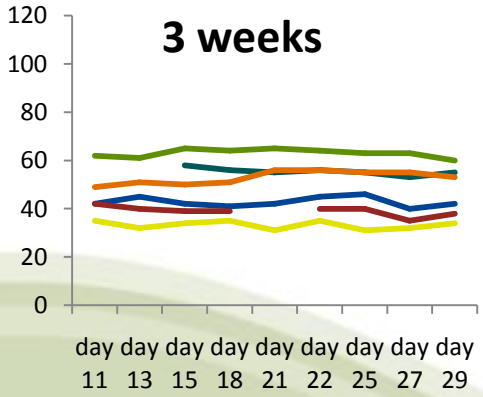
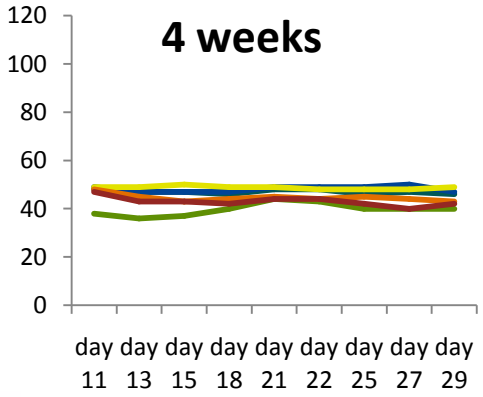
Glen Ample cane Length



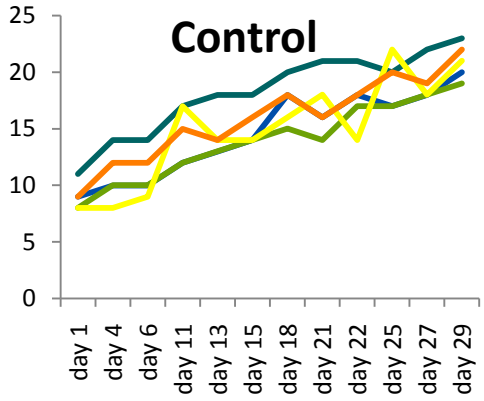


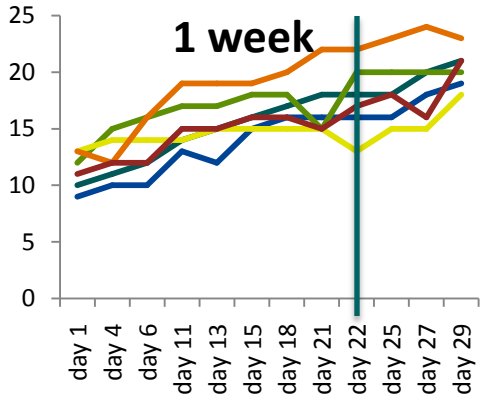


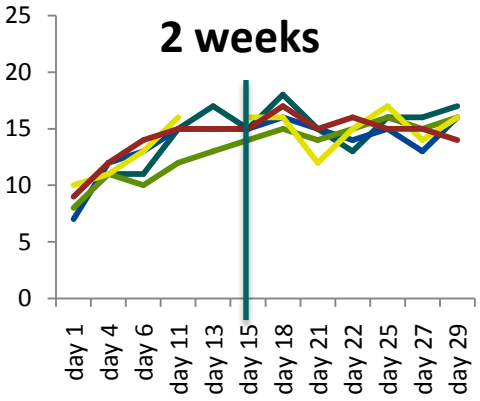


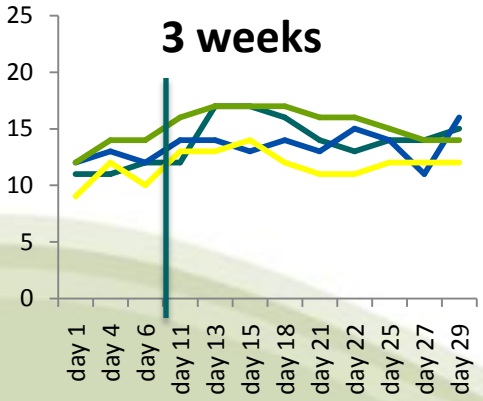


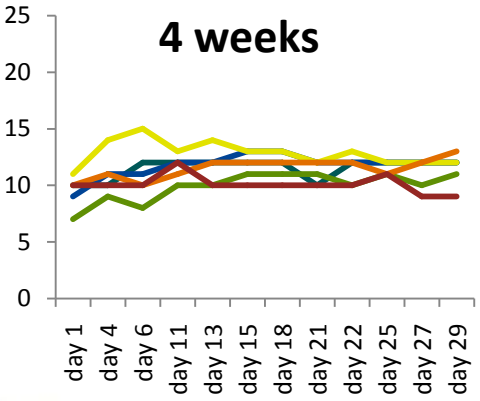
Glen Ample number of nodes



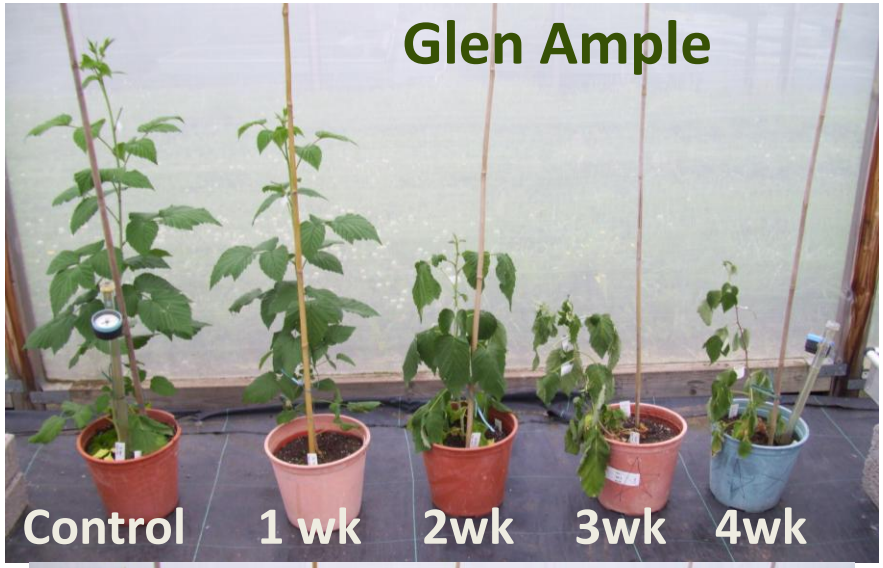


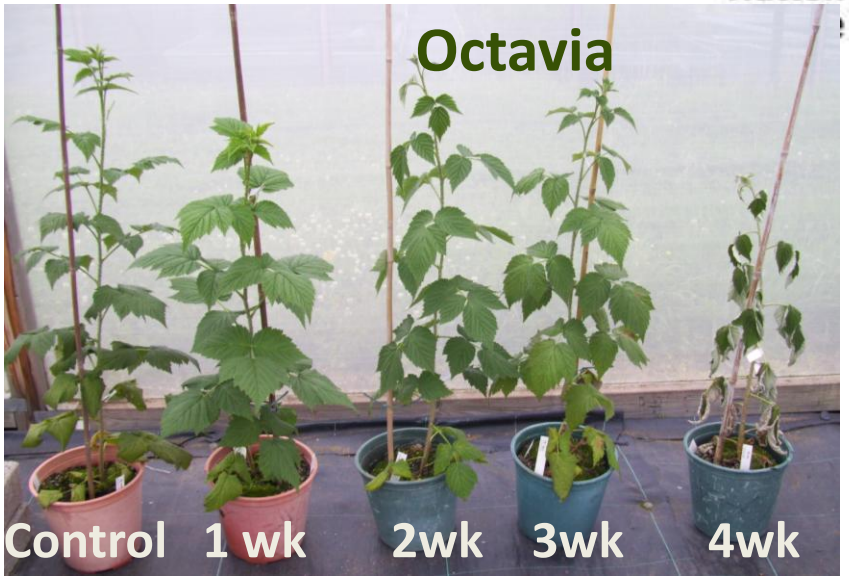






Post-stress and post-recovery





Additional data

- Chlorophyll content
- Internodal distance
- Relative water content
- Lipid peroxidation assay
- GC-MS
  - Terminal leaf of 4th node at date of sampling
  - Terminal leaf of 4th node at date of experiment start
  - 10 and 20 days recovery of terminal leaf 4th youngest node