

Water Stress in Raspberry

 CLIMAFRUIT
Future-proofing berryfruit

The Interreg IVB
North Sea Region
Programme



Lillehammer 22.09.2011



The James
Hutton
Institute

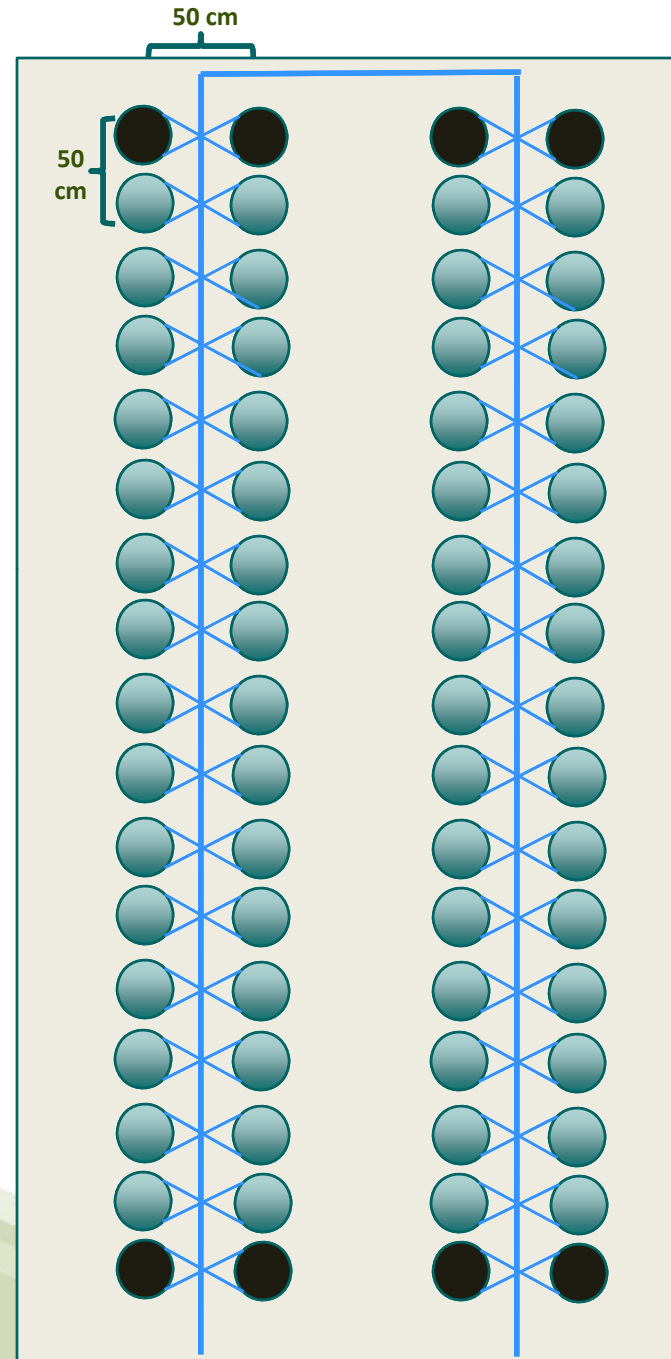
Water stress in raspberry at Scotland

- **Short-term drought stress in primocanes grown in pots in a tunnel:**
 - Determining the mechanisms of stress tolerance/avoidance used by raspberry to cope with water limitation
- **Long-term increased precipitation stress**
 - Test whether increased precipitation as projected by climate change models affects the quality and yield of fruit

Water limitation

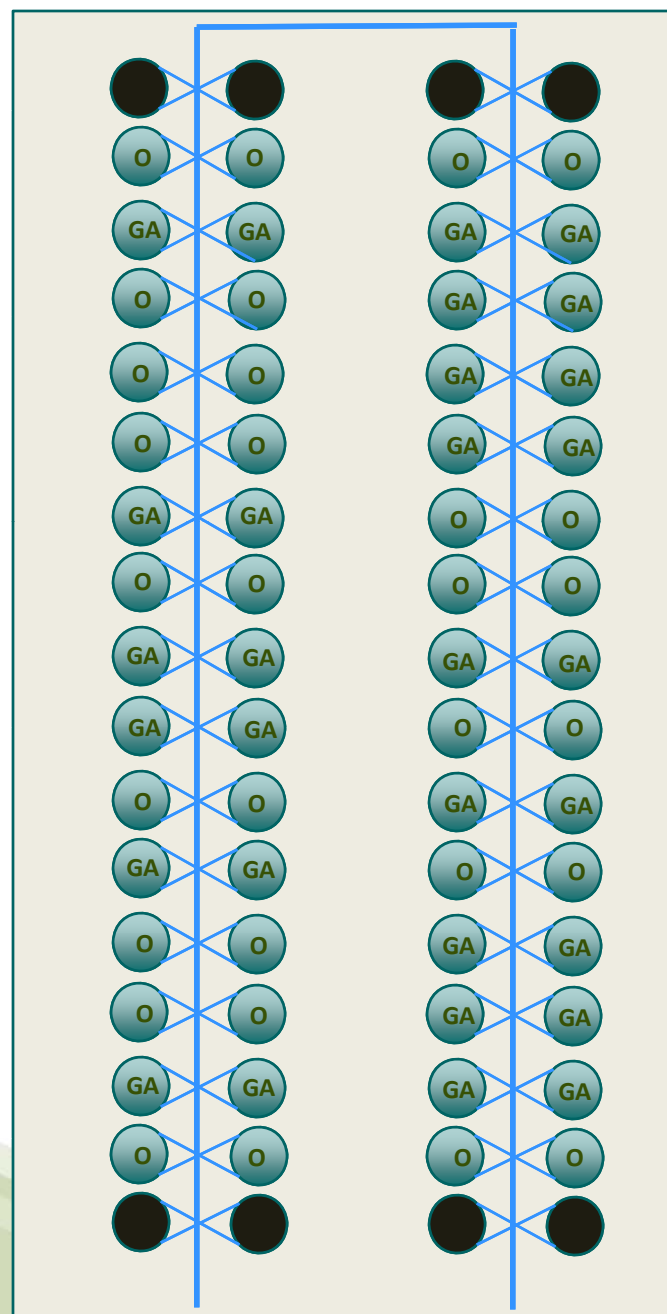


- 4L pots
- 2 irrigation drips in each pot
- Plants irrigated twice daily (aprox 330ml of water for each irrigation step)



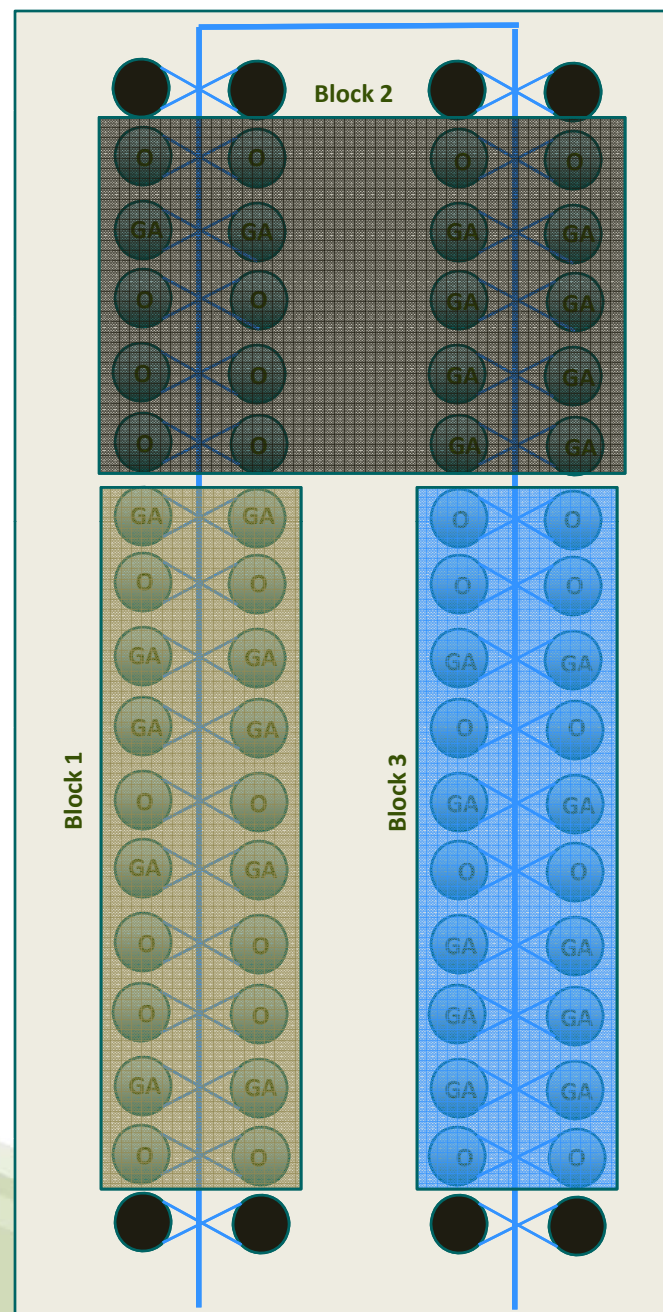
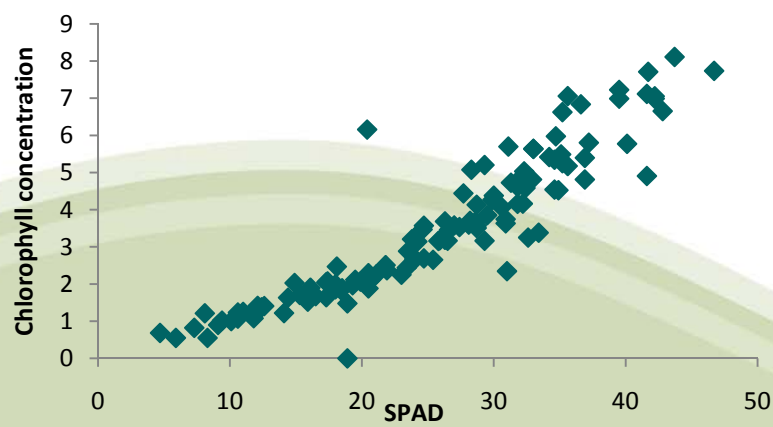
Water limitation

- 2 varieties (Octavia and Glen Ample)
- 5 different treatments
- 3 Blocks
- 2 reps



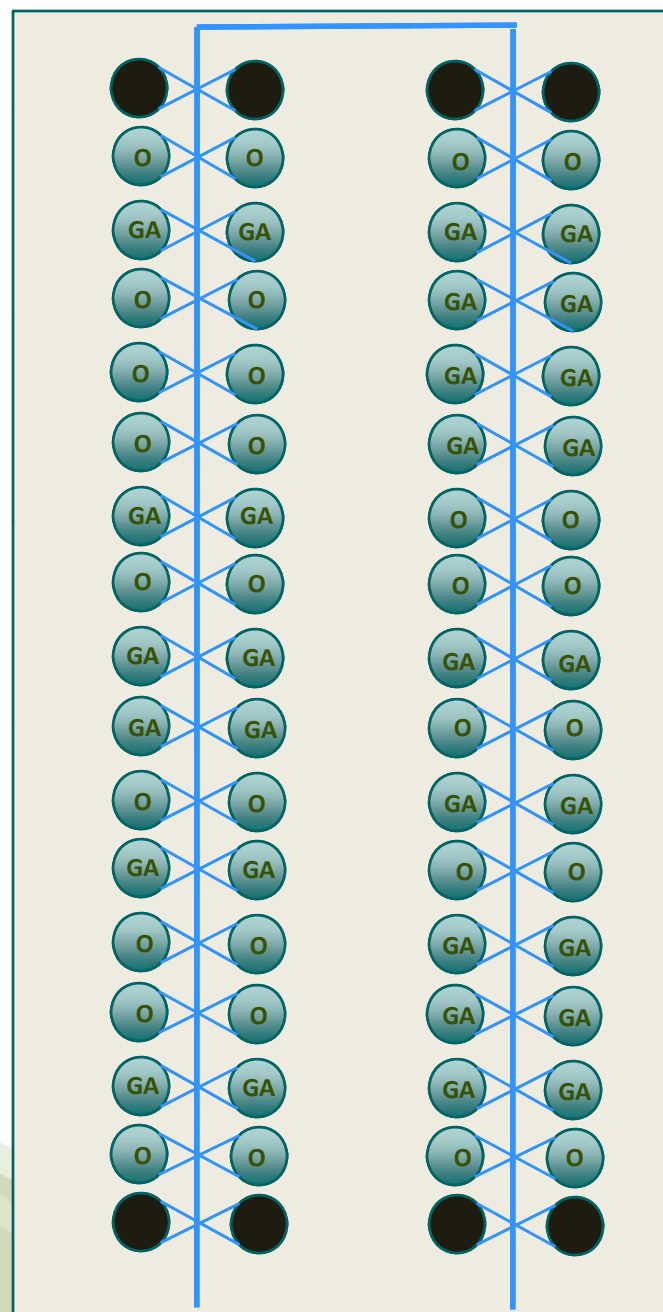
Water limitation

- 5 different treatments
- 3 Blocks
- 2 reps (1 rep sampled at the end of treatment and 1 rep sampled 1 week after the end of treatment)
- Measured chlorophyll content throughout the experiment (using SPAD-502plus)



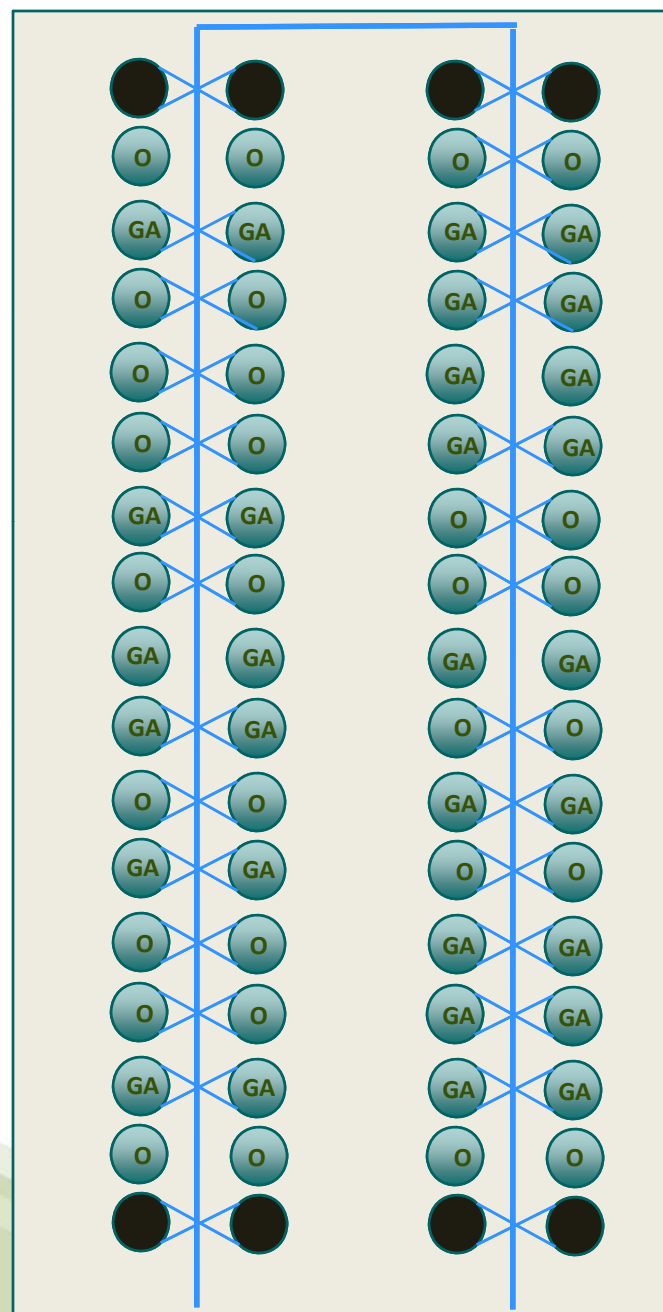
Water limitation

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



Water limitation

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

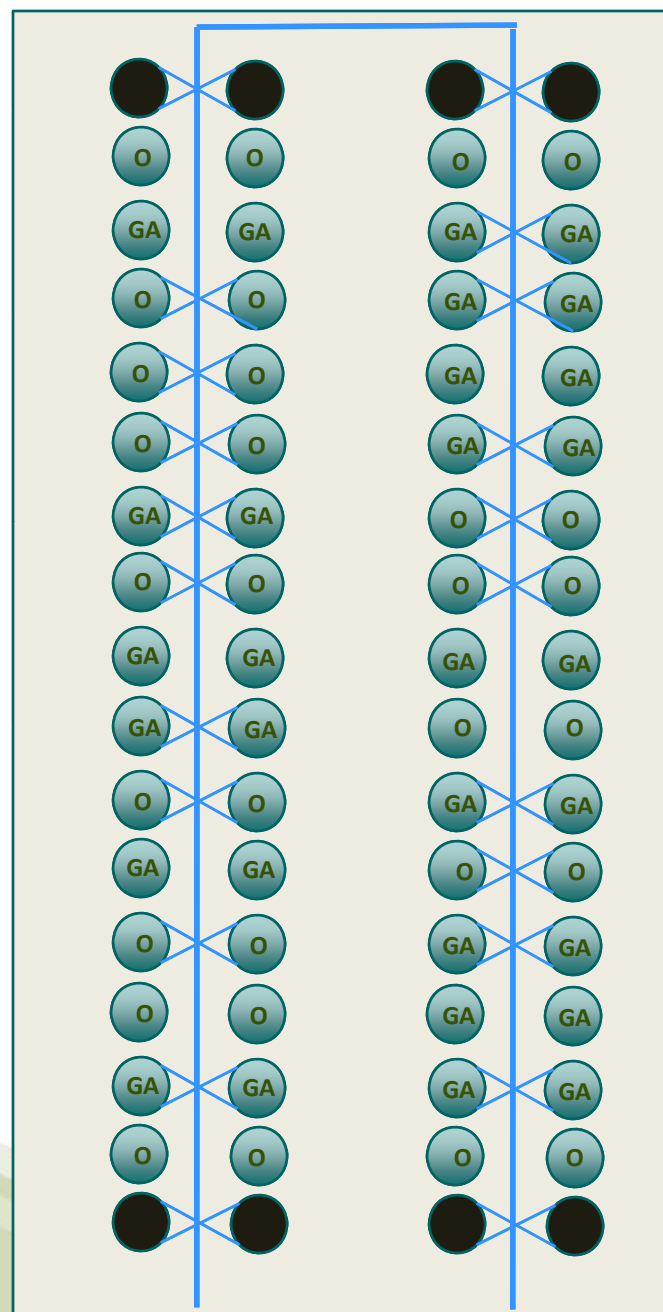


Water limitation

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

-14 days

-7 days

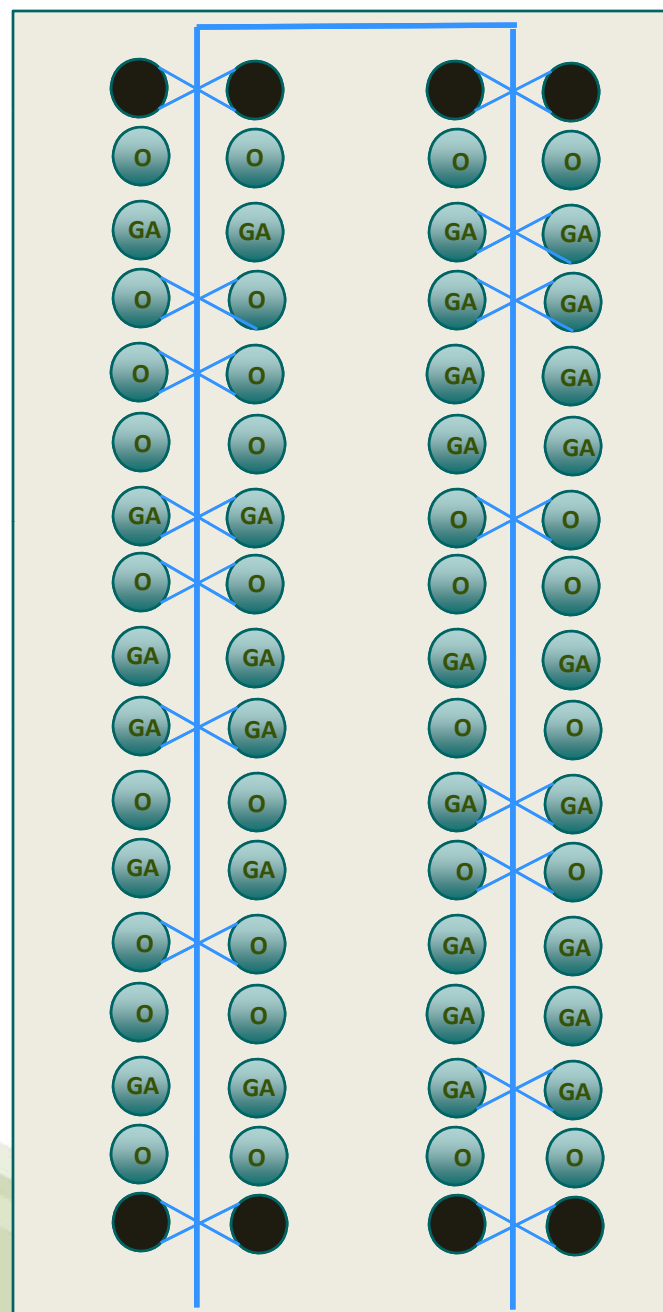


The James
Hutton
Institute

Water limitation

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

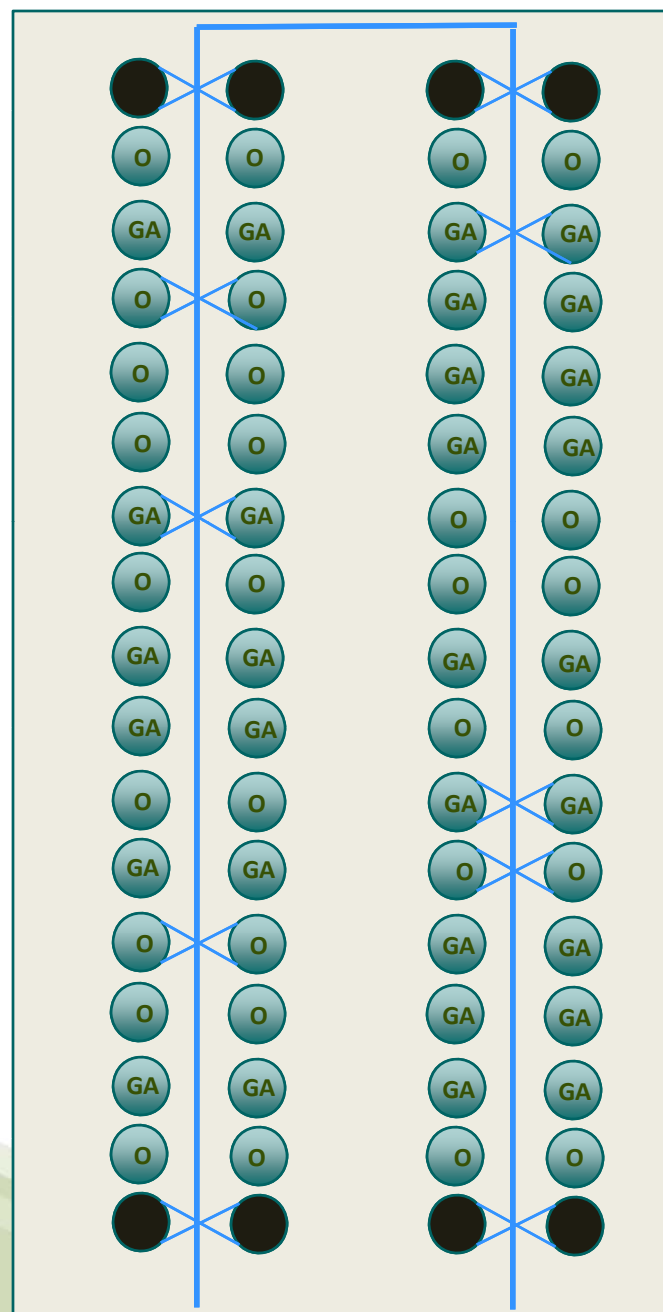
- 14 days
- 7 days
- 3 days



Water limitation

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

- 14 days
- 7 days
- 3 days
- 24 hours

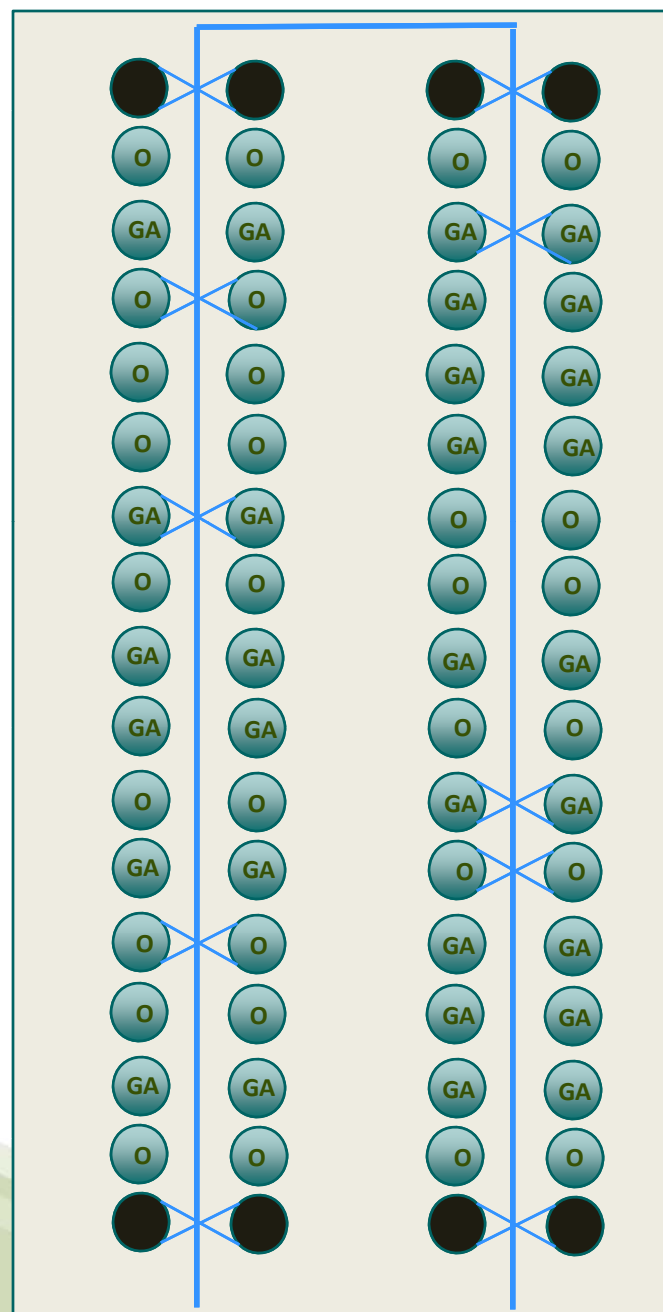


The James
Hutton
Institute

Water limitation

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

- 14 days
- 7 days
- 3 days
- 24 hours
- control

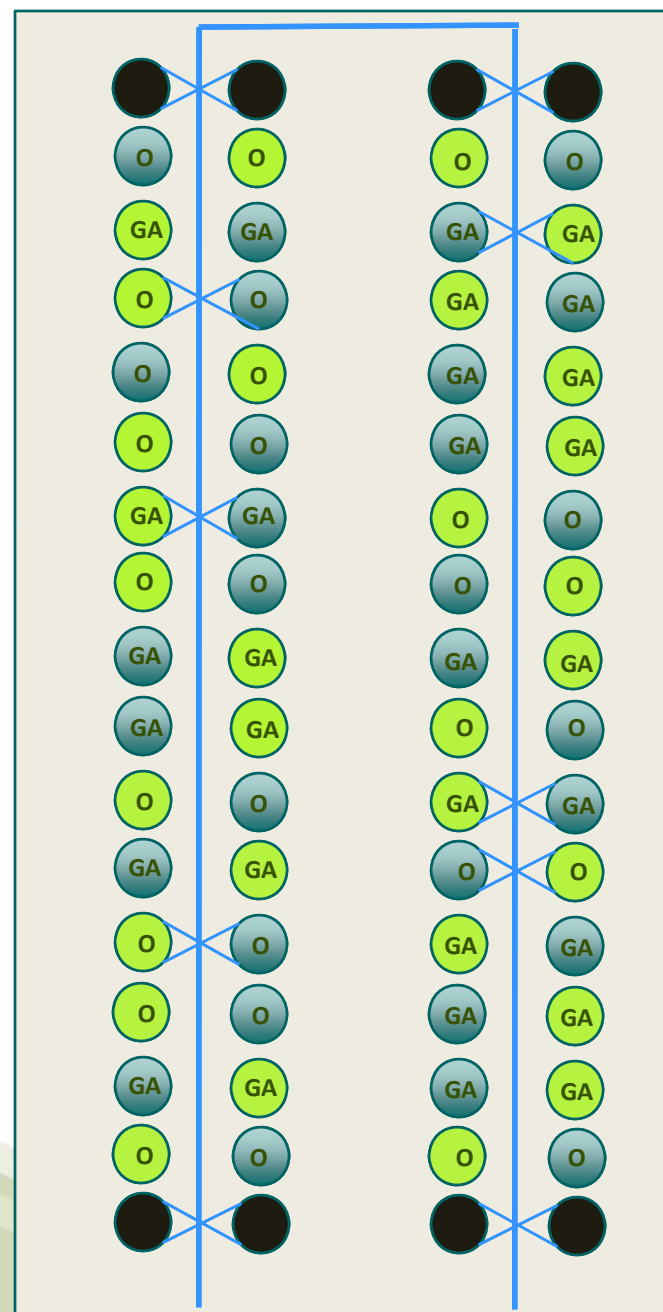


Water limitation

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

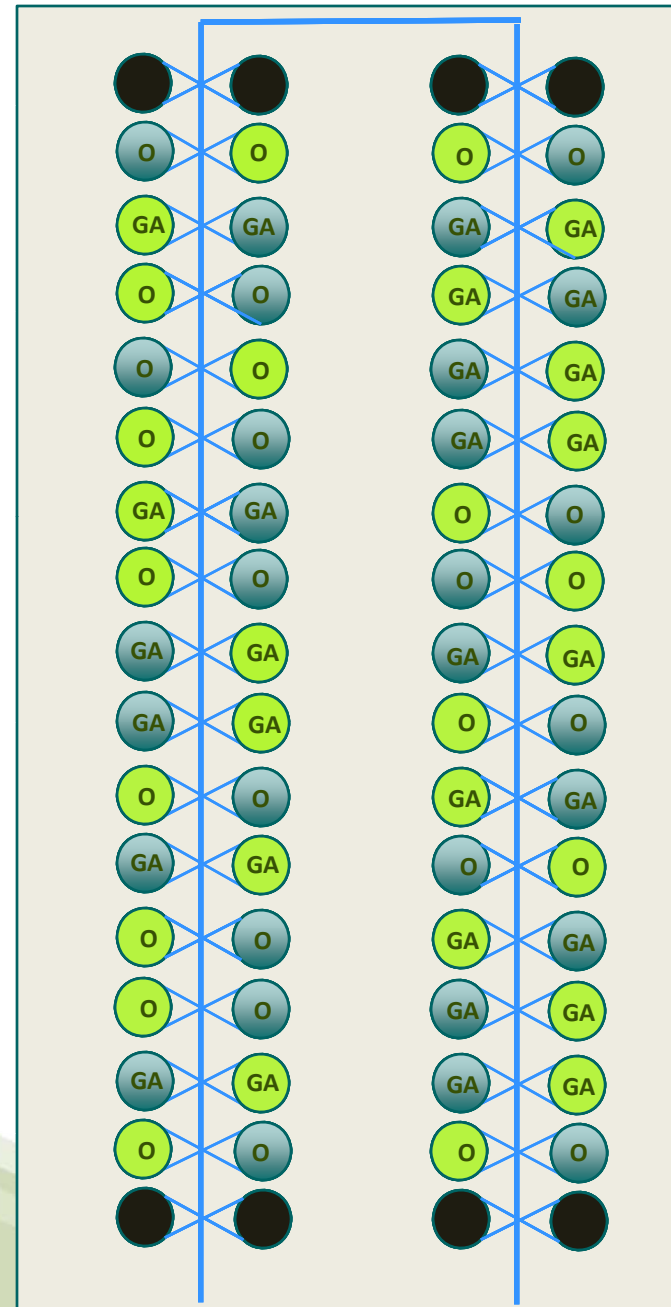
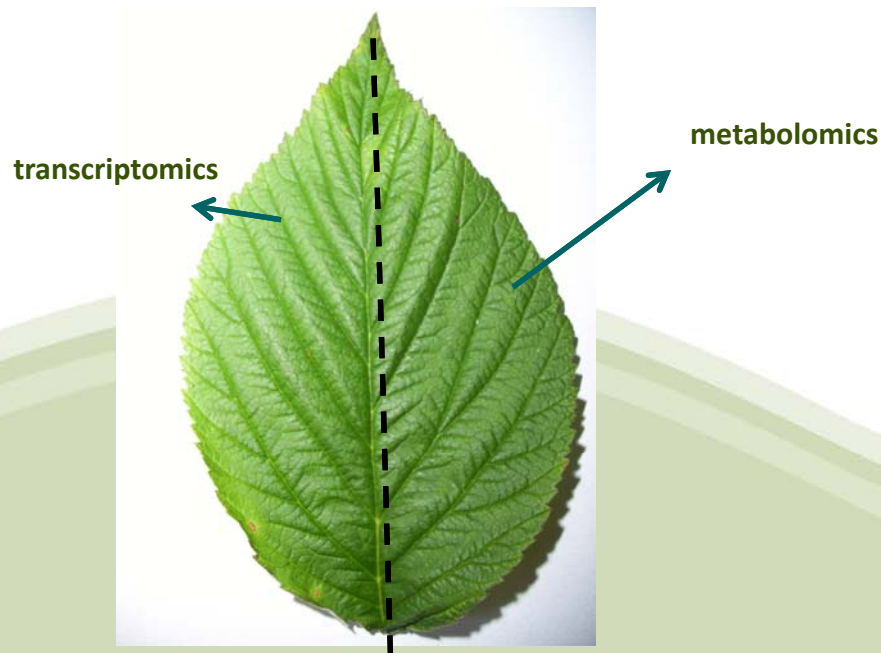
- 14 days
- 7 days
- 3 days
- 24 hours
- Control

Sampled plants



Water Limitation

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



Water limitation

Glen Ample



control



24h



3d

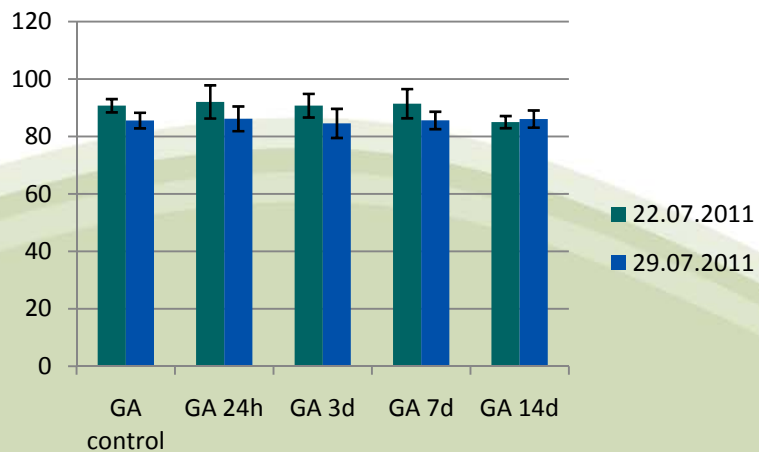


7d

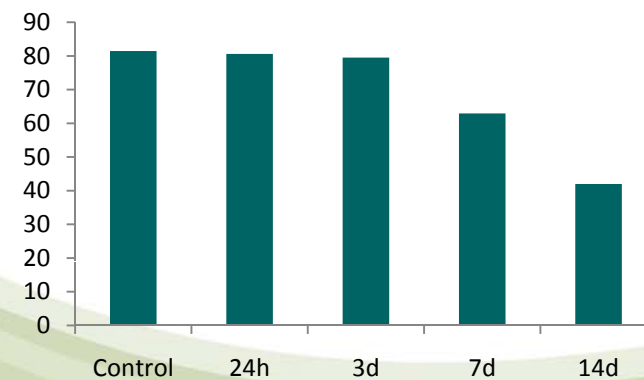


14d

Relative water content (leaf)



Soil water content (3-7cm)



Water limitation

Octavia



control



24h



3d

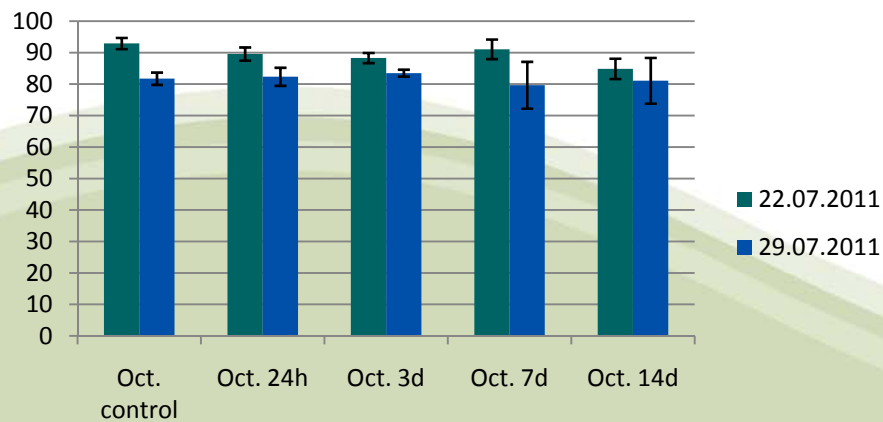


7d

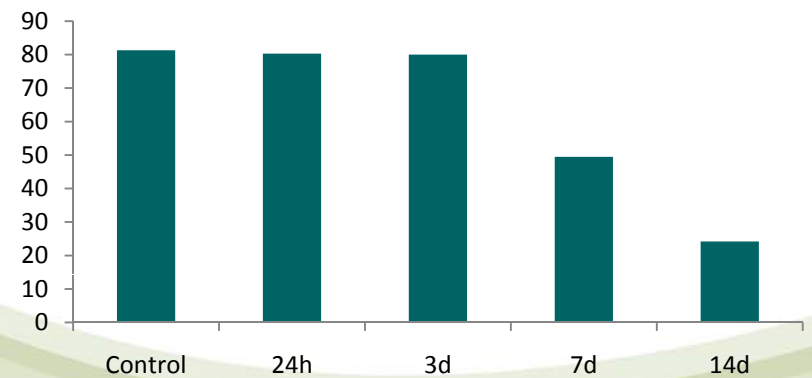


14d

Relative water content



Soil water content (3-7cm)



Long-term increased water supply

- Established a field experiment using 2 cultivars (Glen Ample and Octavia), 2 soil treatments, and 3 different water regimes
- Water regimes will be based on climate change model predictions provided by James Sample (James Hutton Institute, Aberdeen) and historical data from Invergowrie for precipitation and evapotranspiration

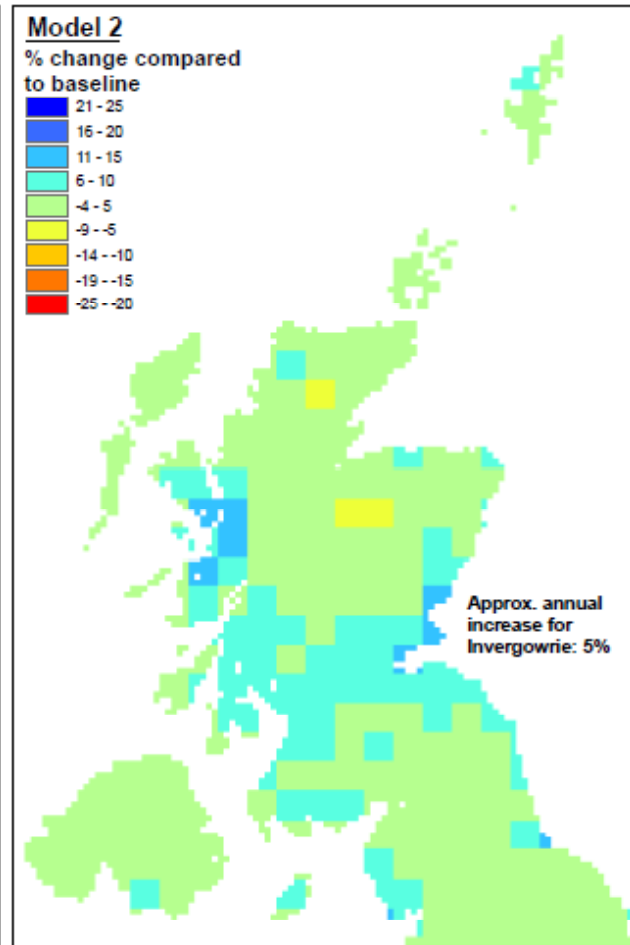
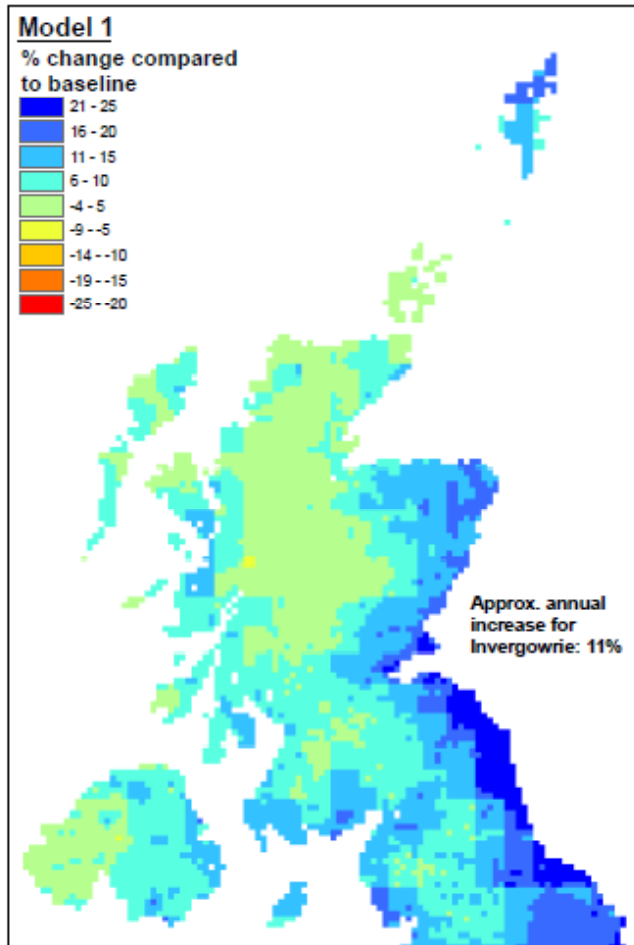
$$IV = HP \times PM - HET \times ETM$$

IV –Irrigation volume
HP – Historical precipitation
PM- predicted precipitation modifier
HET – Historical evapotranspiration
ETM- Predicted evapotranspiration modifier



The James
Hutton
Institute

Precipitation: annual averages 2050



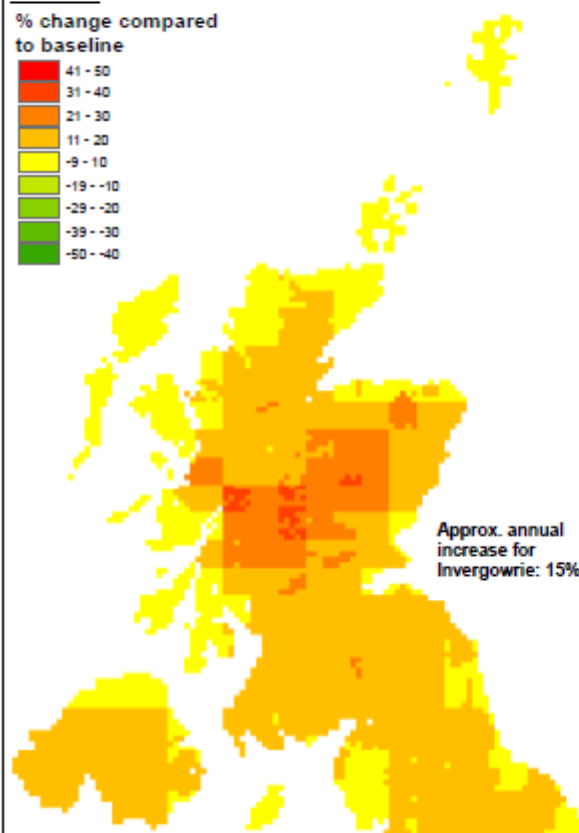
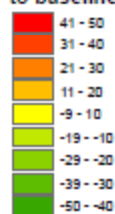


The James
Hutton
Institute

Evapotranspiration Annual averages 2050

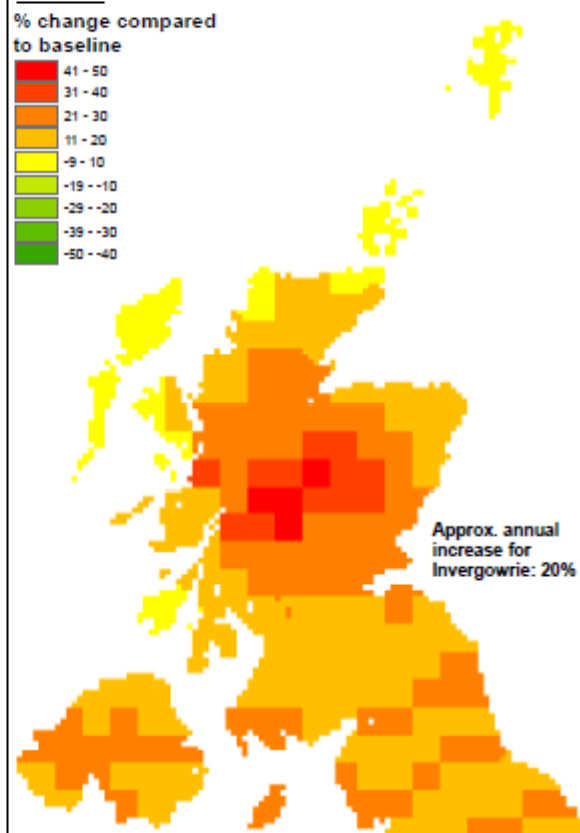
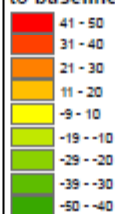
Model 1

% change compared
to baseline



Model 2

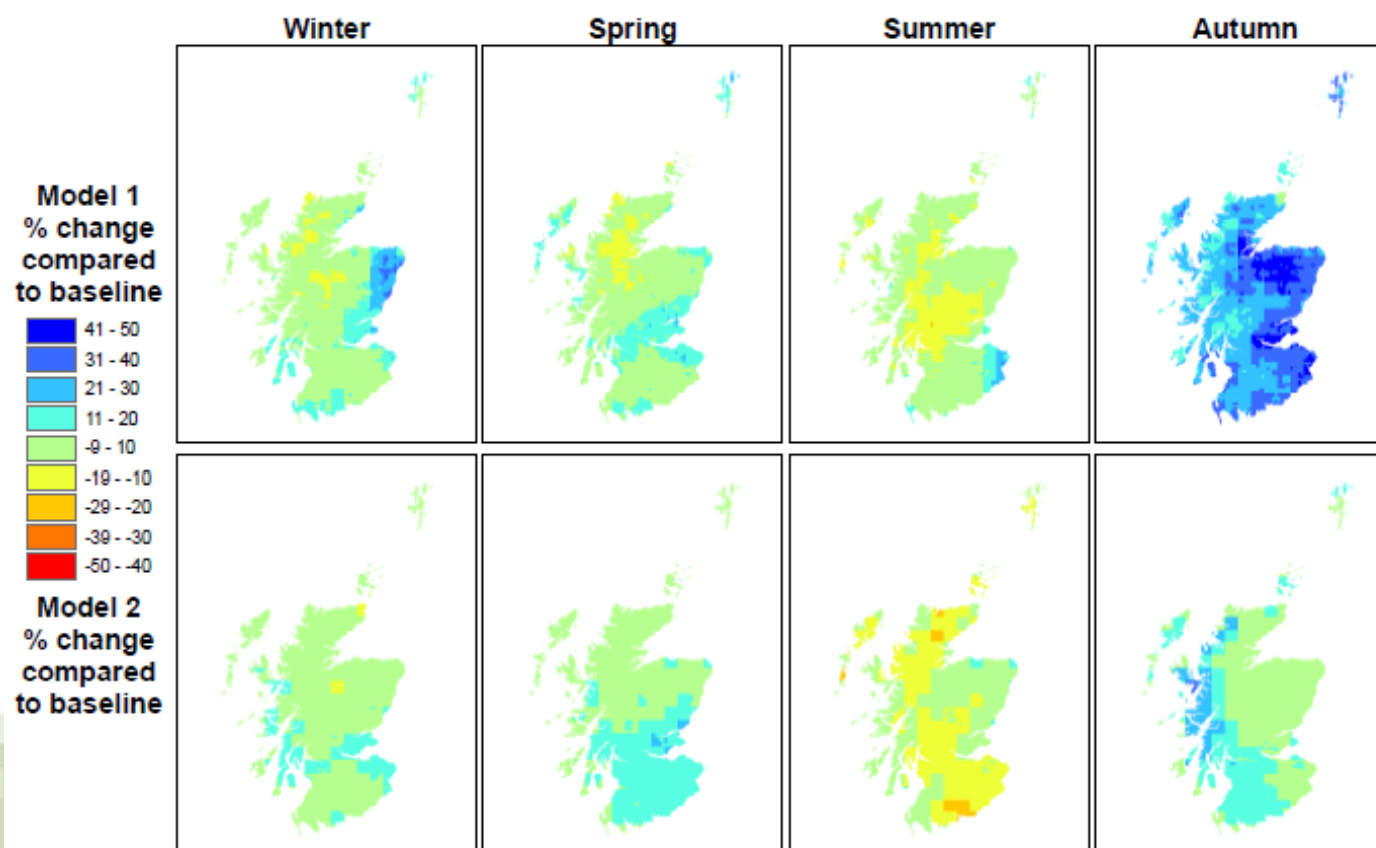
% change compared
to baseline





The James
Hutton
Institute

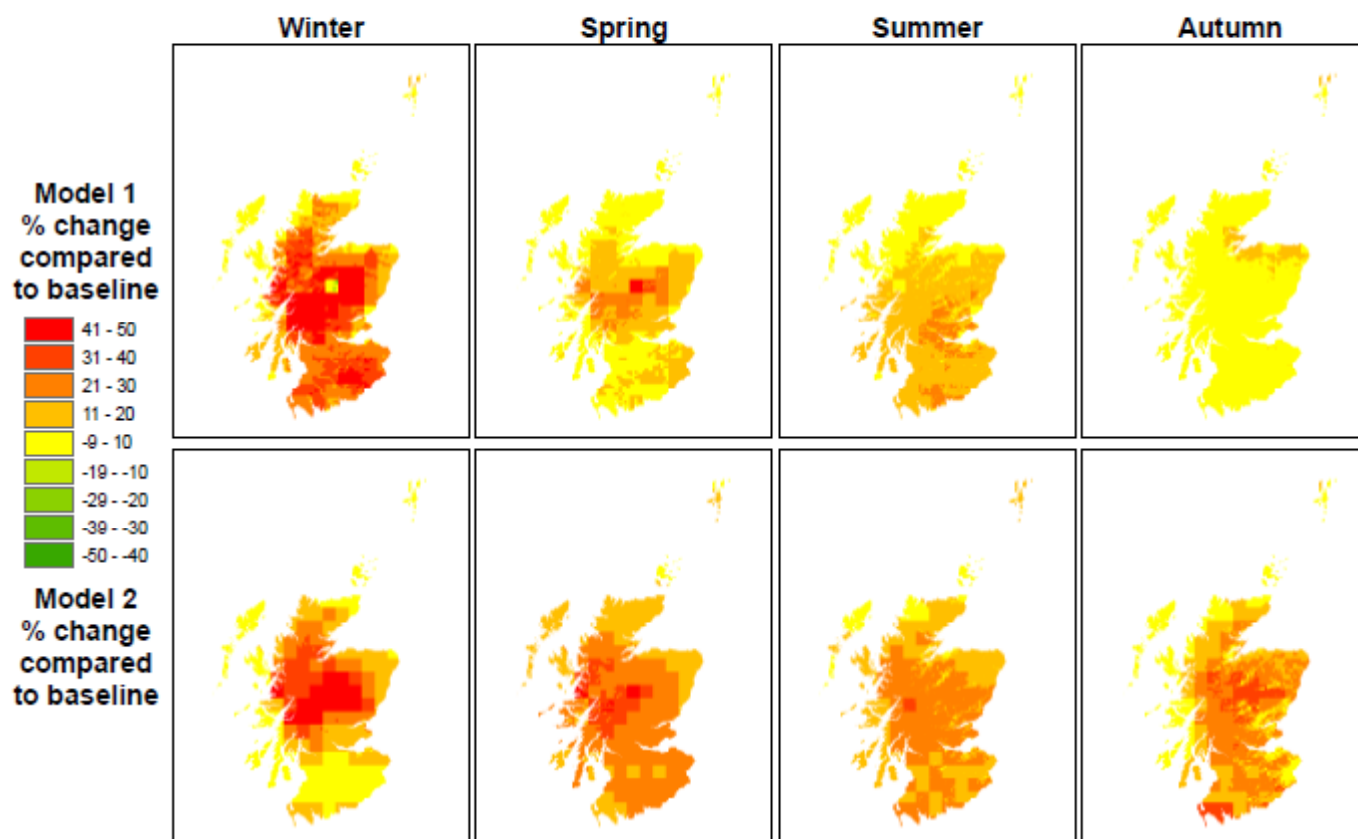
Precipitation 2050





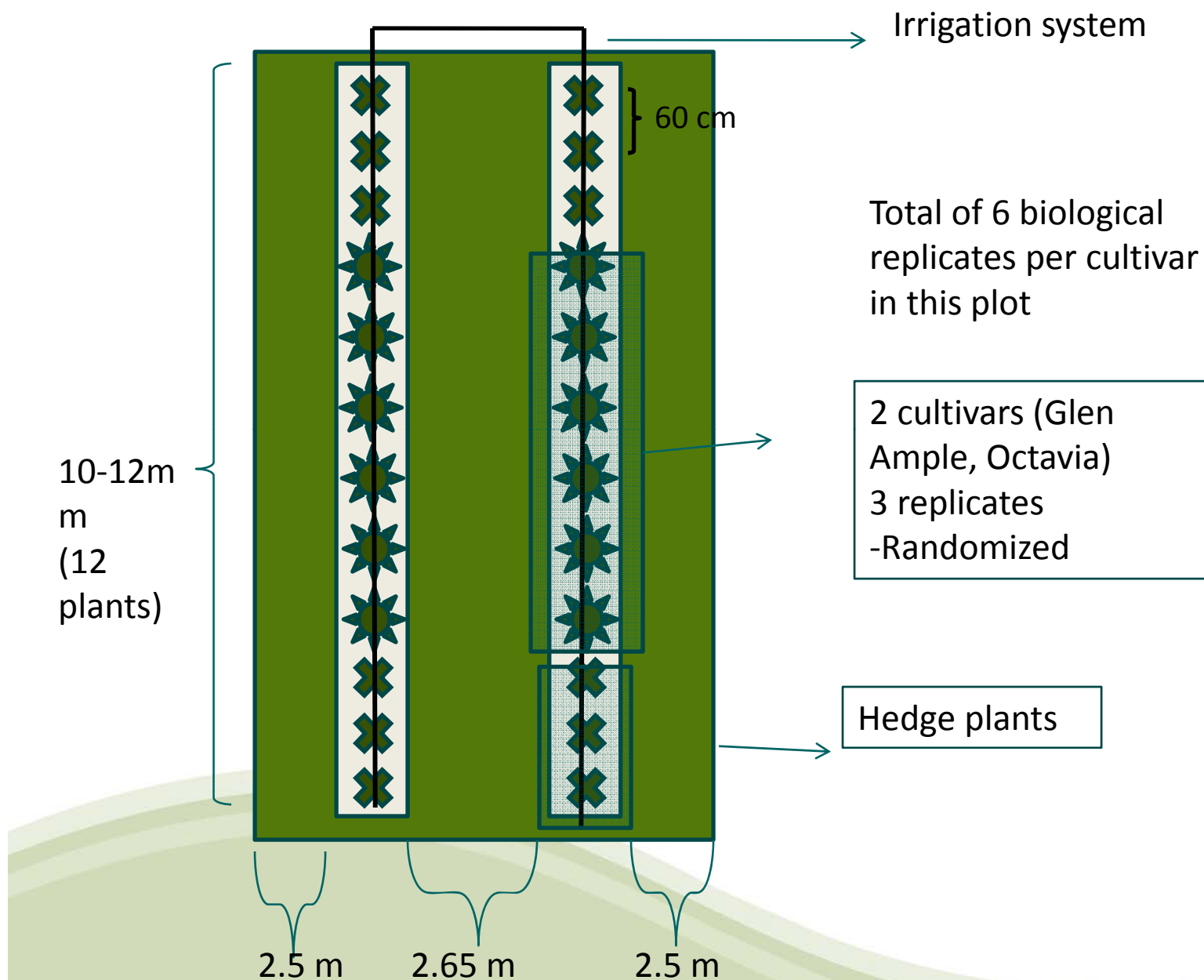
The James
Hutton
Institute

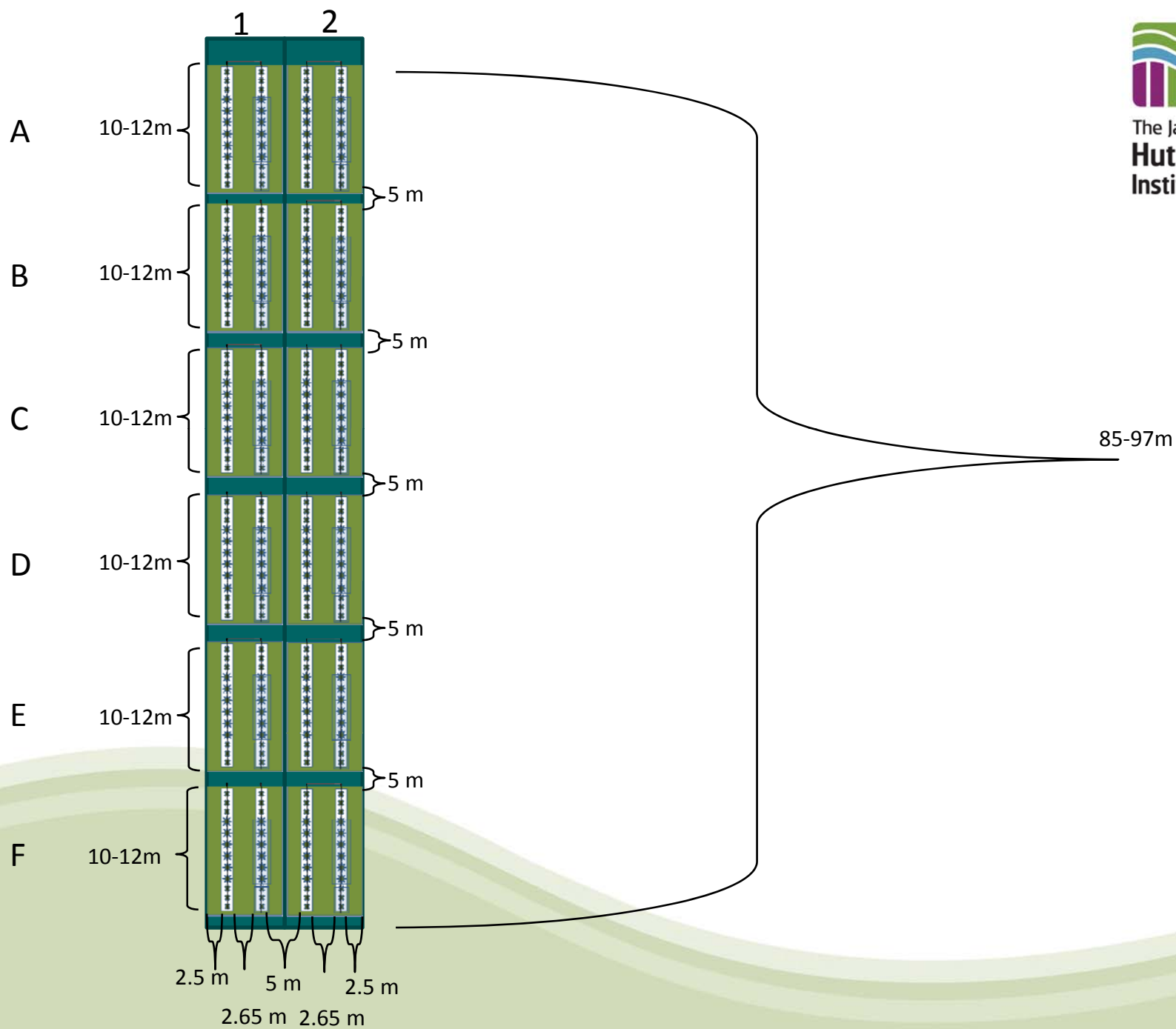
Evapo-transpiration 2050



Long-term increased water supply

- Irrigation volumes calculated in 2 week intervals
- Irrigation regimes over 2 weeks period:
 - Control (ie: no additional water supplied)
 - Intense irrigation (1 x irrigation event = IV)
 - Spread irrigation (6 x irrigation events = IV/6)
- Treatments will begin at dormancy break and will finish when tunnels are covered





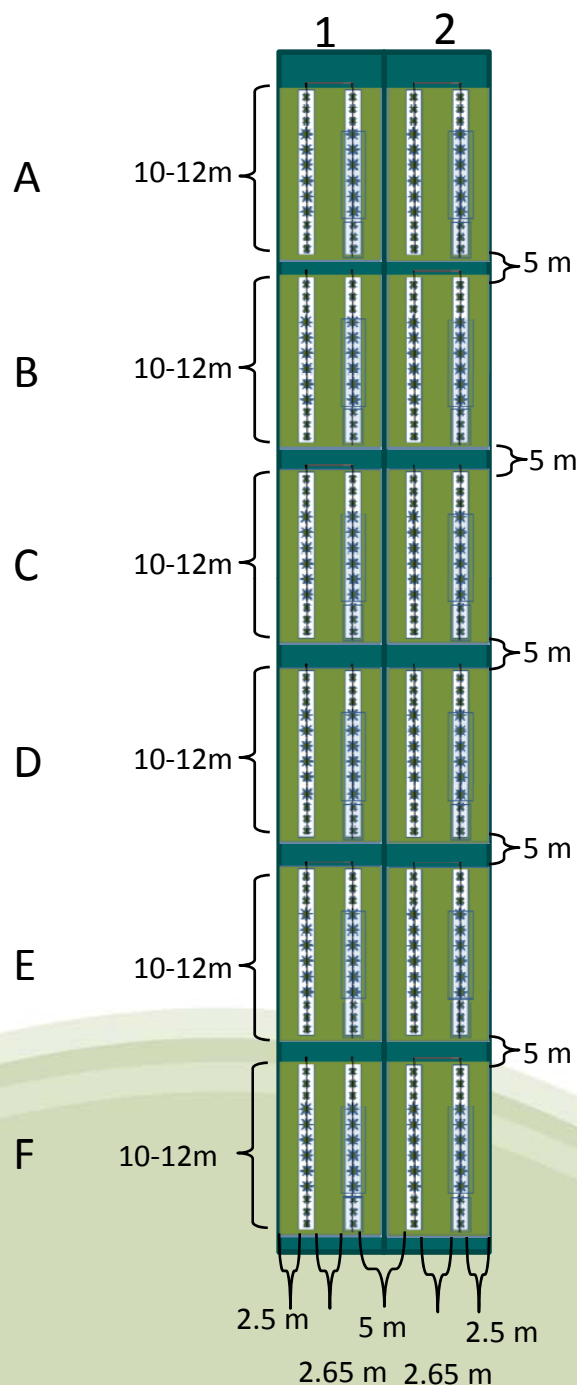
Treatments and randomization:

Polytunnel 1:

- A- Soil2/ standard water
- B- Soil1/ Standard water
- C- Soil 2/ Water treatment 2
- D- Soil 2/water treatment 1
- E- Soil 1/water treatment 2
- F- Soil 1/ Water treatment1

Polytunnel 2:

- A- Soil2/ standard water
- B- Soil1/ Standard water
- C- Soil 2/ Water treatment 2
- D- Soil 2/water treatment 1
- E- Soil 1/water treatment 2
- F- Soil 1/ Water treatment1





23.03.2011



14.09.2011

Future experiments

- Repeat drought experiment in pots (single cane per pot)
- Set up a new long-term pot experiment in which plants may experience stress period (14 days) at different stages of their development (primocane growth, florican growth and during fruiting) to test whether a drought event affects a subsequent response to drought and whether those effects can be seen in fruit quality.
- Add primocane fruiting cultivars to the long term field experiment