Response of two *Anthurium andreanum* genotypes to elevated CO$_2$ concentration

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Purpose of the experiment

- To evaluate if the cost of continuous CO₂ supply in commercial Anthurium cultivation can be paid back by extra production and/or improved flower quality
CO₂ enrichment not a year round practice in commercial Anthurium cultivation in The NL
mostly related to heat demand in the greenhouse
efforts in energy saving lead to less heating = less CO₂ supply
For continuous supply, CO₂ needs to be sourced additionally
Experimental design

- 3 CO$_2$ levels, each level in 2 compartments
  - No enrichment - outside concentration
  - 500 ppm – enrichment with a maximum of 150 kg/ha.hour
  - 800 ppm – enrichment with a maximum of 300 kg/ha.hour
Experimental design

- 2 genotypes
  - Tropical (red)
  - Midori (green)
- Experimental period: January 2010 till January 2011
- Plant density 18 pl / m²
- Substrate: oasis
- Watering: eb/flow
- Plants productive at start
Measurement plan

- **Production and quality**
  - Number of flowers, flower fresh weight, stem length, flower diameter
  - Dry matter (4 x)
  - Generation time (time from harvest flower 1 to harvest flower 2)

- Supplied CO$_2$

- Photosynthesis (3 x)
Dry matter percentage shows the same trend as flower diameter and stem length.
**Results: plant growth**

- In increase % compared to the ambient level

<table>
<thead>
<tr>
<th>CO₂ level</th>
<th>Parameter</th>
<th>‘Midori’</th>
<th>‘Tropical’</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 ppm</td>
<td>Number of flowers</td>
<td>+ 4%</td>
<td>+ 0.9% (ns)</td>
</tr>
<tr>
<td></td>
<td>Avg. flower weight (f)</td>
<td>+ 2.6% (ns)</td>
<td>+ 6%</td>
</tr>
<tr>
<td></td>
<td>Flower diameter</td>
<td>+ 0.3 cm (ns)</td>
<td>+ 0.6 cm</td>
</tr>
<tr>
<td></td>
<td>Stem length</td>
<td>+ 1.5 cm (ns)</td>
<td>+ 3.4 cm</td>
</tr>
<tr>
<td>800 ppm</td>
<td>Number of flowers</td>
<td>+ 10%</td>
<td>+ 1.6% (ns)</td>
</tr>
<tr>
<td></td>
<td>Avg. flower weight (f)</td>
<td>+ 22.5%</td>
<td>+ 11%</td>
</tr>
<tr>
<td></td>
<td>Flower diameter</td>
<td>+ 1.5 cm</td>
<td>+ 0.9 cm</td>
</tr>
<tr>
<td></td>
<td>Stem length</td>
<td>+ 4.1 cm</td>
<td>+ 4.7 cm</td>
</tr>
</tbody>
</table>
Results

- CO$_2$ enrichment increases the number of flowers of higher diameter class.
Results: economic evaluation

- CO₂ enrichment of ‘Tropical’ leads to better flower prices
  - flowers > diametres are better paid, also in the 3\textsuperscript{rd} quarter (no heat demand)
Better prices pay the investment in CO\(_2\) back in Tropical

- Independently of CO\(_2\) source, calculated for the most expensive source

<table>
<thead>
<tr>
<th></th>
<th>Production</th>
<th>Income</th>
<th>Extra income</th>
<th>Costs CO(_2)</th>
<th>benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flowers/m(^2)</td>
<td>€/m(^2)</td>
<td>€/m(^2)</td>
<td>€/m(^2)</td>
<td>€/m(^2)</td>
</tr>
<tr>
<td>No CO(_2)</td>
<td>106.7</td>
<td>37.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 ppm</td>
<td>107.7</td>
<td>40.60</td>
<td>2.83</td>
<td>0.80</td>
<td>2.03</td>
</tr>
<tr>
<td>800 ppm</td>
<td>108.4</td>
<td>41.51</td>
<td>3.73</td>
<td>1.69</td>
<td>2.04</td>
</tr>
</tbody>
</table>
Results: fotosynthesis

- Extra growth Midori result of increased net Photosynthesis at 800 ppm (compared to no enrichment)
  - More fotosynthesis at higher light intensities
Results: light in greenhouse

- Light intensity in greenhouse limited by whitewash and screens

April:
- [graph showing light intensity for April]
  - 200 µmol/m²s

July:
- [graph showing light intensity for July]
  - 200 µmol/m²s
Conclusions

- CO$_2$ enrichment increases growth in both cultivars (more flowers, higher fw & dw, higher flower quality)
- ‘Midori’ is more responsive to CO$_2$ enrichment than ‘Tropical’
- For ‘Tropical’ enrichment with 500 ppm is sufficient, further enrichment till 800 ppm does not improve significantly
- For ‘Midori’ is enrichment with 500 ppm insufficient, significant growth effects are obtained with 800 ppm
- Improvement of results might be possible if more light is allowed
- The cost of CO$_2$ enrichment with 800 ppm is paid back for both varieties by the improved production (‘Midori’) and quality (‘Tropical’). 500 ppm is economically feasible for ‘Tropical’, provided a better price is paid for the bigger diametres.
Thanks for your attention!

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