WAGENINGEN UNIVERSITY
PLANT SCIENCES

Effect of high relative air humidity during cultivation on the water uptake components of cut roses

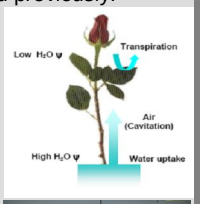
Dimitrios Fanourakis[1], Susana M.P. Carvalho[1,2], Habtamu Gebraeqziabher[1] , Wim van Ieperen[1], Ep Heuvelink[1]

Introduction

It is generally accepted that the negative effects of high relative air humidity (RH > 85%) during cultivation on vase life of cut flowers are largely mediated via water relations. However, the effect of high RH on water uptake components has not been studied previously.

Aims

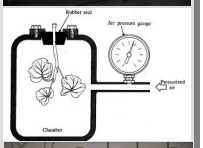
To evaluate the high RH effect on water uptake components: (1) the leaf water potential (driving force for water uptake), and (2) the conductivity of the transport path (stem and leaf).



Material and methods

Cut rose cultivar 'Prophyta' grown at two RH levels: moderate (60%) and high (90%).

- WATER RELATIONS (CULTIVATION):
- Daily total plant transpiration rate for 5d;
- Leaf water potential at 3, 6 & 9h after the lights were on (n=8).

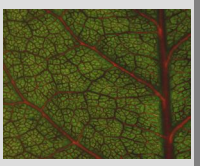


- LEAF WATER POTENTIAL (Leaf Ψ):
- Re-hydrated leaves were allowed to dry for 4h;
- The balance pressure (-Ψ) was measured in time with a pressure chamber (n≥7).

- STEM HYDRAULIC CONDUCTIVITY (C_S) & EMBOLIZATION TREATMENT:
- Solution was pulled through the stem segment using a vacuum pump, while measuring flow rates:

Stem hydraulic conductivity (C_S) = conductance/ stem length
(mmol m s^{-1} MPa^{-1})

- Stem under tension was left to aspire air for 3min;
- Stem segments were returned to the solution and the recovery was assessed for 2.5h (n≥7).



- LEAF HYDRAULIC CONDUCTIVITY (C_L):
- Solution was pulled through the leaf using a vacuum pump, while measuring flow rates:

Leaf hydraulic conductivity (C_L)= conductance/ leaf area
(mmol m^{-2} s^{-1} MPa^{-1})

- This method is independent from the stomatal component (n=8).

Results

Plant water relations during cultivation

- Total plant transpiration rate was reduced by a factor of 2.9 (Fig. 1A);
- Leaf Ψ was significantly lower (35-51%) throughout the light period (Fig. 1B).

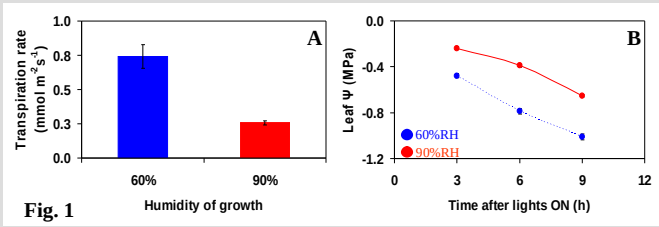


Fig. 1

Leaf water potential and stomatal hydro-sensitivity

- Leaf Ψ was lower (less negative) in leaves grown at high RH for a wide range of RWC (0.02-0.18 MPa, 1-12%) (Fig. 2A);
- Stomatal closure took place at the same leaf Ψ (-1.67 MPa) for both RH levels (Fig. 2B);
- After this threshold value, stomata in moderate RH leaves were significantly more hydro-sensitive (Fig. 2B).

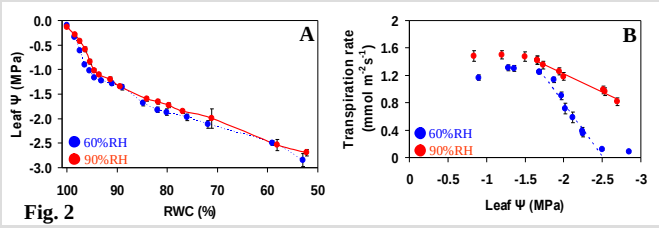


Fig. 2

Stem and leaf hydraulic conductivity

- C_S and the recovery from air emboli were not affected by the RH level during growth (Fig 3A);
- High RH leaves had 54% higher conductivity (Fig 3B).

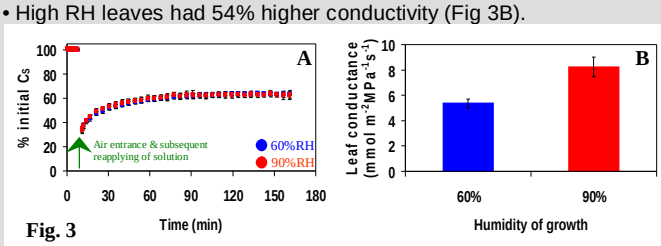


Fig. 3

Conclusions

1) High RH plants are subjected to abnormally high water status;
2) Leaf Ψ sensitivity to changes in RWC was reduced in leaves developed at high RH;
3) Stomatal sensitivity to leaf Ψ was strongly impaired in leaves developed at high RH;
4) C_L was considerably higher, which in combination with conditions (2) & (3), may lead to leaf exposure to very low (damaging) Ψ values under conditions of high evaporative demand;
5) In contrast, xylem properties were not affected by the RH level of growth.

[1] Horticultural Supply Chains
Plant Sciences - Wageningen University
Droevendaalsesteeg 1 (building no. 107)
6700 AP Wageningen
The Netherlands

dimitrios.fanourakis@wur.nl
http://www.hpc.wur.nl/uk

[2] Portuguese Catholic University
College of Biotechnology
Rua Dr. António Bernardino de Almeida
4200-072 Porto
Portugal

spcarvalho@mail.esb.ucp.pt
http://www.esb.ucp.pt/ects/

WAGENINGEN UR

ESCOLA SUPERIOR DE BIOTECNOLOGIA
UNIVERSIDADE CATÓLICA PORTUGUESA