

Greening Buildings on the Inside

(prof. dr) Bert van Duijn

bert.vanduijn@fytagoras.com

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AIPH



PADOVA • ITALY

INTERNATIONAL EXHIBITION
OF HORTICULTURE
LANDSCAPE ARCHITECTURE
AND GREEN INFRASTRUCTURES

Greening Buildings on the Inside

GREEN



Not just beautiful

The effects of plants on your living environment (and **on yourself**)

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Sponsored and inspired by:



Albert Haasnoot, RFH



Universiteit Leiden

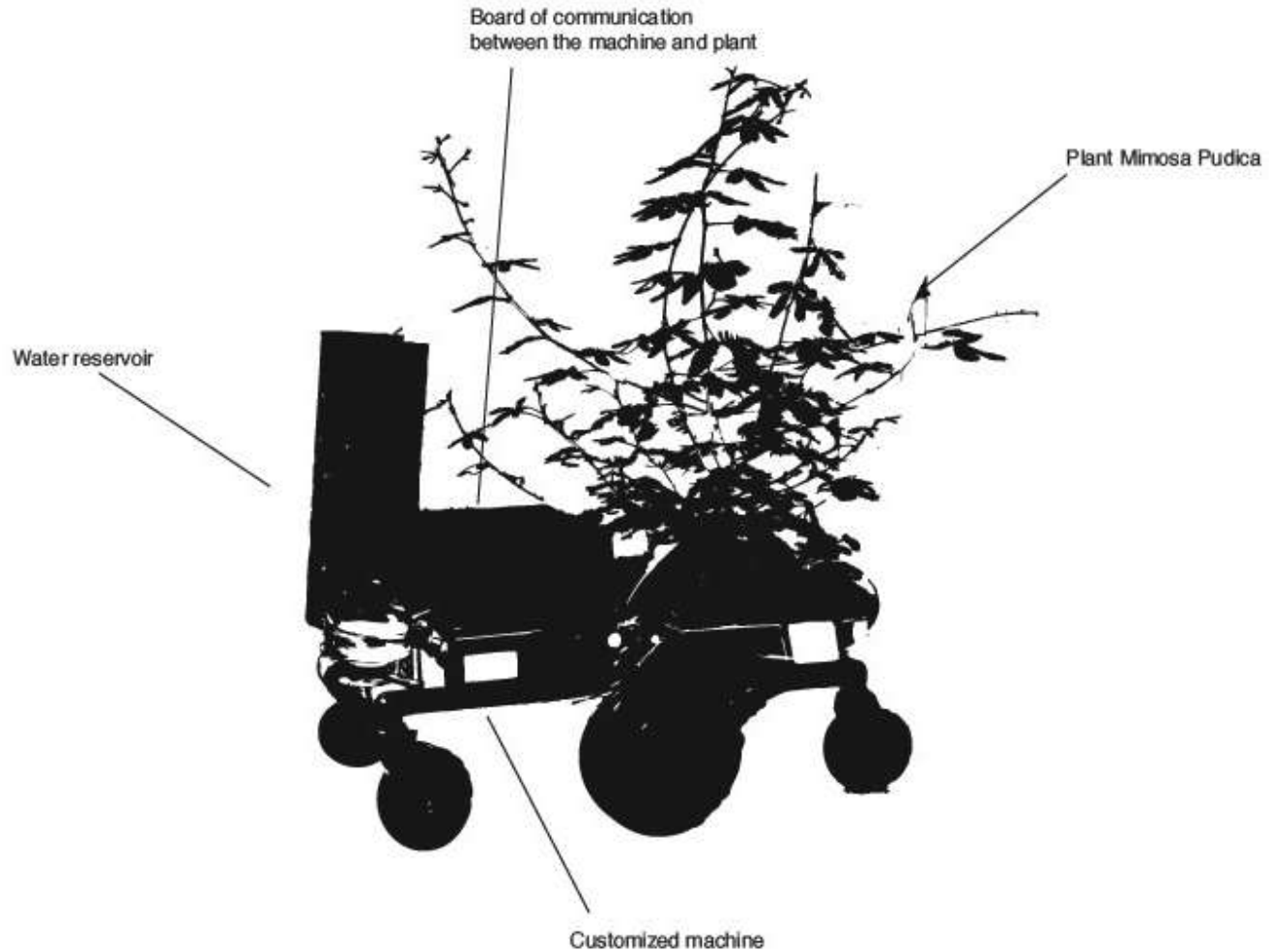


Plants and their reaction to the environment

“Imagine if we could communicate with plants and work together. Is it possible to reshape and redefine our tools to be coherent with the environment? Would we keep on destroying the few existent plants/animals and forests?”

(Ivan Henriques, artist from Brazil
<http://ivanhenriques.com>)

Jurema action plant





“Healthy” aspects of plants in the living, work and education environment

- Effects on the indoor climate: physics parameters, such as relative humidity (RH), CO₂, temperature, sound etc.
- Effects on the presence of harmful chemical compounds (volatiles)
- Effects on well being (subjective experience), health (objective)
- Effects on work/learning performance (objective effects on both creative and standard tasks)
- Effects of education about nature protection, sustainability and nature experience

Effects on the presence of harmful volatile chemicals

Objective, reproducible and discriminating test to measure the air purifying potential of plants.

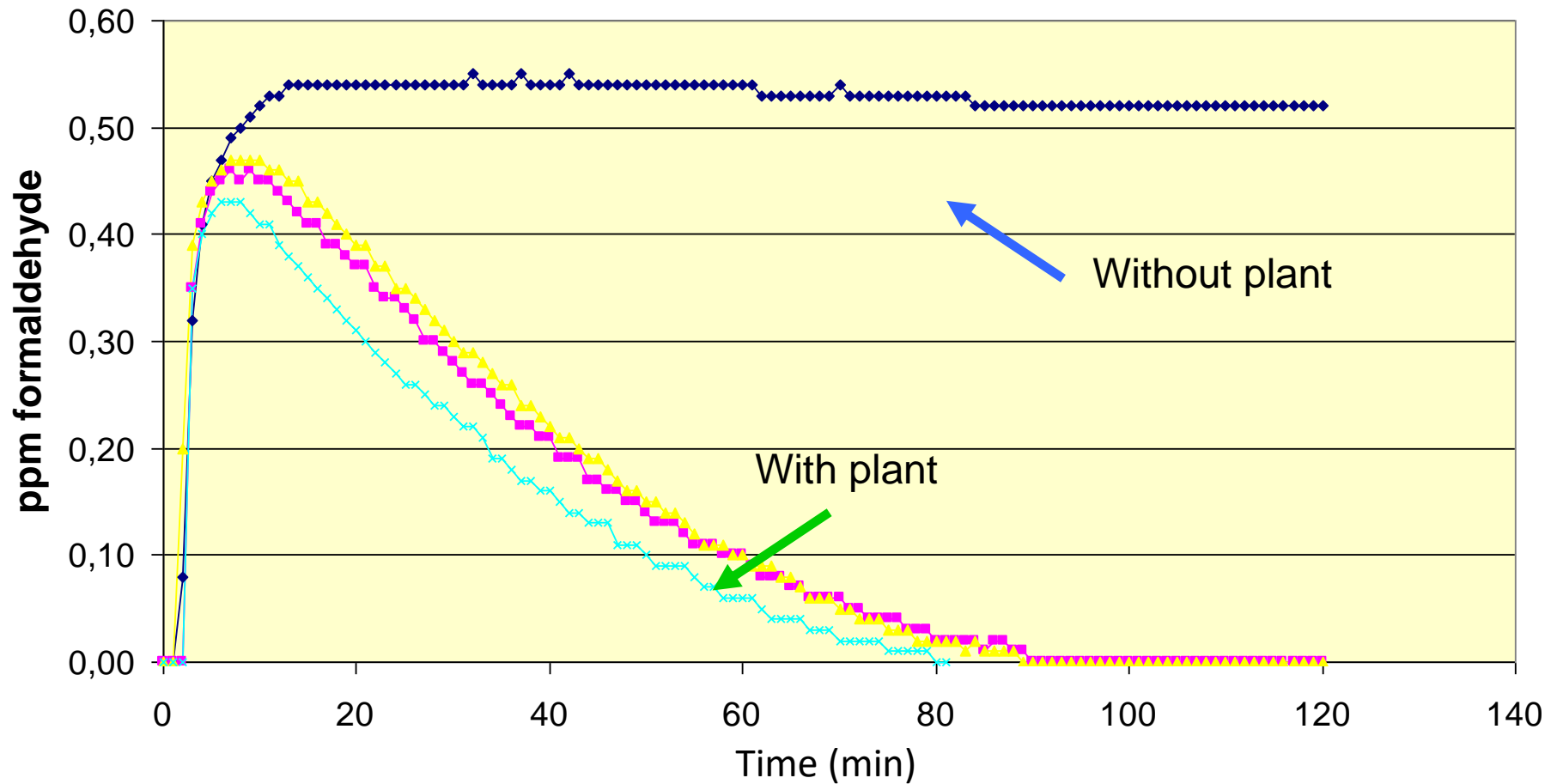
Marker compound: formaldehyde

Basis for standardization

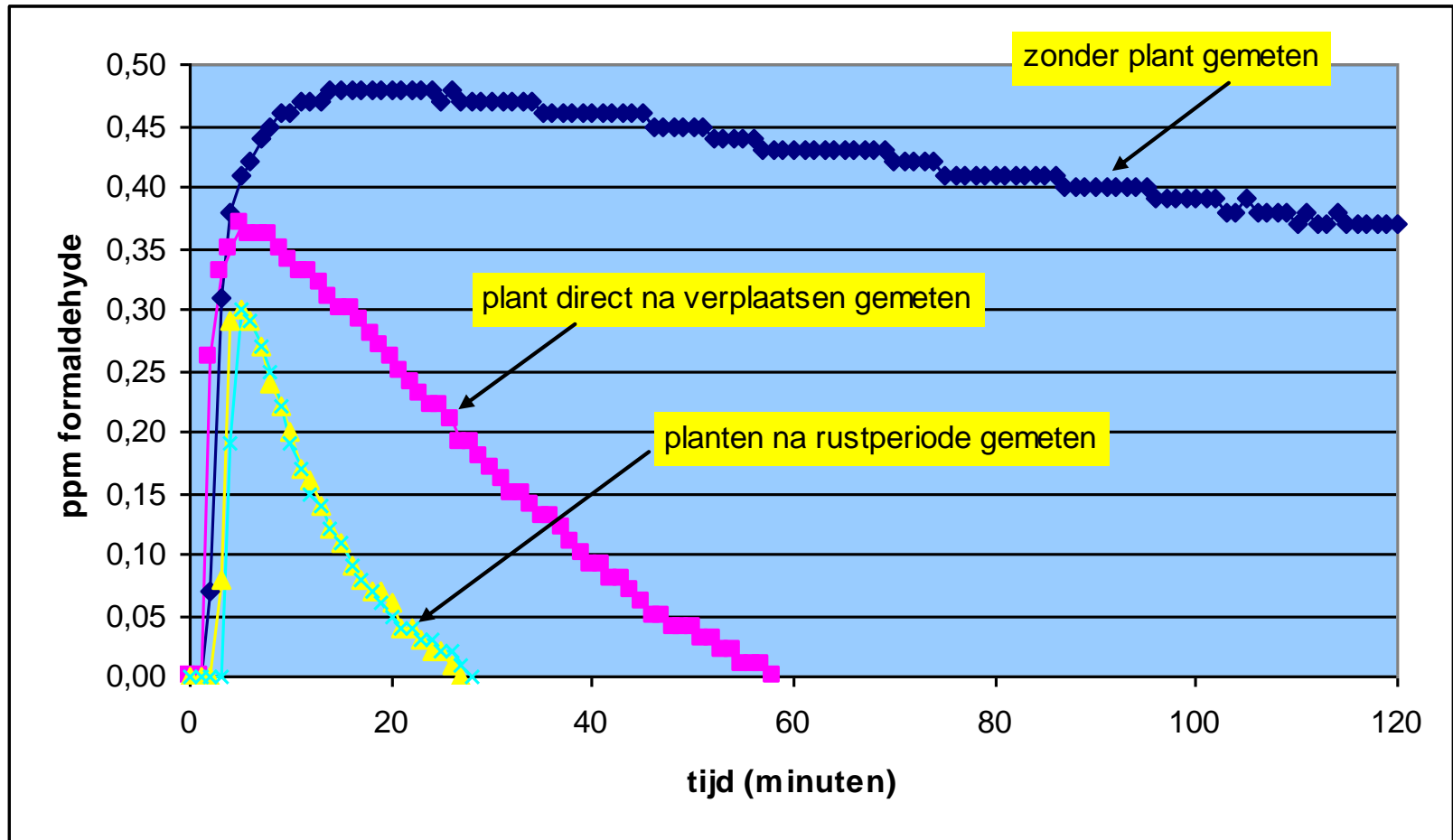
Basis for mechanistic physiological research, breeding and selection



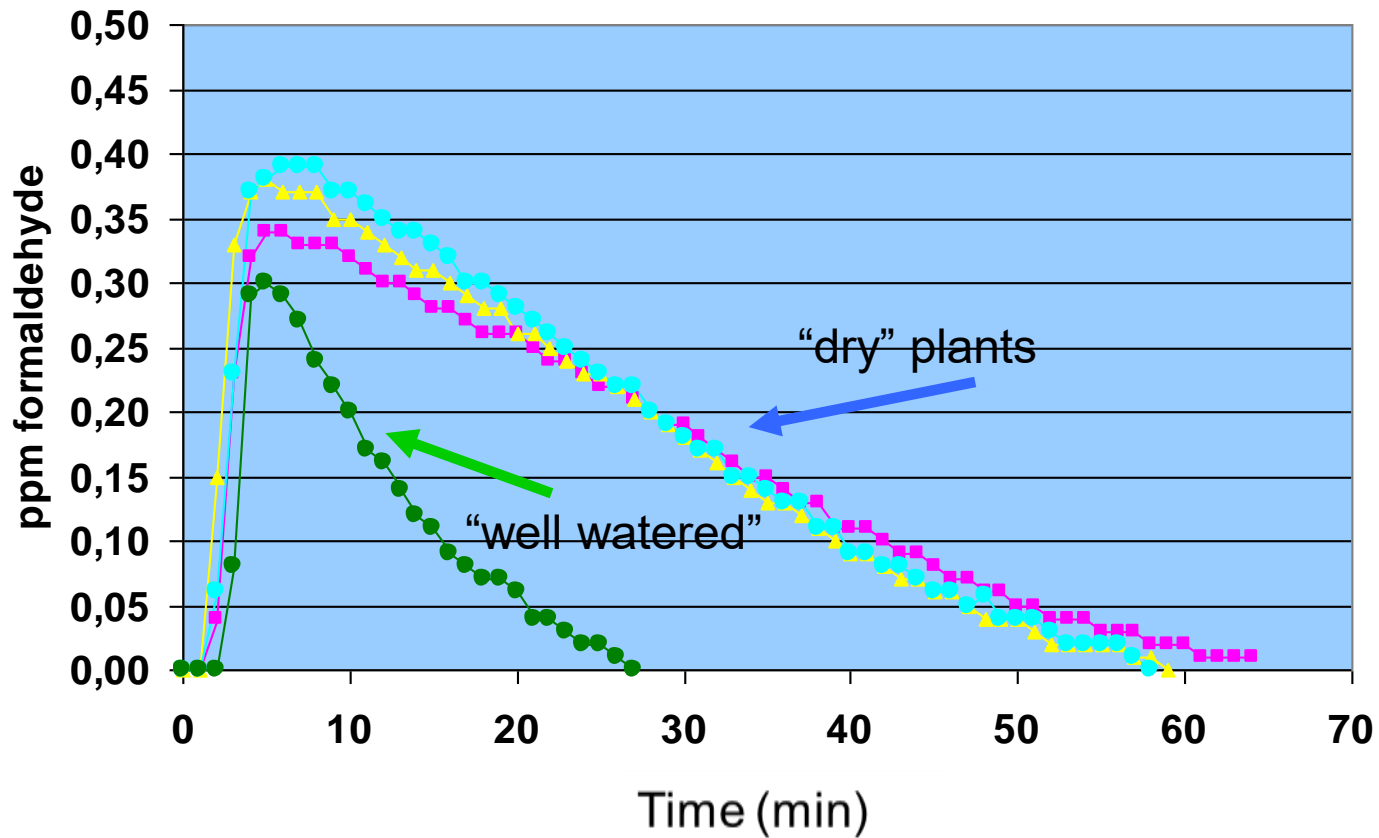
Removal of formaldehyde in the air by plants

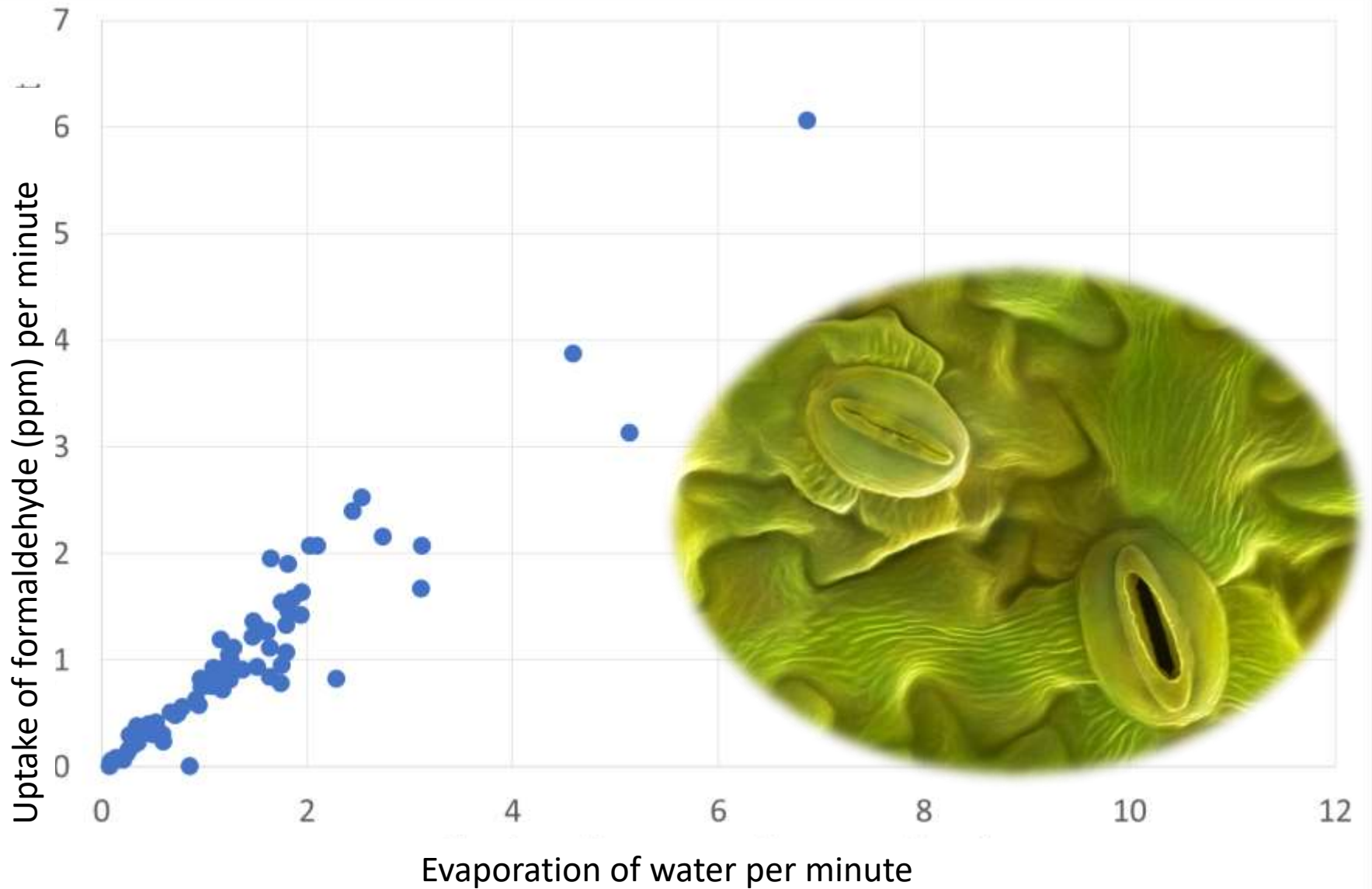


The “sensitive” plant



The “sensitive” plant





Formaldehyde enters via the leaf stomata

Toilet:

The removal of ammonia gas:
Bamboo palm, Spathiphyllum, Anthurium.

Study Room:

Negative ions release and absorb carbon dioxide:
Cactus, Japan fatzia, Rosemary, Leaf philodendron.

Bedroom:

Plants that have function to purify air at night
Moth orchid, Cactus, Succulent plants...

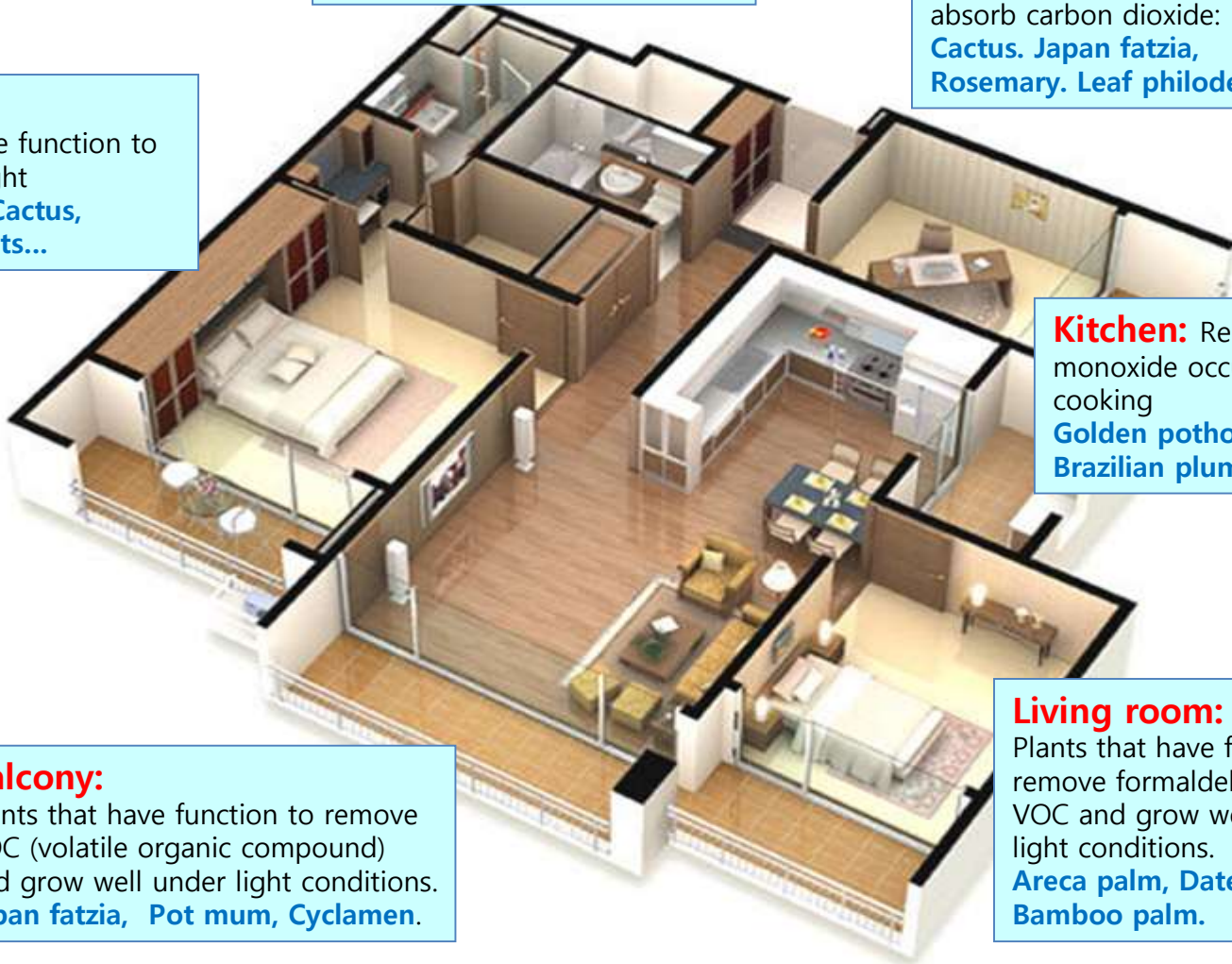
Kitchen: Remove carbon monoxide occurred during cooking
Golden pothos, Tiger Plant, Brazilian plume.

Living room:

Plants that have function to remove formaldehyde and VOC and grow well in low-light conditions.
Areca palm, Date palm, Bamboo palm.

Balcony:

Plants that have function to remove VOC (volatile organic compound) and grow well under light conditions.
Japan fatzia, Pot mum, Cyclamen.



Plants in the living, work and teaching environment

Effects on relative humidity (RH)

Effects on work performance

(objective effects on both creative and standard tasks)

Effects on health



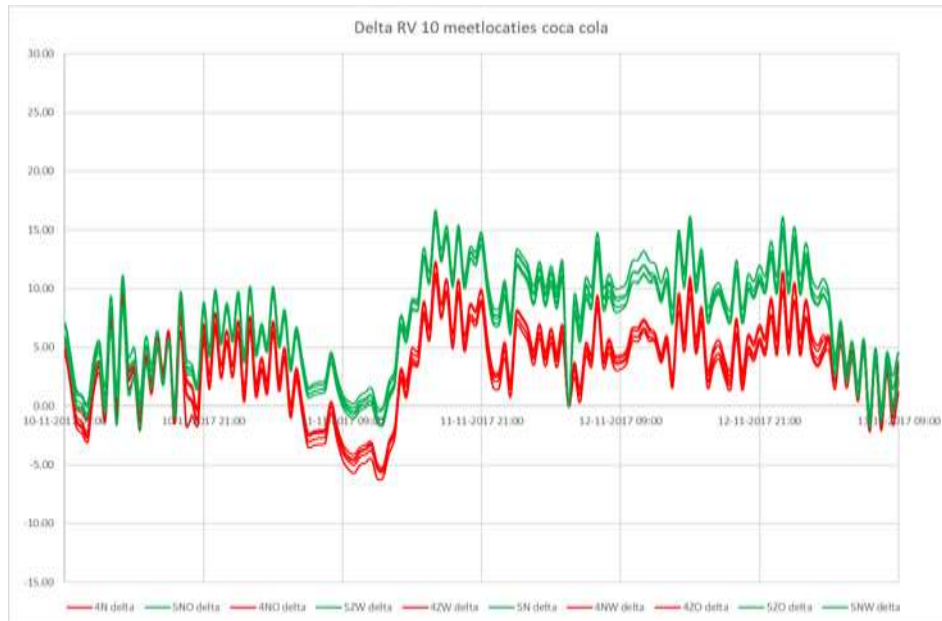
TKI project: Plants for an Excellent Indoor Climate

(<https://www.plantbenefits.nl/>)

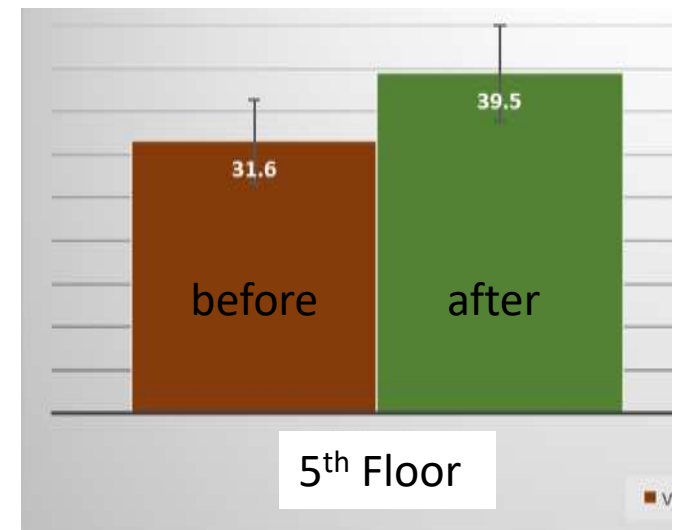
Example: effects on relative air humidity (RH) at



ΔRH (%)



Average RH before and after plants were applied



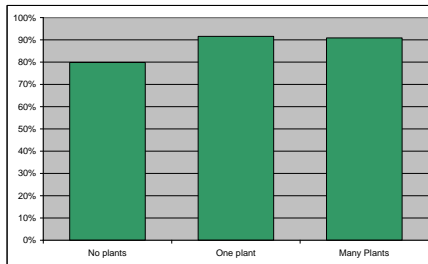
Calculations of the practical situation

- ▶ The project proposal assumes 7 °C in the winter with a RH of 87%
 - ▶ In the weekend of November 11/12 the average is 7 °C with an RH of 82%
 - ▶ Untreated air, with an indoor temperature of 21 °C results in a RH of 34.3%
 - ▶ To increase RH to a comfortable 40% we need to add 0.89 g water per kg air.
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- ▶ In an average weekend in November the plants add 0.86 g water per kg air.

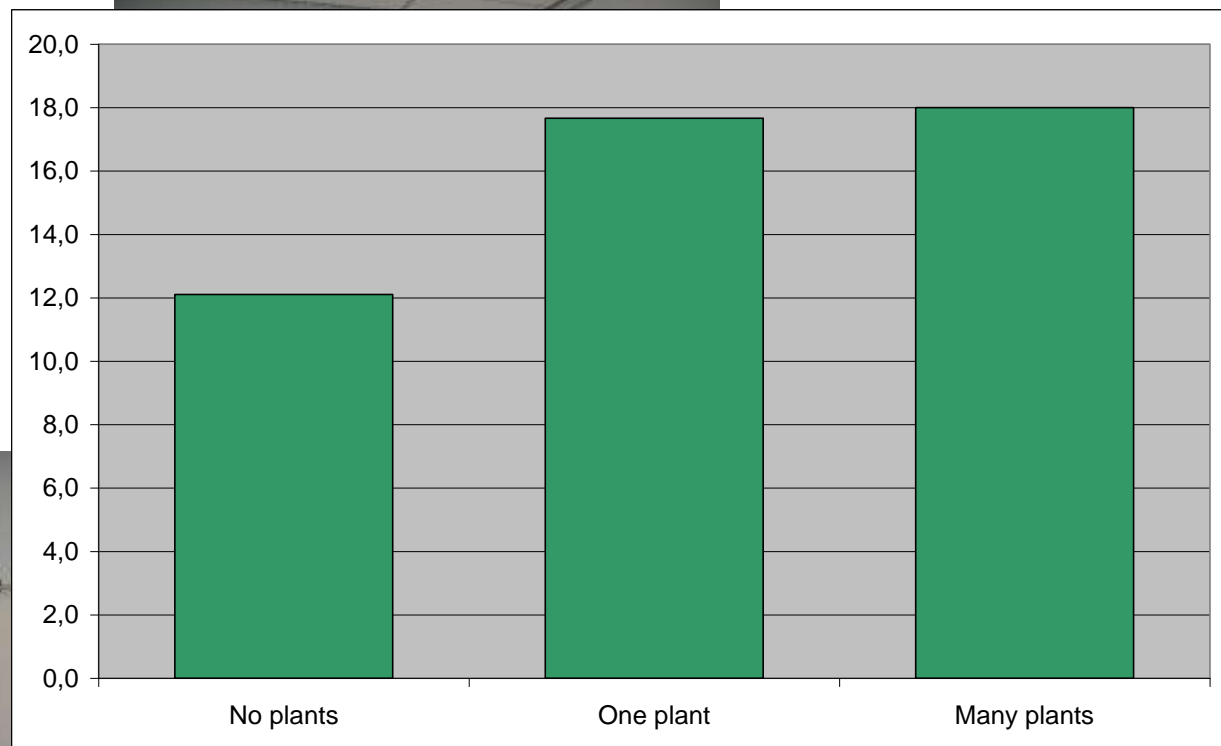
Plants are reliable air humidifiers in winter and their contribution can be predicted and calculated.

Effects on creative tasks

(project: working with plants)



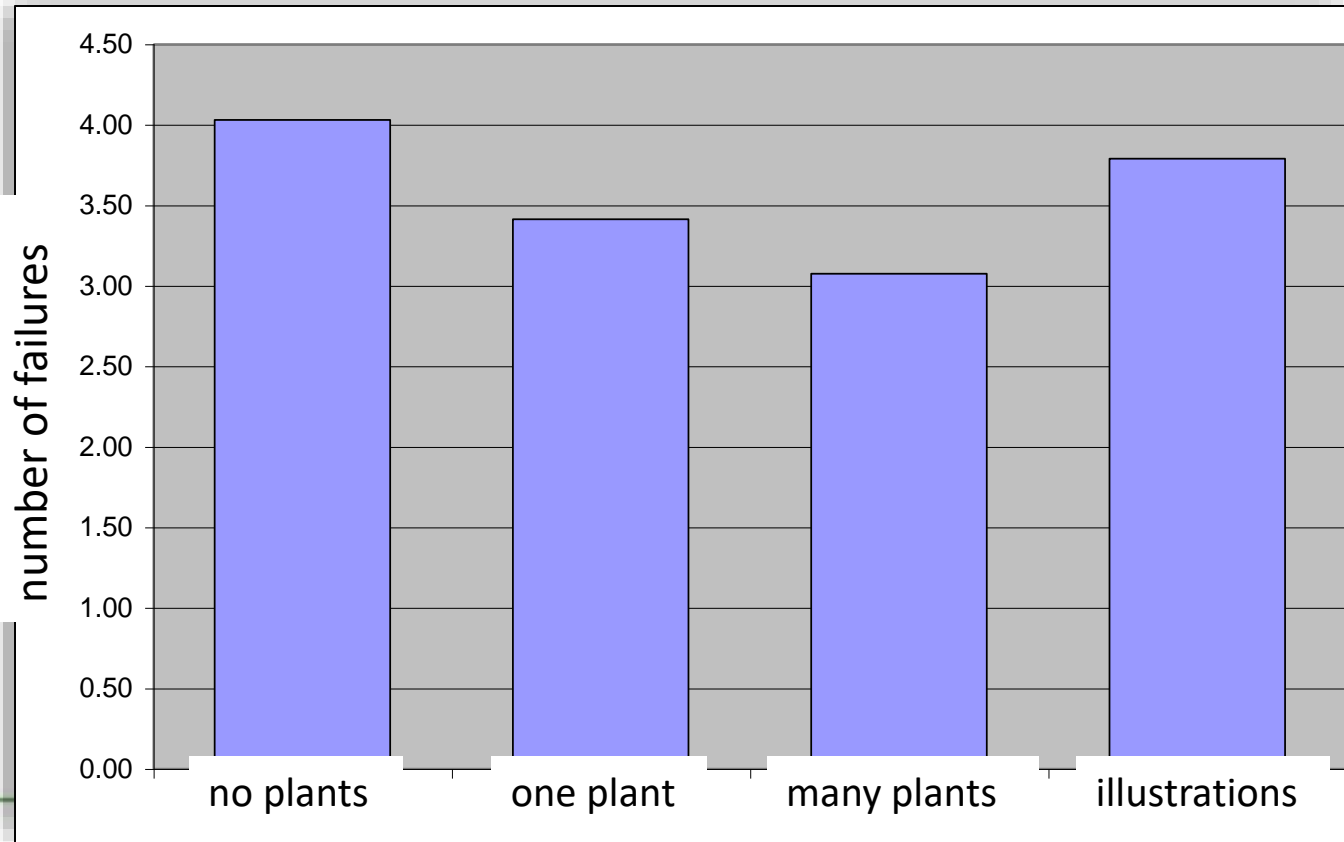
Mean percentage of correct associations (creative tasks)



Mean number of correct associations by students with a high score on self-reported physical exhaustion

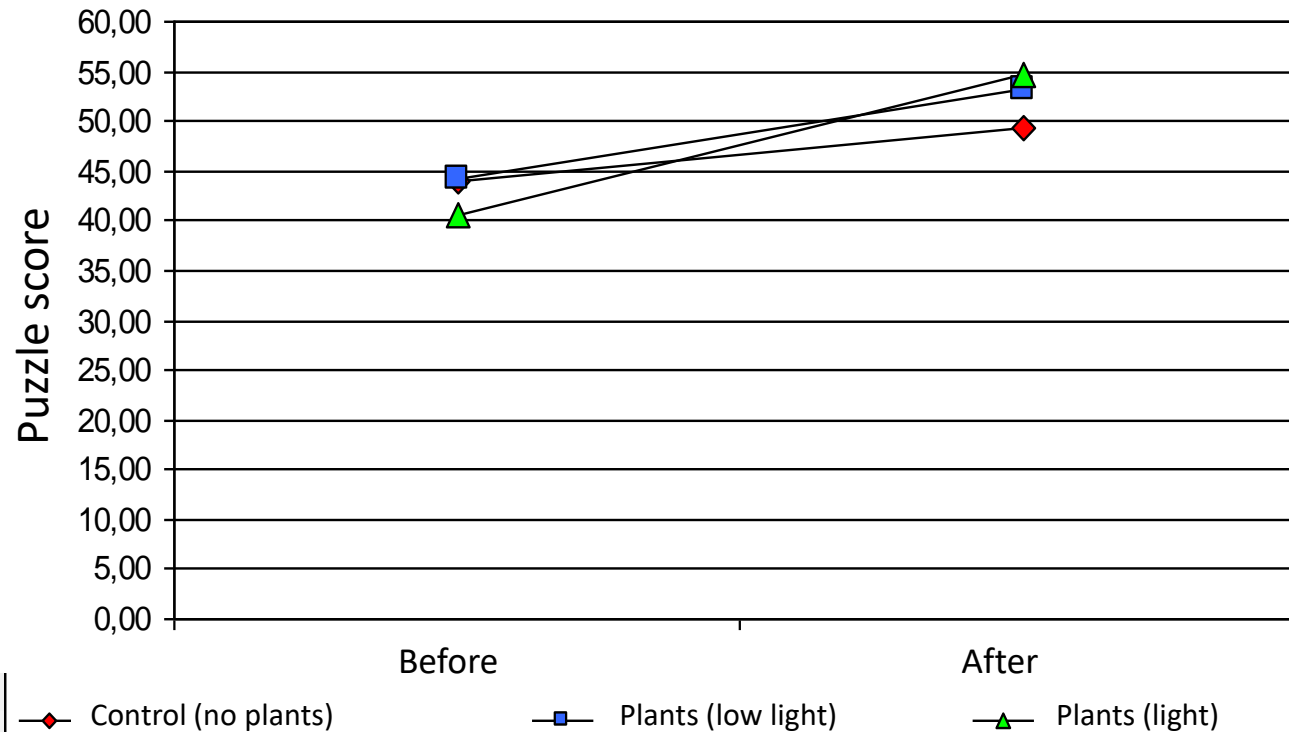
Effect on tasks requiring concentration

(project: working with plants)

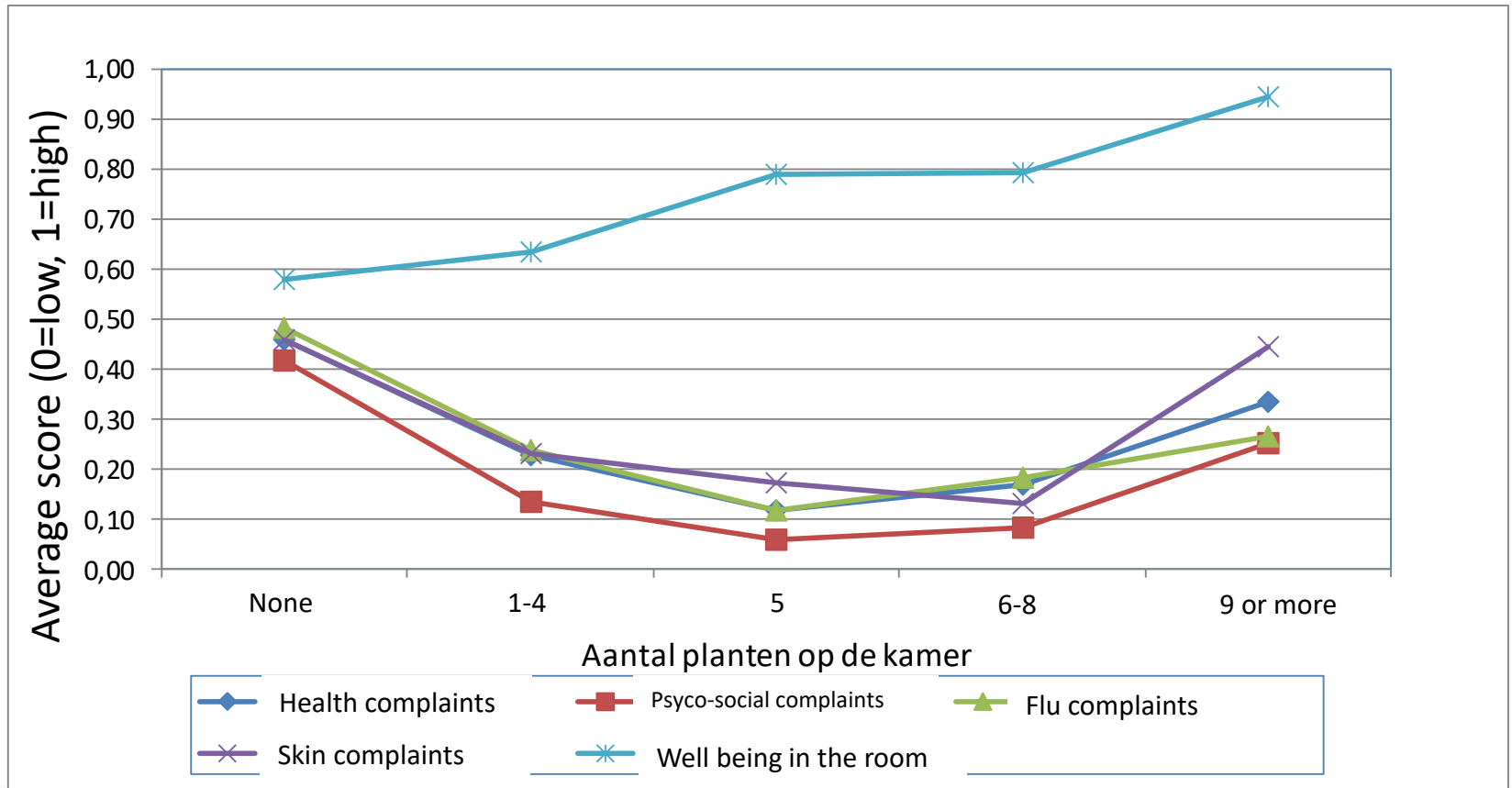


Effects on school tasks

(plants in the classroom)



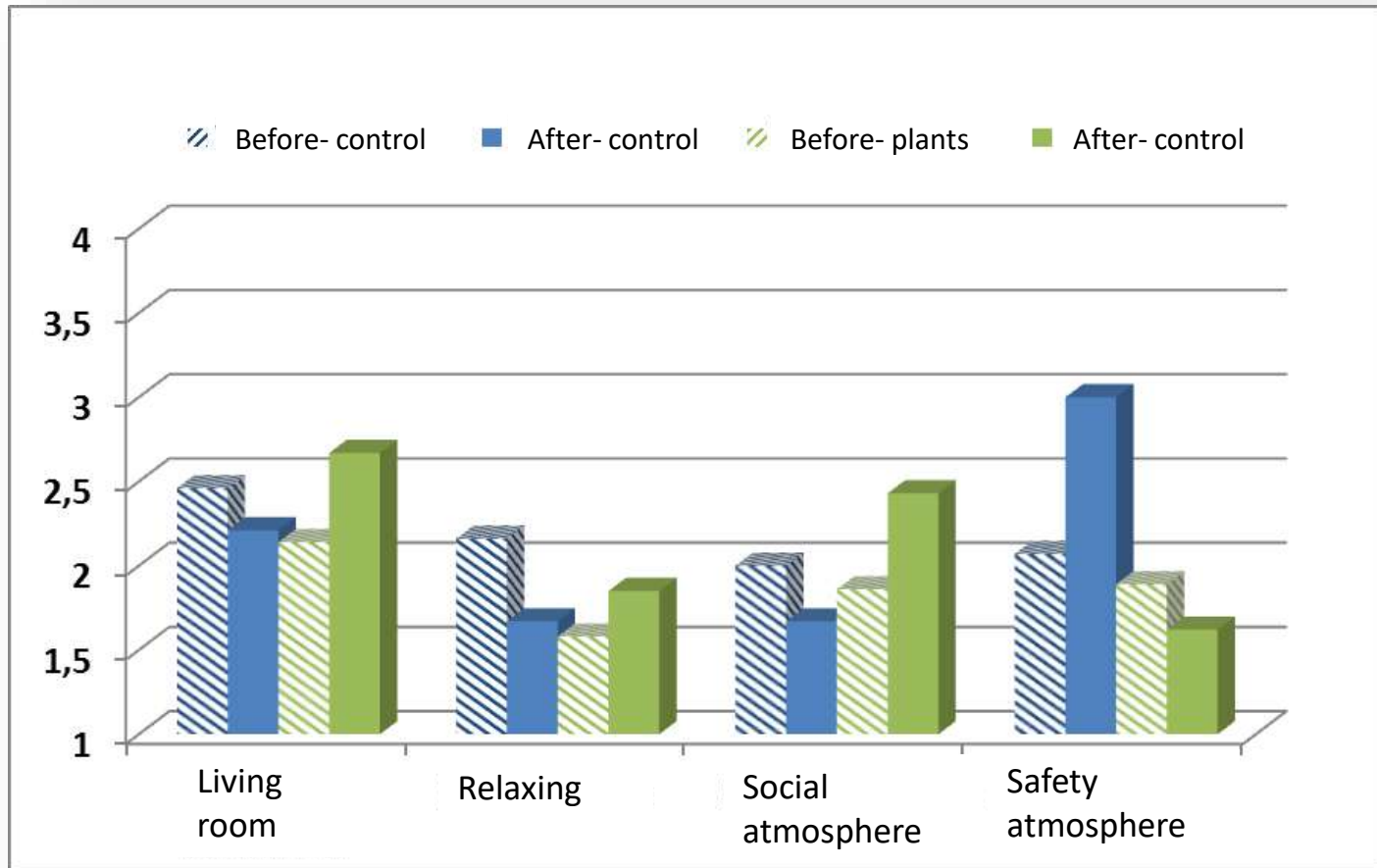
Effects on health (plants in elderly care)



Effects on atmosphere/safety (plants in prison clinic)



Effects on atmosphere/safety (plants in prison clinic)



1= minimum score, 4 is maximum score

GREEN

=

more than beautiful

- Plants do have interaction with people
- Plants purify the air
- Plants improve the relative air humidity
- Plants are cooling the room in summer
- Plants improve human performances
- Plants improve health and well being



Plants take care of you!





Fact sheet green and work: <https://www.royalfloraholland.com/en/about-floraholland/who-we-are-what-we-do/sustainable-healthy-future/the-green-agenda>

https://www.royalfloraholland.com/media/8106879/Royal-FloraHolland-De-Groene-Agenda_Factsheets_Groen-en-Werken-EN.PDF

De Groene Agenda: Planten voor een prima binnenklimaat <https://youtu.be/MfkiNah5j5g>

The Green Agenda (general): <https://youtu.be/cTuiyw3qWw8>



TKI project: Plants for an excellent indoor climate (<https://www.plantbenefits.nl/>)



There is more green in our head than we know.



Thank you for your attention

Bert van Duijn

bert.vanduijn@fytagoras.com



International Association of Horticultural Producers
Horticultural House, Chilton, Didcot, Oxfordshire, OX11 0RN, United Kingdom Tel: +44 (0)1235
776 230 | Email: sg@aiph.org | Web: www.aiph.org