FACULTY OF BIOSCIENCE ENGINEERING

GHENT UNIVERSITY, PLANTS & CROPS

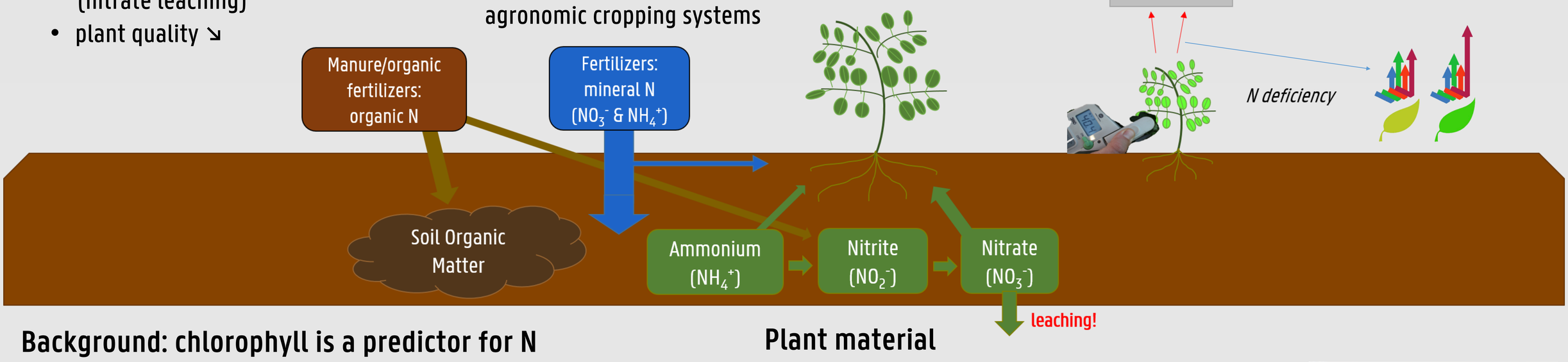
NONDESTRUCTIVE OPTICAL CROP PHENOTYPING TO IMPROVE NITROGEN FERTILIZATION IN FIELD-GROWN ORNAMENTALS

Nitrogen (N) nutrition

- Sub-optimal: plant quality ↘ (height, branching, leaf colour)
- Supra-optimal:
  - environmental impact ↗ (nitrate leaching)
  - plant quality ↘

Today

- Excessive application of N due to unknown uptake levels: generally high levels of residual nitrogen
- Destructive leaf analysis: expensive + time consuming
- Sensors based on the optical properties of chlorophyll to predict N content have already proved their use in various agronomic cropping systems



Tomorrow?

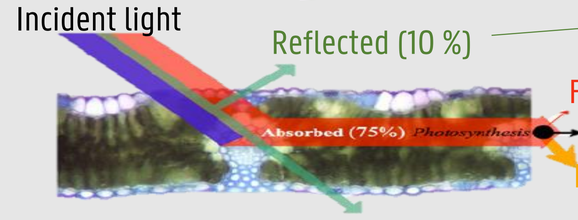
- Monitor plant dry matter yield and N uptake to optimize N fertilization rate
- Use non-destructive crop sensors as easy & quick decision supporting tools

Background: chlorophyll is a predictor for N

+N => chlorphyll
- N => polyphenols

Protein Competition Model

Incident light



After: Tani C. & Agati G. (2006)

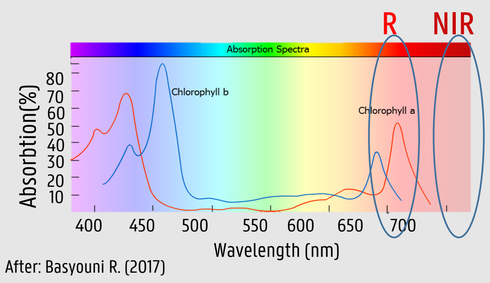
$$NDVI = \frac{R_{NIR} - R_R}{R_{NIR} + R_R}$$

Polyphenols (Dualex)

$$Chl\ (SPAD) = log\ \frac{T'_{NIR}/T_{NIR}}{T'_R/T_R}$$

T' = measured transmittance, T = constants

After: Markwell et al. (1995)



After: Basyouni R. (2017)

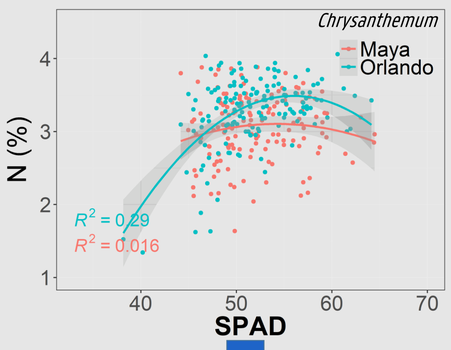
Plant material

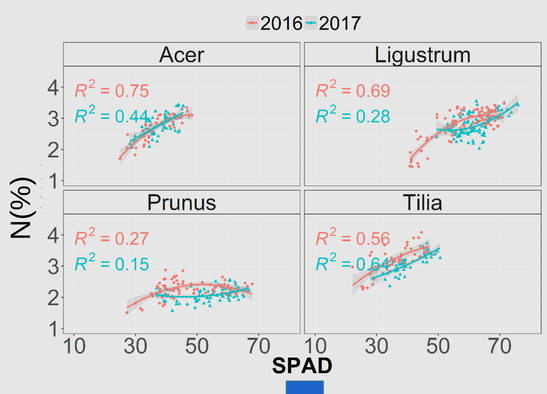
Woody ornamentals: *Acer pseudoplatanus*, *Prunus laurocerasus*, *Ligustrum ovalifolium*

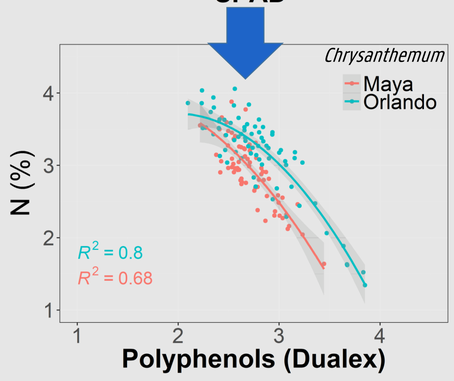
Herbaceous ornamentals with crop residues: *Begonia x tuberhybrida*

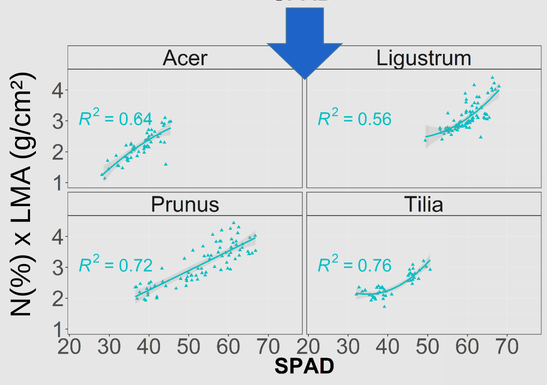
Herbaceous ornamentals without crop residues: *Chrysanthemum morifolium*

Some results: Leaf level





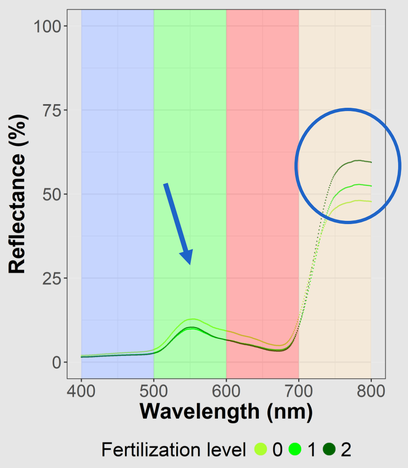


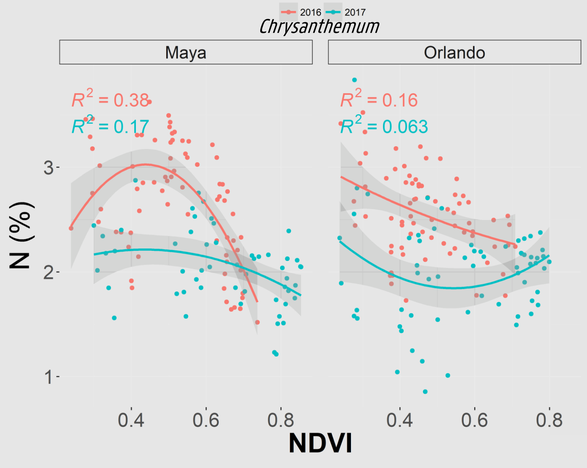


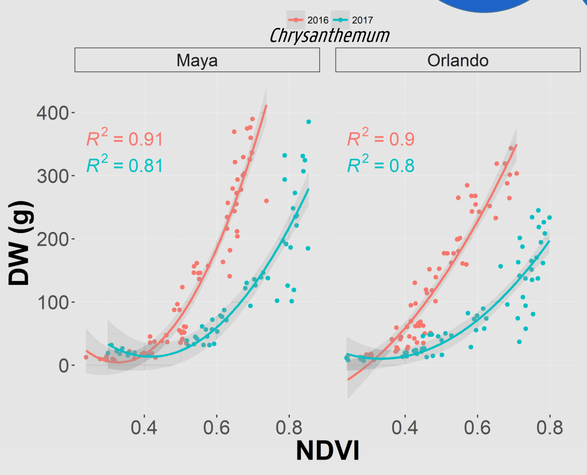
Conclusions:

- Sensor-plant relations are plant & cultivar specific.
- Dualex: sometimes better correlated with N than SPAD.
- SPAD vs. N% is LMA-dependent for some species.
- NDVI is useful for predicting biomass, but not for N% in most experimental species.

Some results: Canopy level







Jolien Bracke

Bracke, J. (1, 2, 3), Adriaenssens, S. (4), Elsen, A. (3), Vandendriessche, H. (2, 3), Van Labeke, MC. (1);
(1) Ghent University, Department of Plants and Crops, Faculty of Bioscience Engineering, Ghent, Belgium,
(2) KU Leuven, Department of Biosystems, Faculty of Bioscience Engineering, Leuven, Belgium, (3) Soil Service of Belgium, Leuven, Belgium,
(4) PCS Ornamental Plant Research, Destelbergen, Belgium; (J.Bracke@UGent.be).