FACULTY OF BIOSCIENCE ENGINEERING

NONDESTRUCTIVE OPTICAL CROP SENSING TO MONITOR NITROGEN CONTENT IN WOODY ORNAMENTALS

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).

Nitrogen (N) nutrition

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

Challenge

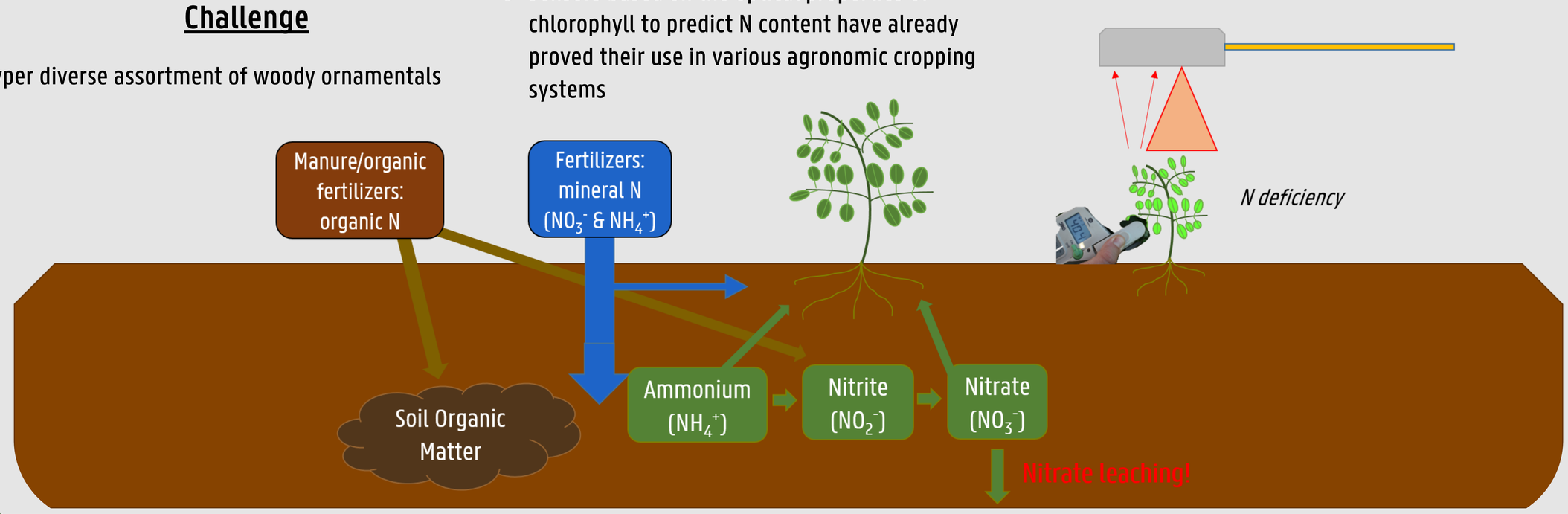
- Hyper diverse assortment of woody ornamentals

Today

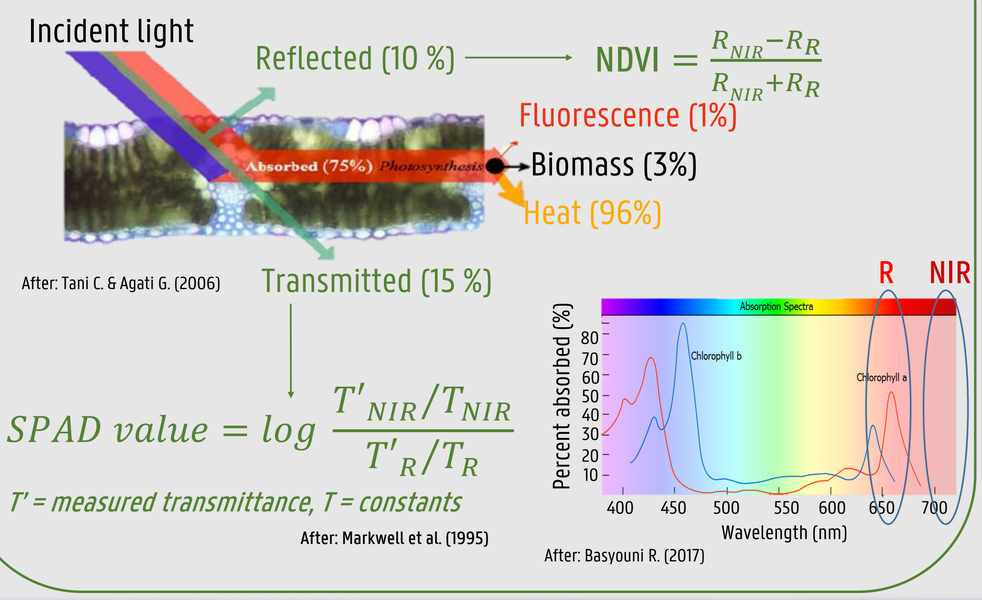
- Excessive application of N due to unknown N uptake levels: generally high levels of residual nitrogen in the nursery sector
- Destructive leaf analysis: expensive + time consuming
- Sensors based on the optical properties of chlorophyll to predict N content have already proved their use in various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

Tomorrow?

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



Background: chlorophyll % is a predictor for N %



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

After: Markwell et al. (1995)

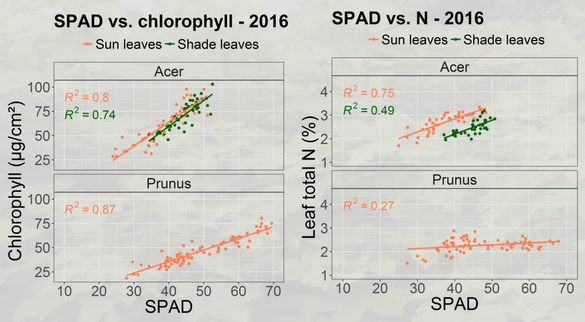
After: Basyouni R. (2017)

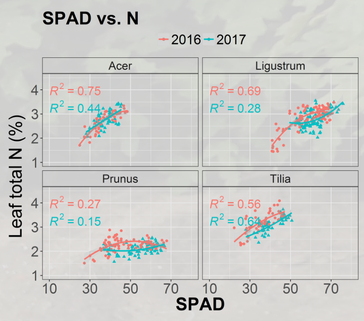
Materials & methods

- 4 species: *Acer pseudoplatanus*, *Ligustrum ovalifolium*, *Prunus laurocerasus* 'Rotundifolia' and *Tilia cordata*
- 2 sensors for non-destructive measurements:
  - Leaf level: SPAD-502 (Minolta) - chlorophyll meter (650 & 940 nm)
  - Canopy level: GreenSeeker RT100 (Trimble) – active NDVI meter (656 & 774 nm)
- 3 different N treatments in 3 replicates (zero, advise and double dosage; after soil analysis)
- During growing season:
  - Growth, biomass and nitrogen concentration measurements
  - Non-destructive N measurements with SPAD & GS
  - Destructive chlorophyll analysis for *Acer* & *Prunus* in 2016

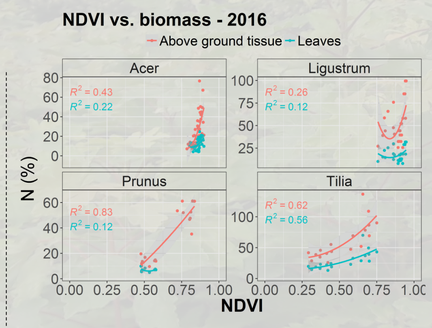
Results

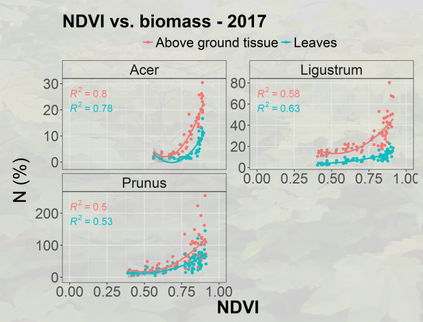
Leaf level

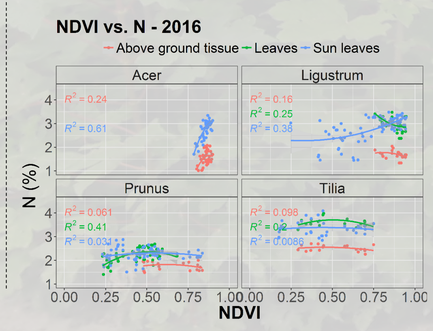


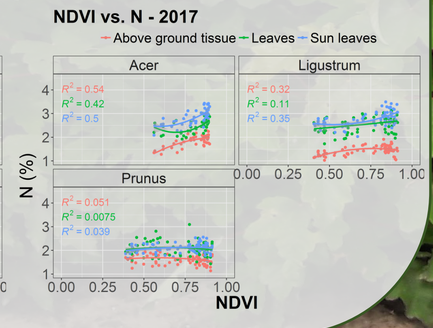


Canopy level









Conclusions

1. Correlation between SPAD & N is species- & leaf type (sun/shade) dependent.
2. SPAD is a good predictor for chlorophyll for *Acer* & *Prunus*, but fails for predicting foliar N concentration for *Prunus* (leaf structure, wax layer,...). The correlation between SPAD & N is also good for *Ligustrum* & *Tilia*. The SPAD meter was demonstrated to be a potential useful device for non-destructively assessing foliar N status for 3 out of 4 of the tested ornamental species.
3. GreenSeeker readings (NDVI) do correlate well with aboveground biomass for *Acer*, *Ligustrum* (2017 only) & *Tilia*. Generally, correlation does not improve when taking only leaf biomass into account.
4. GreenSeeker readings (NDVI) show limited potential to predict N concentration in different plant tissues of all 4 tested woody ornamentals.

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