On-farm experimentation with low-tech sensors for monitoring and managing cover crops in viticulture

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Introduction

- The development of low-cost sensors for measuring agroecological indicators offers new prospects for accessible monitoring of agricultural practices
- In viticulture, the evaluation of cover crop biomass is a major challenge for the management of ecosystem services
- We tested the ability of a low-cost sensor (Vegemeter), to return measurements comparable to those of a high-tech sensor (Greenseeker™) and to predict cover crops biomass

Material and methods

- The vegemeter: a low-cost multispectral device
  - 18 spectral bands between 410 and 940 nm
  - Measures canopy reflectance (passive measurement), computes NDVI in real time, records the full spectral signal for post-processing
  - 3D printed housing
- Field trial
  - Three cover crop modalities: spontaneous vegetation, sown multi-species cover crops, faba bean
  - Greenseeker™ + Vegemeter data acquisition on 20 plots
  - Destructive biomass measurement on the same 20 plots
- Data analysis
  - Calculation of NDVI + other vegetation indexes (red-edge chlorophyll index (CI), green band CI, Modified Simple Ratio (MSR)
  - Biomass prediction with NDVI and multivariate linear regression using Vegemeter indexes

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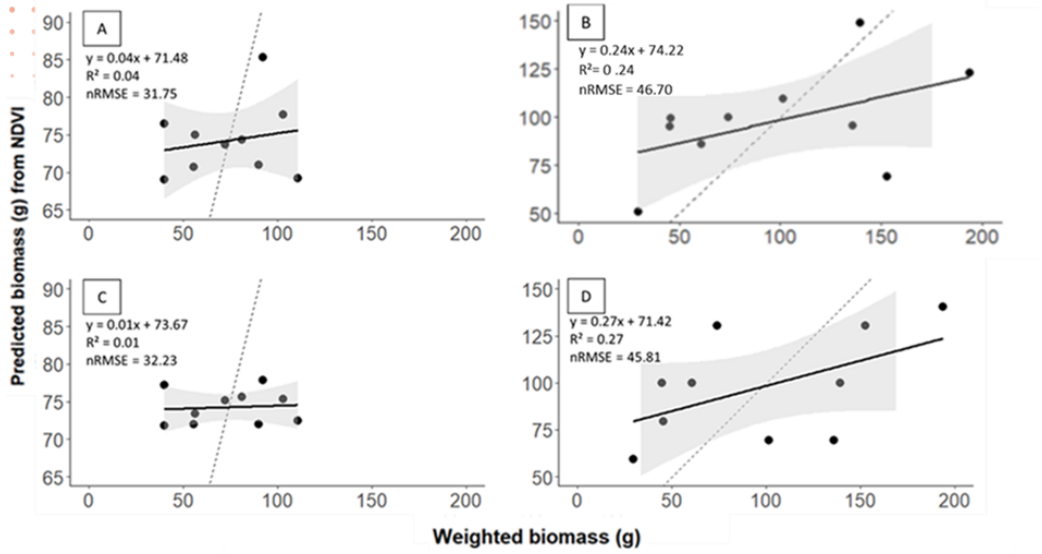
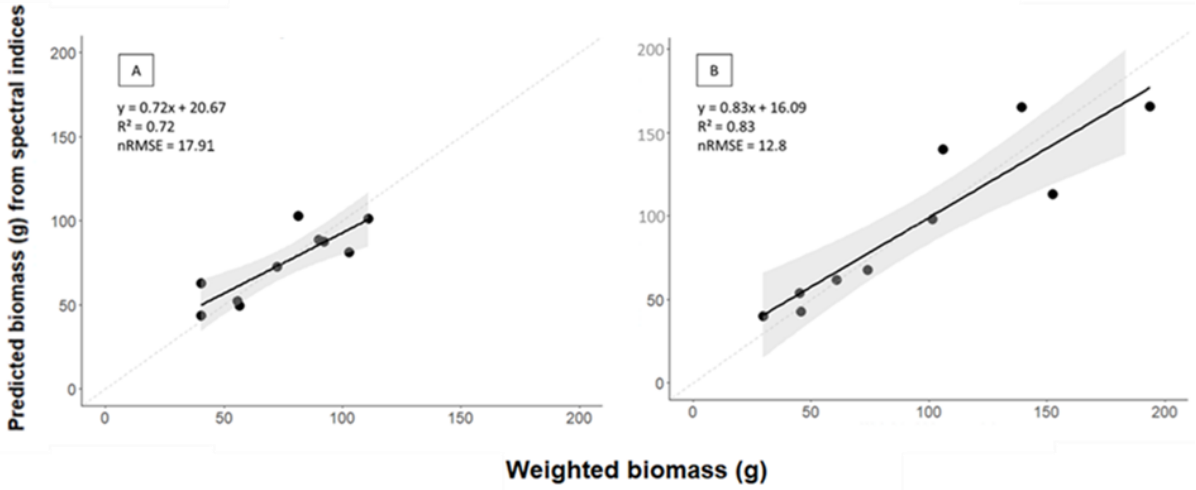
Results





- Vegemeter and Greenseeker NDVI values are strongly correlated ($R^2 = 0.85$)
- **NDVI** alone showed **limited biomass prediction** accuracy, with performance varying by grass cover type
- **Alternative spectral indices** significantly **improved biomass prediction**
  - For sown species, CI_{green} and $CI_{rededge}$ provided excellent results ($R^2 = 0,83$)
  - For spontaneous vegetation, the addition of MSR improved model performance ($R^2 = 0,72$).

Perspectives

- **Data acquisition** in **various agronomical situations**: cash crops, intercropping, understory vegetation strip in agroforestry systems…
- Assess overall Vegemeter performances, models robustness
- Deployment of **biomass measurements at large scale**: onboard sensor and mapping

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Thanks for your attention