1.12 SYLVAIN JAY[1], FABIENNE MAUPAS[2], N. GORRETTA[1]
[1] UMR ITAP, Irstea, 361 rue J.F. Breton, F – 34196 Montpellier
[2] ITB, 45 rue de Naples, F – 75008 Paris

OPTICAL REMOTE SENSING OF CANOPY NITROGEN CONTENT IN SUGAR BEET CROPS FOR PHENOTYPING APPLICATIONS

ABSTRACT

Nitrogen content is one of the most important limiting key nutrients in sugar beet crops, so plant nitrogen status has to be carefully monitored throughout the plant life. In particular, for phenotyping applications, it is essential to better understand why genotypes differ in the use of nitrogen sources so as to create new cultivars that consume less nitrogen. For this purpose, following up the nitrogen status of crops using optical remote sensing has appeared as a powerful tool because it allows a high throughput and non-destructive vegetation characterization.

In this study, we evaluated the potential of ground-based spectro-radiometric measurements to estimate canopy nitrogen content. Along the 2015 growing season, 44 reflectance spectra of sugar beet canopies and the associated canopy nitrogen contents were measured, encompassing three cultivars and two locations with different soil and weather conditions. Numerous vegetation indices originally designed for retrieving the chlorophyll content (which is known to be correlated with the nitrogen content) and computed from the visible and near-infrared spectral range were compared based on their correlation with nitrogen content.

As expected, the nitrogen content was strongly correlated to the chlorophyll content when integrated at the canopy level (R^2=0.97 at the canopy level, R^2=0.39 at the leaf level). Overall, the MERIS Terrestrial Chlorophyll Index (MTCI) obtained the best correlation with canopy nitrogen content (R^2=0.90) and a cross-validated error of prediction of 0.805 g/m² (i.e., 19% of the mean value). Compared with the leaf-level relationship, the canopy-level relationship was much more robust among development stages and cultivars, thus proving that optical remote sensing is a promising tool for sugar beet phenotyping.