# Comparison of narrow band vegetation indices and empirical models from hyperspectral remote sensing data for the assessment of wheat nitrogen concentration

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The assessment and mapping of total canopy nitrogen (N) concentration of agricultural crops is very important to optimize nitrogen fertilizer management in agronomy. An efficient and precise use of N-fertilizer is helpful to improve yield, reduce costs and lower environmental pollution at the same time.

During a field campaign in May 2011 the above-ground plant material of 37 plots (each with a size of 0.25 m²) of a field northwest of Koethen (Saxony-Anhalt, Germany) was harvested completely and the N-concentration of the samples was determined in laboratory afterwards. At the same time hyperspectral imagery of the test site was acquired by the airborne scanner AISA-DUAL (450-2500 nm). For the assessment of the N-status, narrow band indices like the Red Edge Inflection Point (REIP), the Normalized Difference Red Edge Index (NDRE) and the Normalized Difference Nitrogen Index (NDNI) were calculated from the AISA-DUAL imagery. Additionally, empirical models based on support vector regression (SVR) and partial least squares regression (PLSR) were developed. Subsequently, the indices and the empirical models have been applied to AISA-DUAL image data of the field to assess the spatial distribution of N.

The N-concentrations estimated by SVR from AISA-DUAL data showed the best results ($r^2_{cv}$=0.75). Predicted N-concentrations are consistent to laboratory chemical analysis and predicted N-values reflect the spatial distribution of the investigated field. Compared to SVR, PLSR ($r^2_{cv}$=0.70) and narrow band indices ($r^2_{cv}$=0.69) allowed lower prediction accuracies. The results clearly indicate the high potential of SVR for fast and reliable spatial N assessment from hyperspectral imagery.

Keywords: Nitrogen, Hyperspectral Data, Empirical Models, Vegetation Indices