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Prediction of crop growth and nitrogen status using hyperspectral canopy reflectance and partial least square regression

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Objectives

The study intended to predict rice crop growth and N status before heading stage using hyperspectral canopy reflectance and partial least square regression.

Materials and Methods

Two experiments were conducted in 2000 and 2003 at the Experimental Farm of Seoul National University, Korea. The experiment included two *rice* varieties (Hwasungbyeo and Dasanbyeo) and four levels of nitrogen (N) application in year 2000 and four rice varieties (Hwasungbyeo, SNU-SG1, Juanbyeo, and Surabyeo) and 10 *nitrogen* treatments in year 2003. Hyperspectral canopy reflectance (300 to 1100 nm) data recorded at various growth stages before heading were used for partial least square regression (PLS) model to predict eight crop variables: shoot fresh weight (FW, g/m²), leaf area index (LAI, m²/m²), leaf dry weight (LDW, g/m²), shoot dry weight (SDW, g/m²), leaf N concentration (LN, mg/g), shoot N concentration (SN, mg/g), leaf N density (LND, g/m² ground) and shoot N density (SND, g/m² ground).

Results and Discussion

The results revealed that PLS using hyperspectral canopy reflectance data to predict eight plant variables produced acceptable model precision and accuracy. The model coefficient of determination (R²) and relative error of prediction (REP) ranged from 0.81 to 0.88 and 10.0 to 23.8% for calibration and 0.76 to 0.85 and 11.1 to 24.6% for validation, respectively. Evaluation of year and variety dependence of the model showed that R² and REP were better in year 2000 (0.73 to 0.87 and 9.5 to 20.9%, respectively) than year 2003 (0.55 to 0.85 and 9.0 to 21.7%, respectively).

Keywords: *partial least square, canopy reflectance, nitrogen, rice, biomass, nitrogen concentration, nitrogen density, LAI.*

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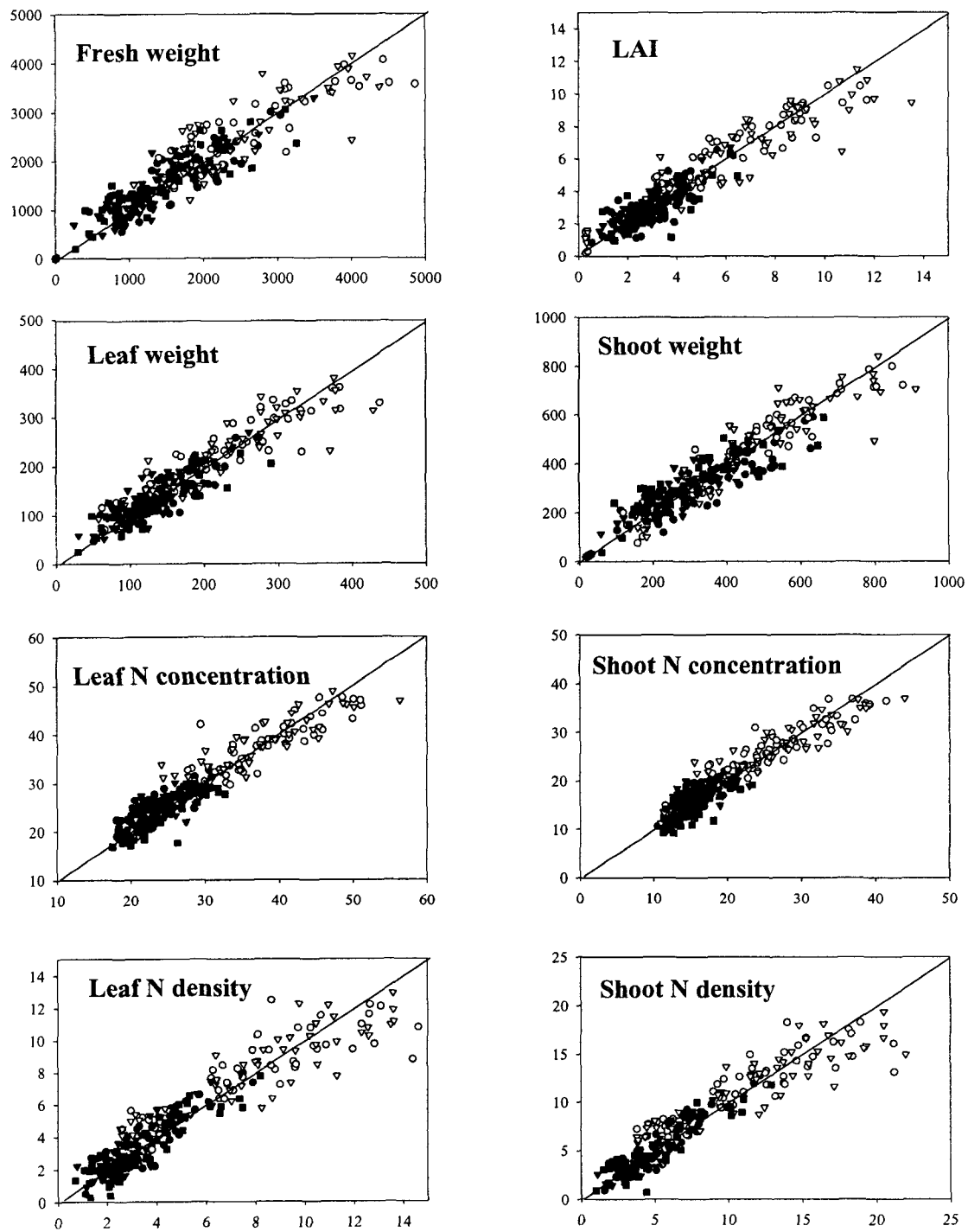


Fig. Relationship between observed (X) and predicted (Y) values by PLS. Open and filled symbols are observations from year 2000 and 2003, respectively. Circles, squares and triangles are Hwasungbyeo, SNU-SG1 and Dasanbyeo, respectively. Solid line is 1:1 line.