Title Feasibility of estimating peanut essential minerals by near infrared reflectance spectroscopy

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Citation Sensing and Instrumentation for Food Quality and Safety, 5, Number 1, 43-49, 2011

Keywords *Arachis hypogaea*; Minerals; Multivariate analysis; Near infrared reflectance spectroscopy; Peanut; Plant breeding; Plant selection

Abstract

The use of near infrared reflectance spectroscopy (NIRS) to evaluate the nutritional quality of peanut kernels has potential applications in plant breeding as a rapid, non-destructive tool for seed/plant selection, and in quality control. We investigated the feasibility of applying NIRS to the estimation of essential mineral composition in peanut kernels using two sample sets: A, comprising 56 diverse genotypes ($N = 163$); and B, comprising nine genotypes grown in five distinct environments ($N = 156$). Essential mineral composition was analyzed by inductively coupled plasma-optical emission spectroscopy (ICP-OES) and -mass spectrometry (ICP-MS). Calibration models were developed by partial least squares (PLS) regression, and explored a variety of data pre-treatments. Models allowing approximate estimation of K (RPD_{CV} 2.25, r_{CV}^2 0.800, RPD_P 2.22) and Mg (RPD_{CV} 2.24, r_{CV}^2 0.786, RPD_P 1.74), and to a lesser extent Ca (RPD_{CV} 1.85, r_{CV}^2 0.649, RPD_P 1.52) and P (RPD_{CV} 1.77, r_{CV}^2 0.634, RPD_P 1.65), were developed for Set B, but poorer calibrations were obtained for Set A. This level of accuracy does not allow accurate prediction, but permits approximate quantification that may be useful in plant improvement programs for screening breeding populations. The results are remarkable because NIRS is rarely applied to analytes present at such low concentrations, especially inorganic constituents that are not inherently NIR-absorbent. Further analysis of more diverse peanut samples is warranted to confirm batch-to-batch accuracy and to improve the robustness of calibrations.

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