

## **Evaluation of new-generation hand-held NIR spectrometer and semi-automated multivariate data analysis through investigation of protein content of proso millet**

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Miniaturized near-infrared spectrometers are becoming more accessible to consumers, as guided data recording and semi-automated data processing is offered with the new generation. The performance of this emerging technology has rarely been tested for complex matrices like cereals yet. This is why, a set of 42 millet (*Panicum miliaceum*) samples was investigated for its protein content using three different handheld and one benchtop near-infrared spectrometer, as well as Kjeldahl analysis as a reference method. The semi-automated data analysis tools of one handheld instrument was also tested.

The four instruments operate in different regions of NIR and at different spectroscopic performances, which gives interesting insights into the spectroscopic advantages and disadvantages of each region. The results show that the benchtop instrument is able to estimate protein content (7.1–13.5 %) of milled and intact grains with RMSEP values of around 0.5 %. Two handheld devices (MicroNIR 2200, microPhazir RX) perform better when milled grains are measured with RMSEPs of around 0.6 %. The RMSEP values of the respective intact grain model are above 1 %. The remaining handheld (SCiO) performs equally with intact and milled grains with RMSEP values of around 0.8 %. The semi-automated data analysis was not able to replicate the results of the sophisticated data analysis processing software. Additionally, even if the same spectral pre-treatments were used, results differed from the professional software.