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Rapid detection of fumonisin B1 in maize kernels (*Zea mays*) using a semi-portable near-infrared spectrometer

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Introduction

- Fumonisin B_1 (FB_1) is a mycotoxin that represents a threat to the health of humans and livestock.
- Traditional detection analysis can be expensive and time consuming. There is a need to develop easier and cheaper detection technologies.
- The aim is to evaluate the feasibility of a rapid detection method using a semi-portable near-infrared spectrometer (NIRS) to detect FB_1 on contaminated maize kernels.

Material and Methods

- For contamination, individual maize kernels were submerged in 500 µl FB_1 solutions at different concentrations (0, 1, 5, and 10 mg kg^{-1})

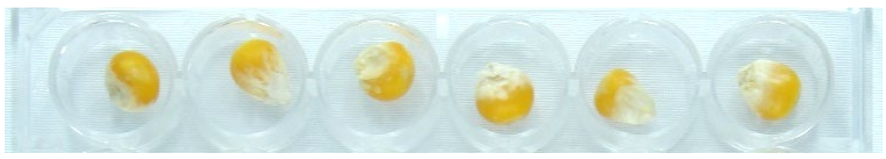

Fig 1. Wells from a cell culture plate used for individual kernel contamination.

- Samples were analyzed milled and whole using a semi-portable NIRS (Ocean Optics) in the wavelength range of 900-2,500 nm.

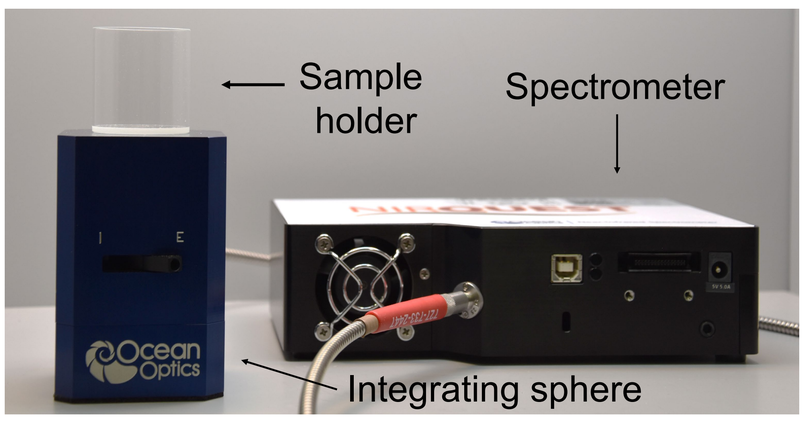

Fig 2. Semi-portable NIRS steup used for the sample analysis.

- An enzyme-linked immunosorbent assay (ELISA) was used as a reference method for the detection of total fumonisins.

Results

- PCA showed a good separation between the different concentrations used in both milled and whole kernels.

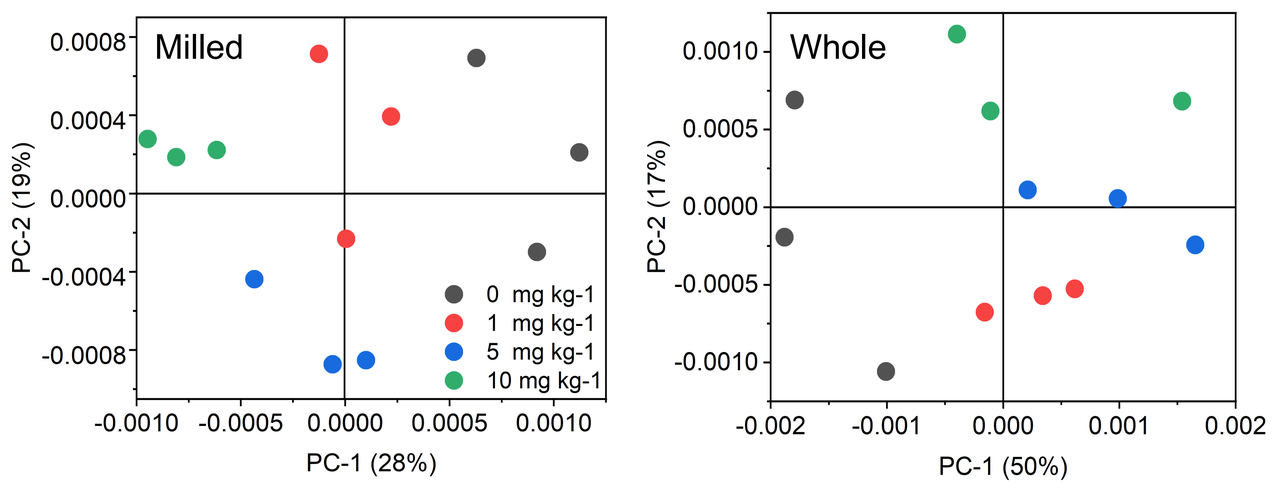

Fig 3. Principal component analysis (PCA) of contaminated maize with four different FB_1 concentrations. Milled sample (left) and whole samples (right).

- The PLSR model allowed the fitting of a better prediction model for the milled samples than for the whole kernels.

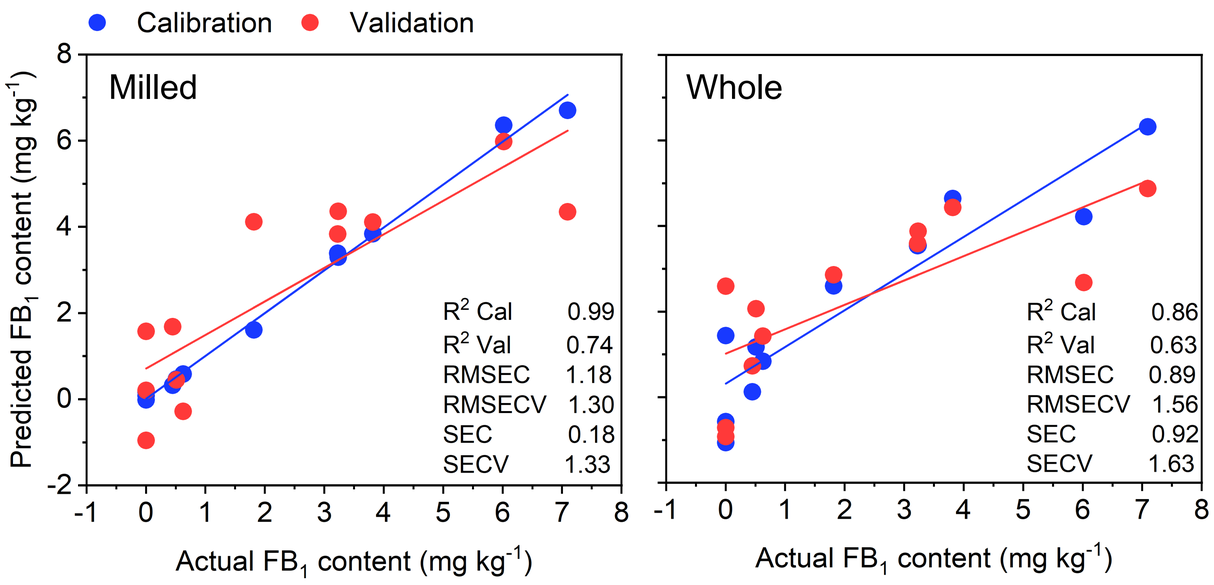

Fig 4. Partial least square regression (PLSR) of contaminated maize with four different FB_1 concentrations. Milled sample (left) and whole samples (right).

Conclusions

- Initial results showed that the use of a semi-portable NIRS is promising for the detection of FB_1 on maize.
- Milling the sample gave a better prediction model.
- The developed method can help to carry out rapid analysis to ensure mycotoxin monitoring along the production chain.

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