Abstract

Influence of kernel orientation on NIR hyperspectral images for whole maize kernel characterisation

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Introduction

Maize kernel endosperm is a composite of vitreous and floury textures, the proportions of which determine the hardness of the kernel. Maize hardness is an important grain parameter as it influences dry-milling yield and processing for certain foods. The promise of NIR hyperspectral imaging in the classification of vitreous and floury endosperm of maize kernels has previously been shown by the Manley laboratory. However, these classifications were made based on samples aligned with the embryo "facing down". The purpose of this study was to determine the influence of kernel orientation on the characterisation of maize endosperm.

Materials and Methods

A sisuCHEMA shortwave infrared hyperspectral imaging system was used to acquire images from randomly positioned kernels. Images of six grains from each triplicate of 37 cultivars grown in three locations (333 samples) were recorded. Spectra were collected over the wavelength range 996 to 2502 nm at intervals of 6.3 nm. Hyperspectral data were converted to pseudo-absorbance in Evince image analysis software. Standard normal variate preprocessing, PCA and PLS-DA were used. A Nikon D90 was used to record light box images of the kernels.

Results and Discussion

The embryo "up and down" images of a subset of 56 samples (336 kernels) were analysed using PCA. Clusters in the PCA scores plot were attributed to floury, intermediate and vitreous endosperm and germ by comparison with light box images. A PLS-DA model was calculated based on 42 of these samples (252 kernels) and tested on the remaining 14 samples (84 kernels). The predicted images agreed well with the light box images. Subsequently, this PLS-DA model was applied to the individual kernels of 14 new samples (84 kernels). The endosperm/embryo proportions for each kernel were used to calculate a model to classify embryo up/down. Embryo up and embryo down models were calculated to classify samples for milling.

Conclusions

NIR hyperspectral imaging may be used to classify maize kernel hardness irrespective of orientation.

Reference paper as:
McGoverin, C.M. and Manley, M. (2012). Influence of kernel orientation on NIR hyperspectral images for whole maize kernel characterisation (abstract), in: Proceedings of the 15th International Conference on Near Infrared Spectroscopy, Edited by M. Manley,C.M. McGoverin, D.B. Thomas and G. Downey, Cape Town, South Africa, p. 64.