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DETECTION OF FUSARIUM DAMAGED KERNELS IN WHEAT USING HYPERSPECTRAL IMAGING

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ABSTRACT Fusarium head blight is a disease of wheat, barley, oats and other small cereal grains. This disease reduces yield and grade and may also contaminate the grain with fungal toxins such as deoxynivalenol (DON). Fusarium damaged kernels (FDK) with a severe level of infection are typically characterized by thin or shrunken chalk-like appearance, which can be readily identified by human visual inspection. Kernels with mild infection, however, are extremely difficult to recognize by human inspectors. A 10-power magnifying lens is sometimes used to confirm evidence of a white or pinkish mould or fibrous growth which is time consuming. Fast and accurate instrumental methods are required to meet the needs of grain industry. In this study, the use of hyperspectral imaging was investigated for detecting FDK in Canadian wheat samples. Samples of CWRS wheat grown in different regions were collected from which 600 individual kernels were picked representing three levels of FDK namely sound, moderately damaged and severely damaged. These kernels were imaged with a hyperspectral imaging system in the 400-1000 nm wavelength range. Average spectra from individual kernels were extracted to develop partial least squares discriminant analysis (PLS-DA) models for predicting the extent of Fusarium damage. A PLS-DA model classified the wheat kernels into three classes with an accuracy approaching 90%. Accuracy for 2-class (sound & FDK) segregation was better than 95%. Hardware implementation of the proposed method can provide a signal for automatic removal of FDK from wheat shipments thus improving overall grade and value of grain.

Keywords: Wheat, Fusarium damage, FDK, Hyperspectral imaging.