

## Abstract

# Detection of *Fusarium* damage in Canadian wheat by hyperspectral image analysis

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## Introduction

Wheat and other cereal grains can be infected by a fungus called *Fusarium*. The presence of *Fusarium* damaged kernels (FDK) in wheat lots causes downgrading and lower market value of wheat shipments. In a previous study, the authors used hyperspectral imaging to detect FDK in Canada Western Red Spring wheat. A principal component analysis (PCA) based model using 6 wavelengths detected FDK with an accuracy of 92% and false positives of 8%. This study aims at testing the same method on major classes of Canadian wheat that vary significantly in physical characteristics of kernels.

## Materials and Methods

Over 5200 kernels were collected from seven classes of Canadian wheat including Canada Western Amber Durum (CWAD), Canada Western Red Spring (CWRS), Canada Western Red Winter (CWRW), Canada Eastern Red Spring (CERS), Canada Eastern Soft Red Winter (CESRW), Canada Eastern Hard Red Winter (CEHRW) and Canada Eastern White Winter (CEWW). These kernels were individually inspected and scored as sound or FDK based on the absence or presence of fungal growth anywhere on the kernel. The kernels were imaged, in batches of 25 kernels per image, with a hyperspectral imaging system in the 400-1000 nm wavelength range. PCA was performed on the image data and kernel mean and variance for the first 6 PCs were measured for each kernel. A Linear Discriminant Analysis (LDA) classifier was developed for kernel classification.

## Results and Discussion

The accuracy of kernel classification for all seven classes of wheat was 85% on average. Maximum accuracy of classification was achieved for CWAD (91%) while minimum accuracy was observed for CEWW (79%). Detection of *Fusarium* damage was more accurate in the Western wheat classes (87%) than in the Eastern classes (83%).

## Conclusion

Hyperspectral imaging can successfully detect *Fusarium* damage in major Canadian wheat classes that vary considerable in kernel physical characteristics. A PCA-based LDA classifier can be used to distinguish between sound and damaged kernels of multiple classes of wheat.