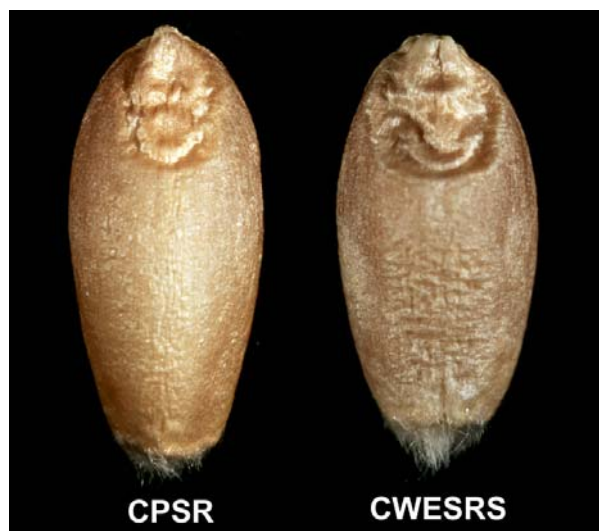


## Marketing Wheat by Electronics I. Electronic Classification of Wheat

**Summary** Wheat marketing involves identifying wheat by class, and grading it within a class, to assess its value to the consumer. The main purpose of grading grains is to assign a price to the commodity. In Canada, identification of wheat by class is achieved by visual appraisal. This tends to be subjective, because grade factors and lighting conditions can affect the appearance of the grain. Variability among inspectors as to their ability to differentiate between often subtle differences in appearance can cause differences in the assignment of classes and, therefore, prices of wheat. An instrumental method, Near-Infrared Discriminant Analysis (NIRDA), that can improve both speed and consistency in classifying wheat is demonstrated.

**Visual appraisal** has served the Canadian grain industry well for nearly 100 years, but the diversification of wheat classes is exerting heavy pressure on visual grading. Two of the classes, Canada Western Extra Strong (CWES), and Red Canada Prairie Spring (CPSR), can sometimes be confused by visual evaluation (Figure 1). The two classes differ considerably in kernel hardness, gluten strength, and general functionality. Electronic classification can be carried out at the same time as testing for protein and moisture contents.

**The feasibility** of using Near-infrared Discriminant Analysis (NIRDA) in classification of wheat is demonstrated. All the samples for the work were from commercial sources, representing deliveries of wheat to terminal grain elevators. Samples of the Canada Western Red Spring (CWRS) class were included for comparison with the CWES and CPSR wheats. Spectra were recorded on a Foss/NIRSystems Model 6500, VIS/NIR spectrophotometer. NIRDA was effective in both low (570 - 1098 nm) and high (1100 - 2498 nm) wavelength ranges.



**Figure 1. Canada Prairie Spring Red (CPSR) and Canada Western Extra Strong Red Spring (CWESRS)**

The software used was the Discriminant Analysis option of Foss/ InfraSoft International WINISI version 1.5. Figure 2 illustrates that the three classes are clearly distinguished from one another.

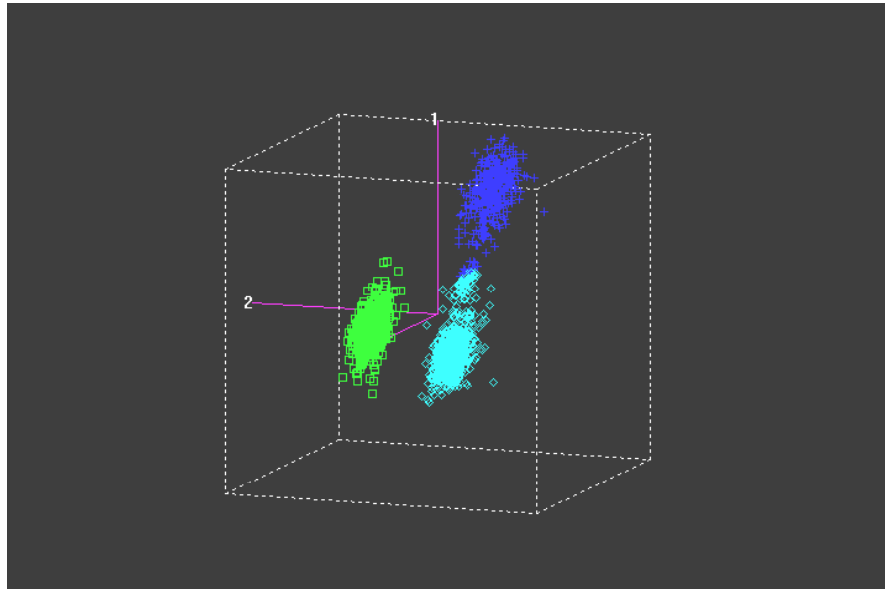


Figure 2. NIRDA for Canadian Red Wheat Classes. Blue symbols are CWRs, green are CWES, and aqua are CPSR

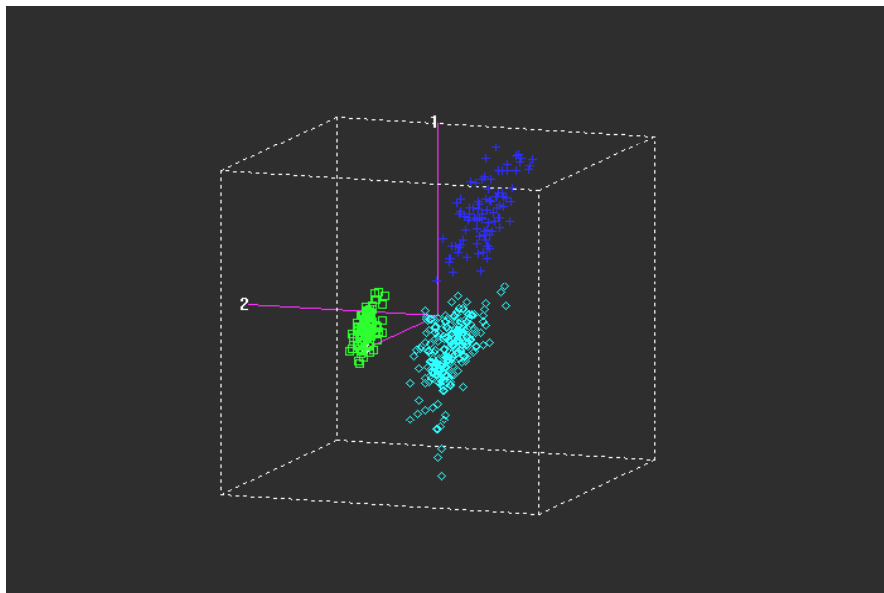


Figure 3. NIRDA for Canadian White Wheat Classes. Blue symbols are CWSWS, green are CWHW and aqua are CPSW

The NIRDA system is equally applicable to the Western Canadian White Wheat classes. The three classes of white wheat are Canada Western Soft White Spring (CWSWS), White Canada Prairie Spring (CPSW) and the new class of Canada Western Hard White (CWHW) spring wheat. The Hard and Soft White Spring classes both have spring wheat kernel characteristics, and can

be confused with one another. These three classes can also be separated using NIRDA (Figure 3). Differences in size, shape and colour, but mainly in kernel texture cause differences in the spectral characteristics of wheat classes. This enables their separation by discriminant analysis (Table 1).

**Table 1. Classification of western Canadian wheat classes using NIRDA. Values are number of samples**

<b>Red Wheat classes</b>	<b>CWRS*</b>	<b>CWES</b>	<b>CPSR</b>	<b>% Correctly Classified</b>
Guidelines	Red	Red	Red	93.2
Predicted	29	18	22	
Actual	28	19	22	
<b>White Wheat classes</b>				
<b>White Wheat classes</b>	<b>CWHW</b>	<b>CPSW</b>	<b>CWSWS</b>	<b>% Correctly Classified</b>
Guidelines	White	White	White	99.8
Predicted	33	40	40	
Actual	33	40	40	

\*CWRS = Canada Western Red Spring; CWES = Canada Western Extra Strong;  
 CPSR = Canada Prairie Spring (Red); CWHW = Canada Western Hard White;  
 CPSW = Canada Prairie Spring (White); CWSWS = Canada Soft White Spring

In conclusion, the capability of NIRDA to identify wheat by class is demonstrated. Most of the work described has been carried out on scans in the wavelength range of 570-1098 nm, the range used by the NIR instruments most widely used in testing for protein content in Canada. New instruments that extend the wavelength range to 1700 nm are becoming available, and have even greater potential for application of NIRDA to handling and marketing of wheat.

## Acknowledgements

The samples were assembled and scanned while the author was working at the Canadian Grain Commission, Grain Research Laboratory. Figure 1 was compiled from a photo taken by the Digital Imaging Section of the Grain Research Laboratory.

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