

## Near-Infrared Spectroscopy (NIR)

**Authors:**

**Per Lidén**  
PerkinElmer, Inc.  
Stockholm, Sweden

**Cecilia Riccioli**  
PerkinElmer, Inc.  
Madrid, Spain

## Analysis of whole Olives and Olive Paste using the DA 7250 Analyzer



**DA 7250 NIR Analyzer**

### Introduction

For the olive industry it is important to be able to rapidly and accurately determine moisture and oil in the olives, as these parameters define the amount of oil that can be extracted. Acidity affect quality of produced oil and is an indicator if the olives have been picked from trees or ground.

The Near Infrared Reflectance (NIR) technology is highly suitable for these measurement purposes. Instead of the time consuming and labor intensive traditional wet chemistry methods, with NIR the multi component analysis is done in seconds. The latest technology and software developments allows the benefits to be even further exploited with easy to use instruments and web-based instrument networking.

### DA 7250 NIR Analyzer

The DA 7250™ is a Near Infrared Reflectance (NIR) instrument designed for optimal use on agricultural products. Using novel Diode Array technology, the DA 7250 is unique in its measurement speed, versatility and accuracy. The instrument is handled by an intuitive touch screen interface and in less than 10 seconds samples are measured in flexible open dishes.

## Method

More than 1400 Olive samples were collected and analyzed on DA 7250 instruments. Some samples were analyzed as they were, with no grinding or any other sample preparation. Majority of samples were analyzed homogenized to Olive paste.

Calibration models were developed to model the relationships between the instruments NIR spectra and the reference chemistry results. Model development were done using scatter correcting spectra pre-treatments and multivariate Partial Least Squares PLS regression and PerkinElmer proprietary Hongjis regression HR Models were combined both combining all samples and making dedicated models for whole olives.

## Results and Discussion

Statistics of developed calibrations are summarized in tables below. High accuracy was seen on both whole and combined whole and homogenized olive samples models. A bit higher accuracy and lower repeatability error comparing to lab was seen measuring samples as olive paste. As expected, as this makes exact match to lab measurement easier. Being that the difference in accuracy is so small; using the dedicated whole olive models and not having to mill samples prior to analysis might be preferred use in many cases.

Table 1. Whole olive models

Parameter	Range	N	R
Fat % asis	10.1 – 36.5	300+	0.90
Moisture %	21.7 – 64.8	300+	0.95
Acidity %	0.3 – 6.8	200+	0.85

Table 2. Combined models, whole and paste

Parameter	Range	N	R
Fat % asis	9.6 – 37.2	1400+	0.97
Moisture %	28.0 – 72.0	1200+	0.97
Acidity %	0.1 – 10.7	1400+	0.90

The differences between the DA 7250 and the reference method are of the same magnitude as typical differences between two different reference labs. Typically, around 1% difference for Soxhlet extraction fat method and 2% for oven drying moisture method.

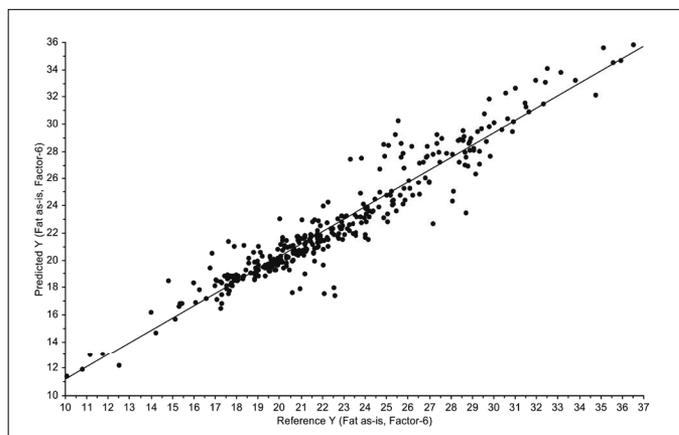


Figure 1. **Fat:** NIR Predicted vs Reference results for whole Olive fat calibration.

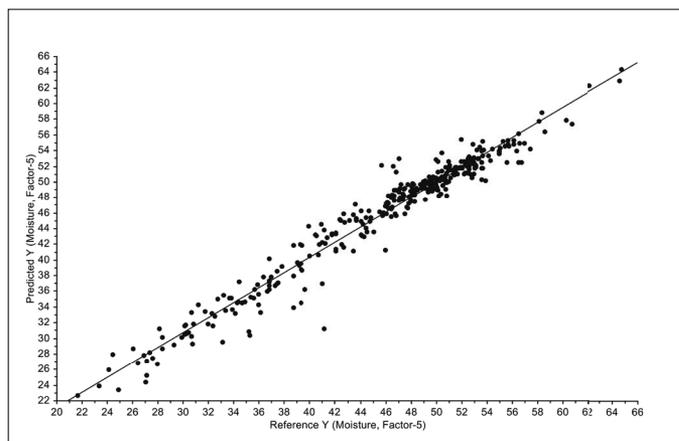


Figure 2. **Moisture:** NIR Predicted vs Reference results for whole Olive moisture calibration.

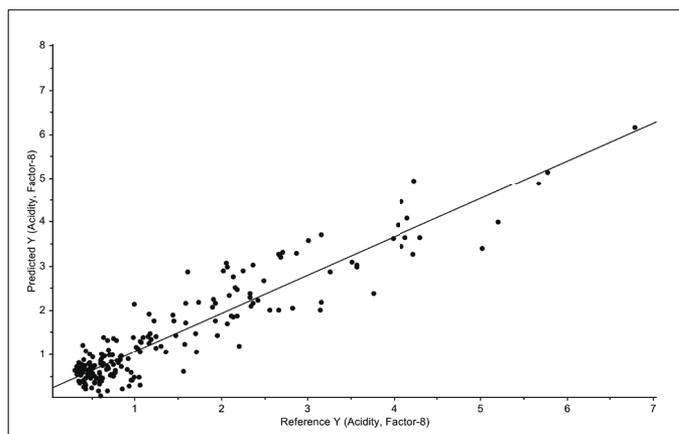


Figure 3. **Acidity:** NIR predicted vs Reference results for whole Olive acidity calibration. Results are not to be used as certification of virgin extra quality or not, but as guideline to determine low, intermediate or high acidity content in olive samples.

## Conclusion

In summary it is concluded that the DA 7250 can analyze fat and moisture in olives, whole or as paste, with high accuracy. Acidity measurements can be used as guideline.

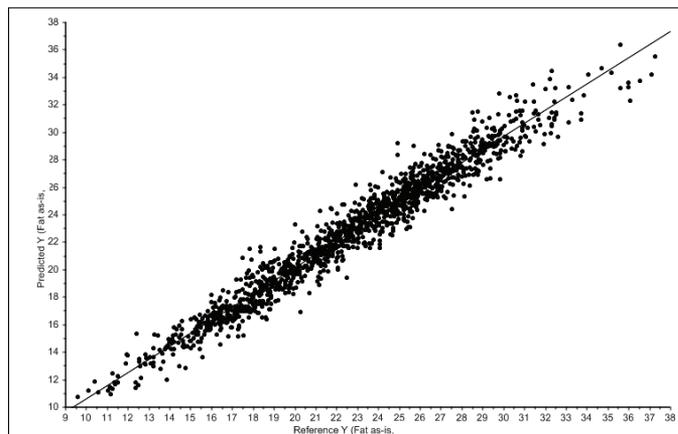


Figure 4. **Fat:** NIR Predicted vs Reference results for combined Olive fat calibration.

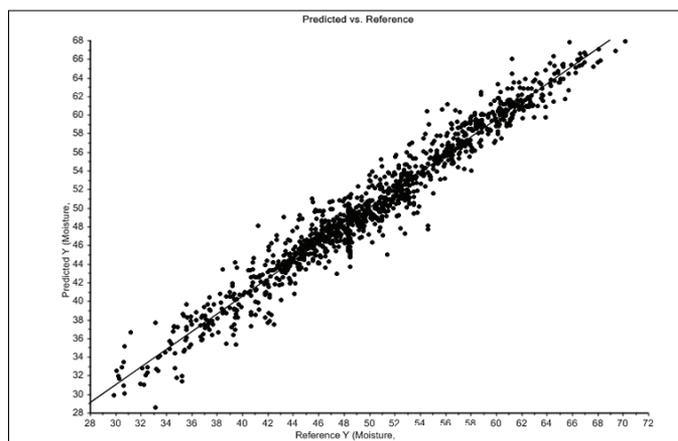


Figure 5. **Moisture:** NIR Predicted vs Reference results for combined Olive moisture calibration.

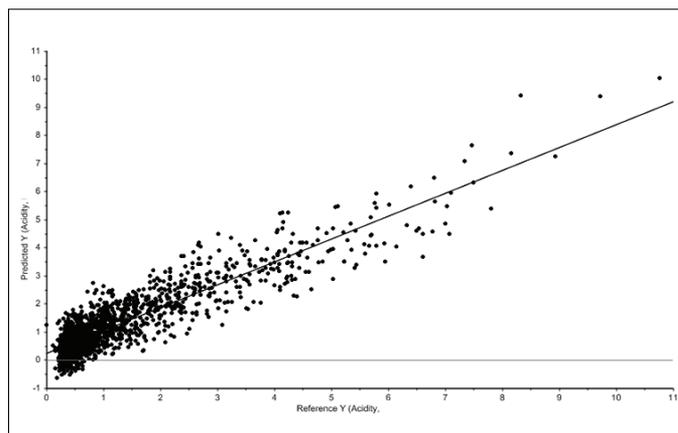


Figure 6. **Acidity:** NIR predicted vs Reference results for Olive acidity calibration. Results are not to be used as certification of virgin extra quality or not, but as guideline to determine low, intermediate or high acidity content in olive samples.