Application Note 74: Comparison of NIT-38 Olive Analyser with other NIR analysers.

Introduction:

NIR analysers are widely used for the measurement of oil and moisture levels in olives through out Europe. More recently the Australia Olive Industry has begun to take up NIR for this analysis. The NIT-38 Olive Analyser was developed in Australia for use in the Spanish Olive Industry. A number of calibrations have been developed for measuring oil and water content in olives and olive paste, as well as free fatty acids in virgin olive oils.

The purpose of this study is to demonstrate the ability to transfer a calibration for oil and water in olives from Spain to Australia and to compare the performance of the NIT-38 Olive Analyser with reference laboratory data and 7 other NIR analysers in use within Australia.

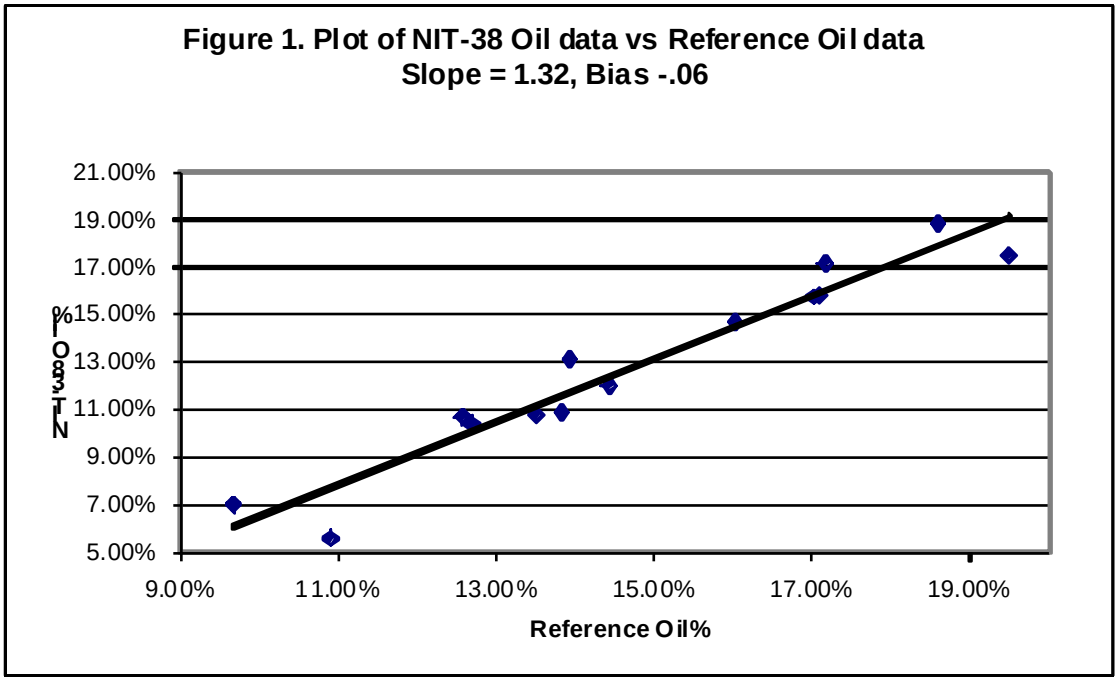
Procedure:

The Spanish calibration was loaded into the NIT-38 Olive Analyser. Olives were macerated using a Retsch hammer mill to form a semi-homogeneous paste, which was loaded, into a Squeeze Cell with a 10mm pathlength. The sample was compressed between two glass windows to form a consistent 10mm thick layer. The cell was inspected for air pockets in the sample and for even spread across the cell. The cell was loaded into the NIT-38 Olive Analyser which moves the cell up and down in front of the light beam to collect ten spectra for each sample across the wavelength range of 720nm to 1100nm. The averaged results were recorded for the fourteen samples.

Results:

Data was provided from a round robin analysis of fourteen samples of olives by eight near infrared analysers including the NIT-38 Olive Analyser. The data obtained from each NIR analyser were compared to the laboratory reference values for the fourteen samples.

Since the NIT-38 Olive Analyser used a Spanish based calibration and a different grinder, it was necessary to adjust the raw data from the instrument with a bias and slope correction. Figure 1. and 2. show the plot of the NIT-38 Olive Analyser's data vs the reference methods for oil and water.



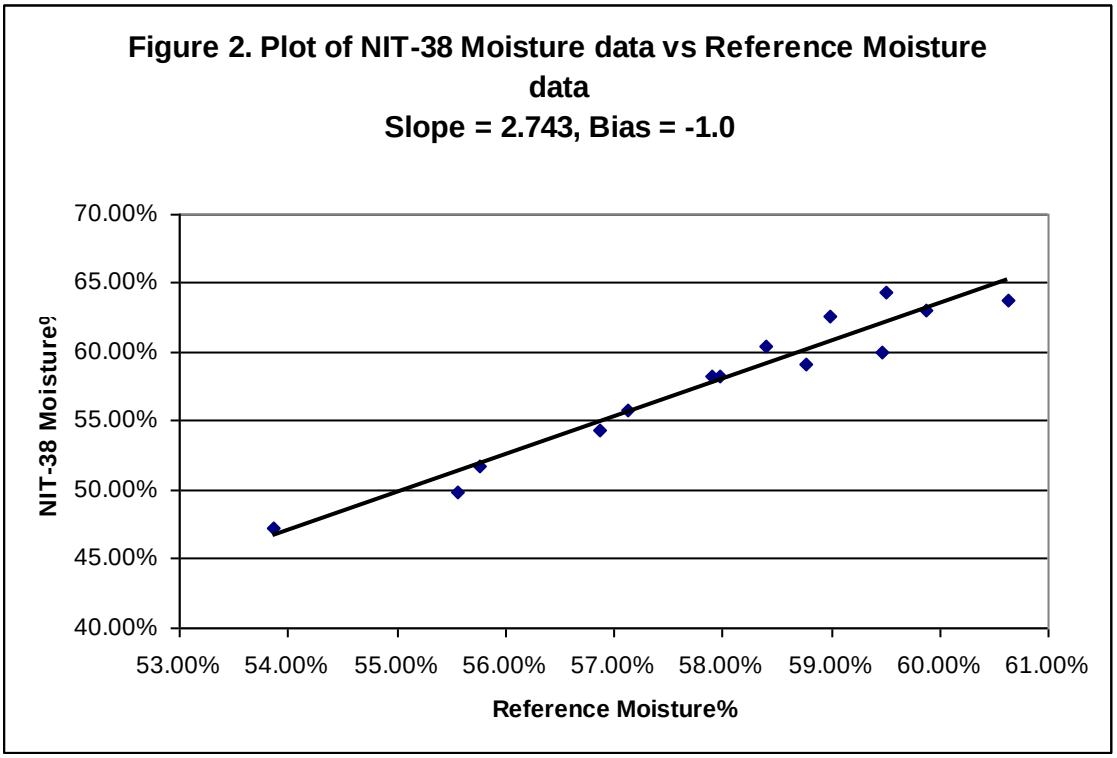


Figure 3. presents a comparison of the 8 NIR analysers for the 14 oil measurements and figure 4. presents the comparison for the 14 moisture measurements.

Appendix 1. provides tables for the actual oil and moisture measurements for each of the 8 NIR analysers and the reference method. The Standard Error of Prediction (SEP) and the Correlation Coefficient (R), are shown at the bottom of each table for each analyser.

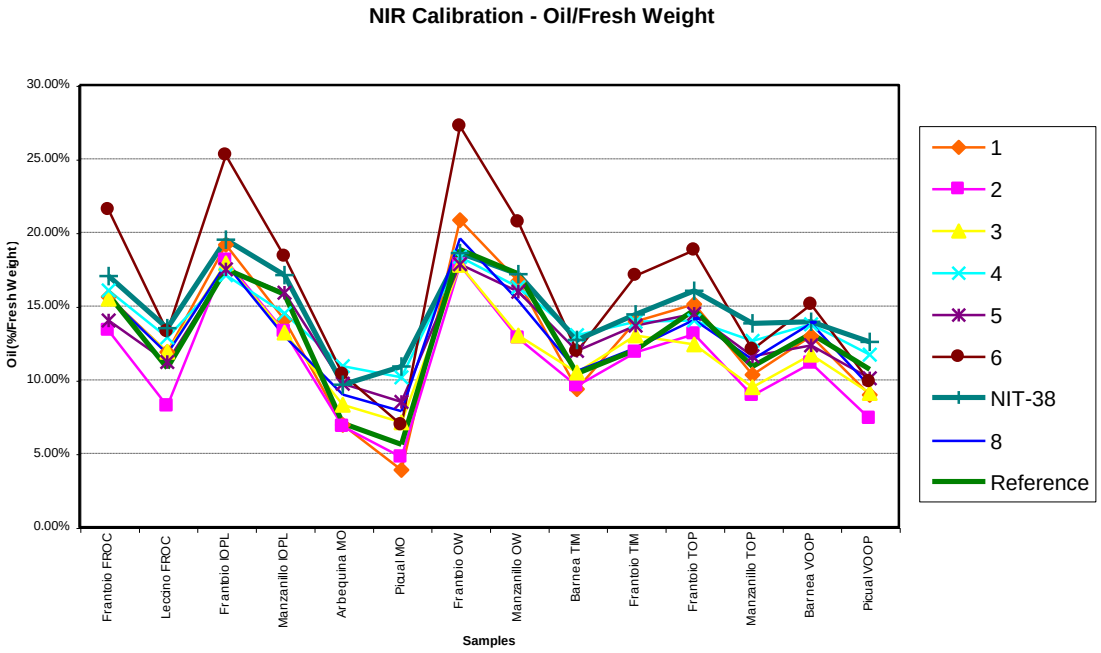


Figure 3: Plot of the Oil measurements for each NIR analyser and the reference method.

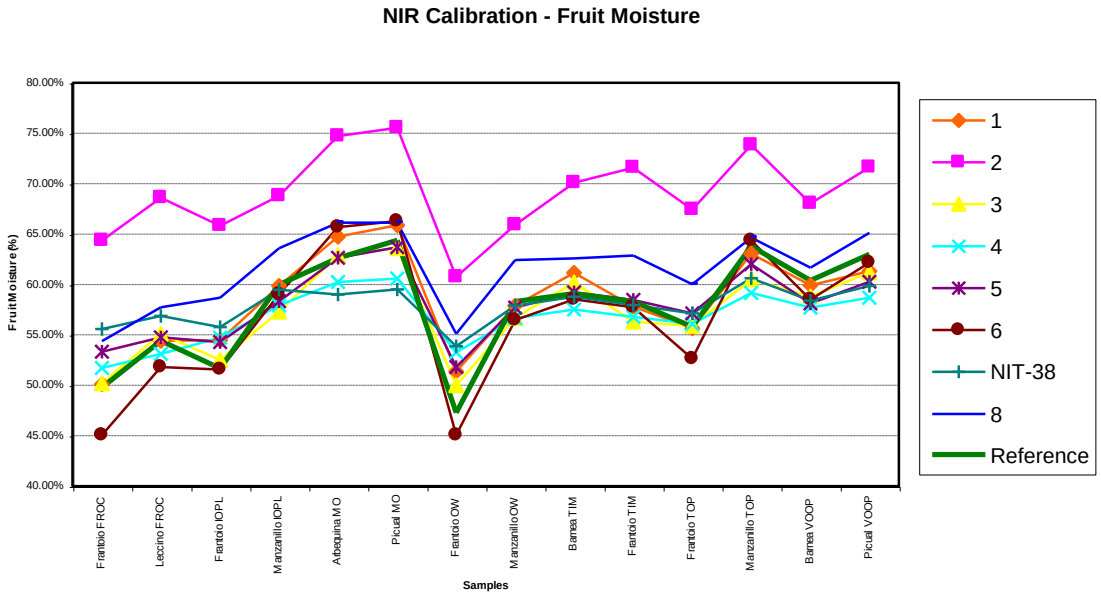


Figure 4: Plot of the Moisture measurements for each NIR analyser and the reference method.

Conclusion:

As can be seen in the above results, that the measurement of Oil and Moisture in olives is reasonably consistent for all analysers. The SEP for both Oil and Moisture as compared with the reference method were less than 1.5%.

The NIT-38 Olive Analyser compared favourably to the reference measurements after a slope and bias correction were applied. The NIT-38 Olive Analyse provided equivalent or slightly better results than the other 7 NIR analyser.

Appendix 1.

Below are the tables of actual resultant measurements.

Samples	NIR 1	NIR 2	NIR 3	NIR 4	NIR 5	NIR 6	NIR 7	NIT-38	Reference
	1	2	3	4	5	6	8		
1	14.82%	14.66%	16.05%	15.87%	14.02%	16.11%	15.60%	16.48%	**15.76%**
2	11.73%	9.81%	12.09%	10.72%	10.35%	10.96%	11.77%	11.82%	**10.79%**
3	17.72%	19.20%	18.69%	17.53%	18.53%	18.42%	17.87%	19.74%	**17.51%**
4	13.54%	14.60%	13.52%	13.35%	16.45%	14.14%	12.97%	16.57%	**15.81%**
5	7.68%	8.48%	8.13%	7.60%	8.44%	9.15%	9.00%	6.76%	**7.03%**
6	5.17%	6.50%	6.81%	6.37%	6.84%	7.02%	7.87%	8.39%	**5.62%**
7	19.08%	18.88%	18.58%	19.51%	18.96%	19.65%	19.60%	18.55%	**18.83%**
8	15.69%	14.18%	13.30%	16.19%	16.55%	15.60%	15.37%	16.66%	**17.19%**
9	9.68%	11.10%	10.55%	10.98%	11.35%	10.13%	10.60%	10.76%	**10.43%**
10	13.46%	13.27%	13.30%	12.43%	13.56%	13.33%	12.17%	13.05%	**12.03%**
11	14.41%	14.45%	12.64%	12.59%	14.60%	14.41%	14.07%	15.16%	**14.73%**
12	10.47%	10.48%	9.45%	10.33%	10.87%	10.21%	11.37%	12.26%	**10.90%**
13	12.64%	12.55%	11.87%	12.17%	11.82%	12.11%	13.83%	12.39%	**13.14%**
14	9.36%	8.99%	9.01%	8.84%	8.92%	8.85%	9.57%	10.59%	**10.72%**
Standard Error	**1.00**	**1.34**	**1.66**	**1.10**	**1.13**	**1.25**	**1.37**	**1.02**	
Correlation R	**.9353**	**.8854**	**.9072**	**.9605**	**.9174**	**.8996**	**.9422**	**.9660**	**1.00**

Appendix Table 1: Comparison of oil data as given by 9 NIR analysers against reference values

Sample ID	NIR 1	NIR 2	NIR 3	NIR 4	NIR 5	NIR 6	NIR 7	NIT-38	Reference
1	48.51%	52.40%	49.39%	48.51%	51.00%	48.90%	54.37%	52.82%	**49.80%**
2	53.10%	57.28%	55.21%	51.05%	53.09%	54.02%	57.73%	56.39%	**54.40%**
3	53.17%	54.08%	52.12%	54.08%	52.36%	53.84%	58.67%	53.37%	**51.70%**
4	58.94%	57.51%	57.83%	60.02%	58.27%	59.50%	63.60%	63.54%	**60.00%**
5	64.13%	64.28%	64.49%	64.29%	64.53%	64.54%	66.13%	62.25%	**62.60%**
6	65.35%	65.24%	65.32%	64.97%	66.08%	65.02%	66.13%	63.63%	**64.40%**
7	49.86%	48.29%	49.15%	51.37%	48.77%	48.90%	55.10%	48.14%	**47.30%**
8	56.84%	54.20%	57.12%	57.68%	57.35%	57.56%	62.43%	59.23%	**58.30%**
9	60.33%	58.98%	61.28%	59.22%	59.58%	59.12%	62.57%	61.62%	**59.10%**
10	56.73%	60.68%	56.64%	57.87%	58.47%	58.52%	62.87%	59.42%	**58.30%**
11	54.41%	55.95%	56.17%	56.62%	56.52%	54.65%	60.03%	57.11%	**55.80%**
12	62.36%	63.26%	61.63%	62.32%	63.61%	63.56%	64.63%	66.73%	**63.80%**
13	59.01%	56.64%	59.61%	59.59%	57.94%	59.10%	61.67%	60.60%	**60.40%**
14	60.50%	60.74%	62.47%	61.45%	61.09%	61.89%	65.10%	64.64%	**63.00%**
Standard Error	**1.58%**	**2.38%**	**1.47%**	**1.86%**	**1.43%**	**1.16%**	**1.47%**	**1.27%**	
Correlation R	**.9123**	**.8016**	**.9240**	**.8791**	**.9279**	**.9530**	**.9614**	**.9711**	**1.00**

Appendix Table 2: Comparison of moisture data as given by 8 NIR analysers against reference values.

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