Application Note 153. USA Calibrations for Soy Beans

Introduction:

Iowa State University, Dept of Food Science, has one of the largest sets of Soy Beans in the United States. Over a 12 year period, ISU has collected and analysed approximately 10,000 samples of US soy beans. They have used this set of samples to develop calibrations for several brands of Near Infrared Transmission (NIT) whole grain analysers. NIR Technology Systems entered into a contract with ISU in 2009 to develop calibrations based on the CropScan 1000B Whole Grain Analyser. This report presents the results of this calibration development.

Procedure:

The CropScan 1000B uses a diode array spectrometer to collect transflectance spectra from 720-1100nm. Within this region of the NIR spectrum, protein (N-H), oil (C-H), moisture (O-H) and carbohydrates (C-O-H) absorb energy at specific frequencies. The CropScan 1000B meters a sample of whole seeds or kernels of grain and oil seeds through a vertical flow cell. The seeds are metered by a rotating brush wheel so of that up to 15 scans can be collected for a 500ml sample. The average of these scans is then used to develop the NIR calibration against the wet chemistry analyses for protein, oil, moisture and fibre.

A selection of 481 samples of soy beans were made from the ISU sample set. Each sample was scanned using the CropScan 1000B with a 24mm pathlength cell. 15 scans were collected and averaged for each sample. Figure 1 shows the NIT spectra for the soy bean samples.

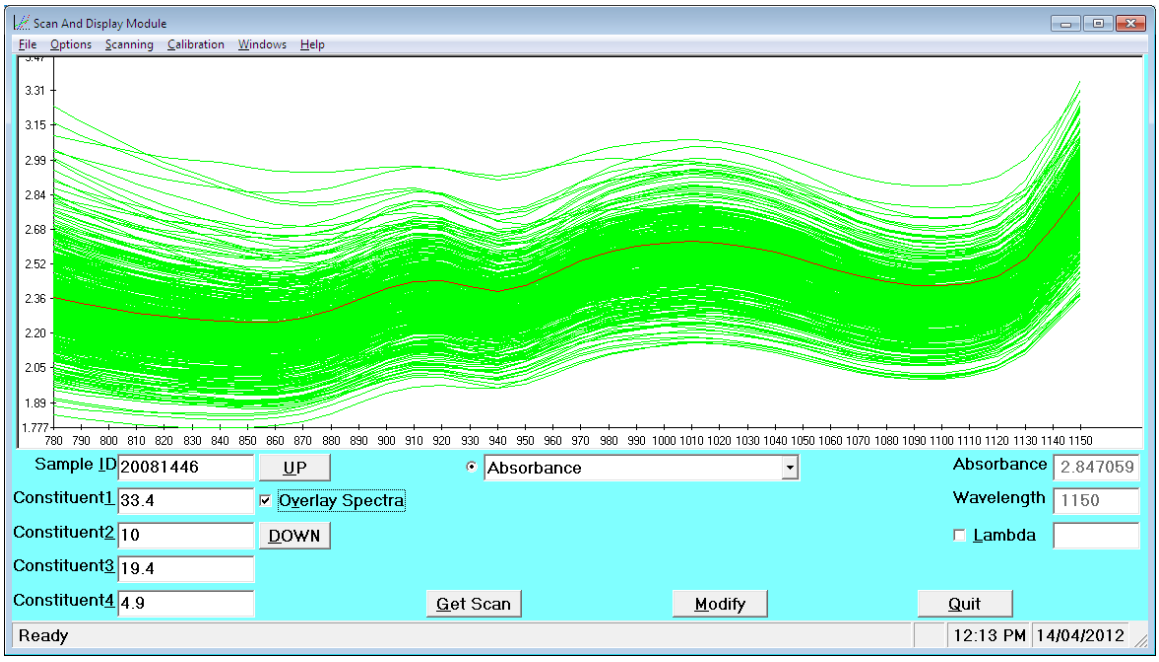

Figure 1. CropScan 1000B NIT Spectra of USA Soy Beans.

The spectra were exported from the CropScan 1000B's internal memory and imported into Unscrambler v 9.8, CAMO SA, Trondhiem, Norway, where a Partial Least Squares (PLS) Regression software was applied in order to develop calibrations foe protein, oil, moisture and crude fibre.

Results:

Figures 2, 3, 4 and 5 show the calibration plots and statistics for protein, moisture, oil and crude fibre respectively.

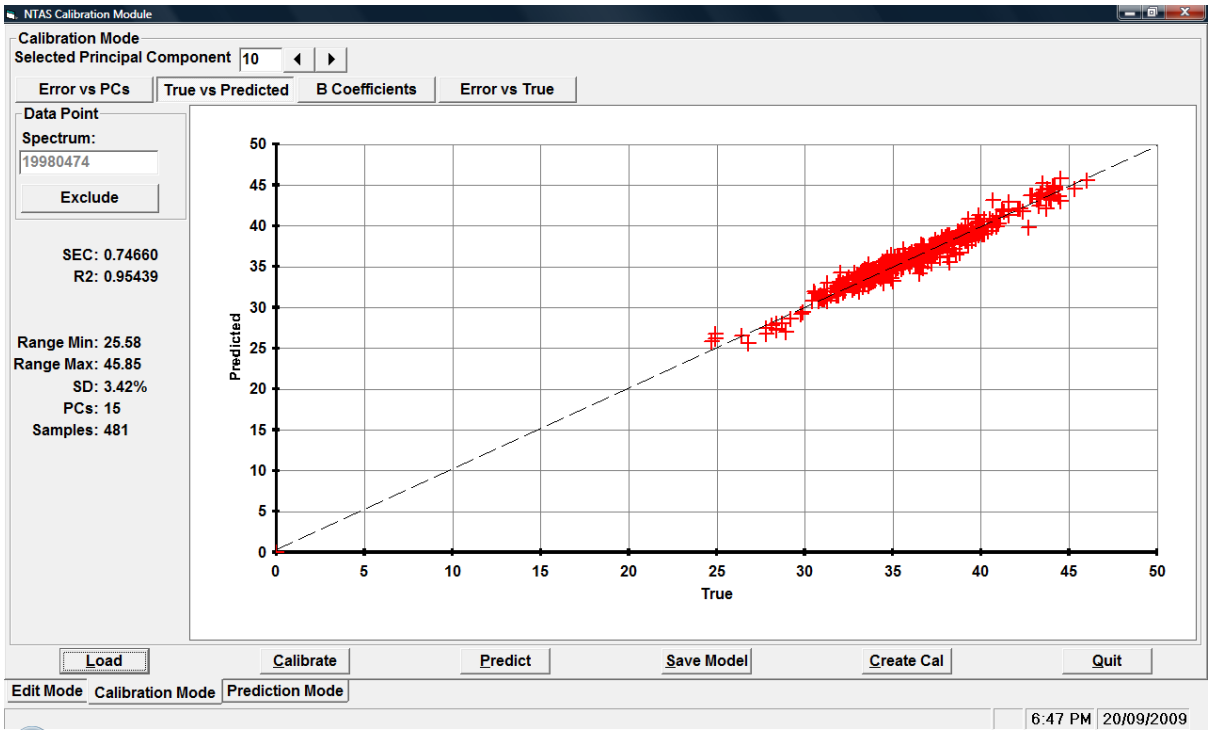

Figure 2. Calibration Plot for Protein

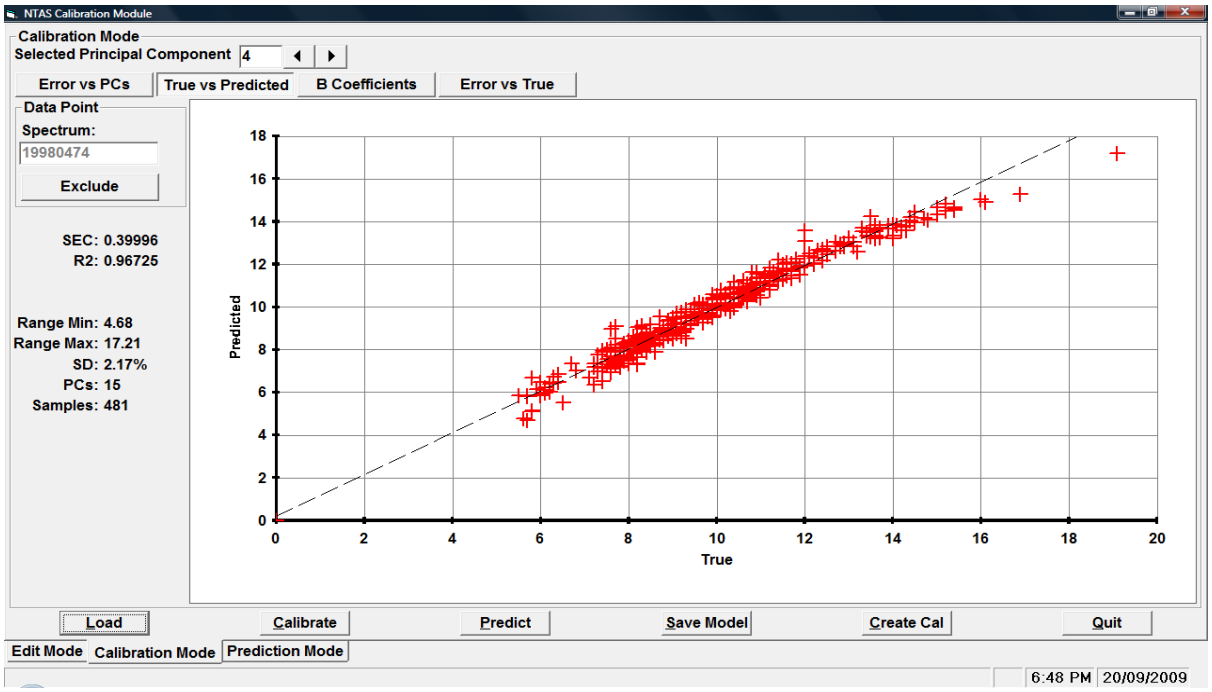

Figure 3. Calibration Plot for Moisture

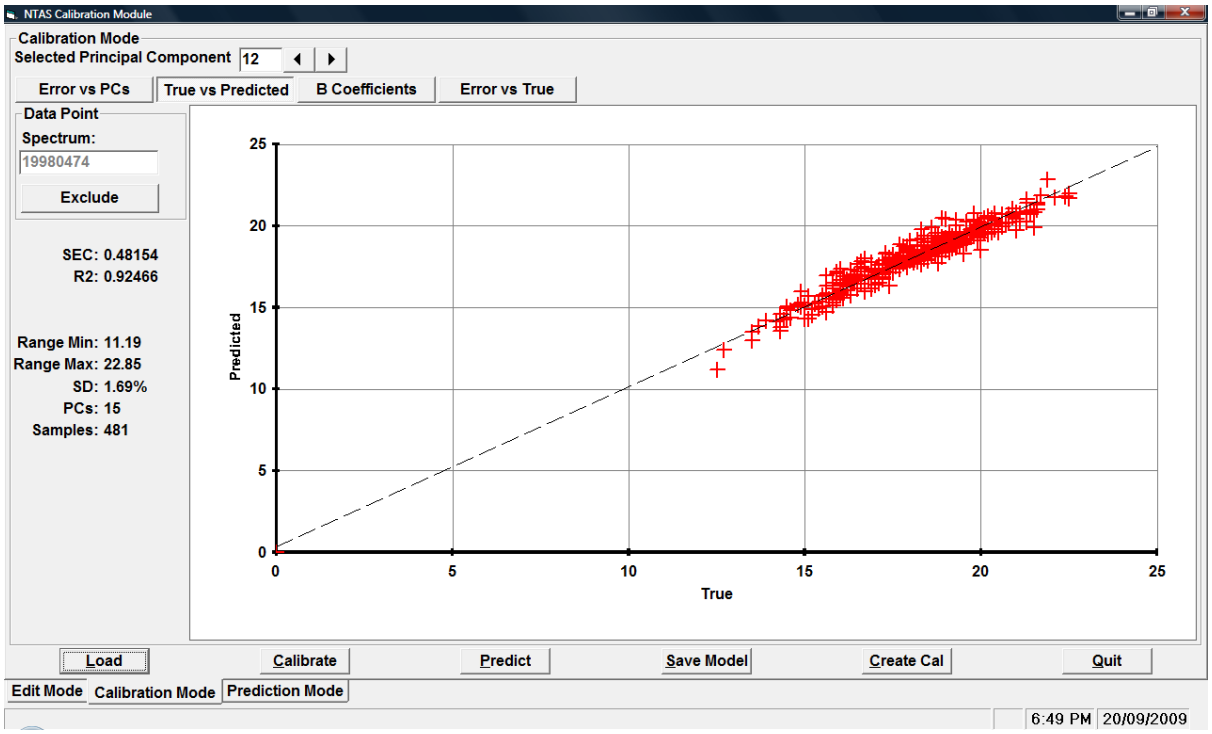

Figure 4. Calibration Plot for Oil

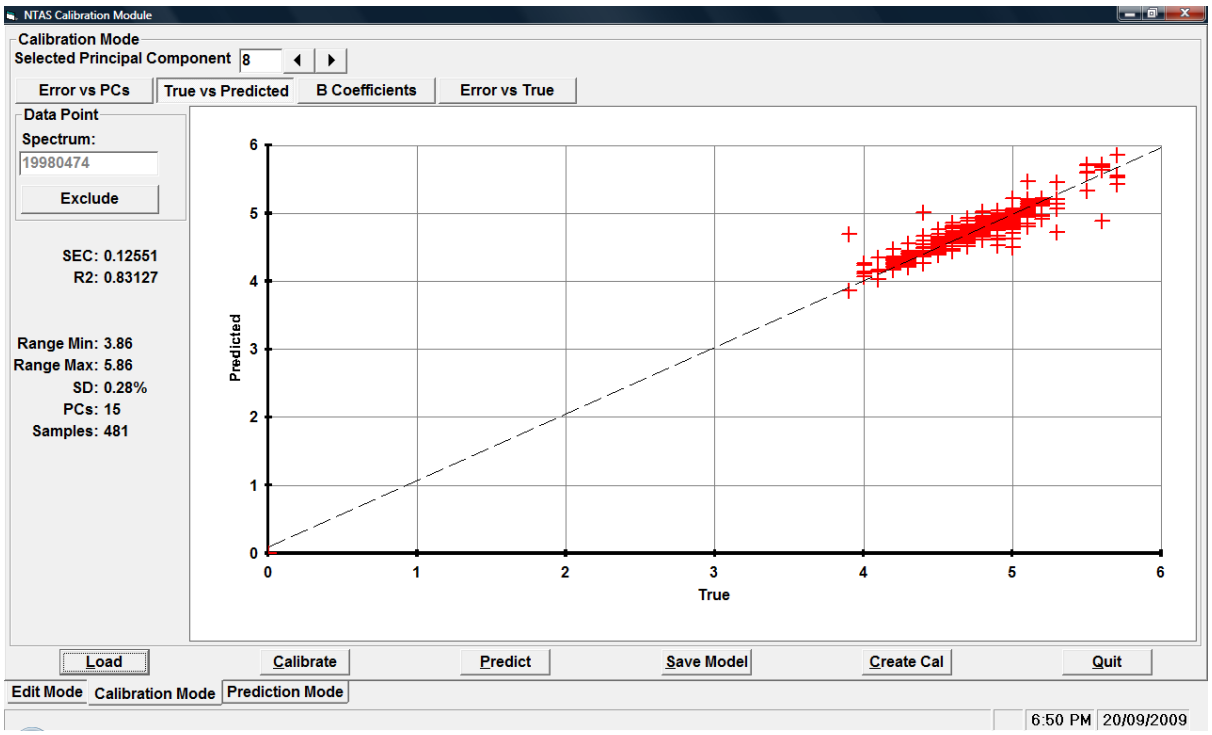

Figure 5. Calibration Plot for Crude Fibre.

Table 1. presents a summary of the calibration statistics.

Constituent	SEC	R^2
Protein	.74	.954
Moisture	.40	.967
Oil	.48	.924
Fibre	.12	.831

Conclusion:

The CropScan 1000B has been used successfully for measuring soy beans in Japan, Australia, Canada and elsewhere. The data presented in this report is consistent with the calibration data from other countries.

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