F-750
Produce Quality Meter

Non-destructive Measurements of Total Soluble Solids in Wax Jambu or Wax Apple (*Syzygium samarangense*)

Sugar (Total Soluble Solids (TSS) or °Brix content is regularly measured in wax apple or jambu throughout development and storage. Using traditional methodology, TSS measurements are destructive and time consuming. To determine effectiveness and viability of the F-750 Produce Quality Meter for non-destructive measurements of TSS in wax apple, a modeling study was conducted on 54 red wax apples. Destructive reference values were correlated with the non-destructive spectral data collected with the F-750 using the F-750 Model Builder Software, and results show that the F-750 Produce Quality Meter precisely and non-destructively measures TSS in wax apple, with a calculated root mean square error of prediction (RMSEP) of 0.46 TSS and a model prediction R^2 of 0.98 for TSS.

Materials and Methods

In January 2016, 54 red wax apples were used to create a new model for the F-750 Produce Quality Meter. Using the screws on the lens housing as alignment markers, wax apples were consistently presented and scanned on the F-750 Produce Quality Meter at room temperature (20°C). Next, the same wax apple regions scanned with the F-750 were destructively measured for Total Soluble Solids (TSS) using the method described in Felix Instruments Mango Standard Operating Procedure (SOP). The spectral range of 729-975 nm was used by the F-750 Model

Builder Software to detect correlations between the F-750 spectral signal and corresponding TSS values. The resulting regression data was analyzed for linearity, root mean square error, and leave-one-out cross validation error to determine the applicability and accuracy of the created model. A second population of 6 red wax apples were measured with the F-750 and used to independently validate the wax apple model. (Figure 2.)
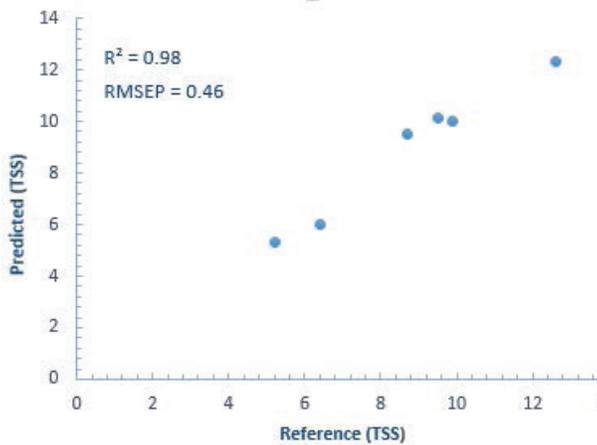

■ *Figure 1. Red wax apple variety (Syzygium samarangense)*

Results and Discussion

Results show that the F-750 Produce Quality Meter precisely, simultaneously, and non-destructively measures the TSS of wax apple. A strong correlation between spectral data and collected reference values is illustrated by a model prediction R^2 of 0.98 for TSS. Figure 2 displays this correlation and demonstrates the consistency of measurement.
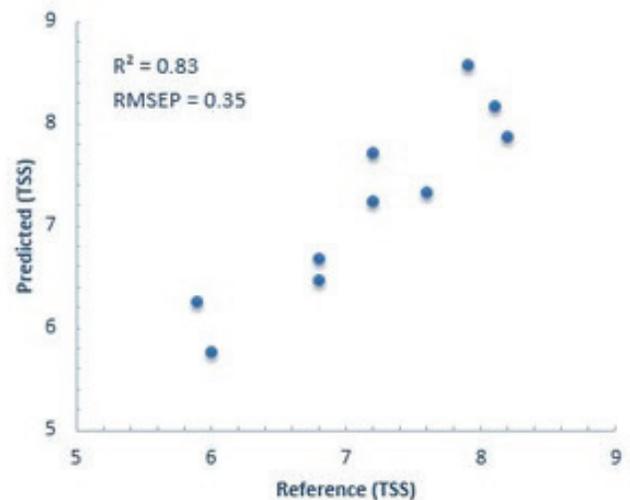
A calculated Root Mean Square Error of Prediction (RMSEP) of 0.46 TSS further illustrates the accuracy of the created model. This RMSEP value indicates the average uncertainty for a given measurement when the model is loaded onto the F-750 and used to predict TSS. The RMSEP is equivalent to the expected uncertainty within 68% of all predictions.

■ *Figure 3. Pink wax apple variety (Syzygium samarangense).*

■ *Figure 2. F-750 prediction value against reference method value of Total Soluble Solids in red wax apple.*

■ *Figure 4. F-750 prediction value against reference method value of Total Soluble Solids in pink wax apple.*

Similar results were found with the F-750 and pink wax apples. A separate model made in January 2016 using 48 pink wax apples resulted in a model prediction R^2 of 0.79 for TSS. A second population of 10 pink wax apples were measured with the F-750 to independently validate the wax apple model. Figure 4 displays this correlation with a calculated Root Mean Square Error of Prediction (RMSEP) of 0.35 and a model prediction R^2 of 0.83 for TSS.

Conclusions

The F-750 Produce Quality Meter accurately predicted Total Soluble Solids (TSS) in wax apple. Other tests and research findings have demonstrated the ability to measure other important internal fruit metrics with NIR technology. Similar results are expected for the F-750 Produce Quality Meter with other wax apple varieties and traits. Acknowledgment and appreciation goes to Dr. Yu-Shen Liang, Assistant Professor at the National Pingtung University of Science and Technology in Taiwan for carrying out much of this work and sharing results to create this application note, and to Mr. Pond, KoHsieh Instruments Co. Ltd., Taiwan in the supportive role of mediating this application note and supporting scientific research.

Further Reading and Supporting Science

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