



Supporting Agriculture in North America

*Guided by Science, Improved Technologies
and Science-based Policies*



20th Annual Meeting of the Board of Directors of PROCINORTE

Task Force on Tree Fruits 2018 Report

**Peter Toivonen (Canada), Samuel Salazar-García (Mexico),
Ricardo Goenaga (USA), and Jorge A. Osuna-Garcia (Mexico)**

Activities undertaken in 2018 by the Tree Fruit Task Force

- a) Task Force Annual Meeting – July 31st. Drs Osuna-Garcia and Goenaga at ASHS, Drs Salazar and Toivonen via Skype - Discussed progress, plans for publications and industry training sessions in Mexico for early 2019.
- b) Completion of model building for Hass avocado (July 2018). Model building was done in Collaboration with technical support from Felix Instruments. Validation of model for Hass avocado (August – September 2018).
- c) Models for maturity in Ataulfo and Tommy Atkins mango completed by Jesús Daniel Olivares Figueroa, an electrical engineering student at the Autonomous University of Nayarit. On July 11 2018, Daniel was awarded a Bachelor of Science in Engineering Degree.
- d) Model validation for apples was initiated in August 2018 ongoing and will be completed by November 30th.
- d) Preparation for industry training that will occur in the first quarter of 2019 in Mexico.
- e) Invited presentation by Dr. Osuna-Garcia at the First Mexican Avocado Congress that will be held in Uruapan, Michoacán, sponsored by the Mexican Avocado Intellectual Society (SIAM) October 25 and 27. His presentation will take place on October 27th.

Jesús Daniel Olivares Figueroa measuring dry matter content of Hass avocado



Actual spectra collected during model building and selected range for use in the model (729 – 975 nm)



Figure 3. Explained Variance for the Hass3 Model = 71.93 %

Linearity of the model



Figure 4. Model Linearity for the Hass3 Model ($R^2 = 0.93$)

Sensitivity of the model



Figure 6. Root Mean Square Error for the Hass3 Model

External validation of the model – essential to confirm that the model is robust.

MICHOACÁN & NAYARIT - 682 avocados sampled

$R^2 = 0.71$ (0.7 and above considered acceptable for a working model)

Root Mean Square Error of Prediction = 1.49 (compared to RMSECV of 1.51 in cross-validation) i.e. prediction strength is not diminished – i.e. model is robust

SDR = s.d. sample/RMSEP = 3.12 (the model is an accurate predictor since a value of 3 and higher is considered excellent)



Where are we now?

- **External validation has demonstrated robustness of model over two growing areas**
- **Felix Instruments can ‘tailor’ and improve the model and is planning to release a stripped down version (F751) to industry**
- **In order to achieve that, an MTA between IICA-PROCINORTE-INIFAP-Felix for Felix to use the model and modify as required should be discussed by the Board, IICA and INIFAP.**

[MTA Document](#)



Where are we now?, cont'd

- **Preparation for industry training sessions in early 2019**
- **Writing of a scientific paper for an international horticultural journal – 2018-19**
- **Presentation (Dr. Osuna-Garcia) to the First Mexican Avocado Congress, October 2018**

Other tree fruit – Status of work

- Two models were built and cross-validated for ‘Ataulfo’ and ‘Tommy Atkins’ mango varieties. In ‘Ataulfo’ the best model had an $R^2 = 0.98$ for skin color, while for ‘Tommy Atkins’ the best model showed an $R^2 = 0.62$ for dry matter content.
- Model for apples (all varieties) built and cross-validated – $R^2 = 0.90$, RMSECV = 0.49, and SDR = 5.29. This model is being externally validated for use in germplasm development at Summerland Research and Development Centre and for evaluating at-harvest quality in apple quality research. MTA with Vineland Research and Development Center in their Apple Breeding Program.

Issues Around Technology Transfer

An MTA with Felix Instruments to transfer the models to them requires discussion and agreement between INIFAP, IICA and PROCINORTE.

A technical brochure including protocol for sampling will be developed for distribution to Mexican participants of the training sessions to be held in early 2019.

Three training sessions are planned for early 2019 to serve the needs of the Michoacán, Jalisco and Nayarit industries. Preparation for those sessions is Ongoing for the last quarter of 2018, including printing of the handbooks.

Felix Instruments will be participating (in-kind) to help deliver the training sessions, including supplying instruments for use in the training.

Productivity

Technology Transfer

2018

- a) Folleto Técnico "Uso del Espectrómetro F-750 para Determinar Materia Seca de Manera No Destructiva en Aguacate 'Hass'". Will publish in November 2018 in preparation for training workshops in 2019
- b) Article for HortTechnology "Building and Validating an Ataulfo Model by Spectrometry to Optimum Harvesting Time". (in preparation)
- c) Article for Scientia Horticulturae - "Determining Dry Matter Non-Destructively in 'Hass' Avocado". (in preparation)
- d) MTA between INIFAP-PROCINORTE-FELIX for facilitating mango and avocado models. Dr. Fernando de la Torre, new General Director of INIFAP and has expressed agreement to sign the agreement with Felix.
- e) MTA between Vineland Research and Innovation Center and AAFC transferring a model for predicting dry matter in apples to the apple breeding program at that institute.

Productivity, cont'd

Technology Transfer

- f) Presentation by Dr. Osuna-Garcia at the First Mexican Avocado Congress Uruapan, Michoacán, sponsored by the Mexican Avocado Intellectual Society (SIAM) October 25 and 27. His presentation will take place on October 27th. Title – “Advances in building and validating the Hass3 Model in avocado”

TREE FRUIT TASK FORCE

Relevance – The work being conducted pertains to developing non-destructive tools to measure composition/maturity of tree fruits and these tools are becoming recognized, in many other jurisdictions, as a new and essential standard for managing quality of fruits in the export market place. It is therefore important for the member countries of PROCINORTE to become capable in the use of such tools.

Impact – Non-destructive spectral analysis for quality using portable instruments will significantly reduce waste in industry which now destroys significant amounts of fruit for making destructive measures to assess quality for harvest. Standardized tools will enable development of a modernized and harmonized quality standard regulations for tree fruits between the US, Canada and Mexico.

Effectiveness of the Task Force – Current activities include participation of industry partners who have great interest in adopting the technology (i.e. it is pre-sold). Other countries in North, Central and South America express interest in interacting with the Task Force members in developing/adopting this instrument for measuring dry matter in avocado, sweet cherries and other tree fruit.

TREE FRUIT TASK FORCE BUDGET EXECUTION 2018

TASK FORCE	EVENT / ACTIVITY	DATE	TOTAL SPENT	BUDGETED	SURPLUS / SHORTFALL
TREE FRUIT	Task Force Meeting, Washington, USA	July 31 – Aug 3, 2018	\$ 1,835.0	\$ 4,000	\$ 2,165
	Evaluating avocado maturity using spectral analysis.	Dec. 2018	\$ 4,000.0	\$ 4,000	\$ -
	Evaluating Mexican mango maturity using spectral analysis	Nov. 2018	\$ 2,000.0	\$ 2,000	\$ -
	Improve and update the taskforce web site.	Apr. 2018	Service provided by USDA	\$ -	\$ -
	Negotiate with sites in three Mexican states (Nayarit, Jalisco and Michoacán) and Felix Instruments to hold training session for avocado packing house staff on the use of the Vis-NIR spectrometer to predict dry matter. The expected date for the training will be the first half of 2019	Nov. 2018	\$ 5,000.0	\$ 5,000	\$ -
	Evaluating sweet cherry quality using spectral analysis.	Nov. 2018		\$ -	\$ -
	Evaluating apple maturity using spectral analysis.	Nov. 2018		\$ -	\$ -
	Website Restructuring	Oct. 2018	\$ 379.5	\$380	\$ -
Total			\$ 13,214.5	\$15,000	\$1,786

Plans for the future?

- **Come to an end with the current goals – more interest in expanding to other fruits, but that may be better supported with other funding**
- **Should complete this TF theme by documenting the progress and issues faced by the TF in reaching the final outcome and success.**
- **Two of the Tree Fruit TF suggested that redirection into evaluating effects of variable climatic/weather conditions in different growing seasons on crop quality**
- **Three of the four TF members have indicated that they will be retiring in the next few years – i.e. opportunity to shift membership in the TF**
- **Suggest that 2019 be used as a year to organize a workshop for interested scientists from the US, Mexico and Canada to formulate a new TF theme**
- **Development of a new work plan to focus the new direction of the TF**

Proposed Budget 2019

Member	Specific Objective	Expected Results	Date	Venue	Delivery Instrument	Resource Implications	Funding Mechanism	Participants
TREE FRUIT	Improve and update the taskforce web site.	Disseminate Taskforce accomplishments	April 2019	Website	Website Documents	\$-	\$7,000 INIFAP, AAFC, USDA/ARS	R. Goenaga, S. Salazar, P. Toivonen, and J. Osuna
	Task Force Meeting	Discuss current research progress; Prepare Action Plan 2019	March 2019	TBC	Analysis of results, Report, 2019 Work plan	\$4,000	8,000 INIFAP, AAFC, USDA/ARS	R. Goenaga, S. Salazar, P. Toivonen, and J. Osuna,
	Compiling mango maturity using spectral analysis.	Protocol for testing mango maturity	July 2019 (subject to funding beyond Taskforce's current budget).	Mexico	Report	\$2,000	\$2,000 INIFAP, AAFC, ARS/USDA (In-kind) \$2,000 Industry	R. Goenaga S. Salazar, P. Toivonen J. Osuna
	Compiling avocado maturity using spectral analysis.	Protocol for testing Avocado maturity	Jun. 2019	Mexico	Report of analysis of data	\$2,000	\$40,000 INIFAP, AAFC, ARS/USDA (In-kind) \$10,000 Industry	R. Goenaga S. Salazar, P. Toivonen J. Osuna

Proposed Budget 2019, con't

Member	Specific Objective	Expected Results	Date	Venue	Delivery Instrument	Resource Implications	Funding Mechanism	Participants
TREE FRUIT	Hold training session for avocado packing house staff on the use of the Vis-NIR spectrometer to predict dry matter.	Development of the third generation model having a full range of dry matter contents included.	Feb-March 2019	Mexico	Training materials, confirmed site locations, contribution agreements and list of participants.	\$2,000	\$20,000 AAFC, INIFAP, USDA/ARS (In kind) \$10,000 Industry	R. Goenaga S. Salazar, P. Toivonen J. Osuna
	Prepare and complete technology transfer package	Technology transfer package	Nov. 2019	TBC	Communication products	\$5,000	\$10,000 INIFAP, AAFC, ARS/USDA (In-kind) \$3,000 Industry	. Goenaga S. Salazar, P. Toivonen J. Osuna
	Evaluating apple maturity using spectral analysis.	Validate model for dry matter content of apples at harvest maturity under field conditions	Nov. 2019	BC., Canada	Field work and data collection	\$--	\$10,000 INIFAP, AAFC, ARS/USDA (In-kind) \$3,000 Industry	P. Toivonen
TREE FRUIT SUBTOTAL						\$15,000		

ACKNOWLEDGEMENTS



The Task Force would like to thank the board of directors for their approval of the purchase of a commercial spectrometer – made huge improvement to progress.

The Task Force would like to thank Audia Barnett for her responsiveness, guidance and support over the past year.

The Task Force would also like to thank Gloria Ramirez for her excellent help with communications and keeping up with the paperwork required to complete the work.