

2017 ANNUAL REPORT FOR PROCINORTE

May 1st to December 30th, 2017

Ph. D. Jorge A. Osuna García

Jesús Daniel Olivares Figueroa

I. Building Ataulfo Model:

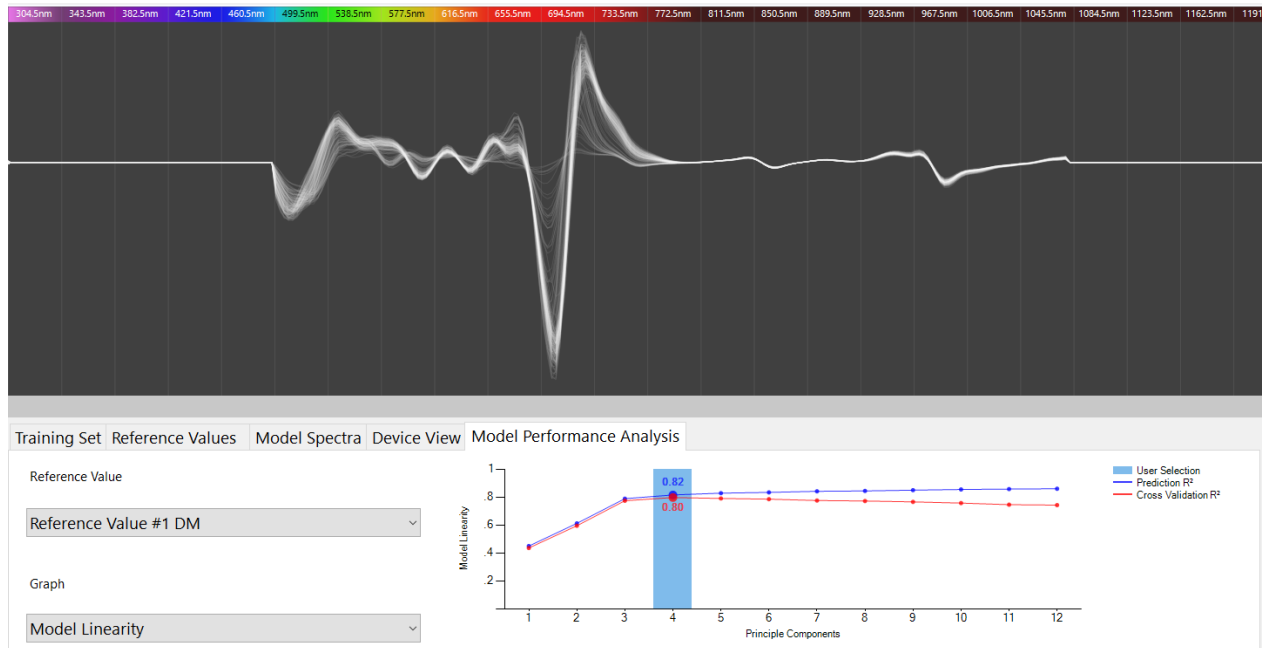
Reference samples harvested on May 8th, 2017, from an orchard located in 5 de Mayo, San Blas County, Nayarit State, Mexico. Three hundred fruits were harvested at different ripening stages to finally select 200 at five categories: 1. Unripe, 2. Green Mature 1 (GM1), 3. Green Mature 2 (GM2), 4. Green Mature 3 (GM3), and 5. Fully mature (Figure 1). Fruits were scanned with the F-750 at ambient temperature (25 ± 2 °C), skin color measured with a Minolta 400 Chroma meter reporting 'a' value, and total soluble solids using an Atago PAL-1 refractometer. DM was calculated according to Lee and Coggins (1982) using the microwave oven.



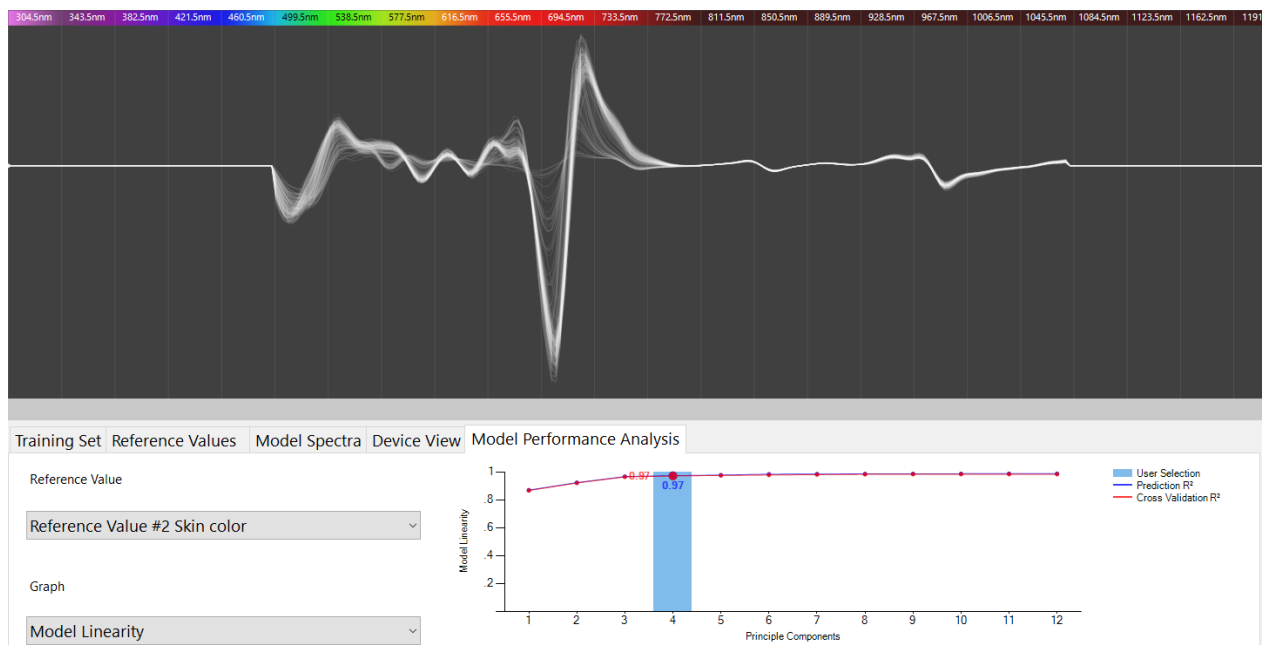
Figure 1. Ataulfo fruit for building the Model.

Results

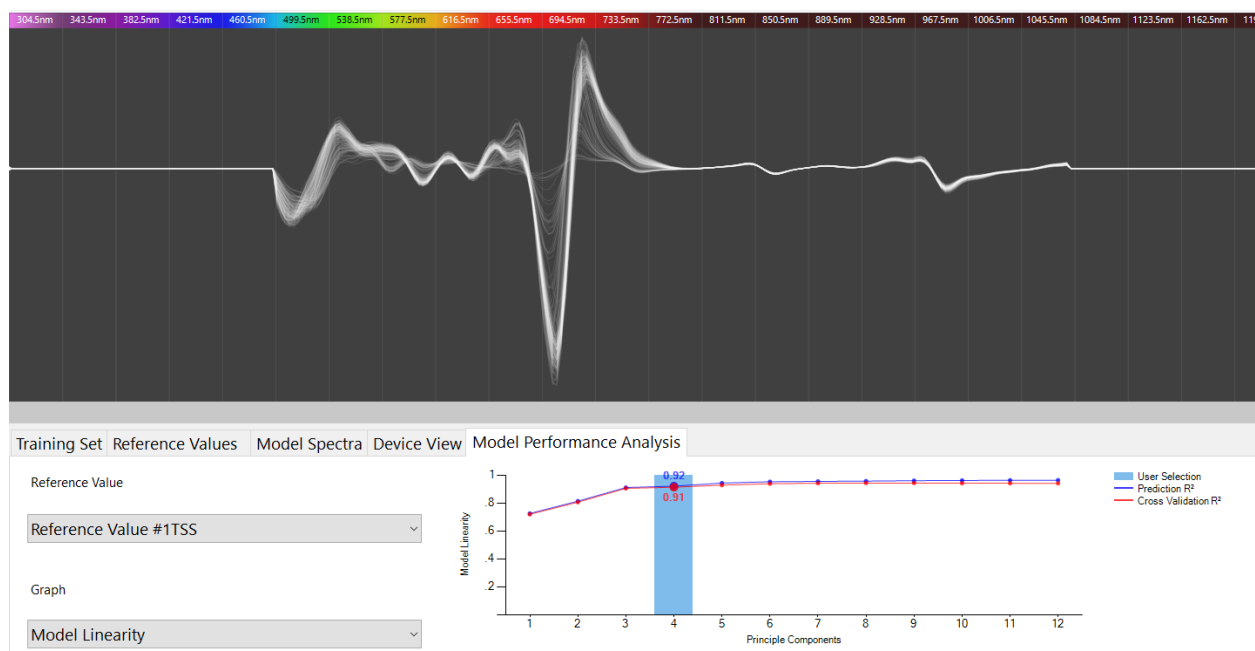
a. Ataulfo Model for Dry Matter (DM).



b. Ataulfo Model for Skin color.



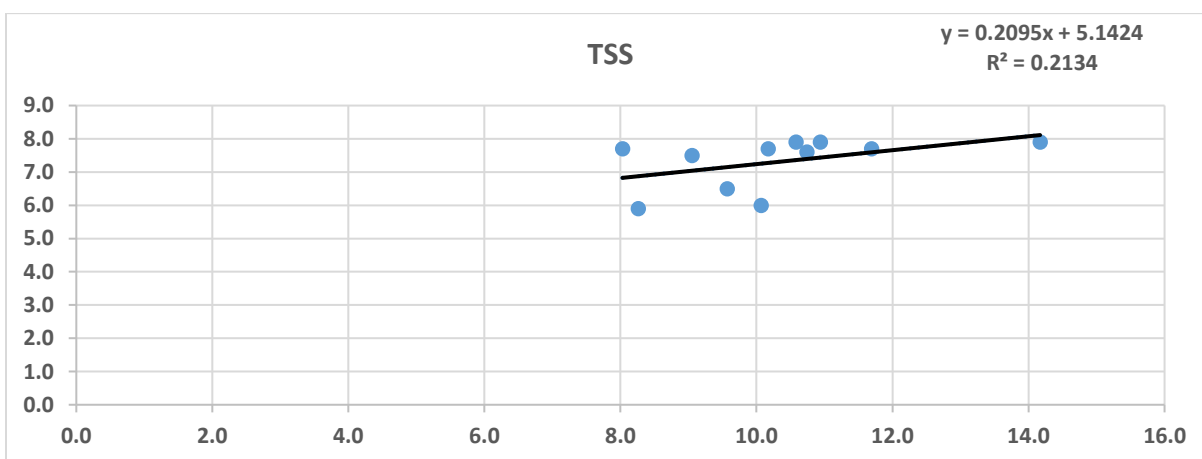
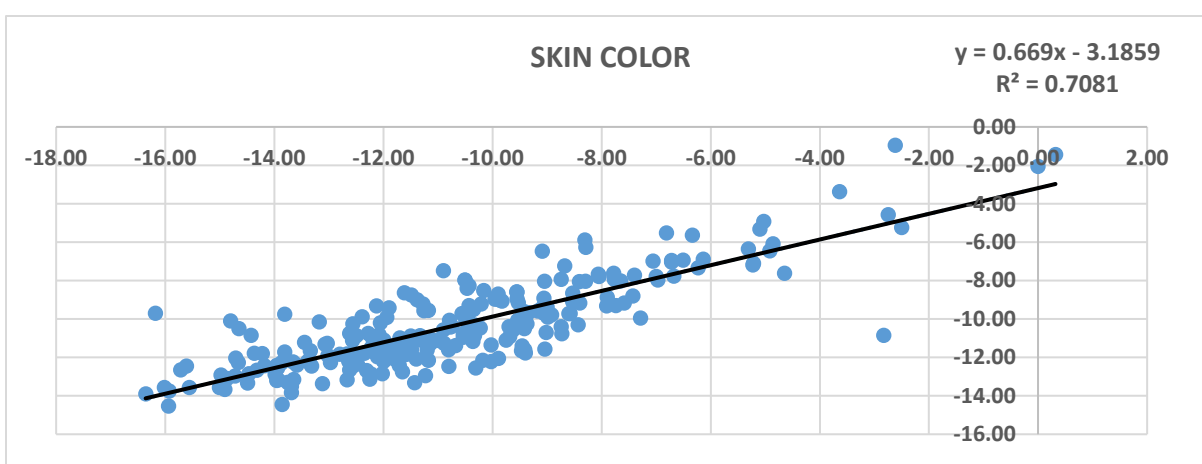
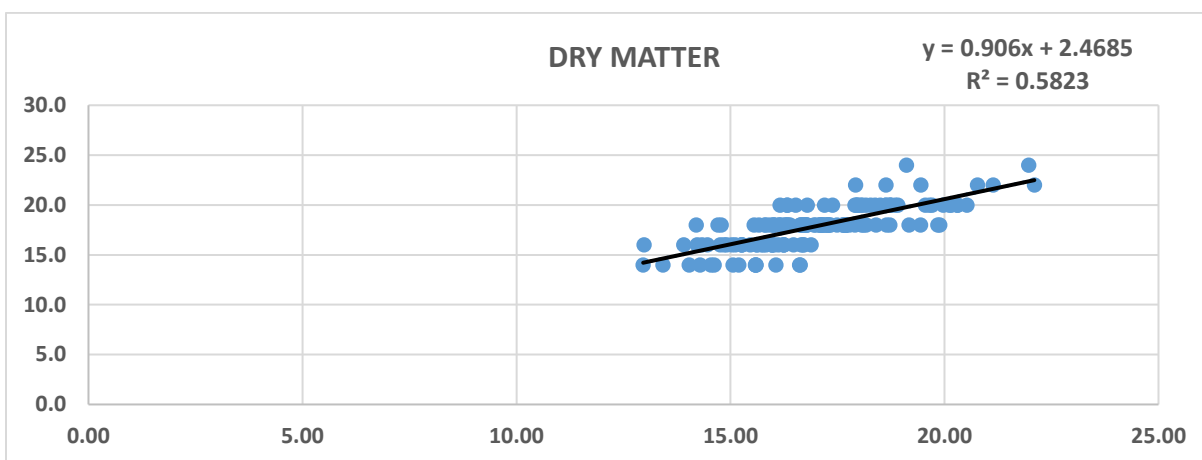
c. Ataulfo Model for Total Soluble Solids (TSS).



The model linearity was best for Skin color 'a' ($R^2 = 0.97$), followed by TSS ($R^2 = 0.92$), and DM ($R^2 = 0.82$).

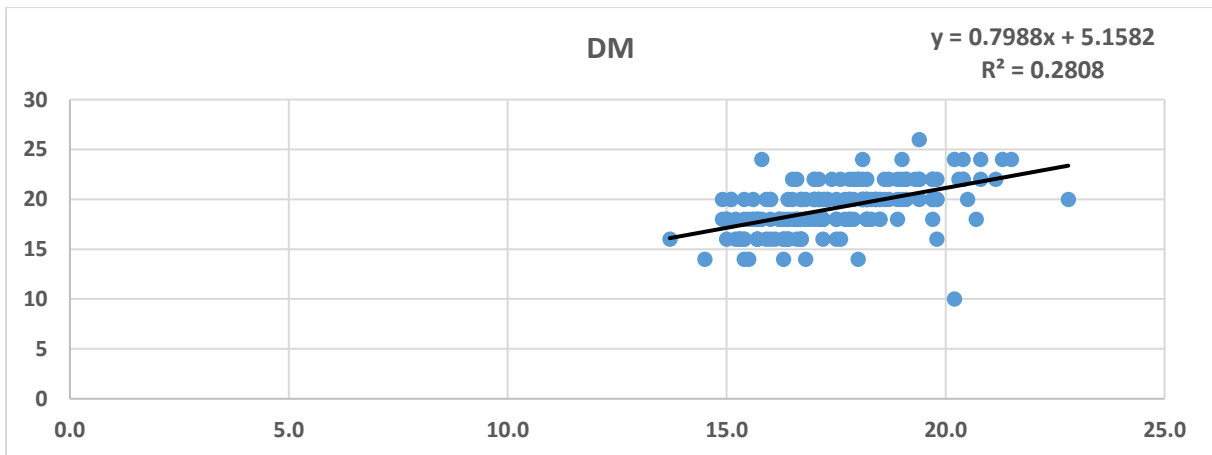
1. First Validation Ataulfo

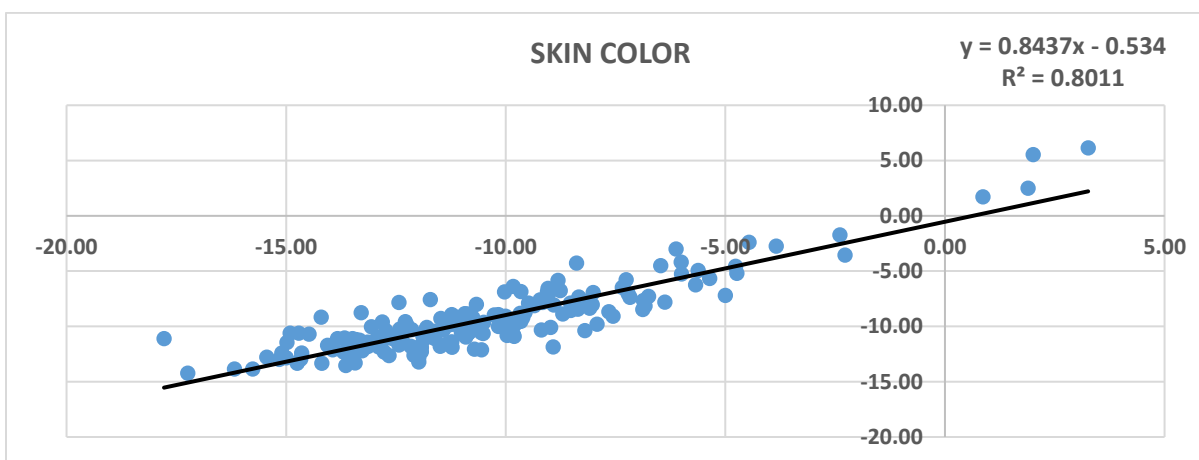




As results showed, the best predicted values were Skin color 'a' with a $R^2 = 0.7081$, followed by DM with a $R^2 = 0.5823$, and finally TSS with a $R^2 = 0.2134$. Therefore, we did a second round of validation with six different lots using only Skin color 'a' and DM.

2. Second validation Ataulfo





The adjusted predicted values for Skin color improved a lot in this second round with a $R^2 = 0.8011$, while the DM decreased with a $R^2 = 0.2808$.

II. Building 'Hass' avocado Model: All this information is contained in the manuscript "MODELO NO DESTRUCTIVO PARA DETERMINAR MADUREZ DE COSECHA EN AGUACATE 'HASS'", published in the V Latin-American Avocado Congress held in Cd. Guzmán, Jalisco last September, 2017 (file attached).

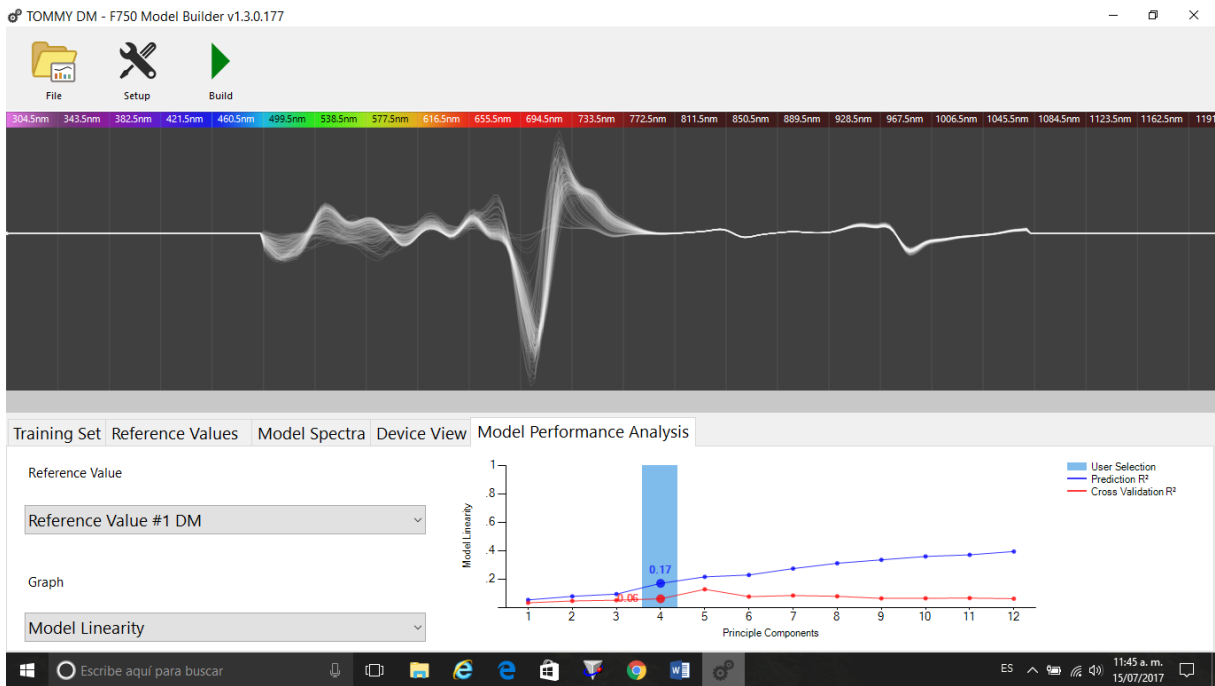
III. Building Tommy Atkins Model.

Reference samples harvested on June 15, 2017, from an orchard located in El Puente, Santiago Ixcuintla County, Nayarit State, Mexico. Three hundred fruits were harvested at different ripening stages to finally select 200 at five categories: 1. Unripe, 2. Green Mature 1 (GM1), 3. Green Mature 2 (GM2), 4. Green Mature 3 (GM3), and 5. Fully mature (Figure 1). Fruits were scanned with the F-750 at ambient temperature ($25 \pm 2^\circ\text{C}$), pulp color measured with a Minolta 400 Chroma meter reporting 'Hue' value, and total soluble solids using an Atago PAL-1 refractometer. DM was calculated according to Lee and Coggins (1982) using the microwave oven.

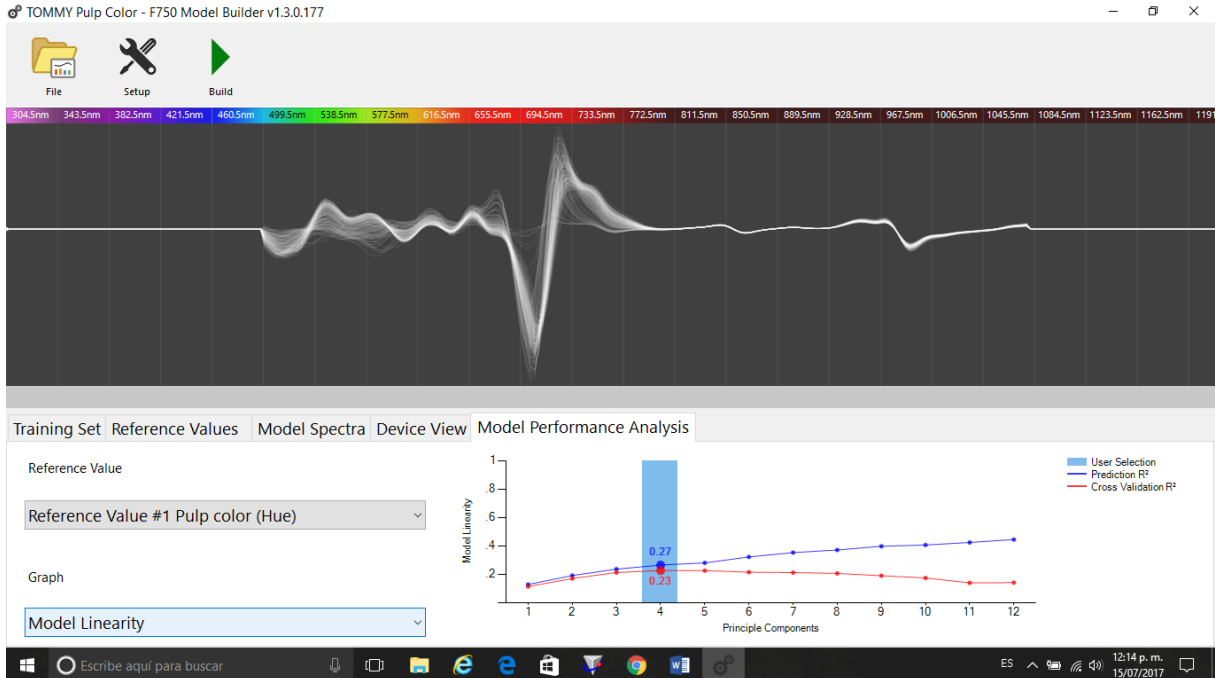


Figure 2. Tommy Atkins fruit for building the Model.

a. Tommy Atkins Model for Dry Matter (DM).



b. Tommy Atkins Model for Pulp color (Hue).

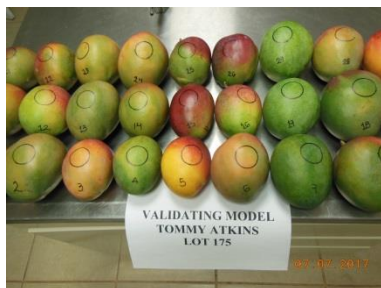


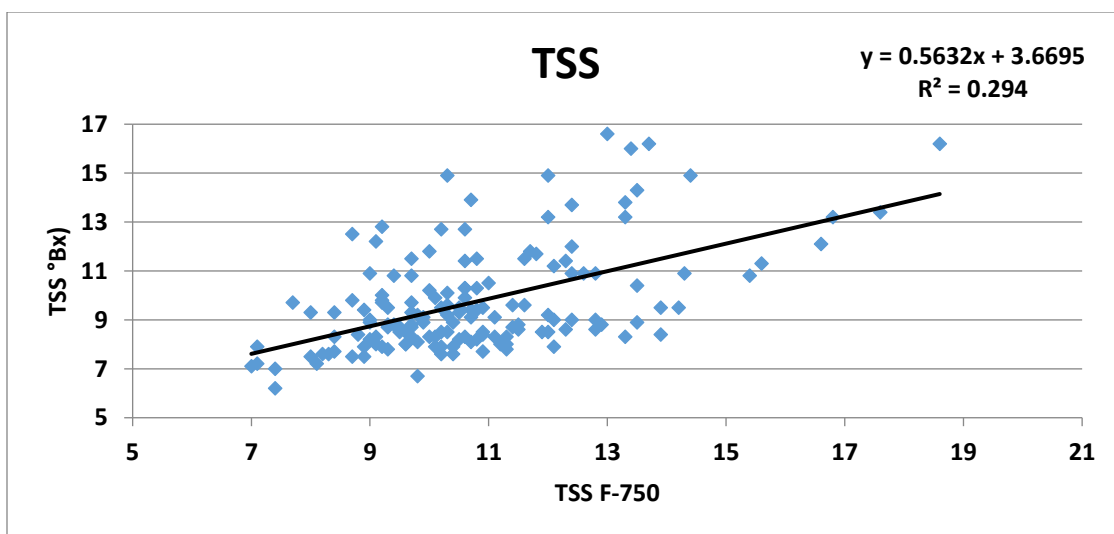
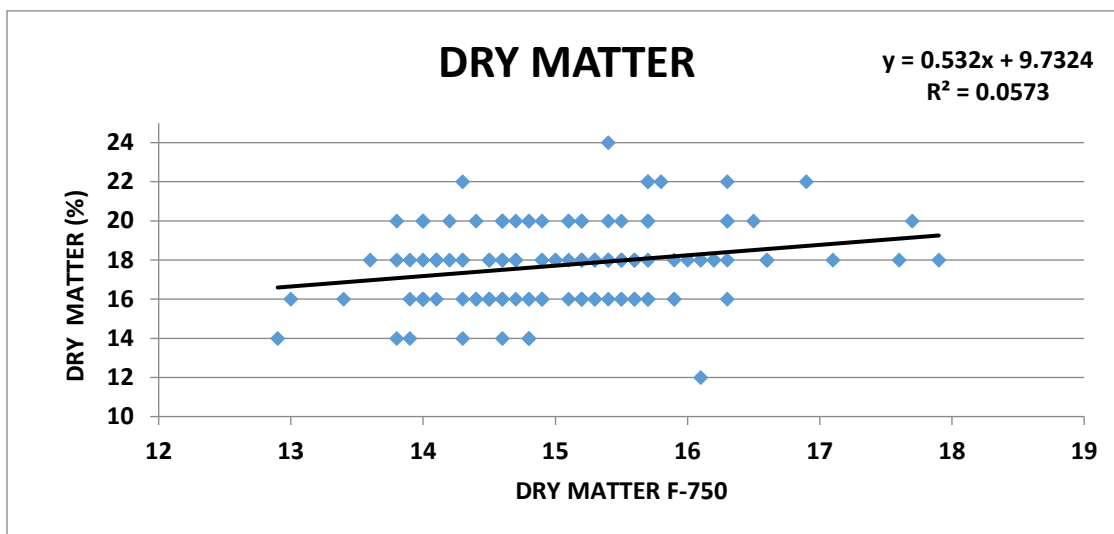
c. Tommy Atkins Model for TSS (°Bx).



The only variable that correlated was TSS with a $R^2 = 0.80$. DM neither pulp color had a correlation. We did two validation processes.

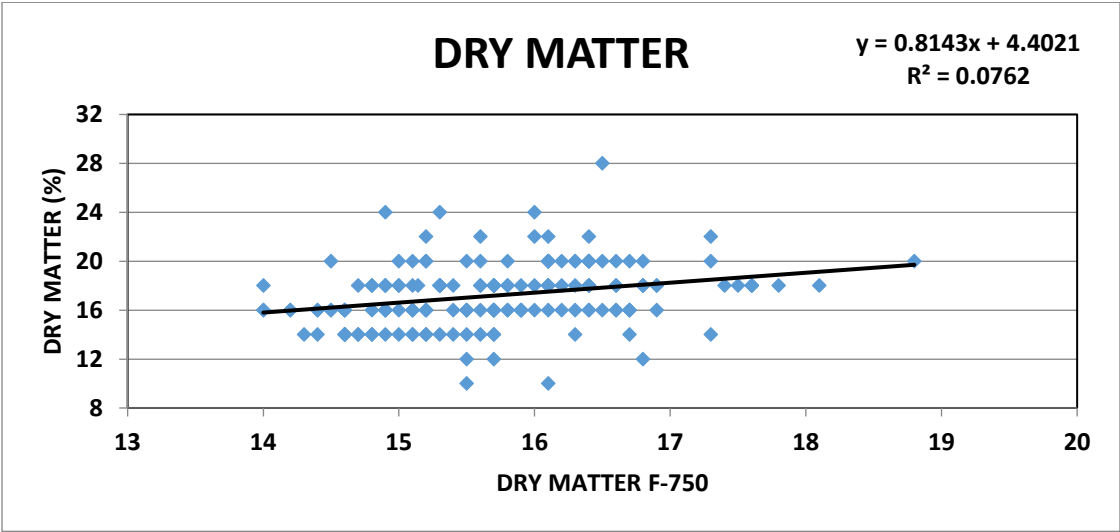
1. First validation Tommy A.

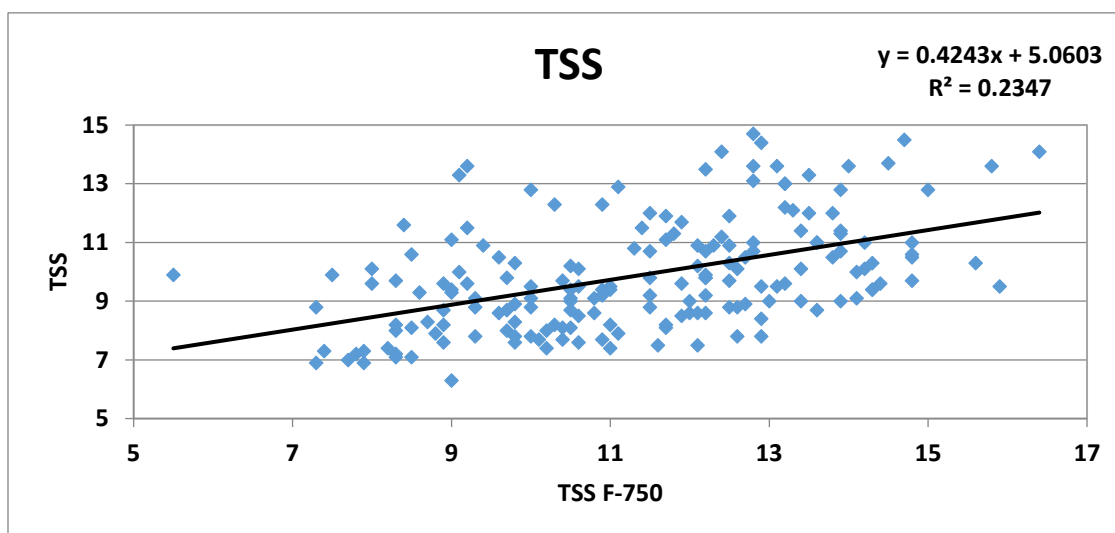




As results showed, the best predicted value was Total Soluble Solids (TSS) with a low $R^2 = 0.294$. DM had a very low $R^2 = 0.0573$. We did a second round of validation with six different lots using TSS and DM.

2. Second validation Tommy A.





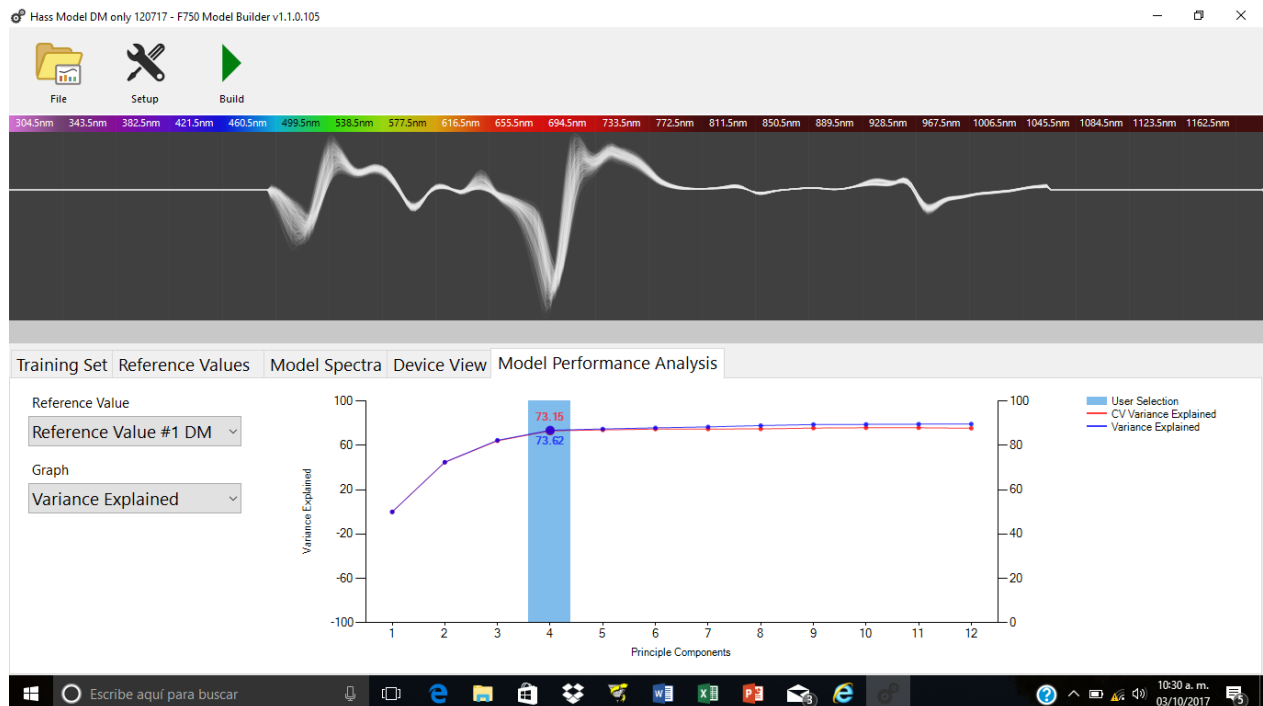
As results showed, the best predicted value was Total Soluble Solids (TSS) with a low $R^2 = 0.2347$. DM improved a little bit but still very low $R^2 = 0.0762$. It will be necessary to repeat the whole process during the 2018 mango season, not only in 'Tommy Atkins', but also in 'Ataulfo' fruit.

IV. Building Hass Model 1

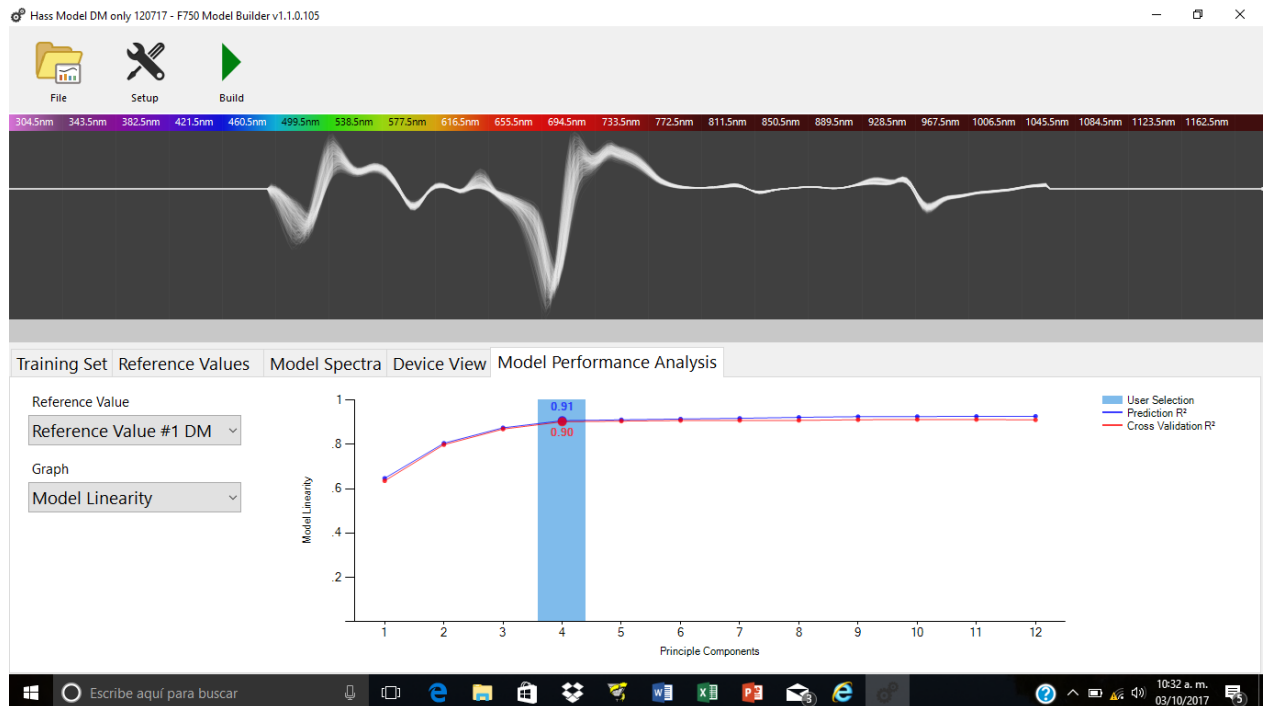
Characterization of 'Hass' avocado fruit used to build the Model 1

Category	Weight (g)		DM Content (%)		Sample size (n)
	Mean	Stand. Dev.	Mean	Stand. Dev.	
1	101.9	11.4	14.7	1.2	40
2	120.2	12.6	14.9	1.5	40
3	161.0	18.3	21.9	4.1	40
4	192.0	20.1	23.8	2.0	40
5	215.9	29.1	24.7	2.0	40

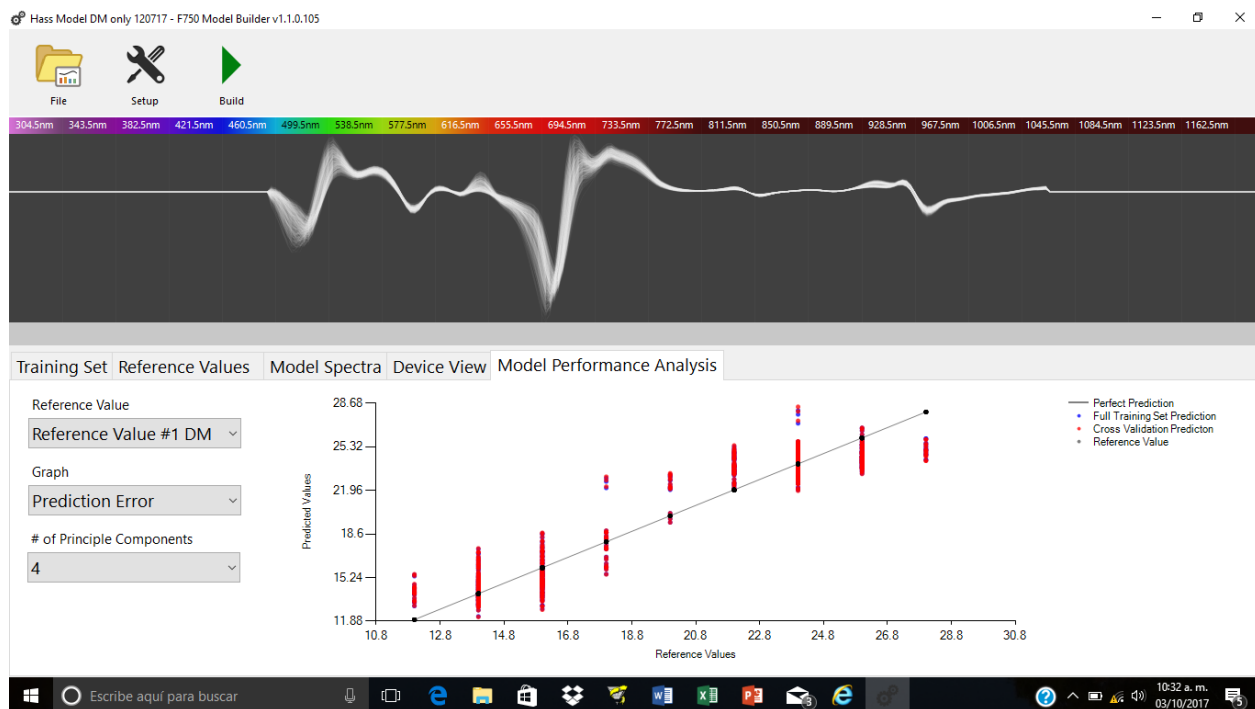
a. Hass Model 1 for Variance Explained.



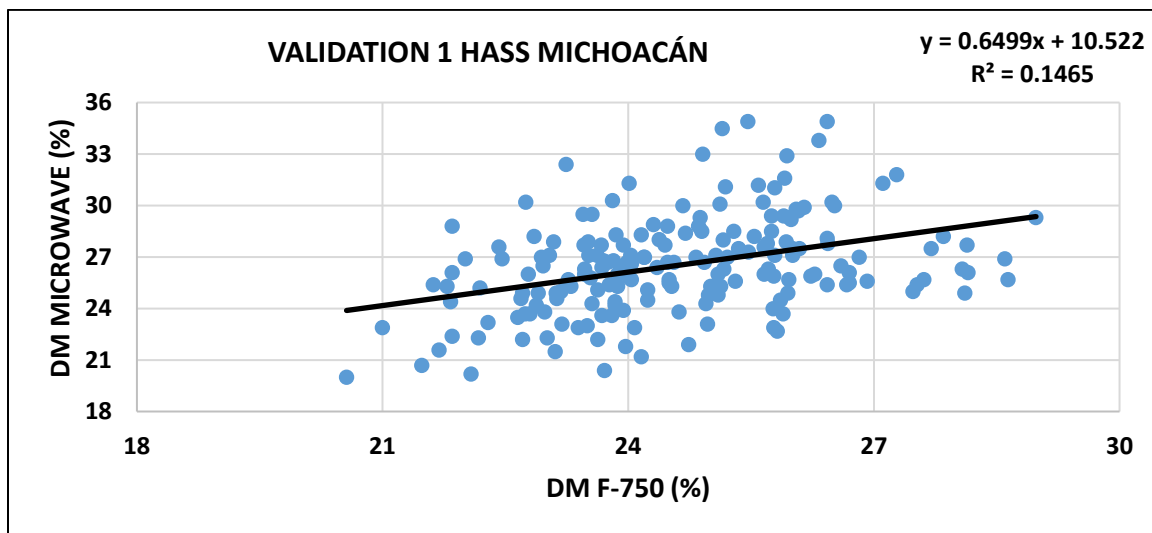
b. Hass Model 1 for Model Linearity.



c. Hass Model 1 for Prediction Error.



1. First Validation Hass Model 1



DM (%)	F-750	Microwave
Max	29.0	34.9
Min	20.6	20.0
Average	24.6	26.5
Correlation	0.3827	
R ²	0.1465	

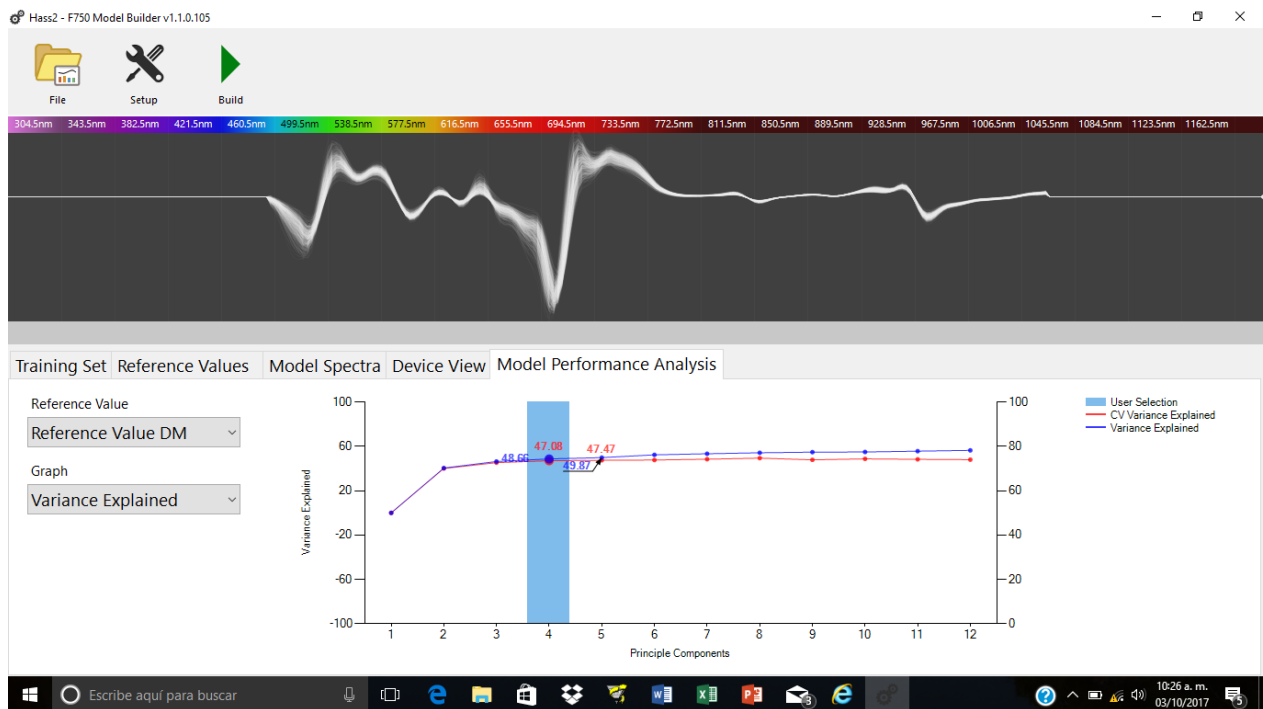
In spite of the model linearity of the first 'Hass' model was very high ($R^2 = 0.91$), the regression for the first validation done with fruit harvested in Michoacán was very low ($R^2 = 0.1465$). According to Felix people, this value was extremely low maybe to the use of a scale with accuracy of only one digit when calculating DM. Therefore, we bought a new scale with an accuracy of two digits (centesimal point), and built the 'Hass' model again.

V. Building Hass Model 2

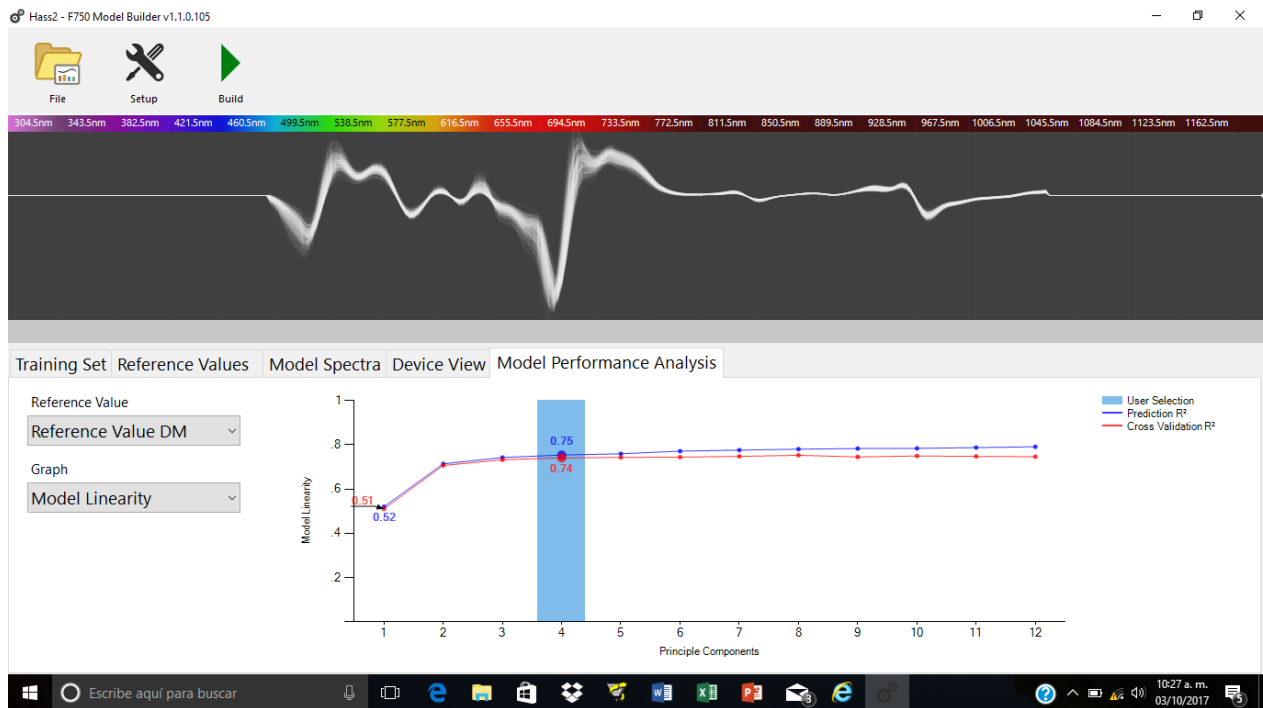
Characterization of 'Hass' avocado fruit used to build the Model Hass2

Category	Weight (g)		DM Content (%)		Sample size (n)
	Mean	Stand. Dev.	Mean	Stand. Dev.	
1	108.5	12.0	17.7	1.7	40
2	145.3	15.4	19.3	1.9	40
3	169.9	19.8	19.9	1.6	40
4	190.3	16.0	24.3	2.9	40
5	240.8	20.3	27.1	1.4	40

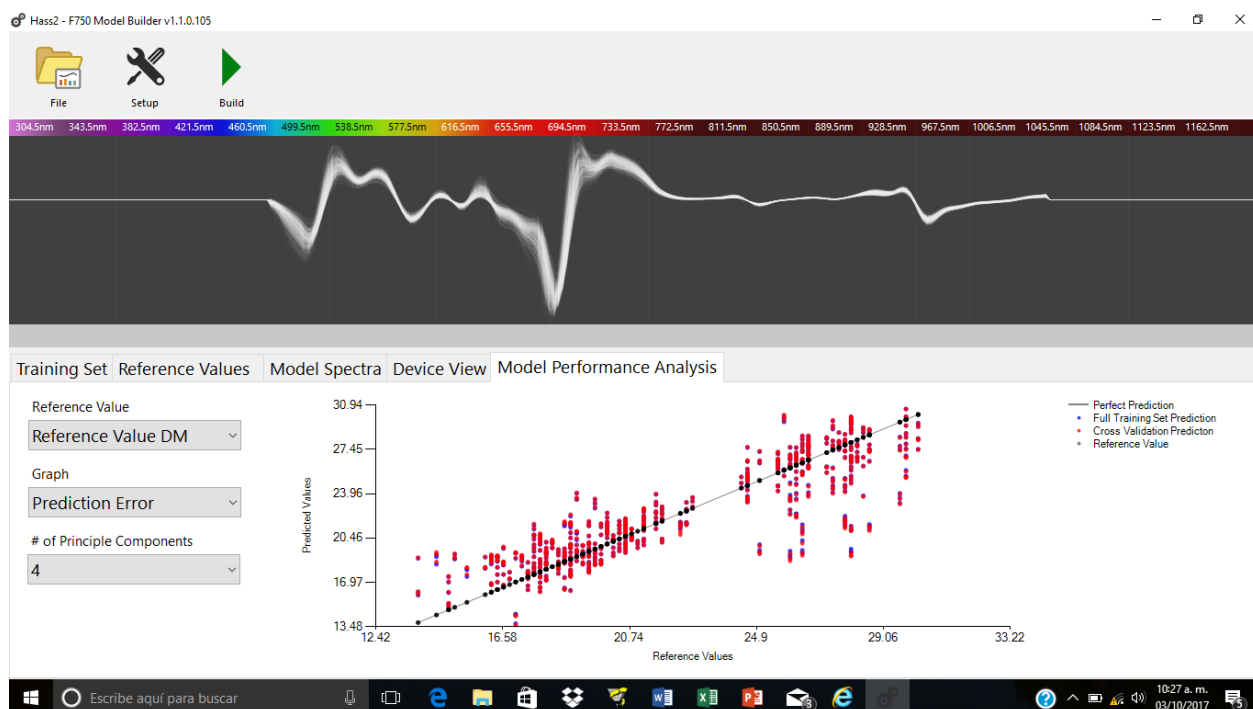
a. Hass Model 2 for Variance Explained.



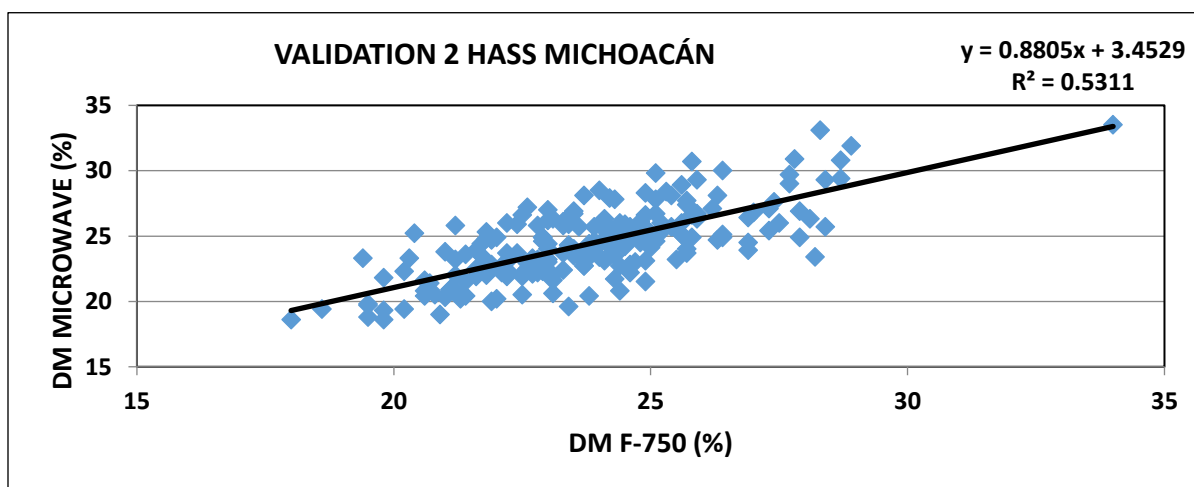
b. Hass Model 2 for Model linearity.



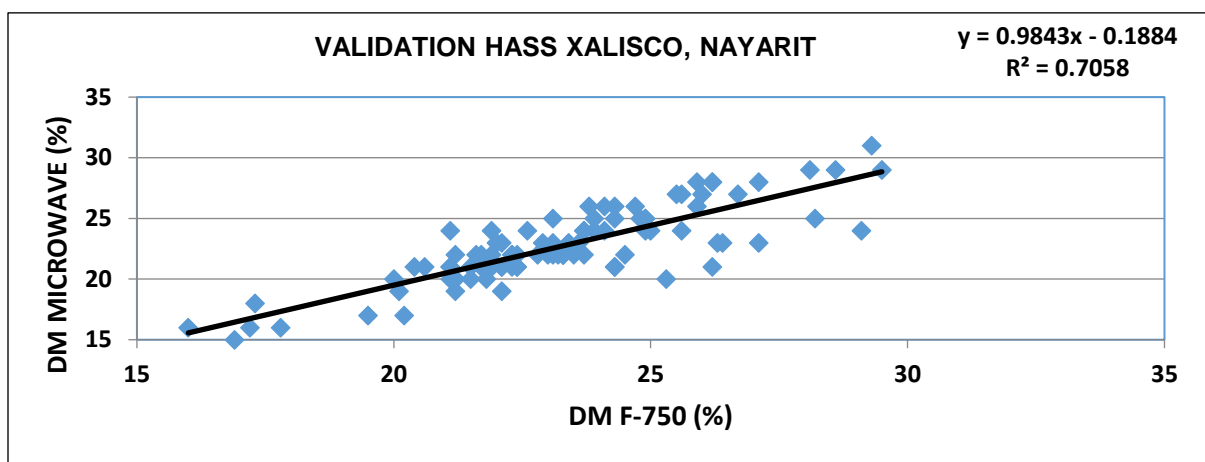
c. Hass Model 2 for Prediction Error.



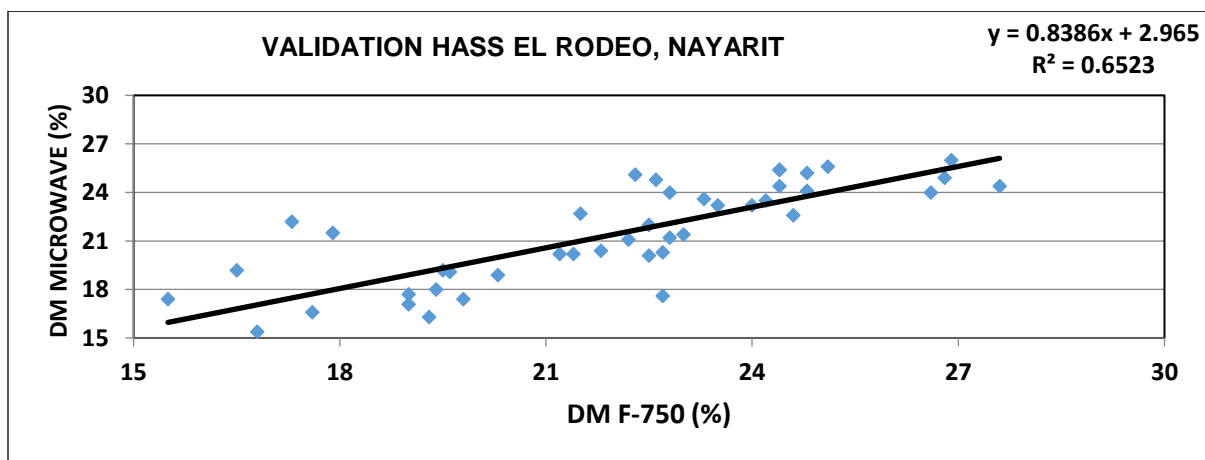
2. Second Validation Hass



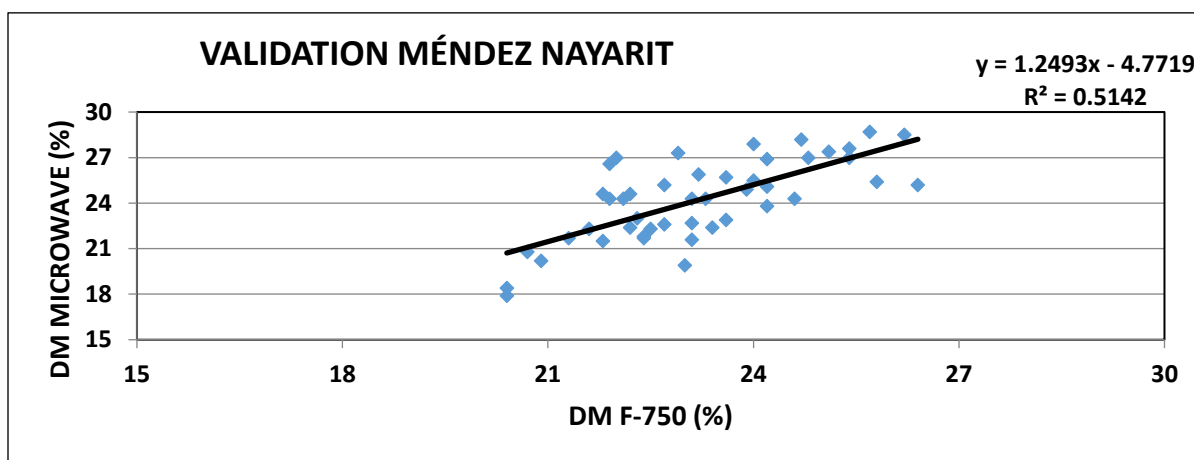
DM (%)	F-750	Microwave
Max	34.0	33.5
Min	26.3	24.7
Average	24.0	24.6
Correlation	0.7163	
R ²	0.5311	



DM (%)	F-750	Microwave
Max	29.5	31.0
Min	16.0	15.0
Average	23.2	22.7
Correlation	0.8401	
R ²	0.7058	



DM (%)	F750	Microwave
Max	27.6	26.0
Min	15.5	14.4
Average	21.9	21.3
Correlation	0.8077	
R ²	0.6523	

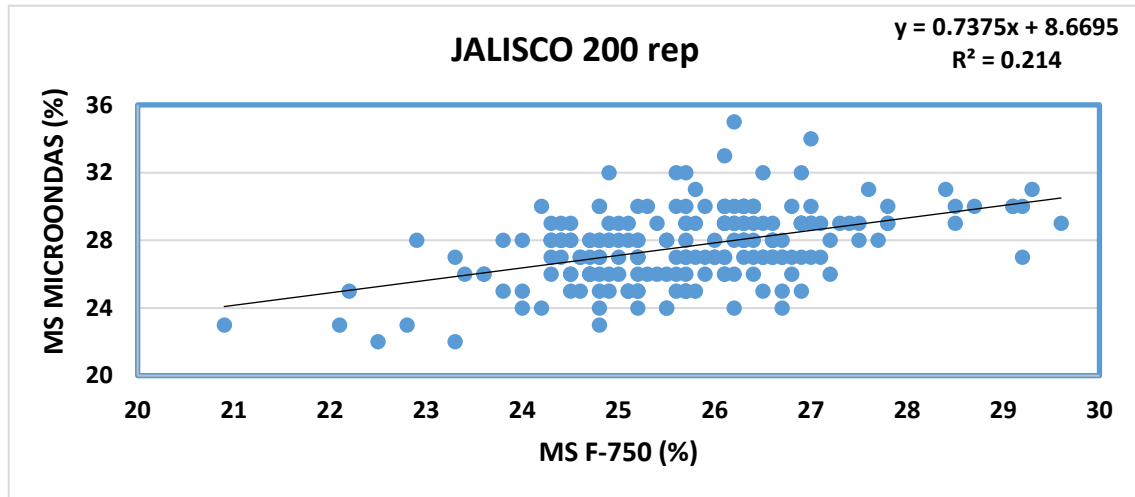


DM (%)	F750	Microwave
Max	26.4	28.7
Min	20.4	17.9
Average	23.2	24.2
Correlation	0.7171	
R ²	0.5142	

Results are very encouraging since in all cases of validation of 'Hass' model 2, there were very acceptable values of Regression and Correlation Coefficients.

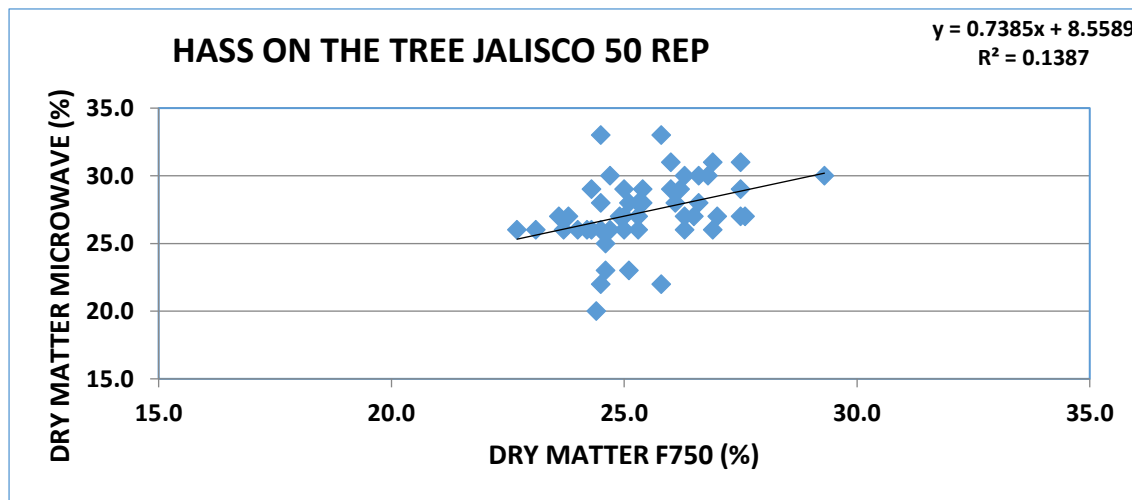
Results got in Agro González Packinghouse, Cd. Guzmán, Jalisco.

MS (%)	F-750	Microwave
Max	29.60	35.00
Min	20.90	22.00
Average	25.74	27.65
Correlation	0.4626	
R ²	0.2140	



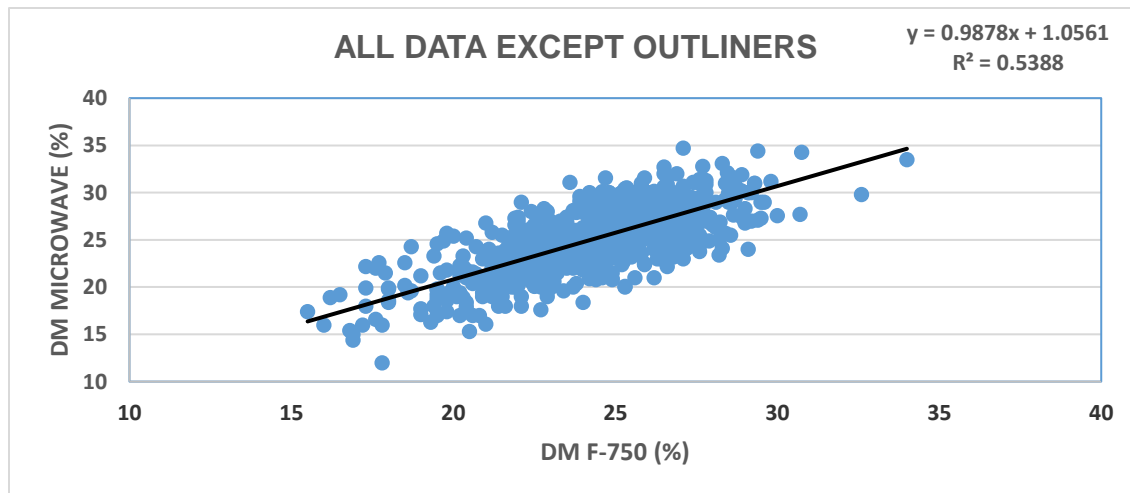
Results got with unharvested fruit in Agro González Orchard

DM (%)	F-750	Microwave
Max	29.30	33.00
Min	22.70	20.00
Average	25.46	27.36
Correlation	0.3724	
R2	0.1387	



Results got combining all the data, except outliers (847 fruits)

DM (%)	F-750	Microwave
Max	34.00	34.70
Min	15.50	12.00
Average	24.32	25.08
Correlation	0.7340	
R2	0.5388	



The average DM content got with the F750 was 24.32% while for the Microwave method was 25.08% having only -0.76 difference. This difference is acceptable; however, the correlation and regression values are still low. It is necessary to continue working on the model to improve the device performance.