ORAL PRESENTATIONS

Tuesday, July 15, 2008

Food Science and Postharvest Technology (Regency Ballroom)

11:30 – 11:45 am
Evaluating Avocado Maturity Using Hyperspectral Imaging
D. Girod[1], J.A. Landry[1], G. Doyon[2] and J.A. Osuna-Garcìa[3]
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The maturity of avocado fruit is usually assessed by measuring its dry matter content (DM), which is a destructive and time consuming process. The aim of this study is to introduce a non-destructive and quick technique that can estimate the DM content of an avocado fruit. 'Hass' avocado fruits at different maturity stages and varying skin color were analyzed by hyperspectral imaging in reflectance and absorbance modes. The DM ranged from 19.8% to 42.5%. The hyperspectral data consist of mean spectra of avocados in the VIS/NIR region, from 400nm to 1000nm, for a total of 163 different spectral bands. Relationship between spectral wavelengths and DM content were carried out using a chemometric partial least squares (PLS) regression technique. Calibration and validation statistics, such as correlation coefficient (R^2) and prediction error (RMSEP) were used as means of comparing the predictive accuracies of the different models. The results of PLS modeling, over several different randomizations of the database, with full cross validation methods using the entire spectral range, resulted in a mean R^2 of 0.86 with a mean RMSEP of 2.45 in reflectance mode, and a mean R^2 of 0.94 with a mean RMSEP of 1.59 for the absorbance mode. This indicates that reasonably accurate models (R^2>0.8) could be obtained for DM content with the entire spectral range. Also this study shows that wavelengths reduction can be applied to the problem. Starting with 163 spectral bands, the DM could be predicted with identical performances using 10% of the initial wavelengths (16 spectral bands). Thus the study demonstrates the feasibility of using VIS/NIR hyperspectral imaging in absorbance mode in order to determine a physicochemical property, namely DM, of 'Hass' avocados in a non-destructive way. Furthermore it gives some clues about which spectral bands could be useful for that purpose.
Keywords: Non-destructive, dry matter, spectroscopy

POSTER PRESENTATIONS

FRUITS, VEGETABLES, AND SPECIALTY CROPS

Poster #13
Yield and Fruit Quality of Rambutan Cultivars Grown at Two Locations in Puerto Rico
R. Goenaga[1] and A. Marrero[1]. [1]USDA-ARS, Tropical Agriculture Research Station, 2200 P. A. Campos Ave., Suite 201, Mayagüez, Puerto Rico 00680-5470. *Ricardo.Goenaga@ars.usda.gov*

Eight rambutan (*Nephelium lappaceum*) cultivars grown on an Oxisol and Ultisol were evaluated for three years under intensive management at Isabela and Corozal, Puerto Rico, respectively. There were significant differences in number and weight of fruits per hectare between locations and years. Significantly more fruits were produced at Corozal (357,004 fruits/ha) than at Isabela (168,083 fruits/ha). Fruit yield at Corozal and Isabela was 11,357 and 5,111 kg/ha, respectively. At Corozal, varieties were not significantly different for number of fruit and yield per hectare. At Isabela, cultivar Gula Batus and R-162 produced significantly more fruits and higher fruit weight than other cultivars averaging 234,153 fruits/ha and 6,979 kg/ha, respectively. Cultivar R-156Y had the lowest yield at both locations. Cultivars R-156Y and Rongrien had fruit with significantly more pulp (58%) than other cultivars (47%). At both locations, significantly lower fruit soluble solids (Brix) values (19.1) were obtained from fruits of cultivars R-156Y and Gula Batus; there were no significant differences in Brix among the rest of the cultivars (20.2).
Keywords: tropical fruits, rambutan, adaptability, soluble solids

Poster #18

Crecimientos Vegetativo y Reproductivo del Aguacate 'Hass' en Varios Climas de Michoacán, México

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En Michoacán se cultivan más de 96 mil ha de aguacate 'Hass' pero existe poca información para entender su comportamiento fenológico en los diferentes climas. El objetivo del estudio fue cuantificar la influencia del clima sobre la ocurrencia e intensidad de los flujos vegetativos (FV) y su importancia para la floración. Se seleccionaron 14 huertos adultos de 'Hass' distribuidos en siete climas. En cada huerto se eligieron 10 árboles y en cada uno de ellos se marcaron cinco ramas de 1-1.5 m de longitud; en cada rama se etiquetaron 15-20 brotes del FV de invierno para darle seguimiento a cada brote. Los brotes vegetativos producidos por cada FV fueron etiquetados para determinar el tipo de crecimiento producido (vegetativo, floral o inactivo) durante 2006-2008. En todos los climas hubo tres FV (invierno, primavera y verano) y cuatro flujos de floración: "Loca" (Ago-Sep), "Aventajada" (Oct-Dic), "Normal" (Dic-Feb), y "Marceña" (Feb-Mar). El clima influenció ($P = 0.05$) la intensidad de floración producida por los brotes originados en los tres FV's. La floración Normal fue la más abundante en los tres FV's y en la mayoría de los climas. El FV de invierno fue el más importante para la producción de cualquier flujo de floración. Para el FV invierno, la mayor intensidad de las floraciones Loca y Aventajada ocurrió en climas Semicálido subhúmedo (**SS**) y Templado húmedo (**TH**). En brotes de los FV's primavera y verano estas floraciones fueron más intensas en los climas SS, Semicálido húmedo (**SH**), Templado subhúmedo (**TS**) y TH. La mayor intensidad de floración Normal ocurrió en los climas SH y TH (brotes de invierno), Cálido subhúmedo (**CS**) (brotes de primavera), y en climas SS, SH y TH (brotes de verano). Para los tres FV's, la floración Marceña fue más intensa en los climas CS y SS. En cualquier FV la floración Normal tendió a ser más intensa en los climas fríos (SH, TS y TH), mientras que la Marceña se incrementó en los climas cálidos (CS y SS).

Palabras clave: *Persea americana*, floración, fenología.

Poster #19

Corrección de la Deficiencia Crónica de Zinc en Aguacate 'Hass'

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En los huertos de aguacate 'Hass' de los municipios de Tepic y Xalisco, Nayarit, son frecuentes los niveles foliares debajo de lo normal de zinc (Zn) y la presencia de síntomas visuales de deficiencia de Zn en hojas, brotes y frutos. Esta investigación se desarrolló del 2001 al 2005 en dos huertos comerciales de aguacate 'Hass' cultivados sin riego en el Mpio. de Tepic con el objetivo de evaluar el efecto de las aplicaciones de sulfato de zinc ($ZnSO_4$), al follaje o al suelo, sobre la producción, tamaño y forma del fruto. El suelo de los huertos era de textura ligera, pH 5.8 y bajo contenido de Zn (1.4 a 3.13 $mg \cdot kg^{-1}$). Los tratamientos al follaje fueron aplicados en 8 L agua/árbol y consistieron en: **a**) una aspersión con 4.056 g $ZnSO_4$/L agua (1.46 g Zn), y **b**) dos aspersiones con 2.028 g $ZnSO_4$/L agua (0.73 g Zn); ambos tratamientos proporcionaron 11.68 g Zn/árbol. Los tratamientos al suelo consistieron en: **a**) una aplicación (1.5 kg), y **b**) dos aplicaciones (0.75 kg c/u) anuales de $ZnSO_4$ (35.5% Zn) al suelo. El tratamiento Control no recibió Zn. Las aspersiones foliares con $ZnSO_4$ no afectaron la producción y tamaño del fruto. El promedio de las cosechas 2003, 2004 y 2005 mostró que dos aplicaciones al suelo con 0.75 kg $ZnSO_4$/árbol/año resultaron en la mayor producción total de fruto (173 kg/árbol), producción de fruto grande (170 a >266 g/fruto; 109 kg/árbol), y la relación largo-ancho del fruto (1.9), comparado con los árboles Control, que tuvieron menor producción total (136.7 kg/árbol), menor producción de fruto grande (59.2 kg/árbol), y forma más redonda del fruto (rel. largo-ancho = 1.36). La aplicación anual de 1.5 kg $ZnSO_4$/árbol mostró valores significativamente inferiores a dos aplicaciones anuales de 0.75 kg c/u, pero significativamente superiores al Control. Se encontró una pobre relación entre los niveles de $ZnSO_4$ aplicados al suelo y el contenido foliar de Zn.

Palabras clave: *Persea americana*, producción, deficiencias nutrimentales

SOCIOECONOMICS AND POLICY

Poster #22
PROCINORTE'S Tropical and Subtropical Fruits Task Force: a Tri-National Effort to Improve Fruit Quality and Trade

R. Goenaga[1], S. Salazar-García[2], G. Doyon[3], J.A. Osuna-García[2], I.J.L. González-Durán [2] and J.A. Landry[4]. [1]USDA-ARS, Tropical Agriculture Research Station, 2200 P. A. Campos Ave., Suite 201, Mayagüez, Puerto Rico 00680-5470 (*Ricardo.Goenaga@ars.usda.gov*); [2]INIFAP-Campo Experimental Santiago Ixcuintla, Apdo. Postal 100, Santiago Ixcuintla, Nayarit, Mexico 63300; [3]Food Research and Development Centre, Agriculture and Agri-Food Canada, 3600 Casavant Blvd. West, St. Hyacinthe, Quebéc, Canada J2S 8E3; [4]University of Quebéc, 1100 Notre Dame W. St., Quebéc, Canada H3C 1K3

Canada, Mexico and United States are countries that share many interests in agricultural affairs. The three countries have been commercial partners for many years, and most recently they have been working under the North American Free Trade Agreement (NAFTA) umbrella. The three countries are natural commercial partners sharing several common problems in agriculture. Some of these problems are related to food safety and quality, control of pests and diseases, and other issues concerning food exports and imports. One very important mechanism to facilitate the institutional and technical integration of Canada, United States and Mexico is PROCINORTE under the umbrella of the Inter American Institute for Cooperation on Agriculture's (IICA), Northern Regional Center. PROCINORTE is a cooperative Program in Research and Technology for the Northern Region, with an Umbrella Task Force that determines common research priorities. Within PROCINORTE, several initiatives or task forces have been formed. The Tropical and Subtropical Fruits Task Force was established in 2002. The main goal of this task force is to improve production, consumption and trade of tropical and subtropical fruits in the entire PROCINORTE region. Specific objectives are to: 1) encourage the communications and collaboration among scientists working in quality, safety, and production of tropical and subtropical fruits; and 2) identification of common problems and opportunities associated with tropical fruit production and quality and work jointly in research projects to solve these. A summary of activities carried out by the Tropical and Subtropical Fruits Task Force is presented here.
Keywords: commerce, exportation, food safety.

Food Science and Postharvest Technology

Poster #81
Relationship between Chlorophyll Fluorescence and Dry Matter Content of 'Hass' Avocado Fruit

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Mexico is the main 'Hass' avocado exporter in the world with more than 100,000 ton exported every year. Canada is an important importer country accounting for 12-15% of total exports from Mexico. Normally, from December to May exported fruit to Canada have very high dry matter content which is determined with a destructive and time consuming method. The objective of this experiment was to correlate skin chlorophyll fluorescence, as a non-destructive method, with dry matter content of 'Hass' avocado fruit. From December 2007 to April 2008, 10 fruit of five different skin color categories were collected monthly from a packinghouse in Michoacan, Mexico and rated using the following scale: 1 = fully green, 2 = <25% skin blackening, 3 = 26- 50% skin blackening, 4 = 51-75% skin blackening, and 5 >76% skin blackening. Two days after harvest, individual fruit were assessed for chlorophyll fluorescence using a modulated fluorometer, Model OS1-FL reporting fluorescence under steady state conditions (Fs), maximal fluorescence under steady state conditions (Fms), and quantum efficiency yield (Y). Immediately after reading fluorescence, fruit mesocarp dry matter content (DM) was determined using a microwave oven and values were correlated with fluorescence. Fs values varied from 147 to 292; FMS from 357 to 989 and Y from 0.504 to 0.818, while DM did so from 19 to 42%. The only fluorescence parameter that correlated significantly ($P<0.001$) with DM was Fs; however, correlation was low ($r = -0.31$). This could be due to the relative high DM content of fruit (avg. 32.9%), which was much higher than the maturity standard (DM ≥ 21.5%). The results showed that chlorophyll fluorescence did not correlate with DM content of over-ripe avocado fruit. Efforts are underway to find out if fluorescence may be useful to predict legal maturity on unharvested 'Hass' avocado fruit.

Keywords: non-destructive, fluorescence, fruit maturity

Poster #82

Effect of Harvest Time and Ripening Degree on Quality and Shelf Life of 'Hass' Avocado

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Canada is an important avocado importer country accounting for 12-15% of total avocado exports from Mexico. 'Hass' avocado is harvested year round in the state of Michoacan. For most part of the season, fruit reach adequate mesocarp dry matter content (DM), ripen properly and consequently, quality and shelf life are excellent. However, after early January fruit DM content increases and skin blackening occurs. Shipments to Canada containing fruit with blackening skin have been rejected since this characteristic is sometimes associated with low pulp firmness and short shelf life. The objective of this experiment was to study the effect of harvest time and ripening degree on initial quality and shelf life of 'Hass' avocado. Fruit were harvested in October and December, 2007 and from January to April, 2008 and rated according to the following scale: 1 = fully green, 2 = <25% skin blackening, 3 = 26-50% skin blackening, 4 = 51-75% skin blackening and 5 > 76% skin blackening. At harvest, DM, skin color, pulp firmness, and pulp color were evaluated. Fruit were then refrigerated (6.0±1.0 ºC; 90±5% RH) for seven days to simulate terrestrial shipment to Canada. After this period, fruit were stored under market conditions (22±2 ºC; 75±10% RH) until they reached the edible ripening stage. Weight loss (WL), fruit with skin blackening, pulp firmness, and pulp color were determined every three days. Pulp DM, skin color and pulp color significantly increased with harvest time and degree of skin blackening. However, there were no significant differences for WL and firmness. Our results showed that there is no reason for Canadian retailers to reject fruit with blackened skin since fruit quality and shelf life were not affected by harvest time and degree of skin color.
Keywords: skin color, maturity index, firmness

Poster #83

Influencia del Clima, Riego y Época de Floración Sobre la Composición Nutrimental del Fruto de Aguacate 'Hass' en Michoacán

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El objetivo de esta investigación fue evaluar el efecto del clima [semicálido subhúmedo (**SS**), semicálido húmedo (**SH**), y templado subhúmedo (**TS**)], la condición de humedad (con y sin riego) y época de floración que originó al fruto ["loca" (septiembre) y "normal" (enero)] sobre la composición nutrimental del fruto de aguacate 'Hass' en Michoacán. Se seleccionaron dos huertos de 'Hass' por cada clima y condición de humedad del suelo. En cada huerto se seleccionaron 10 árboles y cuando su fruto alcanzó la madurez legal (≥ 21.5% de materia seca de la pulpa), de cada árbol y tipo de fruto (floración Loca o Normal) se cortaron cinco frutos de la misma edad para diseccionarlos en sus componentes (epidermis, pulpa, tegumento y cotiledones). El clima afectó la composición nutrimental de las partes del fruto. En la epidermis, los nutrimentos afectados fueron: N, P, Ca, Cl, Fe, Mn y B; en la pulpa: N, P, K, Ca y Mn; en el tegumento: S y Mn; en cotiledones: P, S, Cu, Mn y B. La condición de humedad del suelo tuvo poco efecto sobre la concentración de macronutrimentos en el fruto. En huertos sin riego, el fruto presentó mayores concentraciones de K, Ca, y S en la epidermis, de K y Ca en la pulpa y de Mg en el tegumento. El N y P no fueron afectados. En frutos de la floración Loca (cosechados en agosto) fue mayor la concentración de N (epidermis y pulpa), Ca (cotiledones), Mg (cotiledones) y Zn (pulpa y cotiledones). En frutos de la floración normal (cosechados en octubre), solamente el N presentó mayor concentración en el tegumento.
Palabras clave: *Persea americana*, nutrición.