Plenary talks




The *Persea* genetic resources in Mexico

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Persea in America consists of about 85 species distributed from the Southern United States [Persea borbonia (L.) Spreng] to Chile (Persea lingue Ruiz & Pavon). The genus was divided into subgenera *Persea* and *Eriodaphne*, and currently is proposed the separation of the two as independent species. In Mexico there are about 20 species of *Persea* and is found in 28 states out of 32, with a distribution according to weather into three groups: Group I (16 species) in the humids warm, semi warm and temperate, and the semi-cold; Group II (11 species) in sub humid, warm sub humid, temperate sub humid and semi-arid; and Group III (10 species) in the humids semi warm, warm and temperate. It is mainly present in the Sierra Madre Oriental, Sierra Madre del Sur, Neo Volcanic Axis, Gulf Coastal Plain, Sierra de Chiapas and Yucatan Peninsula. The history of collection and conservation of germplasm in Mexico date back to the 50s when it was stablished in Tacámbaro Michoacan the first formal avocado Germplasm Bank, in what became known as "The Policlinica" where the idea was for preserving local Creoles and was promoted by local growers and Ing. Salvador Sánchez Colín. Currently there are banks that are in The Avocado Network of the National Plant Genetic Resources System (SINAREFI) including Celaya (INIFAP), Tepic (UAN), Chapingo and Huatusco (UACh) and that of Salvador Sánchez Colín-CICTAMEX Foundation, which is the most diverse, with close to 680 accessions.

Postharvest quality - what does it mean for the producer, packer, marketer and consumer?

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The driving force for successful sales is the willingness of the consumer to purchase the product at a price sufficiently beneficial to all involved to encourage continued investment in the industry. While there may be minor differences in consumer preferences, and tolerances for defects may vary, factors of major importance relate to the fruit ripening normally, an acceptable taste, the presence or absence of physiological disorders and rots, and any factors which may create doubt in the mind of the consumer, such as chilling damage or blemish. Food safety and increasingly, environmental issues, are not negotiable. Most of these are influenced by physiological and pathological factors, the management of which may be complex, especially with expanding production in areas environmentally different to that of the natural habitat of the avocado, or traditional production areas. In order to ensure the right fruit quality for the consumer, it is necessary to start with the producer, to supply fruit to withstand the packing and shipping conditions, and arrive in suitable condition. Plant nutrition, especially nitrogen, the manipulator of growth, is important. This, together with water management, influences shoot to fruit ratio, assimilate partitioning and calcium content of fruit, all affecting post harvest physiology. The producer may also be able to influence fruit resistance to pathogens. Once harvested, fruit need to be treated, then packed and shipped using the most suitable conditions of temperature and container atmosphere. The challenge is to match the fruit to the best treatments. This will require new technologies and better knowledge of fruit physiology. Techniques, challenges and future research directions are discussed. The ultimate aim is to allow the producer to grow fruit suited to packing, shipping and market requirements, and the packers to match fruit to optimum handling conditions, to the benefit of all in the supply to consumer chain.

Integrated pest management in avocado at the Chavimochic irrigation, La Libertad-Peru

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In Peruvian conditions for avocado growing there is no only one but many agro ecosystems, thus in order to establish a program of integrated pest management it is necessary evaluate this factor and its influence in the population dynamics and insect trophic chain because many of them can become pests.

The Chavimochic irrigation has desert conditions, sandy soils and drip irrigation that uses water from the Santa river. Its main crops are asparagus, avocado, sugar cane and blueberries. The irrigation borders with a valley of small and medium growers that for many years have grown the same crops using gravity irrigation. The avocado area is about 7400 hectares where it is mainly grown the Hass variety with Zutano and Etinger as varieties to assist with pollination.

The development of integrated pest management in avocado starts based on technical, economic, social, integrating considerations. To start an IPM program is important to know how to manage the key pests without ignoring the consequences over the other pests.

This selection of components comes from the technical observations and experience, then these are validated in the field through testing to end up incorporating them to the IPM program. If needed, corrections are made. If these were successful then they will be part of IPM otherwise they are left aside.

The key problems in avocado are scales (*Hemiberlesia* sp, *Fiorinia* sp etc), spider mites (*Olygonychus* sp), whiteflies and moths (*Oxydia* sp). IPM components like scouting, manual picking, dust control, hedgerow or fences, cropping, mulching, plant washing, weed management, plant density management, biological control, etologic control and chemical control have been used according to the opportunity and compatibility with the agricultural activities. Depending on the agroecosistem, many of these practices are efficient but in some cases they become in permanent problems.

The social an economic environment should be consider since the integration of the components should be done harmonizing them with the goal of economic productivity.

Any plant health program should be based in pest scouting in order to have efficient pest management practices, many of the practices have been built over the improvements of the scouting and monitoring methods. For our circumstances this has the tendency to be individual which let us track the field practices targeting the problems.

The pest scouting population dynamic, thresholds crop management history forecasting and the pest presence.

It should be mention that at the Chavimochic irrigation there are companies dedicated to produce and sell different high quality biological control agents as follow, antagonist, entomopathogens and beneficial insects for the growers which contribute to practice a sustainable agriculture for next generations.

The potential for laurel wilt to threaten avocado production is real

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During 2002, the exotic redbay ambrosia beetle [*Xyleborus glabratus* (Xg)] was introduced into Port Wentworth, Georgia, U.S. By 2004, the link among Xg and its fungal symbiont [*Raffaelea lauricola*) (Raf)] the causal agent of the disease laurel wilt (LW) was confirmed. This insect-disease complex is indigenous to subtropical areas of Asia (e.g., Myanmar, Taiwan, Japan, and India) where it is associated with plants species in the Lauraceae [e.g., Asian spicebush, (*Lindera latifolia*)], Dipterocarpaceae (e.g., Shorea robusta), Fabaceae (e.g., *Leucaena glauca*) and Fagaceae (e.g., *Lithocarpus edulis*). However the LW disease is not known to occur in these species. In the Southeastern U.S., Xg and Raf have only been associated with plants in the Lauraceae. At least ten native plant species in Florida are LW hosts [e.g., Redbay (*Persea borbonia*) and swampbay (*P. palustris*)] and a potential host in California is the California laurel (*Umbellularia californica*). *Xyleborus glabratus* naturally disperses about 30 to 50 miles per year through infestation of native host plants; this suggests Xg could easily reach Ontario, Canada to the north and Texas, U.S., to the west and thus threaten plants in the Lauraceae in Mexico and California. This could have profound ecological consequences for native Lauraceae throughout North, Central and South America and avocado production throughout the western hemisphere.

Raffaelea lauricola was first detected in north Florida (Duval County) in 2005 and by 2006 had spread to central Florida. The vector of LW Xyleborus glabratus was first detected in a natural area about 41 km north of south Florida's commercial avocado production area in March 2010. By February 2011 LW was confirmed in dying native swampbay (*P. palustris*) trees and by February 2012, LW had been confirmed in a commercial avocado orchard. Several other ambrosia beetles (AB) species, *X. volvulus* and *X. ferrugineus* are now known to carry Raf and appear to be more important vectors of Raf under orchard conditions. Although AB are responsible for short and long distance movement of Raf, the most rapid spread occurs once LW is present in an orchard and spreads via root grafts among adjacent avocado trees. Recommendations for control of LW include: (1) early detection of Raf infected trees by frequent scouting of orchards; (2) sampling suspect trees for the pathogen; (3) tree uprooting, chipping of all wood possible and burning wood too large to chip and; (4) treatment of wood chips with insecticide. Additional recommendations include prophylactic infusion of propiconazole into avocado trees adjacent to infected trees or all trees in the orchard and periodic aerial insecticide applications to reduce AB populations. More information on the AB vectors, the LW pathogen and control recommendations and costs of control will be discussed.

Florida's relatively small (~3,035 ha) but valuable (US$100 million) avocado industry has been impacted by LW. To date the death of approximately 8,500 commercial avocado trees may be attributed to LW with an estimated value of US$3.5 million. Short-, mid- and long-term research on the control of Raf and AB is on-going and will be discussed..

Avocado nutrition: building the foundation for U.S. marketing and promotion

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The Hass Avocado Board (HAB) works to raise avocado awareness as well as demand for avocados through nutrition message marketing and promotion in the U.S. The nutrition research program builds the messaging foundation and removes barriers for the marketing of avocados. HAB supports research focused on preventing obesity and associated metabolic dysfunction. Early research suggests that consuming avocados can help subjects reduce risk for chronic diseases and alleviate co-morbidities associated with these diseases. This talk will review the history of HAB's research pipeline including its development and early research findings. Recent study results will be presented and the future of HAB supported avocado nutrition research will be presented. HAB nutrition research will continue to build a foundation for placing avocados as a key food to improve health and wellness in U.S. consumers.

Optimizing 'Hass' avocado tree nutrient status to increase grower profit

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To remain profitable in an era of increasingly expensive inputs to crop production (land, labor, water, fertilizer, etc.), avocado growers worldwide must increase yield of high quality commercially valuable size fruit per hectare, while reducing production costs. Optimizing tree nutrient status, irrigation and canopy management are fundamental to achieving this goal. All plants, including 'Hass' avocado trees, require 17 essential elements; 14 are mineral nutrients that are found in soil, organic matter and some sources of irrigation water and can also be supplied as soil- or foliar-applied fertilizers. For maximum yield and optimal fruit size, avocado trees must have adequate amounts of each nutrient at each stage of tree phenology. When the amount of one or more nutrients is low, yield will be reduced to the level supported by the least abundant nutrient. Properly timing soil- and foliar-applied fertilizers to meet the needs of 'Hass' avocado trees during phenological stages of high nutrient demand is a cost-effective strategy for optimizing tree nutrient status that can increase yield and fruit size, improve fertilizer-use efficiency, protect the environment and increase grower net profit. As examples, foliar-applied boron to 'Hass' avocado trees at the cauliflower stage of inflorescence development increased ovule viability, number of ovules penetrated by pollen tubes, and yield. Foliar-applied potassium phosphite at this stage of tree phenology increased avocado fruit size. Doubling soil-applied nitrogen (N) during fruit set increased yield and reduced alternate bearing. Back-to-back soil applications of nitrogen, phosphorus and potassium (N-P-K) during exponential fruit growth increased total yield and yield of commercially valuable size fruit. Multiple soil applications of N-P-K reduced 'Hass' avocado yield compared to trees receiving back-to-back N-P-K or mulitple applications of only N. Additional principles to assist growers in developing a fertilization program to meet specific production goals will be presented.

Avocado production, marketing, and consumption: a global perspective

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Global avocado production has experienced an expansion without precedent, of 139% in the last 20 years, reaching a total of 4.7 million metric tons in 2013 (FAO, 2013). Import-export trade has also increased. In 2013, 1.36 million tons, or 29% of the world production, were sold in international markets. This presentation provides an analysis of the situation and perspective of the main producing countries. While Mexico is the largest producer (1.47 million tons) and exporter (802,533 tons), representing 31% and 59% of the global figures, respectively, there is important progress in other countries, whose production is rapidly increasing. Concomitantly, consumption in importing countries has also grown at a fast rate. For instance, the American market consumed 897,354 tons in 2014 (domestic production and imports), which represents an increase of almost 500% in 20 years. While some international markets show stability, others are growing, and some others are offering great potential for expansion. This presentation also provides an analysis of the situation and perspectives of the main importing markets. The discussion also includes a brief reference to the regional distribution of exports and to the marketing strategies of the main producing countries.

Avocado reproductive physiology and climate change

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Changes in climate are challenging the avocado industry worldwide. Variations in temperature are greater and extreme weather events are more frequent. Tropical areas that previously experienced frost damage now suffer from excessively high temperatures. In contrast, avocado-growing areas located north or south of the 33rd parallel or at high elevations are experiencing more frequent frosts along with temperatures that are higher than normal earlier in the year. Higher than normal temperatures cause out of season root and shoot growth, reduced bloom intensity and weak flowers that result in poor fruit set and excessive fruit drop. Fruit development, fruit size, harvest maturity and postharvest quality are also affected. In addition, classical "optimal" regions for growing avocados face more frequent and extended droughts or torrential rains, hail and strong winds. Climate change and population growth increasingly jeopardize the availability of high quality irrigation water at an affordable price. It is imperative that growers reduce the cost of inputs and/or increase yield of commercially valuable size fruit per hectare on an annual basis to increase and stabilize grower income and industry sustainability. Knowledge of avocado reproductive physiology at every step in the process is fundamental to increasing flowering, fruit set and yield and for mitigating alternate bearing to achieve these goals. This talk covers the most important physiological effects of environmental stresses caused by climate change on tree phenology, floral development, fruit growth, retention, and size, and fruit quality. In addition, strategies for managing tree nutrient status and using plant bioregulators to mitigate the negative effects of stress on key physiological processes influencing yield are presented to help growers increase profit in an era of climate change.