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The Tropical Fruit and Nut Collections and Research Activities at the USDA-ARS Pacific Basin Agricultural Research Center, Tropical Plant Genetic Resources Management Unit

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The Tropical Plant Genetic Resource management unit in Hilo, Hawaii, formerly known as the USDA/ARS National Clonal Germplasm Repository, is responsible for the collection of tropical fruits and nuts for the USDA/ARS, National Plant Germplasm System. In addition to efforts in maintenance, characterization and distribution of designated crop germplasm, we impact the diversified agriculture industry in Hawaii as one of the Pacific Basin Agricultural Research Center (PBARC) units.

The USDA/ARS facility established in 1987 is located in a rainforest at the University of Hawaii, Waiakea Experiment Station 19°38'68" N. and 155°04'89" W. Elevation is approximately 146 m, with mean temperature maximum and minimum at 28 and 16°C. Annual rainfall averages 4445 mm, and is most abundant during October to February. Soil type is an extremely stony Papai muck with organic soils formed over mostly fragmental a'a lava. The unit cares for a living collection of approximately 1000 accessions from fourteen designated fruit and nut crops and their relatives. The total area at Waiakea is about 13.36 ha of field plantings, greenhouses and a tissue culture laboratory. The unit is managed by a curator horticulturist, two research scientists and seven field and laboratory technicians. The fourteen designated tropical fruits and nuts include: *Ananas* (pineapple), *Artocarpus* (breadfruit), *Averrhoa* (star fruit), *Bactris* (peach palm), *Camellia* (tea), *Canarium* (pili nut), *Carica* (papaya), *Dimocarpus* (longan), *Litchi* (lychee), *Macadamia* (macadamia nuts), *Malpighia* (acerola cherry), *Nephelium* (rambutan and pulasan), *Psidium* (guava), and a back up of *Theobroma* (cacao). The web site is http://ars.gov/pwa/hilorepository.

The diversification of agriculture in Hawaii accelerated during the 1990s with the closing and liquidation of the sugar industry. However on Maui and Kauai, raw sugar is still valued at USD $74.8 million (3). In the same period, pineapple was valued at $62.4 million, followed by coffee at $37 million (parchment basis), macadamia at $38.9 million, floral and nursery $100,689, papaya at $11 million and specialty tropical fruit at $2.61 million. Among the specialty tropical fruit, mango led with $769,000 ($0.50/kg) in total value, followed by longan at $657,000 ($1.57/kg), lychee at $453,000 ($1.33/kg), rambutan at $292,000 ($1.25/kg), persimmon at $141,000 ($0.71/kg) and others such as breadfruit, abiu, atemoya, mangosteen, poha, rollina, sapodilla, soursop, starfruit, white sapote, cherimoya, durian, jaboticaba, jackfruit, langsat, loquat, caimito and canistel at a combined value of $284,000 (3).

Lychee

Consistency and availability are important factors determining the success of a crop; for example, longan generated the highest income return for the farmers among the Sapindaceae (lychee, longan and rambutan) group because of the use of potassium chlorate in longan culture which allowed for off-season production. No chemical is available for flower induction in lychee as is the case with potassium chlorate

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in longan; a management method was developed for 'Kaimana' lychee using moderate pruning and timing of fertilizer applications immediately after harvesting (4). The removal of all branches at 30 to 60 cm beyond the fruit clusters at harvest, and the application of fertilizer a week after, physically synchronized and promoted new vegetative growths immediately after harvest. In the Hilo and Kona studies, average yield of 45 kg per tree was reported on 9 year old plant (1). The method so far was successful with 'Kaimana' lychee, which requires fewer chill units for flowering. Most lychee cultivars require a much longer period of lower temperature than what is available at most of the Hawaiian Islands.

New lychee germplasm should be explored and collected to improve lychee production potential in Hawaii and Puerto Rico. China is the center of origin and diversity of lychee; three important regions of lychee germplasm are Guangdong, Yunnan and Hainan. Hainan Island is the lychee center of origin with the greatest similarity to the warmer climates of Hawaii and Puerto Rico. In the past five decades, many unusual and new commercial litchi cultivars were selected and released from the Hainan germplasm. Some examples are: 'Hainan Wuheli' which has no seed or a very small aborted seed in more than 85% of the fruits; others, such as 'Dadingxiang' have large fruit averaging 32 g, and 'Erdanli' ("goose egg") has fruit 50-80 g. None of these new high quality cultivars is available outside of the Chinese domestic markets. Many of these new lychee cultivars were selected from landrace populations scattered among villages and fields in a 2000 ha area in Xiuying District, Haikou city, Hainan. Hainan lychee cultivars should be prioritized for collection for Hawaii, Puerto Rico and Florida.

Peach Palm

Bactris gasipaes (Kunth.) is a potential new crop for Hawaii and Puerto Rico. The introduction of the thornless peach palm by Charles Clements in the 1980s ['Yurimagus' and 'Benjamin Constant' landraces from the National Research Institute for Amazonia (INPA), Manaus, Brazil] was the beginning of the palm heart industry in Hawaii. The multiple-stemmed thornless peach palm allows for the relatively easy harvest of palm heart when compared to the thorny wild types. Palm heart is highly valued as a gourmet vegetable by the culinary trade and fetches good returns to the farmers. The thornless peach palms grow rapidly and are harvested throughout the year in the deep soil of former sugar cane fields along the Hamakua coast of Hawaii.

Pili Nut

Canarium ovatum (Engl.) from the Philippines has potential as a new nut crop for Hawaii. The USDA/ARS, Pacific Basin Agricultural Research Center (PBARC) has a seedling collection of over 50 trees donated by Dr. Roberto Coronel from the Philippines in the 1980s. These plants are being evaluated for their qualities and production potential.

Giant Rambutan

Nephelium cuspidatum var. *robustum* (Radlk.) Leenh., from Sabah, Malaysia has an average total soluble solids of 25% or more. This germplasm has the potential to improve fruit size and fruit quality of rambutan (*Nephelium lappaceum* L.). The challenge is to bring down the tree size of the giant rambutan (>12.2 m) so it is more manageable and can be used for making crosses with rambutan (4.6 m). The Kho laen or mak waeo (Thai) (*Nephelium hypoleucum* Kurz) is a handsome tree with slender narrow leaves that produces small flat oval-shaped fruits with the smooth peel of the lychee but with the seed of the rambutan. The genetic potential of Kho laen includes its use as rootstocks, and for resistance to corky bark (*Dolabra nepheliae* C. Booth & Ting) (2).

Ohelo Berry

In recent years, increased difficulty in plant introduction, exploration and collection from foreign countries resulted in the redirection of our collection efforts to germplasm within U.S. borders. In Hawaii, the ohelo berry (*Vac-*

cinium reticulatum Sm.) populations on the island of Hawaii and Maui need to be surveyed, collected and protected (5). Ohelo has the potential as a specialty crop for culinary and ornamental uses.

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