Food Security and Economic Sustainability: Current Research in Tropical Fruit Production at the University of Hawaii

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As a tropical fruit researcher, there are several philosophies one may pursue as the guiding light for their research program. In particular, two philosophies come to mind and both have their place.

One philosophy is to be on the cutting edge of developing new, high quality, high demand crops. This pursuit is important because it provides new products to both growers and consumers. Growers who get into the game early may be able to make substantial economic gains. This can be exciting, and for those who are excited by diversity and entrepreneurship, the financial rewards and personal passion can be great. Drawbacks can be that the economic advantage and viable time horizon may be short lived. When the product is in high demand and price is high, other growers get into production, and in short time economic viability may wane. We have seen this story over the last several years with rambutan. It used to be a big ticket item and growers quickly got into production. Now, the price for rambutan has dropped significantly, many orchards are in decline, and I know four growers with plans to remove their rambutan orchards in the near future.

Dr. Mark Nickum collecting breadnut seed.

Another philosophy is to focus on food security issues by examining which crops we can grow effectively and economically in Hawai'i in order to develop a high quality product and replace high quantities of imports. For food security, we may look at the development of staple crops, or the replacement of common imports. It is still important to focus on economic opportunity, because without economic sustainability the grower will yet again suffer. In many instances Hawai'i's high cost of production simply cannot compete. The cost of importing fertilizers and fuel, and the high cost of land may leave little or no way for growers to make a living. However, many of our Islands do have lease lands available via the State, Kamehameha Schools, Bishop Estates, and others, and the price can be as low as $200 per acre per year in some areas. There can be many risks involved with leasing, especially for planting tree crops compared with annual crops. This all said, I believe there are a few examples of fruit tree crops

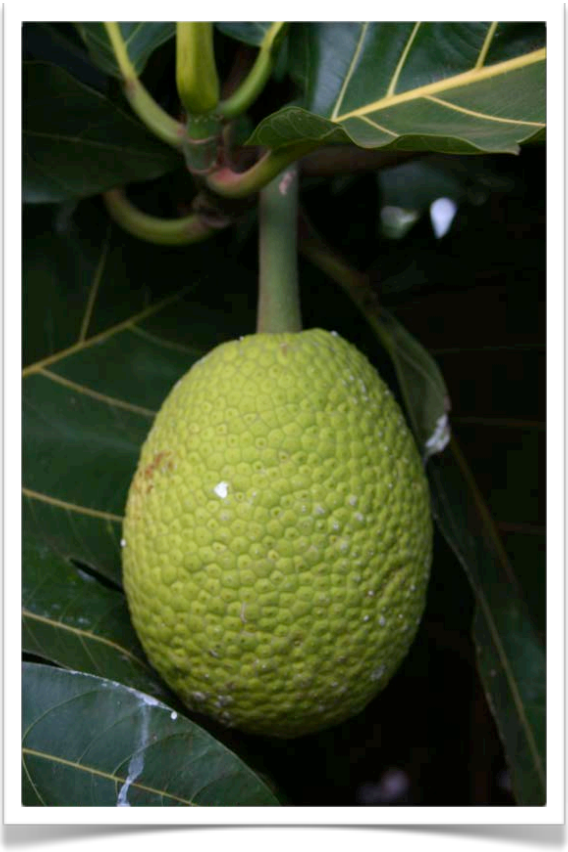
which are worth developing in order to improve both our food security and economic sustainability here in Hawai'i.

My research program is currently working with Avocado, Breadfruit, and potentially Citrus.

Clonal avocado rootstock ordered from Brokaw Nursery, similar to what will be used for the project in Honoka`a, on Hawai'i Island.

Avocado

Currently, in Hawai'i, we produce 1 million pounds of avocado a year for local consumption, but we import 2 million pounds, so there may be an economic opportunity there. In a project funded by Hawaii County RC&D, and with a group of about ten motivated growers in Honoka`a, we will soon be planting four to six summer bearing avocado cultivars at multiple elevations to increase availability of good quality locally grown avocado during the summer months.



One of the 'Ma`afala' fruit.

Breadfruit

Breadfruit is a traditional Polynesian and Micronesian crop with great potential, but for which very little is known about commercial production and orchard management. Through an HDOA Specialty Crop Block Grant, I am collaborating with Wayne Ogasawara of the Mililani Agricultural Park on Oahu in order to plant 10 acres of breadfruit. We will be determining planting densities, pruning strategies, orchard establishment and fertilization recommendations, as well as determining yield, marketability, and developing value added products such as gluten free flower. Growing breadfruit on this scale has never been done in Hawai'i in modern times to our knowledge (i.e. not counting the ancient Hawaiian plantings of Kona). So this will be an important test to determine the economics involved in establishing a commercial breadfruit orchard, and to test if breadfruit at this quantity can be effectively marketed and sold.

Breadfruit propagation is a challenge. Traditionally, breadfruit was propagated from root suckers, but this is a slow process and very limited in numbers when considering planting a large

scale orchard. Currently, the most successful approach for mass production of plants has been via tissue culture. Diane Ragone of the National Tropical Botanical Garden, and her collaborators in tissue culture laboratories in Canada have perfected producing the 'Ma`afala' cultivar in tissue culture. However the limitation is that the protocol requires completely different recipes of hormones and nutrients for each individual cultivar. Thus the bottleneck has been getting other varieties into tissue culture and releasable to the public. I am currently looking into grafting breadfruit onto related Artocarpus species including breadnut, marang, champedek, and a champedek X jackfruit F2 hybrid. A patch graft technique has been proven possible for breadfruit on breadnut by Dr. Ricardo Goenaga, a researcher at the USDA-ARS in Mayaguez, Puerto Rico. Also, a cleft graft of breadfruit on breadnut has been published by Indrani Medagoda and W.M.C.J. Kumari Chandrarathna of the Horticultural Crop Research and Development Institute in Gannoruwa, Sri Lanka. Alternatively, breadfruit can also be propagated by cuttings, a technique proven by our CTAHR researchers L. Chia, R. Hamilton, and R. Criley many years ago. I will be retesting this technique. The purpose for grafting and cuttings will be to increase the diversity of breadfruit cultivars available for planting.

Citrus

Fresh citrus could be developed into a greater industry in the State than it is currently. We import between 10-15 million pounds of oranges alone, about 1.5 million pounds of grapefruit, about 3.5-4 million pounds of lemons, and about 2 million pounds of limes. This is a huge food security issue for the State with great potential upside economically for import replacement if it can be done. I was contacted about a year ago by a fresh juice company from New Zealand wanting to buy land on the Big Island and develop an industry, so there could be potential. However, there are citrus diseases including citrus blight and citrus tristeza virus. Research into citrus blight and citrus tristeza would need to be progressed and extended more completely to growers. Appropriate rootstocks need to be developed, tested, and extended to growers. Some of these projects have already been conceived of by our CTAHR colleagues, and perhaps in the future may lead to important research potential.

This has been a brief glimpse into some of my current research projects. Please enjoy the following photo essay.

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Mr. Wayne Ogasawara in front of one of his mature breadfruit trees at the Mililani Agricultural Park. He has about 75 mature trees.

One of the fields at the Mililani Agricultural Park where the 10 acres of breadfruit will be planted.

Shadehouse where approximately 450 tissue cultured 'Ma`afala' breadfruit are being grown out in one gallon pots for planting in the breadfruit orchard.

Inside the shadehouse.

Breadnut seedlings in a greenhouse at the Komohana Research and Extension Center in Hilo. As of this writing 182 out of 255 seed germinated.

Collecting breadnut seed from Lyon Arboretum, Manoa Valley, Oahu. Mahalo to Dr. Mashuri Waite, Collections and Grounds Manager at Lyon for his cooperation.

Approximately one year old 'Ma`afala' breadfruit planted which was from tissue culture planted at the Mililani Agricultural Park.

Breadnut seed.

Marang seedlings for rootstock, another Artocarpus breadfruit relative. It appears to have a wider caliper at a younger age, however it also is less woody, which may or may not lend itself to grafting.

Breadfruit from tissue culture planted into dibble tubes and forestry pots. The purpose of these pots is to train the roots to grow downward, without resulting in J rooting or roots circling the pot thus malforming them. When the roots reach the bottom, they reach air, and stop growing. This is called air pruning of the roots.

Breadfruit roots at the bottom of their dibble tube. Notice they appear to be growing straight down and not curling around.

Champedek X Jackfruit F2 Hybrid seedlings for use as rootstock. When their caliper is sufficient, both cleft and patch grafting of breadfruit onto them will be tested.

Clonal avocado rootstock ordered from Brokaw Nursery, similar to what will be used for the project in Honoka`a, on Hawai'i Island.

Tag on an older avocado rootstock from Brokaw Nursery. Please note we have not yet tested any of these clonal avocado rootstocks under Hawai'i conditions. They were developed for California conditions, and how they will perform in Hawaii is completely unknown. So do not in any way consider this an advertisement for this product. We are only at the beginning stages of testing. The key is that the stocks we will be using are known to be resistant to Phytophthora Root Rot.

Our lead cooperating grower in the avocado project in Honoka`a, Mr. Bill Beach.

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