Peach Palm In Hawaii: Development Of A New Crop

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Development of a New Crop

The peach palm was introduced recently into Hawaii as part of a new crop development effort by the University of Hawaii at Manoa, financed by:

- a USDA Section 406 grant for genetic and growth analysis, density studies and market creation, coordinated by Dr. Richard M. Manshardt;
- a GACC-CAPE grant for herbicide and groundcover evaluations, coordinated by Dr. Joseph DeFrank;
- Department of Horticulture - CTAHR resources for quality analysis and market creation, coordinated by MS. Catherine Cavaletto.

The objective is to develop this new crop as a source of fresh heart of palm, to be marketed initially as a gourmet vegetable in up-scale restaurants, later in up-scale specialty markets, and possibly for export to Asia or the mainland.

The palm heart is composed of the tender unexpanded leaves just above the apical meristem; the tender stem tissue just below the meristem is also edible and can substitute advantageously for bamboo shoot.

The executive chefs who have sampled fresh palm heart have been impressed and are willing to pay premium prices for the product. Some have desired to place orders for 50 lbs/month with the project.

Most consumers who have tried samples, either fresh or prepared, have been enthusiastic. Some now ask if palm heart is on the menu in the few restaurants that have received samples for experimentation.

Demand exists and can be expanded easily. This is the first step in developing a market.

This report outlines progress in this research and development program to date, our current evaluation of the peach palm's potential, and some of the areas that still require research to guarantee its successful development in Hawaii.

We hope that the GACC will take an expanded interest in this crop, since it now seems likely that peach palm could become another star in Hawaii's diversified agriculture sector with just a little more research and development.

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Genetic Variability

Seeds from three tropical American peach palm populations were introduced:

- Yurimaguas, Peru, with the highest frequency of spineless plants, in 1991;
- Benjamin Constant, Brazil, with a moderate frequency of spineless plants, in 1991;
- San Carlos, Costa Rica, with a moderate frequency of spineless plants, in 1993.

Ten seed-lots were obtained from each population. Each seed-lot is an open-pollinated progeny from a single plant. All maternal plants were vigorous, fast-growing, spineless individuals, which are three of the primary characteristics essential for palm heart production.

Growth and Yield Evaluations

Nine of the seed-lots from Peru and Brazil provided sufficient seedlings to plant a replicated progeny trial at three locations:

- the farm of Mr. John Mood, Ninole, (Hamakua coast, North Hilo) - an excellent site, with good soils and rainfall (see Figure 1 for percentages of plants harvested in each progeny));
- Poamoho Experimental Farm (Waialua) - a good site, which could be excellent with better irrigation, with 15% of the plants harvested in 18 months;
- Waiakea Experimental Farm (South Hilo) - a poor site because of the lack of water holding capacity in the Ola'a lava, with only 1% of the plants harvested in 18 months.

This trial is providing information on adaptation of peach palm to various Hawaiian agroecological zones, which will allow both the identification of outstanding types and the extrapolation of our information to other areas in Hawaii.

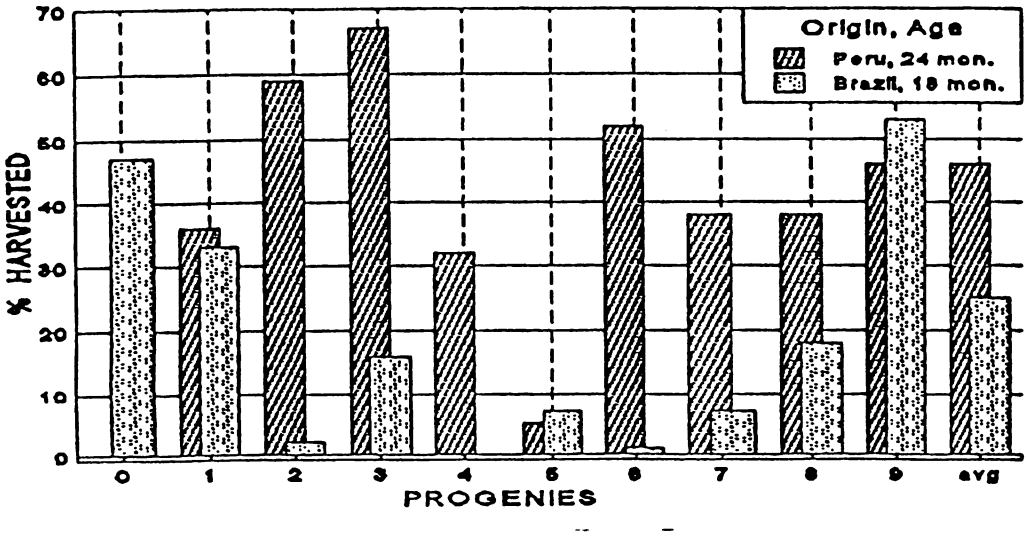

Figure 1. Percentage of plants harvested in each progeny and in average at Ninole (Hamakua coast) between September 1993 and January 1994.

Planting Density

The current commercial planting density in Costa Rica is 5000 plants/hectare. Our trial at Ninole (Hamakua) is providing information on the yield potential of peach palm at three planting densities:

- 3333 plants/ha or 1360 plants/acre;
- 5000 plants/ha or 2040 plants/acre;
- 6666 plants/ha or 2720 plants/acre.

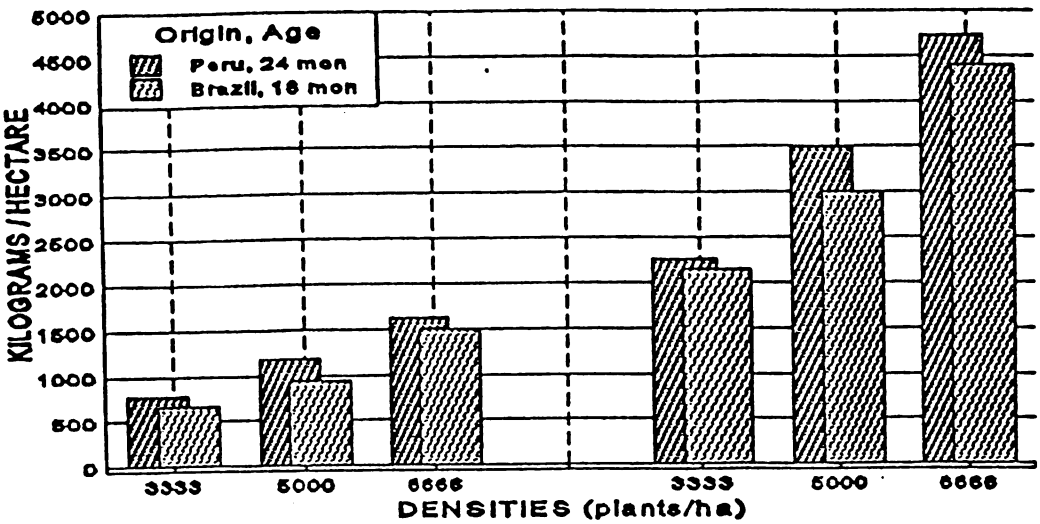

Figure 2. Potential yields as a function of density at Ninole. Left side: yields of pure edible palm heart only. Right side: marketable yields (palm heart + palm stem).

These yield potentials are equivalent to, or higher than, yields obtained in Costa Rica and Brazil, indicating that peach palm is well adapted to the Hamakua coast (Figure 2).

Yield potentials are slightly lower at Poamoho, but would be equivalent or possibly higher, if irrigation were adequate. {Poamoho Experimental Farm is suffering a labor shortage because of a lack of priority given to agriculture in the current state hiring freeze.}

Yield potentials at Waiakea Experimental Farm have not yet been estimated because of slower growth, due to periodic water deficiency.

Herbicides for Establishment

The effectiveness of three herbicides (Goal, Paraquat, and Surflan) and their effect on peach palm from the Brazilian population is being evaluated at Waimanalo, with GACC-CAPE funding. The treatments are:

- Woven black plastic mulch, the control treatment;
- Goal, a pre-emergent herbicide, at two rates;
- Paraquat, a contact herbicide, at two rates;
- Surflan, a pre-emergent herbicide, at two rates.

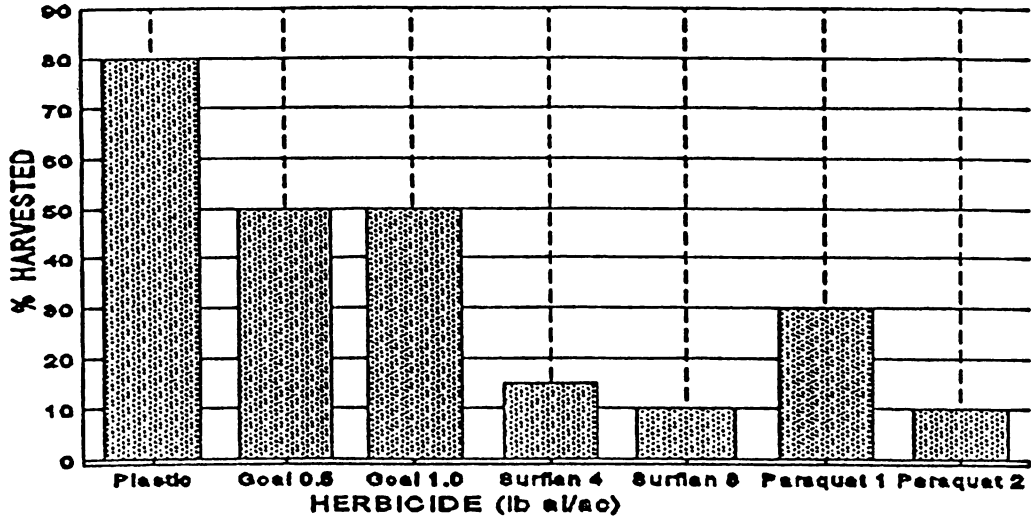

Figure 3. Harvest percentage as a function of herbicide treatments after 19 months of growth at Waimanalo. The number after the herbicide name is the pounds of active ingredient used per acre.

The black plastic provides the best weed control and yields, although Goal yields nearly as much in pounds per acre (not shown in Figure 3).

Goal does not affect peach palm growth and yield significantly, while Surflan reduces yield somewhat and severely inhibits plant growth and is especially injurious to the offshoots (keikis).

There are indications of differential response to herbicides by the Brazilian progenies used, which suggests that some progenies are more tolerant of herbicides than others.

A pre-bearing label for Goal is being requested from the US EPA.

The effectiveness of three legumes and one grass groundcover is being evaluated as weed control strategy and to determine their effects on peach palm from the Brazilian population. The treatments are:

- Woven black plastic mulch, the control treatment;
- *Arachis pintoi*, a nitrogen fixing legume, peanut relative, with a very prostrate growth habit;
- *Cassia rotundifolia* cv Wynn, non-nitrogen fixing legume, with a low growth habit;
- *Desmodium ovalifolium*, a nitrogen fixing legume, with an almost bushy habit;
- *Chloris gayana*, a vigorous pasture grass attaining about 2 feet in height.

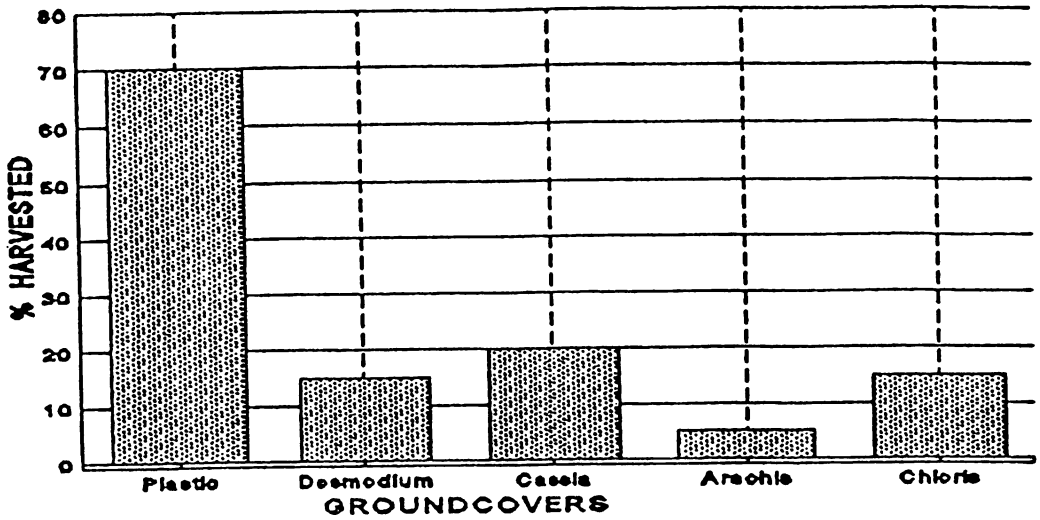

Figure 4. Harvest percentage as a function of groundcover after 19 months of growth at Waimanalo. Note that all vegetative groundcovers compete with the palms.

Black plastic provides the best weed control and yields, because all of the vegetative groundcovers compete with the peach palm for nutrients.

Desmodium ovalifolium and *Chloris gayana* (the grass) provide good cover and weed control, while *Arachis pintoi* provides good cover.

When vegetative groundcovers are used, an enhanced fertilization regime will be required. This requires further study.

Plantation Establishment

The herbicide and groundcover results, combined with information from the progeny x density trials and farmer observations, suggest that plantation establishment should proceed in the following sequence:

- Plow, lime and fertilize as indicated by soil test, and grade a new field along the contour, following SCS recommendations;
- Plant inoculated nursery-prepared seedlings of *Desmodium ovalifolium* or sow seeds of *Chloris gayana* to establish the groundcover;
- Prepare planting strips with Paraquat, Round-up or by tilling;
- Plant the peach palm seedlings and prepare a water terrace around each if required;
- Apply Goal as a directed post-emergent and general pre-emergent around palms;
- Replant palms within one month;
- Install strips of woven black plastic mulch along the palm rows one month later;
- The vegetative groundcover should be mown periodically to maintain a 8-10 inch cover;
- Yields will start just after the 18-month period stipulated by the EPA pre-bearing label;
- Because the peach palm produces offshoots (keikis) at the base of the stem, the crop can be managed as a perennial, with a harvest cycle of approximately 12 months.

This establishment scenario remains to be tested. Other questions involve the width of the woven plastic mat and the number of rows of palms installed within each mat row. These questions are not trivial, as they can significantly reduce labor requirements while maintaining the desired density.

Quality Analysis

Fresh hearts of palm have never been marketed extensively anywhere. Consequently, little is known about the sensory characteristics (flavor, aroma, texture, etc) of the fresh heart.

The palm offers three potential products, only one of which (the heart) is currently processed and commercialized on the world market on a large scale:

- Palm heart, the tender leaves above the palm growing point that are wrapped within the tender sheath of an older leaf;
- Palm stem, the tender stem portion immediately below the growing point;
- Palm leaf, the tender leaves above the palm heart that are not wrapped within the tender sheath of an older leaf.

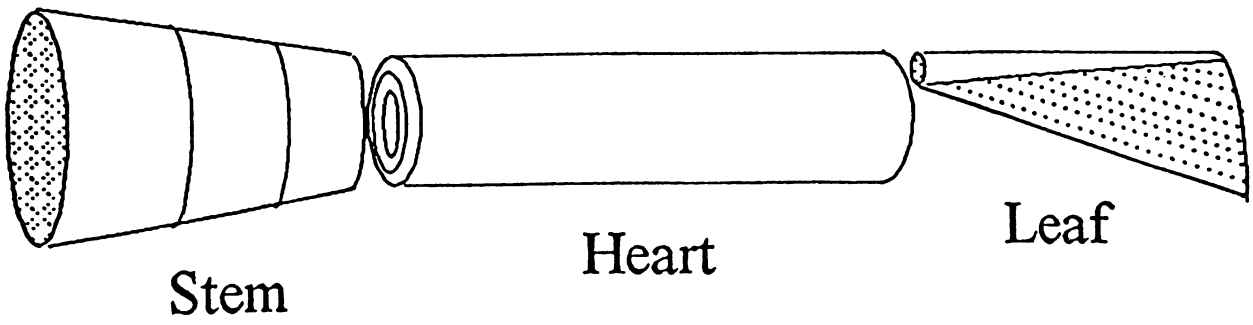

Figure 5. Schematic representation of the three potential products from a palm.

Each section has different sensory characteristics, especially texture and appearance. Consequently, each can be used in different ways and might have a greater appeal to different culinary traditions.

In general, all three parts have a very mild agreeable flavor. All parts may be somewhat sweet, with the amount of sugar depending more upon management than genetics. The heart and the stem are crispy, although distinctly different from each other.

A few plants have presented acridity. Acridity is the itchiness in the throat or mouth that is frequently found in undercooked taro. This negative sensory trait requires more research, as it can limit the use of the fresh product. Acridity does disappear upon cooking, however.

Postharvest Handling

Any fresh vegetable must be properly handled after harvest to arrive at the consumer's table in good condition. This generally means that the product must be packaged and stored without any degradation. Adequate packaging and storage also extend shelf-life, which is essential for distribution and the ultimate consumers.

If left unpackaged, the fresh palm heart will start to yellow within days. It will also dry and lose some of its crispness and may develop a grassy flavor, probably from the development of chlorophyll in the sheath surface cells.

Careful cleaning, followed by packaging in plastic bags or plastic wrap, with storage at room temperature or in the refrigerator, extends shelf-life to different degrees. The best method so far is:

- Wash carefully and surface dry;
- Wrap each piece individually in plastic film;
- Store in the dark in a refrigerator at $5^{\circ}C = 40^{\circ}F$.

With this treatment, the shelf-life of the fresh heart can be extended from 2-3 days to at least 18 days. Further work to extend shelf-life will be essential, especially if the product is to be shipped to Asia or the mainland.

Further work is also necessary to determine the best packaging and storage conditions for the palm stem and palm leaf.

The palm leaf has potential as a component in prepared salad mixes, in substitution for or as a compliment to other leafy vegetables. For this type of prepared product, packaging and storage conditions must be evaluated in conjunction with the other salad components.

Cost and aesthetics will also be a factor in determining the final selection of materials for packaging.

Market Creation

Samples of fresh palm heart were presented to Mr. Chuck Furuya, coordinator of the Honolulu Wine Festival and entrepreneur of gourmet foods in Hawaii. Mr. Furuya was impressed with the quality and took samples to several executive chefs. Within days, the chefs were calling to order **"50 pounds/month, starting right now", "several pounds/week, price no object"**, etc.

The executive chef of the Hawaii Prince Hotel (Honolulu), Mr. Gary Strehl, agreed to prepare a special dish for the Honolulu Wine Festival, in October 1993. Most of the guests at the festival also sampled fresh palm heart presented by project members. Everyone who commented liked both the fresh samples and the Hawaii Prince chef's fish and palm heart dish.

Samples of palm heart were also presented to chefs and farmers during a series of Chef-Farmer workshops on the Big Island in November 1993. Again, the chefs and consumers were enthusiastic.

During the first major harvest at Ninole, January 1994, samples were sent to 6 Big Island restaurants and the culinary class at UH West Hawaii campus, Kona. All chefs and students have been enthusiastic.

To date, at least eight ethnically-oriented (3 Chinese, 1 French/Creole, 2 Japanese, and 2 Thai), several internationally-oriented and two Hawaii 'regional cuisine' chefs have experimented with fresh palm heart. All have been enthusiastic and have started experimenting with recipes.

Some have preferred the palm heart, especially those with international and European orientations, while some have preferred the palm stem, especially the oriental chefs. In the latter case, this reflects the palm stem's similarity to bamboo shoot.

A chef-owner at a Japanese restaurant in Hilo said that **"if I could obtain fresh stem reliably, I would never buy another bamboo shoot"**.

In February 1994, the peach palm was spot-lighted by the UH Hilo television program "Focus on Agriculture," hosted by Dr. Jack Fujii. This program is seen throughout the islands and has a wide audience. During the show, 8-9 callers expressed interest. Since the show, 6 callers have requested seeds and further information.

This market creation effort has been very successful and shows that it will not be difficult to develop a market for all parts of the fresh palm. As harvest continues in the field trials, samples will continue to be delivered to restaurants to maintain their interest and whet the appetite of their guests.

Price Estimates for Fresh Palm Heart

Canned hearts of palm from Brazil and Costa Rica retail for $6-7 per pound at Honolulu supermarkets. Generally, fresh produce retails at a premium over the same canned produce.

The chefs that participated in the Chef-Farmer Workshops were asked how much they would be willing to pay for fresh palm heart. Most indicated a range of $6-8/lb, with a high of $10/lb.

The chef at the Ritz Carlton Mauna Lani, north Kona, paid $5.60/lb in Miami and another $6/lb to air freight it to a chefs presentation in early 1993. This suggests a willingness to pay up to $11.60/lb at very up-scale restaurants.

Given this price information and the interest generated by the distribution of fresh samples on the Big Island, we feel that it is safe to expect a retail price of at least $6 per pound.

On average, a single palm yields one half pound of high quality palm heart per year.

Price Estimates for Fresh Palm Stem

Throughout Latin America the palm stem is generally discarded during processing. Only rarely are small chunks marinated and mixed with heart chunks for bottling and marketing as a prepared marinated vegetable (like marinated artichoke hearts). Consequently, a direct comparison with a canned palm product is not possible.

Canned bamboo shoots retail for $2.50-3/lb in Honolulu, while fresh shoots retail for $9/lb. Given the stem's similarity to bamboo shoot, and the comments of the Japanese chef, we feel that the stem should attract a price between these extremes.

On average, a single palm yields one pound of high quality palm stem per year.

Price Estimates for Fresh Palm Leaf

The quantity and form of fresh edible palm leaf recovered at harvest is erratic. Sometimes it is only an inch or two long with little leaflet material and a lot of rachis (which supports the leaflets); othertimes it may be more than a foot long with abundant leaflet material.

Nonetheless, the palm leaf has potential for salads. If the leaflets are separated one from the other and sprinkled with your favorite salad dressing, it is truly "millionaires' salad", one name for palm heart salad in Europe.

We will not risk a price estimate at this time, but anything that the farmer can receive for this product will increase his returns.

Marketing Channels

Most fresh produce is marketed through an established distribution network. This network charges 30-60% of the final retail value, depending upon the processing required, the perishability of the product, and the demand for it.

Some of the up-scale restaurants are dealing directly with a selected group of farmers. This assures the chefs of high quality and precisely the type of produce that they want. This new relationship was strengthened during the Chef-Farmer Workshops in November 1993.

If the palm heart farmer can deal directly with the chefs and get $6/lb for palm heart and $2.50/lb for stem, each plant will yield at least $5.50/year.

If the palm heart farmer deals with a produce distributor, the farmer's returns will depend upon the amount of pre-processing that is done on-farm. The more processing done by the distributor, the less the farmer will receive.

Commercial Planting of Peach Palm in Hawaii

Several farmers are already planning the first commercial plantings.

Mr. John Mood, Ninole, has received 10,000 seed from Yurimaguas, Peru, and expects to plant 2-3 acres later this year.

Ms. Tanya Paltin, Hilo, has received 1,000 seed from Yurimaguas, Peru, and expects to plant 1 acre, interplanted with mangosteen, later this year.

Mr. Jules Gervais, Hilo, has received 1,000 seed from Yurimaguas, Peru, and expects to plant 0.5 acre later this year to supply the Suntari Thai Restaurant.

Mr. Lee Lopez, Haiku, Maui, has received 800 seed and ordered an additional 3,000 seed from Yurimaguas, Peru, and expects to plant at least 1 acre later this year.

Mr. Nick Dudley, Kahaluu, Oahu, is the nurseryman that is importing the seed from Peru. He is a fully licensed seed importer and is actively involved in maintaining phytosanitary controls to avoid introducing pests or diseases with the seed. Peru is not a host country for lethal yellowing or any other restricted palm diseases at this time.

Future Prospects

Given chef interest, both in quantity and price, and farmer response, the following development scenario appears reasonable.

A niche market, selling directly to up-scale restaurants and produce retailers in the state, can probably accommodate at least 50 acres within the next few years. When in full production, this is equivalent to 50,000 lbs of palm heart and 100,000 lbs of palm stem, with a retail market value of about $550,000 per year.

As this market niche becomes saturated, prices will start to fall somewhat. This will open another, larger niche, that of the middle class restaurants and supermarkets. This market can probably accommodate another 200 acres within the decade. When in full production, this is equivalent to 200,000 lbs of palm heart and 400,000 lbs of palm stem, with a probable retail value of $1,800,000 per year.

Export niches may also exist, especially in Asia and possibly on the mainland, although there will be fierce competition from Costa Rica and other Latin American countries, and Hawaii's window of opportunity is likely to close rapidly. The Latin Americans have not yet managed to develop adequate packaging and storage for these materials, according to Ms. Frieda Caplan, owner-director of Frieda's Finest.

Nonetheless, Teixeira Farms, one of California's largest grower-distributors, is interested in attempting to develop this niche. A representative, Mr. Gary Calloway, has visited the UH program and discussed options with Mr. Yukio Kitagawa, Chairman of the state Department of Agriculture, and Mr. Dennis Teranishi, Office of State Planning.

The UH peach palm program has requested USDA-APHIS authorization to send fresh samples to the mainland, specifically to Teixeira and Frieda's Finest. We expect APHIS to respond soon.

The Next Steps

Obviously all is not rosy. Hawaii has high land, labor and input costs. An earlier cost estimate, without black plastic mulch, the frequent weed management necessary on the Hamakua Coast during establishment, and loan servicing, suggested that the farmer must receive at least $1.50/lb for the palm heart at the farm gate to break even. The fertilization plan was based on the Costa Rican experience and can surely be optimized for Hawaii. Cooperators' and visiting farmers' ideas about plantation establishment, geometry and management are certain to reduce costs, and increase efficiency and yields.

Three years of work have confirmed the potential of peach palm in Hawaii, but also identified various aspects that require more attention before the Hawaiian farmer can validly hope for a good return on investment. Some of the most important aspects are:

1. Fertilization. A 21-7-14 formula gives good results at 1 lb/plant/year. Immediately after application, however, palm heart sweetness is reduced. Since this may be an important quality criterion, can the formulation or the frequency be changed to maintain sweetness? What micro-nutrients are necessary? Can the mycorrhizal symbiosis be exploited in peach palm in Hawaii?

2. Acridity. Acridity is the burning or itching sensation in the mouth that most people experience after eating poorly cooked taro. Some peach palms present low to medium levels of acridity. How frequent is it? Is there genetic variation that will allow it to be eliminated in a breeding program? What are the environmental interactions?

3. Quality control. What are the major quality characteristics of the peach palm heart? How can they be enhanced or conserved during processing and storage? Can hearts and stems be conserved for 3 or 4 weeks? What happens to their qualities? How can they be packaged?

4. Cost/Benefit Analysis. A cost/benefit model must be developed that will allow the research program to evaluate the expected effects of management and market changes on the farmer's potential revenue. This will be critical for evaluating various plantation geometries, ground-cover and weed control options, direct-marketing versus produce distribution networks, etc.

5. Plantation management. What plantation geometry, ground-cover, weed control, fertilization, mycorrhizal, harvesting, and other management practices can reduce costs, especially labor costs, and increase yields? Can harvesting be at least partially mechanized?

6. Improvement. The Costa Rican germplasm will go to the field later this year and will need to be evaluated. Outstanding progenies and individuals from the Peruvian and Brazilian populations are being identified. With the germplasm on hand, can yields and quality be significantly improved? Is hybridization the best route? Or should cloning, via tissue culture, be pursued?

Wherever possible, research should be done on-farm in order to get practical results to the producers as soon as possible. With the large agricultural acreage opening in various places in the islands, farmers cannot wait for on-station research results.