

PROEXAG II

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EXPORT INDUSTRY TECHNOLOGY SUPPORT PROJECT (AGRICULTURAL COMPONENT)

TECHNICAL REPORT ON TROPICAL/EXOTIC FRUIT TREES IN GUATEMALA, COSTA RICA, HONDURAS, AND BELIZE

Assignment Number: ST-015

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**TRIP REPORT TO:
GUATEMALA, COSTA RICA, HONDURAS AND BELIZE.**

GUATEMALA.

I. PURPOSE OF TRIP.

Meet with counterpart organizations in each country, assess exotic fruit cultivars present in the country at different private and government stations and farms and to evaluate the feasibility of locating a nursery at one or more sites in each country to care for new introductions and to propagate good varieties in the country.

II. PERSONS CONTACTED:

Magin Beteta, GEXPRONT, Guatemala City
Francisco Solórzano, GEXPRONT, Guatemala City
Rene Villagran, IICA/MAG Piedra Parada
Juan Matta, Farm owner, Piedra Parada and Extension Chief at Morales.

III. ACTIVITIES AND ACCOMPLISHMENTS.

Feb. 1: Leave Hawaii.

Feb. 2: Arrive Guatemala 6:30 pm.

Feb. 3: Briefing with José Mondoñedo and meeting with Magin Beteta to plan seminar to be held in the afternoon. Presented slides of selected exotic fruits and discussed in detail cultural aspects and nursery requirements to propagate various fruit trees. Concentrated on Lychee, Rambutan, Atemoya and Carambola and to a lesser extent Papaya, Durian and Langsat. Attendance was about 25-30 consisting of students, extension people and growers. José led off with a comprehensive slide show and discussion of exotic fruits in general. Total program was over three hours. We left for Piedra Parada at the end of the seminar.

Feb. 4: José, Javier and Mike (hereafter to be known as WE), arrive at the farm of Juan Matta. This farm has approximately 1000 rambutan and 2000 mangosteen trees. The rambutans are seedling plants and about 50% have turned-up male. José had suggested to the grower that he cut down the males so they would produce side suckers that could then be budded with commercial varieties of rambutan. I demonstrated on the sideshoots of the male trees the proper method of budding, including selecting a dormant bud, using the patch bud system, untying the tie tape after 2 weeks and forcing the bud to break by clipping the top of the rootstock after 4-5 weeks from initial budding. We discussed criteria for selecting good fruit characteristics such as red skin color, free stone, Brix of 17-22, determinant ripening of panicles, fruit of 25 grams or over, etc. Buds should be taken only from these selected trees for grafting. The trees on this farm exhibited typical rambutan seedling traits such as producing few lateral branches and having an exaggerated upright growth pattern. We advised Matta to cut back some of the trees to produce more lateral branches which would then produce more fruiting wood. The rambutans were between 3 and 4 years and had just begun bearing fruits of mixed quality which were well received on the local market. Rambutans do well here and Juan Matta's farm would be a good place to introduce good varieties in a nursery situation. He has the nursery skills and interest for success as he requires good selections to expand his rambutan farm.

Juan Matta has been planting 200 mangosteen seedlings per year alongside a stream on his property and now has 2000 trees, from 1 to 10 years old. We saw 3 or 4 of 10 year old trees that are bearing heavy crops of good quality fruit. The yellow exudate problem that damages the internal quality of the mangosteen fruit is found here as in most places. Little work has been done on this problem, however, It needs attention if this fruit is to be exported in large numbers. The problem only appears occasionally and therefore difficult to determine if it is an unavoidable environmental problem or it can be corrected with cultural inputs.

IV. OBSERVATIONS AND RECOMMENDATIONS.

Juan Matta's farm shows that soil and climatic conditions favor the growth of rambutan and mangosteen and should also grow good quality carambola, durian and possibly atemoya. As an extension chief and grower of other crops, this person has the necessary skills and existing nursery site to be used as a place to send selected cultivars to be grown and propagated. It would be necessary to teach the proper methods of receiving bare rooted plants, how to propagate various fruit crops and to create the various environments for the different trees. One important characteristic to look for is a degree of self interest which will motivate the project towards success. As a grower of these crops self interest is present. Lychee and longan require a different climate for producing fruits but could be grown in the nursery here with a well drained soil mix.

Guatemala has tremendous potential for lychee and longan. Areas that have cool, dry winters with no frost and humid wet summers should be located for testing varieties of lychee and longan. The details of the various variety requirements will be summarized in the horticultural report.

COSTA RICA.

I. PURPOSE OF TRIP.

Meet with counterpart organizations in each country, assess exotic fruit cultivars present in the country at different private and government stations and farms and to evaluate the feasibility of locating a nursery at one or more sites in each country to care for new introductions and to propagate good varieties in the country.

II. PERSONS CONTACTED:

Edgar Valverde, CINDE-Agriculture Division, San José.
Emilio Chincilla, CINDE-Agronomist, San José.
Milena Robert, CINDE-Industrial Division, San José.
Patricia Morelli, CINDE-Industrial Division, San José.
Richard Cubero, Multifruit, fruit processor, San José.
Edwin Alfaro, Manager, Corporación Cafetalera, San Marcos.
Frank Monge, President, Frutsantos Coffee Coop., San Marcos.
Carlos Umaña, CATIE, Genetic Resources Unit.
Rodrigo Rios, Manager, Rambutan Farm, Roxana.
Robert Mack, ANAI, San José.

III. ACTIVITIES AND ACCOMPLISHMENTS.

Feb 5: Guatemala to Costa Rica.

Meet at CINDE with Edgar Valverde, Emilio Chinchilla, Milena Robert and Patricia Morelli. The main interest is for a crop that possesses both demand as fresh and has processing capabilities as well. The crops that potentially have both are papaya, rambutan, lychee, longan, atemoya and carambola. Crops that have primarily processing capabilities are soursop (guanaba), guava, acerola and lulu. The two that interest CINDE at present are papaya and soursop, with the most emphasis on papaya as there is the possibility of shipping fresh papaya from Costa Rica and the potential for a large industry of fresh fruit will mean a parallel industry of papaya processed products. José informed them of the many types of canned fruits and juices made from lychee, rambutan, carambola and longan. It became clear at this meeting that CINDE itself doesn't have the facility to propagate plants or the personnel to conduct cultivar trials. CINDE does have many connections and we were escorted around the country to various sites of potential production and nursery locations.

Feb 6: Meet with Richard Cubero at his processing plant in San Jose. He tells us that there is good reception locally for juices obtained from local fruits. The backbone of his process in business are pineapple, banana and local papaya, with a supply of these crops the good year round. He

needs soursop, guava and passion fruit. The current suppliers are erratic in supply and charge more than he can pay to make a profit. Better cultivars and cultural methods are needed to produce a better supply of soursop, guava and passion fruits, according to Mr. Cubero. We told him that there are better rootstocks for soursop as well as better producing cultivars. We have introduced good Hawaiian guava to Belize that could be made available to Costa Rica. Passion fruit is a special case that needs specific cultural requirements to produce good consistent crops. The local papaya may suffice for local markets but will not be acceptable for any international trade in puree or juice.

Feb. 6:

Drive to San Marcos and meet with Edwin Alfaro. His company processes coffee for 10 different grower coops. The coffee prices are the worst in 25 years with no end in sight. There is a strong interest in alternate crops among all the coops. The farms are from less than 1000 meters to more than 2200 meters in elevation. The potential crops are lychee, longan and cherimoya or atemoya. This area has a cool, dry winter that is necessary for good lychee and longan production. My only reservations are: if there is enough rain after flower set in January to retain and size the fruit, and can the fruit be harvested and brought to a central packing house soon enough after harvest to avoid post harvest problems considering how spread out are the farms. There is a problem in all growers of commodity crops with the care necessary for the cosmetic aspects of fresh fruit. They are not used to dealing with the extra care and the faster pace needed to bring the crop in good condition to the packing house for packing and cooling. After a fine lunch at Mr. Alfaro's house we went to the company's experimental farm located at 1600 meters elevation. The farm consisted of 7 ha and is mostly in grafted Hass avocados, wood trees and some stone fruits. The site of the farm is not that good as the soil is poor. A well was drilled but there is no irrigation for the field crops.

There are 3 workers but no agronomist or technicians at the farm. I would hesitate to put PROEXAG introductions here due to the general lack of technical experience and facilities. They, however, indicated that there are some funds available to them to perhaps purchase some lychee and longan cultivars. If this is the case, we could provide them with the necessary information to receive and grow their own purchased lychees and logans.

After the visit to the experimental farm we went to a meeting with Frank Monge and Ronald Illama. We discussed the climatic and cultural requirements of lychee and longan and how they would need to test several cultivars at various sites to determine which ones would produce best at the various altitudes. They requested help on the local blackberry industry. There is now an out of season market due to the introduction of commercial blackberry which has different marketing season. The various coops have alternate crops but, with the exception of the blackberries, none are doing too well.

On the way home from the meeting we stopped at the farm of the brother of Frank Monge and saw a coffee farm interplanted with avocados that also provided shade for the coffee. The lychee is a denser tree than the avocado but is interplanted in the coffee orchards of Kona, as is longan. This farm is very similar in size and cultural practices to small coffee farms in Kona that frequently have interplanted avocado, lychee, longan and carambola.

Feb. 7: Drive to CATIE and meet with Carlos Umaña. He briefs us on the purpose of CATIE which is conservation and seed collection. They have no atemoya, squamosa, cherimoya or Beaumont guava. José will be receiving a printout on their inventory. There are seedling rambutans that could be used for rootstock somewhere else. Most species in the collection are seedlings, lychee being one of the exceptions. They have Mauritius, Groff, Bengal, Kwai Mi and Hak Yip in their collection. These trees should be cut back to produce new wood that would produce better air layers. I gave a demonstration on the proper method of air layering and selecting which branches to use. The presence of these trees in Costa Rica could mean an accelerated test program for lychee in the highlands as most of these varieties are either cool or cold type lychee. These trees could be air layered on one side and tip pruned on the other to produce a fast crop of air layers in the short term and the tip pruned side could produce double the amount in one year. This is a big asset for Costa Rica. We don't know CATIE's policy on releasing or selling plants but this could get the lychee trials off to a good start as most of the trees are big enough to produce 50-100 air layers to be made on them. As for producing lychee fruit, this is probably the worst of locations due to the wet, warm weather.

Feb. 7: Visited a farm in Roxana that has 10 ha of seedling rambutan of which 927 are females. In the 4th year they produced 50,000 lbs but only 30,000 pounds this year due in large part to the close spacing which is restricting fruits to the tops of the trees. The harvest season is July to October. The fruit brings 20-60 colones per Kg. The male trees have been cut back and patch budded with a large 1"x 2" patch bud taken from one of the three trees they have selected for their good qualities. When the male trees that have been reworked come into production the plan is to rework all the female trees with buds from the 3 selected types. Some trees will be removed in this process to achieve proper spacing. This project will take about 4 years to complete or ten years from the first planting date. Although this farm has a good plan, it points out the need for importing the correct cultivars at the beginning so that ten years after planting each tree they will be producing 400 lbs instead of having just been reworked. This farm selected their seedling trees using red color, 35 fruit/kg, Brix of 17-22, freestone and determinant ripening as their criteria. The fact that they have 3 selections from 927 trees points out why importation of commercial cultivars is so important. This farm would most likely purchase its own cultivars and is a potential site for a nursery for PROEXAG introductions. My hesitation with this site is the lack of nursery facilities. The plus is that the head of the farm is enthusiastic and well acquainted with rambutan and eager to get commercial varieties.

Feb. 7: Presented a seminar with slides to 25-30 people at CINDE. Audience consisted of growers, extension specialists and other interested parties. As in Guatemala, José gave an overview of exotic fruit crops and I gave a more technical talk on the cultural and nursery aspects of atemoya, lychee, rambutan, carambola and papaya. Response was good. However, the loss of electric power restricted the after seminar questions.

Feb. 8: Traveled to the Jaco area surveying the topography and climate for possible crop areas. The higher areas between the ocean and San Jose have good potential for lychee, atemoya, longan and carambola with the limiting factor being water. Closer to the ocean, there isn't enough humidity for most of the exotic fruit tree crops.

Feb. 8: Had dinner with Robert Mack. His organization deals with small landholders and his main concern is the dissemination of the new cultivars to the small grower. We suggested that he bring in some himself and that PROEXAG would provide the necessary technical information for handling the introduced cultivars and propagating them. He seemed amenable to this idea and in fact has faxed a request to me in Hawaii for prices of the various cultivars.

IV. OBSERVATIONS AND RECOMMENDATIONS.

Costa Rica has tremendous potential for these crops with its variety of climates. The first problem is the site for the PROEXAG introduced cultivars. The new university EARTH may have Panfilo Tabora from FHIA in Honduras as a department head. His familiarity with the crops and his years of experience in propagation and trials would seem to make this a good location for a nursery. CINDE must create a program to get funding to help with the introduction and nursery establishment and this will be too time consuming for immediate introductions. CATIE is a very large operation with goals different from this project. I have a feeling that if this site was chosen our introductions might not get the care they require. The lychee trees here should be used as a source for air layers so trials can begin at different sites around the country to determine which cultivar would do best in which locations. Some person or organization should contact CATIE to determine exactly how the procedure would work in regard to obtaining air layers. My advice is to have the agency with the nursery try to do the actual air layers to be sure and get a good amount of successful trees and they pay CATIE for the trees in cash or with some of the air layers. It is important to begin these air layers immediately. Air layers can be taken twice a year from the same trees. The farm in Roxana would be another choice for a nursery of introductions. The plus is a familiarity with rambutan, and a very professional agronomist who realizes the value of the trees. The down side is it would put the plants in private hands. There didn't appear to be an established nursery and management could change in which case, the information needed to grow the trees would not be passed on. Still, the Roxana site should at least be encouraged to bring in their own supply of cultivars with technical assistance from the project. The coffee farm in San Marcos didn't seem to have the appropriate technical people on hand to oversee the new introductions. Also, while you can grow lychee, longan and cherimoya in a nursery in a tropical climate, you can't grow rambutan, durian and mangosteen in a cool climate nursery. There may be professional nursery people that could be contracted to perform the necessary service with appropriate training. The farm in Roxana, AINAI and CATIE are all sources of rambutan seed for seedling rootstock production. AINAI and CATIE are sources for carambola seed for rootstock and possible mangosteen seed for plants. There will be a chart in the Horticultural Report listing the sources for the various rootstocks. The sooner a site for the nursery is selected, the sooner that various rootstock plants and air layered plants can be moved to that site for budding and grafting as early as the end of 1992. Some plants can be at test sites in the country as early as mid 1993 if decisions can be reached soon enough.

HONDURAS.

I. PURPOSE OF TRIP.

Meet with counterpart organizations in each country, assess exotic fruit cultivars present in the country at different private and government stations and farms and to evaluate the feasibility of locating a nursery at one or more sites in each country to care for new introductions and to propagate good varieties in the country.

II. PERSONS CONTACTED:

Panfilo Tabora, FHIA, Director New Crops, La Lima.

Gene Ostmark, FHIA, Overall Head of Project, La Lima.

Hector Aguilar, FHIA, Agronomist, La Lima.

Luis Orellana, Daysi Farm, Owner, Tela.

Ricardo Rivas, Farm Manager and nurseryman, Lancetilla, Tela.

Medardo Galindo, Director, FPX, Non Traditional crops, San Pedro Sula.

III. ACTIVITIES AND ACCOMPLISHMENTS.

Feb. 9: Arrive at San Pedro Sula. Met at airport by Panfilo Tabora.

Feb. 10: Meet Gene Ostmark FHIA Research Director. We discuss the purpose of PROEXAG and our need for a nursery site for the first phase of the project. Unlike CATIE, FHIA is ideally suited as a site for the introduction of various cultivars as it has a long history of plant research, first as a private entity now as a government body.

With Hector Aguilar we travel to Daisy Farm near Tela and meet with Colonel Luis Orellana, the owner. He has been planting seedling trees from the garden in Lancetilla for the past 30 years. He has pulasan, rambutan, mangosteen, durian and lychee in production. The lychee bear fruit in March-April, (a very good time for the world market) although it was unclear if they were seedlings or airlayers. Rambutan bears in August-November which is later than Costa Rica. Pulasan bears in Oct-Nov but with only 1/3 as much fruit as rambutan. Durian has 2 crops, one in March and the other in September (a good time for the world market). Fruits were sold locally at 1000 fruit for \$20. US, and for export at \$ 6 for a 2 kg box, FOB Honduras. This farm has 10 ha of fruit and has a site for washing fruit and packing by hand. This farm and another of 45 ha sold 17,000 2 kg boxes in Europe the previous season and are eager to get good cultivars and to learn propagation techniques such as patch budding. They are presently using approach grafting which is very laborious and extremely limited in how many trees are produced. Several good cultivars of rambutan have been selected on this farm and are being air layered and approach grafted to produce trees that have export quality fruit.

Feb. 10: Went to the Lancetilla Garden nursery which has seedlings of longan, pulasan, mangosteen, lychee, rambutan, durian and jaboticaba. This nursery can be a good source of rootstock for nurseries to use in grafting and budding. After leaving the nursery, we observed longan trees flowering in a nearby farm which seemed unusual for this area. We were told that the lychee here also bear in March-April.

Feb. 10: Meet Ricardo Rivas, manager of a 45 ha seedling rambutan farm bordering Lancetilla. They

have been selecting good varieties from their seedling trees using the criteria mentioned previously in the report on Roxana in Costa Rica. We went to the Rivas' nursery where he is approach grafting seedling trees to air layered trees taken from selected seedlings at the farm in Lancetilla. In spite of his industrious approach to propagation it is obvious that many seedling trees will be planted as the approach method produces one tree with a lot of labor where the budding method would produce ten trees with much less labor than one approach grafted tree. Fruits for export are packed in 2 kg boxes which are put in wooden frame that holds 40 boxes to avoid damage and they are shipped in this manner by air to Europe. Post harvest treatment includes a dip in Benomyl at 1 gm/l with chlorinated water. This is followed with a dip in Semper Fresh after which the fruits are dried and placed in 1 kg plastic bags. The one kg bags are placed in a box and cooled to 12 C. Fruits have been kept in good condition in this manner for 18 days. The problem has been poor shelf life after the fruit is placed in ambient temperature.

Feb. 11: Meet with a personnel of the Non-traditional crop counterpart, FPX, in San Pedro Sula. They feel a pilot project with a farmer and FHIA introducing varieties and a program of multiplication on 1-2 ha using adaptive research to expedite the expansion of the export type fruits is the best approach. They feel it is not necessary to reinvent the wheel by starting their own research on the basics of these crops but to get good varieties and use the technology supplied by the project to quickly upgrade the industry.

Feb. 11: José and myself give a seminar to approximately 45 people. Response was excellent. Our seminar was followed by Hector giving the data on their trials on post harvest treatment of Rambutan.

IV OBSERVATIONS AND RECOMMENDATIONS

It seems that the FHIA facility is the obvious choice for a place to bring the PROEXAG introductions as well as a body that can propagate from these selections. Individual farmers seem eager to purchase food cultivars of rambutan for propagation. They will need instruction on the post shipment handling of bare rooted trees shipped from overseas. The rambutan industry is starting to explode here after the export of fruit last year. FHIA is doing important work towards declaring rambutan a non host of fruit fly which would mean entry into the US without treatment. The problem with the accelerated plantings is that they are 98% seedlings. The growers are able to sell their non export quality fruit on the local market. With the planting of 200 or more hectares there will be more fruits of poor quality that the local cannot handle and will then put pressure on growers to export this fruit. If poor fruit is exported it will drive down the price of the good fruits and give Honduras a bad name for inferior fruit. It will ultimately drive Honduran farmers out of the business when they can no longer export the poor quality fruits or sell it locally for a profit. Poor fruit quality will run up to at least 75% of the total production of seedling trees. It would be much better for them to go slowly and plant local selections and imported varieties. The first thing that can be done is for them to learn to patch bud their rootstocks so they can increase the amount of good trees available for planting. Secondly there should be an importation of a large amount of bare rooted commercial cultivars to increase the source of buds. While

rambutan is the main crop being planted now there is also a place for carambola, durian and atemoya in the Tela area and lychee and longan in cooler areas. A collection of seedlings from Tela should be taken to FHIA so that good varieties of carambola and durian can be grafted to these seedling rootstock. Local rambutan selections can be budded to rootstock from Lanceilla and a place prepared to handle air layered lychee and longan as well as bare rooted rambutan.

BELIZE.

I. PURPOSE OF TRIP.

Meet with counterpart organizations in each country, assess exotic fruit cultivars present in the country at different private and government stations and farms and to evaluate the feasibility of locating a nursery at one or more sites in each country to care for new introductions and to propagate good varieties in the country.

II. PERSONS CONTACTED:

Fred Hunter, USAID, Belize City.
Tony Chanona, Blue Mountain Ranch, Hummingbird Highway.
Norris Wade, Ministry of Agriculture, Agronomist Melinda.
Evan Guerra, Extension Agent, Melinda Nursery
Henry Canton, Citrus Company of Belize, Ag. Manager, Stan Creek.
John Usher, Citrus Company of Belize, Asst. Stan Creek.
Bertram Faux, Citrus Company of Belize, Agronomist, Stan Creek.
Tony Zabaneh, Banana Growers Assoc., President, Big Creek.
Ken Turk, TAMP Project, Punta Gorda.
Alfredo Villoria, Dem Dats Doin, Punta Gorda.
Carolyn Herron, Pathologist, Citrus Growers Association, Stan Creek.
Reynold Gabourel, Belize Food Products, Asst. Mgr. Stan Creek.

III. ACTIVITIES AND ACCOMPLISHMENTS.

Feb. 12: Arrive Belize. Meet Fred Hunter and are given security briefing. We depart for Southern Belize after reviewing our schedule with Fred.

Feb. 12: Fred accompanies us to the first stop which is with Tony Chanona, owner of Blue Mountain Ranch. Tony is president of the Citrus Growers Association and has a reputation as a progressive farmer. He is experimenting with irrigating citrus in the field and has a citrus

nursery with irrigation and is growing 10 acres of plantains. He is very interested in alternative crops and given his background as a nurseryman he would be able to propagate introductions as well as distribute them as he is very involved with the growers association. This area is well suited for rambutan, carambola, durian and warm weather lychee.

Feb. 12: We meet Norris Wade and Evan Guerra and visit the Melinda processing plant where they were drying banana. We visited the Melinda Experiment station that has 3 seedling rambutan trees of about 30 years old and mangosteen of the same age, as well as one seedling lychee tree. There is a nursery on the station that produces seedling rambutan and mangosteen as well as cacao. The rambutan and mangosteen seedlings are currently distributed to various local growers for the home plots. The nursery produces good trees and the rambutan seedlings produced here could be used for rootstocks. This nursery is not at a highly maintained level and would not be a good choice for placing selections.

Feb. 12: With Norris and Evan we meet with Henry Canton, John Usher and Bertram Faux at their offices at Citrus Co. Belize. All of these people have farms of their own as well as a nursery for the company. The company has been experimenting with various alternative crops, the latest being pineapple. They have approximately 16 acres of smooth cayenne pineapple that they were selling as both fresh and on a small scale as juice. The decision at this point is for the company to stop the pineapple experiment as the fresh market is too volatile and doesn't fit in with their marketing plan and there are too many other large companies in the juice business. All present were very interested in growing exotic fruit trees as an alternative crop. John Usher has 10 acres of various exotic fruit seedling trees he has obtained from the Melinda nursery over the years. The exotic trees will do well here. It is really a matter of which one of two bodies will have the nursery. We passed on here as in all our meeting in Belize the information that BABCO in Orangetown has several varieties of guava, lychee and carambola that could be used as scion material. My feeling is that the company may be too cumbersome to deal with but there is a lot of interest among growers to establish a new industry.

Feb. 13: Overnight in Dangriga and met with Tony Zabaneh, president of the Banana Growers Association in Big Creek. This group represents thousands of acres of bananas consisting of variable sized farms. They are concerned about losing their favored nation trading status with Britain after 1994 being unable to compete with the international banana companies. Tony wanted us to provide him with a plan that he could present to his board of directors. Many members of the Banana growers group also have large plantings of citrus and have nurseries and agronomists on hand to potentially run an introduction nursery.

Feb. 13: Drive to Punta Gorda and meet with Ken Turk. His project is sustainable agriculture and there is no chance for introduced cultivars to be raised here. We suggested he contact Bob Mack in Costa Rica. Mack's ANAI group has been working with the same type of clients as Ken and could tell him what has been successful in their project. ANAI has been planting seedling exotic fruit trees for 5 years in Costa Rica as a food source and not as an export crop.

Feb. 14: Meet Alfredo Villoria in San Pedro. He has a collection of esoteric exotic fruits and gives tours

in small garden. Definitely not a potential site for a nursery for the project.

Feb. 14: Drive to Stan Creek and meet with Carolyn Herron and Reynold Gabourel at Belize Food Products Ltd. Over lunch Reynold tells us that like the other citrus plant and the banana growers they too are looking for alternative crops. They too have a nursery with an agronomist and staff.

Feb. 15: Review trip with José and Javier and organize notes.

Feb. 22:

IV. OBSERVATIONS AND RECOMMENDATIONS

The Punta Gorda district can be eliminated from consideration as a nursery site on the basis of our contacts. It is, however, a good site to grow rambutan, carambola, atemoya, mangosteen and durian. All the areas we visited were good for producing the above crops as long as there is no attempt to grow them on "Pine Ridge" type soils or any calcareous soils both of which will grow citrus or banana but will definitely not grow these exotics. BABCO can furnish either scion wood from atemoya and carambola or grafted plants. There is some potential for air layered lychee of the Mauritius and Pink Kwai Mei varieties but supply will be limited for 1992. Guava, either as tip cuttings to be rooted or established nursery plants could be available. There should be an effort made when the nursery is selected to work with BABCO to utilize these material for multiplication. The citrus growers in this area have been planting up to 1000 acre plantings and they have to be made to understand that these crops must be planted in 20 or 30 acre total for the first year and increase at a measured pace or they will find themselves with too much fruit of inferior quality and no market. As for the nursery site I would favor Tony Chanona. He has the qualifications as a nurseryman, is held in general high esteem and is willing to invest his own money to enlarge the amount of plants that he brings in. Tony is a supplier of fruit to Belize Food Products and there may be political problems if only one site is selected. Hopefully this can be worked out.

V. SUMMARY

All lowland sites in all countries were very suitable for rambutan mangosteen, carambola, atemoya, guava and warm type lychee. The higher elevations in Costa Rica, Guatemala and Honduras must be mapped for high-low temperatures over the year, rainfall pattern, availability of irrigation, humidity and soil type (especially bad for lychee and longan are calcareous soil types). There are perfect places for the establishment of industries in lychee, longan and atemoya/cherimoya in the highland areas. That is why it is imperative that the field plantings of the various cultivars be done in the correct areas. This information needs to be gathered

now.

Select a nursery site in each country and have them collect seedling rambutan, carambola and mangosteen now for propagation later this year or early 1993. Sources of these plants is in the body of this report and on a horticulture report to follow.

Contact CATIE for lychee air layers, Lancetilla for seedlings of rambutan, carambola, mangosteen, durian and air layers of longan and lychee. BABCO should be contacted for scion material or plants of atemoya, carambola and air layers of lychee.

I will be preparing a horticultural report that will go into which cultivars of which crops should be planted.

Nurse plants of good cultivars of rambutan, longan, durian, atemoya, lychee and carambola can be sent from Hawaii or in the case of atemoya, longan, carambola and some lychee they can be sent from nurseries in Florida.

MS/JM/ca
FILE:[TRSTRONG.JM'ca(12Mar92)]

LYCHEE

This crop has a wide range of possible planting sites in all countries visited. The world market is solid and expanding. This fruit is relatively unknown in the US and this gives a tremendous opportunity for marketing of high quality fruit from Central America. The European market, where the fruit is more widely known, is still in an expansion stage. This crop will need to be air shipped to most markets but can be surfaced shipped in refrigerated containers for 4-7 days to southern US markets. It is curious that this fruit hasn't been planted in a region that has what are apparently excellent environmental conditions for its growth. The two obvious reasons are, a small amount of Chinese or Southeast Asian citizens present that would introduce the crop, and secondly, the lychee trees that have been introduced have been placed in collections in tropical areas such as Lancetilla, Honduras and CATIE, Costa Rica where they have not produced fruit due to poor climatic conditions. We were told in several countries that isolated lychee trees produced fruit in March-April. If this is the case, it would be excellent news as the world market is wide open at that time. The lychee market goes from May to August in the Northern Hemisphere and from November to January in the Southern Hemisphere. There is little conflict from domestic US growers as the crop is only being grown commercially in the Homestead area of Southern Florida. There are three basic areas that can be considered for lychee production. There are the "Cold" areas that have night time lows of 5°C and day lows of 15°C, the "cool" areas that have night time lows of 10°C and day lows of 20 °C and the "warm" areas that have night time lows of 15°C and day lows of 25°C. The above temperatures should occur from roughly October to December and be accompanied by dry weather. The three types of areas will determine what cultivars of lychee should be tested in each area. The wider the climatic range in the region, the more cultivars can be grown which will expand the harvest season. None of these areas can have a period of frost. Rainfall should be distributed evenly from fruit set to harvest on well drained soils. Irrigation is critical for establishing orchards and will greatly enhance the quality and consistency of fruit production. Calcareous soils will induce zinc and iron problems but can be corrected with nutrient supplements. In general, acid soil of 5-6.5ph are preferred. Elevation is a limiting factor in some parts of the world but trees may do well up to 1500 meters if other factors are satisfactory. It would be best to keep most trials to elevations below 1250 meters. However, at least one trial with "cold" type cultivars should be done at higher elevations. Over the next year while air layers are being prepared in the nursery, there should be a survey in the interested countries of locations appropriate for trials of each type of lychee. Rainfall amount and distribution, frost elevation, soil type and ph, wind, relative humidity and most importantly areas with a cool dry period from October-December. This survey should be started now so that site selection can be decided when plants are ready to leave the nursery. Costa Rica and Guatemala have the most regions that seem suitable for lychee with Honduras having

smaller areas that are suitable for certain cultivars. Belize can produce warm weather type lychee with good cultural practices.

Nursery sites should be selected now in each country for the growing of air layered cultivars. The nurseries will need irrigation, wind protection, electricity if possible and a trained technician that can monitor plant growth. Air layers can be potted in 3-5 gallon containers and left in full sun with misted spray every 5-10 minutes for 15-30 seconds. The details of preparing to receive and how to send air layers will be provided at another time. Air layers of Kai Mana, Salathiel, Groff, Pink Kwai Mei and Tai So are available from Hawaii. Florida has Mauritius and possibly some other types. BABCO in Belize will have some Mauritius and Pink Kwai Mei by 1993. CATIE has Hak Yip, Groff, Mauritius and Bengal trees of good size that can be air layered. From 50 to 100 plants could be taken from each of these trees. It would save time and money if CATIE could produce plants for the project.

Cold type cultivars - Bengal, Wai Chee, Hak Yip, Tai So.

Cool type cultivars - Salathiel, Mauritius, Pink Kwai Mei.

Warm type cultivars - Kai Mana, Groff.

There is overlap in all these cultivars and Cold and Cool types should be tested together as well as Cool and Warm types. This increases the amount of plants needed but it is critical to determine which cultivars will perform best in each area as lychee are very climate specific. The main reason lychee has not been a success in most areas in the world is because unsuitable cultivars were attempted. The primary selections should be Kai Mana, Pink kwai Mei, Mauritius, Hak Yip and Salathiel. The remaining cultivars should be started but if there is a problem with time or money it is critical that these be tested. It will take 6-9 months in the nursery for air layers to be ready for field planting. The nursery will produce plants quicker if it is in a warm area. It is not necessary that the cold and cool type cultivars be grown in a nursery that meets the environmental criteria for flowering. They will flush much quicker in a warm humid environment with good drainage.

There is a good opportunity to rapidly expand the lychee plantings as there are some cultivars already found in Central America. Another big plus for rapid expansion of lychee is the relatively simple method of propagation - air layering. This enables almost any worker to reproduce trees. The other benefit to using air layers is that they can be cut off the tree and shipped with virtually 100% successful arrivals.

Now is the time to determine how many of which cultivars to order and place the order, locate at least one nursery per country to handle the air layers when they arrive and begin a survey of test planting sites using the criteria above.

RAMBUTAN

Rambutan is well known in many world markets with the exception of the US. There is currently seedling production in Costa Rica and Honduras that is well received on the local market. Rambutan has better shipping and shelf life characteristics than lychee but Chinese and Southeast Asians consider it to be inferior to lychee. The cropping pattern observed in Central America would put lychee and rambutan on the market at different times so that the two crops would not be competing with one another. The rambutan has excellent potential for production and market acceptance. FHIA in Honduras and USDA-ARS in Hilo, Hawaii are both working on having the rambutan declared a non host for fruit flies. This is critical for export to the US as the two current treatments available - dry heat for 4 hours or cold for 15 days - both turn the spines of the fruit black which would greatly diminish their retail appeal. As with all the exotic fruit crops it is imperative to introduce commercial cultivars as the world market will not pay premium prices for seedling fruit. Some 17,000 boxes weighing 2 kg each were shipped from August to October to markets in Holland, France and England from farms in the Tela, Honduras area. Farmers received \$ 6 per box FOB Honduras for selected seedling fruits. The fruits came from farms described in the trip report. It is obvious that rambutan grows here as well as anywhere in the world. However, as I mentioned in the trip report, if the Hondurans continue to plant seedling trees there will quickly come a time when they will be unable to sell the off grade fruits produced by most of the seedling trees on the local market. When the local market is saturated there will be pressure to export inferior fruit which will lower the price of all Honduras rambutan regardless of quality. In the world market it is imperative that there is only the highest quality fruit exported, because once a country is known as a producer of inferior quality produce it is a very difficult process reclaiming their reputation. Lychee will not produce trees that bear fruit from seed. Rambutan will and this has led to rambutan being regarded as inferior to lychee. The only fruit from lychee is from accepted cultivars while, frequently, rambutan fruit is from inferior seedling trees. Now is the time to introduce commercial cultivar, before too many seedling trees are planted.

What needs to be done now is to collect seedlings for rootstock from Lancetilla, Honduras, Melinda Station, Belize and from private growers and bring them to the selected nursery site in each country.

Introduce bare rooted cultivars from Hawaii into the nurseries to be used as sources of scion wood for budding in 1993. Obtain fruit from the selected seedlings from the Roxana farm in Costa Rica, the Daysi Farm, and from Ricardo Rivas in Honduras and test them for export criteria. It is very likely that fruit from these trees will meet the export standards. If this is the case, then buds can be taken from these trees and put on rootstocks collected this spring. The cultivars that should be brought in bare rooted are 134, 156 (red), 162, 167 Jit Lee and Binjai. It is possible to use bud sticks for no more than 48 hours after they are removed from the parent tree. Unless someone is hand

carrying the wood back and can bud their rootstocks the next day it is not worth sending bud sticks of rambutan. The difficulty in transporting bud wood and bare rooting plants is why there are so few places in the world that have good commercial cultivars.

Site selection of the nursery is imperative. Conditions for good growth of Rambutan will also produce good trees of the other exotic fruit trees. Rambutan will require an agronomist/propagator that can monitor the bare rooted trees' progress and do the actual budding. This tree requires a much higher skill level to produce than lychee. The tree will need shade cloth of 56%, irrigation, complete wind protection, high relative humidity, access to fertilizer and chemicals and a good soil mix such as 25% organic matter (bagasse, coffee, husks), 25% coarse sand, 15% aged cow manure and 35% soil. Fertilizers will mainly be chelated minor elements to correct iron and zinc deficiencies common in rambutan.

Begin now to gather information on where to locate trials. The following conditions should be considered. Elevation less than 500 m, mean annual temperature at 22-30 C, humidity greater than 65%, rainfall at 2000-5000 mm, little wind, evenly spaced rainfall or a dry period in late winter early spring, good drainage, access to cooling facilities and soil with ph of 5-6.6. It is obvious that this crop will grow in most of the Atlantic side lower elevations. However, the above guidelines will help in selecting the area that will assure high yields of good quality fruit.

As with all these exotic fruits, if action is taken now to establish nurseries and introduce cultivars, fruits will be produced in the next 3 years.

MANGOSTEEN

Widely known as "queen of fruits", this fruit is in great demand throughout the world although it is unknown in most US markets. This fruit will be an instant success wherever it is marketed. Mangosteen will keep good quality for 21 days if picked at the correct ripeness. There hasn't been any work done on its fruit fly host status. It is currently considered a host by the USDA-APHIS. The fruit fly status could change and it could become known as a non host with appropriate work by USDA-ARS. This fruit holds tremendous potential and is worth the long test period required to declare it a non fruit fly host. Meanwhile, this fruit is in good demand in the local and world market. Mangosteen has one tremendous liability and that is the long time from seedling stage until fruiting, usually 7-10 years. The liability is offset somewhat by the ability of this tree to withstand many poorly drained soils which makes it a good choice for marginal areas with high water tables. It won't tolerate salt so that areas with brackish water are not to be chosen as planting sites.

Mangosteen has truly tropical requirements. It requires temperature higher than 20 °C, humidity greater than 70%, rainfall at 2000 mm-5000 mm, no wind, can tolerate poorly drained soils but does best in well drained areas. Rainfall distribution should be even throughout the year or irrigation provided, soil ph of 4.5-6.5. These criteria should be used for deciding on areas for trials of mangosteen.

Mangosteen is grown from seed that are apomictic so that there is no need for the introduction of cultivars. There are large supplies of seeds and seedling trees at Lancetilla, Honduras and some seedlings and seeds at Melinda, Belize. It is possible there are some trees fruiting at CATIE that could be a further source of seeds. Nursery requirements are the same as for rambutan. Field planted trees will benefit from shade provided by palm leaves or shade cloth.

Many growers are put off in growing this crop due to the length of time before fruiting. A good farm plan would be to interplant carambola with mangosteen for a quick monetary return. Other good planting strategies are to plant along stream banks and to utilize lands that have water tables too high for other tree crops. The mature mangosteen tree produce 500-1000 fruit per year with a potential price of 25 cents per fruit.

CARAMBOLA

Carambola is in the world wide fresh market as well as being used in the juice business. This is one of the few exotic fruits that is in the US market. Florida produces fruits from August through February. There is a fruit fly treatment of 15 days of cold temperatures at 33°F. Florida is using this treatment and shipping up to 30,000 pounds per week to California. Fruits can be kept in good condition for up to 21 days, giving a wide range of shipping possibilities. This crop is in Central America, produced from seedling trees. The fruit is generally too sour for good acceptance as the fruit comes from seedling trees and not commercial cultivars. Seed from the seedling fruits can be used to produce rootstock to graft good cultivars. Scion wood of Kari and Kyra can be obtained from Hawaii and Belize and Arkin from Florida. Scion wood will last from 7-10 days from the time it is cut to when it must be grafted onto the rootstock. The grafted tree can produce 50 pounds of fruit at 2 years old, 100 at 3 years and 200 pounds and more after year 4 making it one of the most precocious and heaviest producing of all fruit trees. Pruning can be utilized to give plant populations of 120 trees per acre. Carambola is an easy tree to grow under most sub-tropical conditions. It cannot tolerate soil as wet as rambutan, and does not do well in calcareous soil and cannot take frost. However, it does tolerate cooler temperatures than rambutan or mangosteen. This fruit is a good crop in its own right as it fruits for 6 months of the year in 3 flushes giving the grower a chance for a steady income. Carambola is also good for interplanting among lychee, rambutan, mangosteen and longan as it will produce income in the short term to pay for orchard maintenance before the other trees fruit. Carambola can be pruned severely with no loss of fruit the following year which makes it ideal for interplanting as it can be pruned to take up less space as the main trees get bigger. There could be export crops of this fruit within two years if seed is collected now for rootstock and grafted this fall. There is no need for bringing in barerooted plants as there are good cultivars in Belize that can be utilized for scion wood.

Seed for rootstocks can be collected from any fruit available. There may be seedling trees available at Lancetilla, Honduras or other small nurseries. These should be collected and germinated now and rootstock plant brought to nursery sites. Carambola seedlings don't need elaborate nursery conditions such as shade and mist systems. They do need irrigation, a wind free area, good drainage and warm temperatures. Most propagators should be able to graft carambola with a minimum of instruction as long as the scion wood provided is at the correct stage of development.

The range that carambola can produce extends from the cool lychee type conditions down to the tropics although it does best in a moderate climate with temperatures in the 20-30°C range, soil ph at 5-6.5, good drainage, irrigation at least while being established, rainfall at 2000-3500 mm, evenly distributed and no wind (the tree is resistant to wind damage but

the fruit is very susceptible to cosmetic damage due to wind). Carambola should be tested as interplant with cool and warm type lychee, rambutan and atemoya. Cold type lychee and cherimoya plantations may be too cold for good carambola production. Interplant of carambola in mangosteen plantings in high water table areas will result in root damage to the carambolas.

ATEMOYA/CHERIMOYA

Cherimoya is more widely known than atemoya although atemoya can be grown in a much wider range of climatic conditions. The fruit is considered a gourmet item throughout the world and a well presented fruit has ready market acceptance. The US market has some exposure to cherimoya from California and Chile and atemoya from Florida. The atemoya season in Florida is from July through September and cherimoya from California is from January through March. There is a window in the US market, from October through December. The European market is very familiar with this fruit as are some areas of Central America although production is very limited. This fruit is a fruit fly host and there is ongoing work at the USDA-ARS laboratory in Hilo, Hawaii for a post harvest treatment that would allow this fruit to be exported into the US. The atemoya can be grown in a wide variety of sub tropical climates and soil types using various root stocks. For wet areas Annona glabra with an interstock of cherimoya is used. For warm areas with good drainage, atemoya or Annona squamosa can be used as rootstock. For cooler areas that are not in the cherimoya fruiting range, cherimoya can be used as rootstock. Cherimoya is grown at altitudes of more than 1250 m with distinct cool temperatures in the winter. The cold weather lychee type area is a good area for cherimoya. This crop can be manipulated with defoliation and hand pollination to produce over a 6 month period. The problem with atemoya/cherimoya is a limited 10-14 days shelf life, making air shipment necessary. Prices to the grower range from \$ 1 to \$ 2 US per pound depending on lateness of the crop. This crop will have ready acceptance in the local market and can be shipped to Europe by air together with rambutan and star fruit.

Seed from atemoya has been obtained for rootstock and cherimoya fruits found in the Guatemala central market should be used for rootstock. Later this year, Annona glabra (pond apple) seed should be obtained from Florida or Hawaii for planting in the nursery. There are two cultivars for atemoya - Gefner and African Pride. Cherimoya cultivars are Bays, White and Jetta. Scion wood for grafting rootstocks can be obtained from BABCO in Belize, Florida or Hawaii. Scion wood will last 7-10 days from cutting to grafting. Annona squamosa (sugar apple) and cherimoya trees that are large trees can have scions grafted to branches to begin expansion of the source of scion wood immediately.

Nursery conditions for atemoya are the same as those for carambola and both trees will do well under those conditions.

Atemoya can be grown in test areas that have cool and warm type lychee trees. Cherimoya rootstock can be used for the cool areas and atemoya, squamosa or glabra used as rootstock for the warm areas. Cherimoya can be grown in the same areas as cold type lychee.

This crop will round out the exotic fruits and extend the farmers harvest season to avoid the reliance on one crop.

LONGAN

Unlike the other exotic fruits in this project the longan is a fruit that has an acquired taste. Other fruits such as avocado share this characteristic. The other exotic fruits we are interested in all have a pleasant, sweet taste that has almost universal appeal. The longan has never enjoyed the popularity of its relatives the lychee and rambutan. However, within the Chinese community, it is prized more highly than either lychee or rambutan. Longan is produced commercially in Thailand, Taiwan and China. It has been planted in commercial orchards in Australia, Florida, Hawaii and South Africa to name a few. The longan has produced alternately at best in these countries and never has approached the yields attained in Thailand and Taiwan. The situation may be better in Central America where the cool mountain climate on the Atlantic side also have high humidity. It is important to include the longan in the trial projects but with less resources attached to them as the potential market is initially smaller than the other crops. There may be a problem acquiring some of the newer cultivars of longan. The cultivars Chompoo and Kohala are available in Florida and Hawaii; Bicw Kiew and Haew from Thailand may be available in Florida or Australia.

Best way to receive the longan is as an air layer. This will produce a good tree with the best chance of survival in transit. Nursery conditions are the same as for lychee.

Conditions for trial plantings mirror the cold and cool type lychee. The longan should be planted in both climates as there may be environmental conditions not recorded in literature that will result in good production.

| <u>CULTIVAR</u> | <u>PROPAGATION</u> | <u>MATERIAL</u> | <u>ROOTSTOCK</u> | <u>SOURCE</u> |
|---|--|--|---|--|
| <u>LYCHIEE</u> | | | | |
| KAI MANA GROFF | AIRLAYER AIRLAYER | BELIZE,HI BELIZE,HI COSTA RICA | NONE NONE | |
| PINK KWAI MI SALATHIEL MAURITIUS | AIRLAYER AIRLAYER AIRLAYER | BELIZE,HI HI FLA, COSTA RICA, HI | NONE NONE NONE | |
| KWAI ME? RED HAK YIP | AIRLAYER AIRLAYER | HI, BELIZE COSTA RICA | NONE NONE | |
| <u>RAMBUTAN</u> | | | | |
| 162 167 134 156-RED JIT LEE BI?JAI | PATCH BUD BARE ROOT TREES, APPROACH GRAFT | HI, AUST. HONDURAS COSTA RICA | LOCAL SEEDLINGS | HONDURAS COSTA RICA GUATEMALA BELIZE HI - SEED |
| <u>CARAMBOLA</u> | | | | |
| ARKIN KARJ KYRA | GRAFT PATCH BUD, BARE ROOT TREES | HI, FLORIDA | LOCAL SEEDLING | HON CR GUA. HI-SEED FLA-SEED |
| <u>ATEMOYA</u> | | | | |
| GEFNER AFRICAN PRIDE | GRAFTING BUDDING BARE ROOT TREES, TIP CUTTINGS | HI, FLA BELIZE | CHERIMOYA ANN GLABRA ANN SQUAMOSA ATEMOYA | HI-SEED SEED MAY BE FOUND THROUGH OUT C.A. |
| <u>CHERIMOYA</u> | | | | |
| BAYS, WHITE PIERCE | SAME AS ATEMOYA | CALIFORNIA CHILE | CHERIMOYA | SEED IN GUATEMALA AND OTHER C.A. AREAS |
| <u>MANGOSTEEN</u> | | | | |
| ONLY ONE | SEEDLING | COSTA RICA HONDURAS, GUATEMALA, PANAMA & NICARAGUA | NONE | N/A |

CULTIVAR

PROPAGATION

MATERIAL

ROOTSTOCK

SOURCE

LONGAN

CHOMPOO I
KOHALA
BIEW KIEW
HAEW

GRAFT
APPROACH
GRAFT,
AIRLAYER

FLA, HI
AUST.
THAILAND

LONGAN

SEED IN
HONDURAS,
FLA., HI

DURIAN

MONTONG
D2, CHANEE
GUAN YAOW

MICROGRAFT,
GRAFT

HI, AUST.

VIGOROUS

HONDURAS

SUMMARY

For an action plan it is essential to collect rootstock plants, seed for rootstock and decide on nursery locations. It is important to collect environmental data now to select field test plots. As resources are limited for plant material acquisition here are my suggestions. Buy lychee air layers. They have the best survival rate and this crop is one of the most promising. Without a good selection of cultivars the potential of this crop will not be realized. Caranbola and atemoya can be propagated inexpensively as the bud stick cost in about 50 cents per tree and seedlings can be grown in country. Mangosteen requires a distribution of seedlings which can be found in Central America. Rambutan should be introduced as bare rooted plants and had carried bud wood. Good local selections should not be overlooked as they may meet export standards and can be obtained in the region. Longan should be brought in as air layers but at a lesser amount than lychee as the appeal of this crop is not as great as lychee and rambutan.

A seminar in Hawaii for nursery training and cultural practices is a good way to reach the most people with the best information. Plants, seeds and bud wood can be taken back to Central America with the appropriate phytosanitary certificate from Hawaii and import documents from the resident countries.

Fruit from trees can be harvested as early as 1994 if the above actions are taken. This project could mean a large scale industry for export and local consumption.

JM/EA
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