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NON-TRADITIONAL AGRICULTURAL EXPORT SUPPORT PROJECT

**GINGER AND YAM PRODUCTION POTENTIAL IN
GUATEMALA, EL SALVADOR, AND HONDURAS**

Assignment Number ST/87-50

Contract Number: 596-0108-C-00-6060-00

Submitted to:

**Regional Office for Central America and Panama (ROCAP)
U.S. Agency for International Development
Guatemala City, Guatemala**

Submitted by:

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through

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June 15-24, 1987

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SECTION I

INTRODUCTION

I came to Central America at the request of Chemonics in order to consult on ginger and yam production in Guatemala, El Salvador, and Honduras. I had previously completed a similar assignment in Panama where the client expressed interest in yam production but very little interest in ginger. Thus the report from the previous trip emphasized background information and recommendations for yams. In my second trip, on the other hand, I discovered an interest in various crops, especially ginger, and I have had to do some consulting outside the area of the original assignment.

SECTION II

CALENDAR OF ACTIVITIES

A. Guatemala

June 15. I travelled to Guatemala and was met at 8:15 p.m. by Armando Soto.

June 16. I was taken to Chemonics' offices where I was interviewed by Edward Hurlston and José Mondoñedo. I then spent the morning preparing for a comprehensive discussion on ginger production and processing. About nineteen persons -- young, progressive, and very much interested -- attended the discussion in the conference rooms of GREMIAL. These included:

José Mondoñedo, Chemonics
Johanna Fialbos, GREMIAL
Jorge Méndez, GREMIAL
Ricardo Santa Cruz, GREMIAL
Irma Calvillo de Arias, GREMIAL
Claudia Martínez, GREMIAL
J. Eleonore Weigel Andrade, PROEXPORT
Fernando García-Salas, Consultores Agroindustriales
John A. Lattman, RHIZOMAS
Jaime Alfaro, RHIZOMAS
Roberto Branton, Instituto Americano para el Desarrollo de
Sindicalismo Libre
José D. Pérez, Agropecuaria "Los Pinos"
Alejandro Sosa
Donaldo Mejía
Rafael Augusto
Roberto de León, Cooperativa el Asintal
José Domingo Samayoa
Mario Estrada
Fernando García Salás, Consultores Agroindustriales

After an hour of detailed discussions I answered questions for another hour. The meeting was then dismissed, and I held interviews with individuals concerning their problems and needs.

Members of the discussion group differed in their experience with ginger. Two young farmers had seven years of experience and developed a very satisfactory system of production with the help of a consultant from Hawaii, Eduardo Trujillo. Others were getting started on a small scale or were representatives of organizations interested in production and export of ginger. Although not everyone had the same experience, it was evident that production technology that has been developed elsewhere is highly suited to conditions in Guatemala; very little knowledge

exists, however, of processing technology. A successful industry will depend on both.

I then returned to Chemonics' offices where I discussed results and possible follow-up with José Mondoñedo. From the discussion it became evident that there are at least two types of ginger known in Guatemala, Cochin ginger and Hawaiian. Both are used internationally, principally for the fresh market and for preservation in sugar, but they are not the best varieties for drying.

June 16. I visited the Cooperativa Agropecuaria El Asintal in Retalhulen in the southern lowlands with José Mondoñedo and Roberto De León. We found that the cooperative is multiplying a type of ginger obtained from Nicaragua with the intention of initiating exports this year. I believe this variety is Cochin, used for the fresh market and for preservation. The system of production, based on multiple cropping under shaded coffee, is not designed for maximum production but produces a good quality of fresh ginger. The soil is excellent for ginger and was well prepared by hand tools. Numerous opinions were given on technical points brought up by members of the cooperative. This group was not aware of the technical progress made by the RHIZOMAS team, and it was questionable whether the technology developed by the group would be applied, given the land and resources of the cooperative.

The conclusion that I came to is that the knowledge and technology available for ginger has to be applied in a flexible manner according to the nature of the situation, and that one technological package will not be suitable for all farmers.

B. El Salvador

June 18. I traveled to El Salvador with José Mondoñedo and Edward Hurlston. We were met at the airport by Pedro Arguilla, president of Anita, S.A. de C.V., and coordinator of ASPENT. We were taken to the offices of ASPENT where we presented background information about our abilities and roles, and were briefed on activities planned for the next few days. We were then taken to our hotels for check-in, in preparation for the afternoon interviews. Members of the association were varied in their crops and interests, and thus a variety of consulting opportunities presented themselves.

In the afternoon, Gerardo Canessa was interviewed concerning his interest in planting ginger for the fresh market. He had obtained material from Nicaragua, which, from the description, must have been the Cochin type. It had been multiplied in several plantings. In the previous year's planting, 8 manzanas (5.6 ha) were planted near San Miguel and a basic error was made

in fertilizing the plants regularly with ammonium sulphate. As a result, beautiful foliage was produced at the expense of the rhizome. Sufficient production was obtained to plant only 5 manzanas (3.5 ha) this year. After this interview we are confident that Sr. Canessa will do better this year.

Later, Sr. Raul Cornejo Giollity was interviewed. This young man is very interested in the production of chayote. A lively discussion ensued, and an appointment was made for Saturday to discuss coconut.

In the late afternoon we were given a tour of the Granja Anita by our host, Sr. Pedro Arguilla.

June 19. Sr. Mondoñedo and I interviewed José Antonio Barrera and technical assistant Victor Garcia concerning yuca (cassava) and many fruits, spices, and vegetables. Sr. Barrera represents H. de Selo, an organization with more than 5000 farmers producing sesame and honey, as well as other items. They are interested in producing new crops of potential long-term value through their network. I discussed the world production of cassava, products, markets, logical steps in developing an industry, and sources of new varieties and information. Finally, we concluded a very successful discussion by talking about many crops but especially ginger, mamey sapote, and cashew as crops of potentially high value for El Salvador.

In the afternoon I interviewed Javier Francés of the Salmar family, a family with extensive successful commercial interest. Sr. Francés is very alert and competent. He has had several years of experience with ginger and has obtained and multiplied several varieties, probably including cochin, Hawaiian, creole, and "bitter." I suspect that the latter is Zingiber zerumbet, a minor species used as a source of bitters. He has experience in extracting essential oils and wants to use ginger for extracts. The discussion was long, detailed, and very useful. I shall visit the farm Saturday for further assessment.

June 20. I visited the wholesale fruit and vegetable market with Pedro Arguilla, watching especially for roots and tubers. Although fresh vegetables were seen in abundance, I saw no ginger, yams, taro (malanga) or tannier (yautia). I saw small quantities of potatoes, smaller quantities of cassava (yuca) and very small quantities of sweet potato (camote). Given the importance of these crops in most Latin American diets, it was a surprise to find so few in the market.

I returned to the farm of Javier Francés, interviewed June 19. This farmer has been developing several minor crops as sources of essential oils. The enterprise includes a steam distillation apparatus that permits the extraction of oil from

raw material grown on the farm. The principal raw material now is vetiver, followed by marigold. An interest also exists in the production of ginger oil for perfumes, drinks, and spices.

The ginger I saw on the farm was of three types. I saw a few potted plants of Hawaiian ginger, and a variety with very low aroma that possesses a fairly large rhizome. This may be Cochin ginger but its description as "bitter" ginger suggests that it might be Zingiber zerumbet. Examination of the mature foliage would permit positive identification. In addition I examined the partially dried roots of a third species with very small rhizomes. The oil from this variety has been tested in the U.S. and shown to be of high quality but different from the Jamaican variety. I examined the soil and planting system and found the former very good, and the latter inadequate. I advised on appropriate technology. The need was evident for authentic Jamaican ginger as a principal product and standard.

In the afternoon I visited the farm of Raul Cornejo, a young farmer involved in the production of coffee and chayotes, who also has a neglected farm producing coconuts. We had previously talked to him about chayote, and on this trip I learned about the excellent production system he manages and counseled him on how to improve his genetic material. The most important aspect of the meeting, however, was a discussion on how to make use of his coconuts.

C. Honduras

June 21. I traveled to San Pedro Sula, Honduras, and spent the day preparing these reports.

June 22. I went to the office of FEPROEXAAH and I met Lic. Manuel Enrique Borjas Mejia, project officer, who had assigned the task of developing a program to Freddy El Bascha and Oscar Aguilar. I spent the morning talking to them about ginger, and found them to be highly interested but with very little good information.

Ginger is not a traditional crop in Honduras. A small planting in Ceiba, when checked out, was found to be abandoned. There is no knowledge of the particular varieties of ginger available in the country, and there is not enough ginger in the country to constitute more than a small plot.

In the afternoon I developed some world market statistics and gave copies of tables to FEPROEXAAH. Because of the lack of any plan or method to get started, I developed a set of recommendations in Spanish for progressing systematically with a plan to introduce ginger to a new region. (See section III below).

In keeping with these suggestions, I felt the most useful contribution I could make would be to develop an outline of production techniques, and an outline of processing techniques. This suggestion was accepted. It is my intention to retain the outlines for the possible writing of tech-packs at a later date.

June 23. I developed the outlines in Spanish on ginger production and processing (see section IV below). The outlines were discussed with FEPROEXAAH personnel. We agreed that the major limiting factor in ginger production in Honduras at the moment is the lack of seed material of appropriate types.

June 24. I left Honduras and I arrived home on June 25.

SECTION III

SUGGESTED STEPS IN INTRODUCING GINGER TO A NEW REGION

A. Basic Steps

1. Determine market prices and seasonal influences via the ROCAP project.
2. Determine which areas or lands are most appropriate.
3. Develop a feasibility study based on these findings. Locate and identify varieties already in Honduras.
4. Introduce appropriate varieties, i.e., one ton of the Hawaiian variety, or that which the Costa Ricans use, and 100 lbs of the Jamaican variety.
5. Multiply the varieties and do small tests for production, processing, and quality.
6. Organize small-scale plantings according to what the buyer will accept initially, emphasizing a fresh market variety.
7. If all is successful, recalculate costs and profits.
8. Organize a production system for farmers and a marketing system for buyers who have already been identified.

B. Requirements for Ginger Cultivation

1. Temperature

Ginger can be cultivated between temperature extremes of 17°-35° C, with average temperatures between 24°-28° C. When temperatures are high and humidity is low, foliage may burn. Lower temperatures are acceptable during dormancy (January - March).

2. Rain

Ginger requires seven to ten months of rain, or irrigation water as a substitute, for a total of 1500-3000 mm per year. A two-month dry period is desirable sometime from January to March.

3. Soils

Soils should be loamy, rich, with a high content of organic matter or nutrients. There should be good drainage and a

neutral or slightly acidic soil condition.

4. Topography and Altitude

The land should be flat, to foothills of 30%. Most ginger is produced from 300 to 1000 meters.

5. Cultivars

There are few ginger cultivars in the world, perhaps 20 to 30. Some of the more commonly known could be duplicated. Those that are used for the fresh market or for sugar preservation are Cochin, Canton, Hawaiian, Rio de Janeiro, and China. These have large rhizomes, are low in oil, and high in oleoresins (which gives them their hot taste). Others are primarily dried, such as Jamaica yellow, Wynad Manantody (India), and Maran (Assam). These have medium-sized rhizomes and are high in oil content. The primary varieties for medicinal use are considered inferior: creole (several varieties), flint, and red (several varieties).

6. Seeds and Their Preservation

Seeds should be harvested as late as possible, and should be cut in convenient pieces for storage. They should be washed, treated with disinfectant like Benlate or 0.1% Ceresan and lightly dried. They should be stored under cool conditions and dried with little air movement, or stored in the field without harvesting and covered with dry leaves until they are needed.

7. Planting

The best land should be used, new land if possible, for ginger cultivation. It is helpful to plow 4-8 months before planting. Manure or chicken droppings can be added at the rate of 25-35 tons/hectare in the first case and 6-8 tons/hectare in the second, fumigating occasionally for nematodes, according to need. Farming beds or ridges should be .70-1.20 meters apart and 15 cm high, to give good drainage.

The time to plant is as early as possible after April 1st, if necessary, adding water after planting. The distance between pieces depends on the type of ginger, the size of the piece, and the distance between the beds or troughs.

Ginger is frequently produced under light shade. This results in healthier-looking plants but lower yield.

The following are recommendations for certain other countries:

<u>Place</u>	<u>Type</u>	<u>Distance between beds (in cm)</u>	<u>Distance between pieces (in cm)</u>	<u>Size of pieces (g)</u>
India	dry	15	15	60
		15	23	80
		23	23	100
Australia	fresh	100	20-35	28-56
Guatemala	fresh	120	35	120

The pieces can be treated in warm water at 52°-54°C for fifteen minutes to eliminate nematodes. They can be treated with a disinfectant like Benlate. They should be planted (most commonly) 4-5 cm below the surface. In some places it is the practice to place dry leaves as much as 10 cm over the beds.

8. Weed Control

Weed control can be achieved by plowing up to a depth of 10 cm. Diuron can also be applied at the rate of 4.5 kg/hectares after planting. Later, Paraquat can be applied very carefully, with a tractor or by hand.

9. Watering

Irrigation should be used as needed to maintain the moisture level during the life of the plant.

10. Diseases

Soft rot is caused by Pythium. To prevent its development, pieces should be planted without soft spots, and excessive watering should be avoided. Rot is caused by Fusarium. To get rid of it, ethoxyethyl mercury chloride with disinfectant is recommended before planting. Bacteria wilt, which starts with yellow leaves and continues to wilt, is very dangerous, and has no remedy. Soils where it occurs should be avoided. Foliage diseases can be treated with Bordeaux or modern fungicides.

11. Nematodes and Insects

If nematodes are left untreated before planting, a nematicidal product can be applied afterward. There are many insects in the region but none are very serious with respect to ginger cultivation, except in certain circumstances.

12. Harvest

Over time, the concentrations of dry material, oil, oleoresins, and fiber increase. Harvest times are as follows:

For fresh ginger, 7 months
For ginger preserved in sugar, 7-8 months
For dried ginger, 9-10 months.

Harvesting can be achieved with a shovel, fork, hoe, or mechanical harvester.

Yields

<u>Place</u>	<u>Type</u>	<u>Amounts</u>
Jamaica	dried	8-10 tons/hectare
India	dried	9-11 tons/hectare
India	dried	40 tons/hectare (maximum reported)
India	dried	7-36 tons/hectare (extremes of different varieties)
Australia	fresh	37 tons/hectare (at the experiment station)
	fresh	59 tons/hectare (at the experiment station)

13. Post harvest

a. Summary of the Principal Ginger Products

- o Fresh rhizome - to be eaten as a vegetable
- o Rhizome preserved in sugar - for use in the home, for baked goods, candies, and marmalades
- o Dried Rhizome - to be used as a spice, for oil and oleoresin extraction, and in baked goods
- o Oil - for use in drinks, perfumes, candies, and baked goods
- o Oleoresin - used the same way as the dried rhizome

b. Fresh Rhizome

Sometimes fresh rhizome is harvested in a very succulent form four, five, and six months after planting. More commonly, it is harvested at seven months. It can also be

harvested at eight and nine months, but the fiber content will be high.

After harvest, the hands should be washed, the ginger cut into convenient pieces and dried for two days in the shade. It can then be packed for the market. It can be stored like this for six months, at 13° C.

c. Ginger Preserved in Sugar

This process is more common in Hong Kong, Taiwan, the Philippines, Thailand, and Australia. The Hong Kong and Australian process are described in this report.

In Hong Kong, the root is cut in pieces, removing the cork. The material is then packed in salt. To 100 kg of ginger in a barrel are added 30 kg of salt. After 24 hours the solution is removed and 30 kg of salt and 30 liters of vinegar are added. It is kept this way for seven days and up to six months.

Later, the ginger is removed from the salt and vinegar solution and the pieces are washed and left in plain water for two days. The water is then changed. The ginger is boiled for 10 minutes in fresh water, cooled, and pierced with a fork so that the sugar will enter. To 100 kg of ginger are added 135 kg sugar and water to cover. It is boiled for 45 minutes and left for two days. Then it is boiled for 45 minutes more. The solution is removed and the fresh syrup added. It is packaged and sold in glass jars.

d. Dried Ginger in Sugar

The preparation is similar to the above. After boiling the second time, the ginger is left alone for a couple of days. It is then boiled a third time. The pieces are removed and rolled in sugar. The product can be sold in glass jars.

e. Ginger Preserved in Sugar (Australian Method)

This process is only briefly discussed in sub-section (4) below because it is appropriate for large businesses with sophisticated equipment.

f. Dried Ginger

Most of the world's ginger is marketed dried. The principal producing countries are Jamaica, India, Nigeria, and Sierra Leone. The price depends a lot on the origin, the variety, and the preparation. The part of the root with the most oil is directly under the cork. It has to be free of damage to be of high quality.

(1) Preparation methods

- o Peeled (without cork) - using knives of the highest quality for peeling.
- o Partially peeled - the cork on the surface is removed but not between the fingers.
- o Without peeling - dried as is.
- o Black - boiled 10-15 minutes, after which the cork is easily removed, and dried.
- o Sliced - without peeling, cut in order to dry better.
- o Ratoon - harvested after more than a year in the field.

(2) Uses

In general, peeled ginger is best for marketing in packages. Other grades are ground down to a spice.

(3) Technique for Dried Jamaican Ginger

- o Carefully harvest between 8-9 months
- o Wash and dry
- o Remove the peel with a knife (one person can do 18 kilos in one day)
- o Wash for a second time
- o Dry in the sun or in a dryer
- o If dried in the sun, it will take 8 days, turning frequently, especially the first few days.

(4) The Australian Technique

Australia has the best ginger production and processing methods in the world, and can serve as a model. The ginger is harvested three times, at approximately 7, 8, and 9 months. The first ginger harvest is preserved, the second is dried for extraction, and the third is ground like a spice.

The ginger is prepared to dry in two ways. The first is in a drum with abrasive metal inside. The pieces are placed in the drum and stirred, removing the cork. The second technique is to slice the ginger into 3.2 mm pieces without removing the cork and dry it in an artificial dryer, using temperatures from 57° to 68°, leaving 6-10% water. Everything is mechanized including the packaging. The quality of the product itself is not as good as Jamaican ginger.

SECTION IV

BACKGROUND INFORMATION ON GINGER

The outlines that appear below contain some of the same material as section III. They were prepared for different purposes, however: section III for FEPROXAAH in Honduras and section IV as a preliminary to the possible preparation of tech-packs at a later date.

A. Introduction

Ginger is one of the oldest commercial spices. It was introduced to Europe before black pepper, and was widely used and appreciated more than 600 years ago. About 10-12 thousand metric tons enter international commerce yearly.

B. Taxonomy

Ginger is a diploid species ($2n=22$) of the Zingiberaceae, Zingiber officinale. Other species, considered inferior gingers, are Z. zerumbet, Z. cassumar, and Z. mioga.

C. Origin

Ginger originated in southern Asia, probably India, and was grown in pre-Columbian times in China, India, Malaysia, and Indonesia. It is not known in the wild state. There are perhaps twenty named varieties.

D. Nature of the species

Ginger is a perennial but is grown as an annual, serving in the dry season as a rhizome. It has a definite season of growth and dormancy, determined chiefly by day length (8-9 months of growth, 3-4 months of dormancy). It resists changing its season of growth, and the effects of humidity and temperature are limited in this regard. The growth of the rhizome is continuous after planting. Its pungency and bitterness are highest before full maturity, and fiber is highest at maturity, when foliage dies.

E. Varieties

Varieties can be clearly distinguished within a country but not among countries. Examples:

- o Jamaica - Jamaican yellow, best quality
- Flint, bluish, poor quality

- Cochin, large rhizomes, for preserving and for the fresh market
- o Indian
 - Cochin, as above
 - Calicut, poorer quality
 - Hawaiian, vigorous and productive, used for fresh ginger.
 - Many local varieties, of which Wynad Manantody is preferred.
 - Brazilian (Rio de Janeiro), high yields, higher water content
- o Criollo - can be any of several varieties, some of which are of low value or for medicinal use.

F. Differences that Distinguish Varieties

Distinguishing characteristics among varieties are external color, yield, internal color, water content, pungency, and bitterness (citral or oleoresin content). Some differences can only be recognized by laboratory tests.

G. Necessities for Production

- o Tropical climate
- o Soil of low acidity
- o Low or moderate altitude
- o Sufficient rain or irrigation
- o Rich, well-drained soil. Ginger especially needs potassium, phosphorous, and medium nitrogen. Minor element deficiencies have been recognized.
- o Fertilizer: 25-30 tonnes/ha of manure is optimal, up to 1000 kg/ha of 8:8:16. Best results if split, 1 month and 3 months after planting. Up to 4 tons mulch after planting.
- o Herbicide: Diuron, 4 kg/ha after planting
- o Shading: light shading often gives higher yields but watery rhizomes

H. Planting

Planting should be done during March-May when pieces are beginning to sprout, and when rain or irrigation water is available. There should be deep plowing, application of manure,

and making of ridges. Recommended spacing is a minimum 15 x 15 cm., 70 x 70 cm., 25 cm. x 1.0 meter, .50 x 1.0 meter. With respect to size, the bigger the piece, the higher the yield per plant. I recommend 100-120 g pieces planted at 0.35 x 1.0 m spacing. Pieces should be treated with Ceresan or Benlate before planting. Recommended planting depth is 5-10 cm. Sets can be covered with mulch for protection.

I. Diseases

Diseases vary according to location. The main ones are:

- o Soft rot - caused by Pythium and controlled with better drainage.
- o Fusarium wilt - controlled with clean seed, rotation
- o Pseudomonas wilt - cannot be controlled, must be avoided
- o Leaf spots - controlled with foliar fungicides (Bordeau)
- o Nematodes - these reduce yields and quality and are controlled by rotation, fumigation of soil, and seed treatment with hot water (15 minutes, 52-55°C)

J. Harvesting

- o Earliest: for fresh, 7 months
- o Mid-season: for conserving (preserving), 8 months
- o Late season: for drying, 9-10 months
- o Tools: forks, plows, or potato harvester

K. Post-harvest Treatment

- o Wash, drain and dry for 1-2 days
- o Store in brine if it is to be preserved later (details can be given)
- o Peel and dry, if for spice
- o Processing is highly variable, resulting in distinct grades of variable value
- o Jamaican ginger is the highest grade. This requires the correct variety, and peeling with care (the flesh under the cork must not be removed, although all of the cork is removed).

- o Careful drying

Note: A very precise processing technology is available.

L. Areas of Production

Areas of production are as follows:

- o India, 50% world production, most in Kerala state, dried.
- o Jamaican, best quality, dried, production is decreasing.
- o Australia, very productive and mechanized, mostly preserved.
- o Hong Kong, preserved.
- o Other parts of the tropics: Taiwan, China, Nigeria, Sierra Leone, Hawaii.

M. Markets, in Order of Importance

U.S., England, Saudi Arabia, Japan, Yemen.

Most international trade is in dried ginger, a smaller amount is in ginger preserved in sugar and a smaller amount, in fresh. Much of the world's ginger is used fresh and never enters international markets.

N. Forms and their Uses

- o Green - used as a vegetable
- o Fresh - used as a vegetable, as a spice, and in baking, drinks, and mostly local uses
- o Preserved - used as a dessert or a sweet in the international market, or crystallized as candy
- o Dried - used in the international market as follows: ground as a spice; steam distilled to yield oil (for flavoring and perfumes); solvent extracted as oleoresin; as a flavoring.

O. Contents of Ginger

- o Water, 78-84%
- o Starch

- o An alcoholic oil responsible for aroma
- o An oleoresin responsible for pungency

P. Standards

Extract standards have been developed for each processed product, especially dry ginger, in the U.S. and England.

SECTION V

GENERAL RECOMMENDATIONS

Based on observations in Guatemala, El Salvador and Honduras, I find the rainy season short and the climate marginal for ginger and yams. Whether irrigated or rain-fed, fresh market ginger needs 6 to 7, yams, 7 to 8, and dry ginger, 9 months of growing time with sufficient water.

- A. I recommend that a flexible technological package be developed to cover all details necessary for successful ginger production under the conditions encountered in Central America and Panama. This task would require three days' time.
- B. I recommend that growers of fresh market ginger be encouraged to plant as early as possible (possibly late March, with irrigation) and to harvest earlier, at about seven months, to assure a better product and to enter the market earlier.
- C. I recommend that other commercial varieties of ginger be introduced and made available to growers including the Hawaiian type (in Guatemala, but controlled by RHIZOMAS), the Brazilian type, Rio de Janeiro, and the Jamaican type for drying. Technical assistance may be required to achieve this end.
- D. I recommend that technical information be prepared for eventual trials of preserved (sugar-processed) and dried ginger. These are important alternatives as the fresh market becomes saturated. Three days would be required to prepare this information.
- E. I recommend that the markets for fresh, preserved, and dried ginger be explored and that information be made available to growers and cooperatives.
- F. I recommend that potential markets for ginger products be explored in Panama and Central America, including the use of dried ginger as a spice and in spice mixtures, in flavoring of beverages, ginger ale, rum and liqueur, and in perfumes and extracts; the use of preserved ginger in baking and as a dessert; and the use of candied ginger as a snack or dessert.
- G. I recommend that a list of persons interested in ginger be developed and that this list be circulated to the people on it. Furthermore, the list can then be used to distribute news, marketing information, and tech-packs.
- H. I recommend that the kinds of technical information be assembled that would go into a tech-pack on cassava, although

interest in cassava is not strong enough at present to merit an actual tech-pack.

I. I recommend, as I did in Panama, that a tech-pack on yams be prepared. Although yams are not important crops in El Salvador and Guatemala, they are appropriate crops with high potential in hot humid areas in all parts of Central America. Three days would be required to produce a first draft.

SECTION VI

FINAL CONCLUSIONS

While climate is marginal for ginger in Central America, fresh market ginger can be produced. No experience with dried ginger is available. Dried ginger, so needed to give stability to the market, cannot be produced in many areas unless irrigation is used. It appears that Hawaiian ginger for the fresh market is the best kind, but is in the hands of only two growers and needs introduction and distribution. It is possible that Jamaican ginger does not exist in Panama or Central America. I urge that an effort be made to introduce in quantity the necessary ginger varieties. Unless this is done, the ginger industry will develop extremely slowly.