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report

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MARKET STUDY OF FRUITS AND VEGETABLES IN THE CENTRAL ZONE: A COMMODITY SYSTEMS APPROACH

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The Project Director for the contract was Joseph A. Reyes. The report was prepared by Rafael Fermoselle, Ph.D., and Laurence Platt, both of whom were on the field team with Bill Ross, the Technical Consultant. Ralph Walker was the Technical Editor for the Project.

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9. ABSTRACT

A comprehensive definition and description of basin irrigation was presented in Water Management Technical Report 49B. A procedure was outlined for the design and evaluation of basin irrigation systems, showing the interactions between the various basin characteristics, the operational parameters, the management parameters, and the performance parameters. A general model was presented that considered infiltration, advance and recession. A simplified model utilized the infiltrated water distribution under basin irrigation.

This report focuses upon the use of furrows in bunded basins, which has both agronomic and engineering advantages. Comparisons between the performance of basin irrigation and basin-furrow irrigation are made. The physical situations analyzed include: nonuniform water advancement due to slope across the width of the basin; delay in water advance time due to nonuniform longitudinal slope; excess ponding and water application depth due to high ground surface spots within a basin; and ground surface irregularities.

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I. INTRODUCTION

This study concerns marketing and production components in the design of the Minifundia Crop Intensification Project. The purpose of the study is to identify those crops which Paraguay can export with a comparative advantage and which small farmers in the Central Zone (the Minifundia)[1/] can produce with an increase to their income. By using the framework offered in this report, USAID/Paraguay and Paraguayan policy planners can determine what crops would be profitable for the small farmer to grow before any money is spent to produce them, or what gaps presently exist in the information based on which such determinations can be made. This can aid in the building up of an agricultural industry in which the small farmers are important components.

Ninety percent of all farmers in the Central Zone are campesinos who own farm units of fewer than 21 hectares.[2/] They earn an average annual per capita income of $119.74 and have a productive output of about one half the average per agricultural worker in Latin America.[3/] Their agricultural technology is primitive. They rely, for example, on oxen for planting and plowing. Currently their primary cash crops are cotton, tobacco and soybeans, which comprise almost half of the their production.

1/ Defined as the political department of Cordillera, Guairá, a great part of Central, Caazapá and Paraguarí, and a small part of Caaguazú.

2/ One hectare equals 2.47 acres

3/ Small Farmer Subsector Assessments and Constraints Analysis. AID/Paraguay, June 1976.

These crops supplement the primary subsistence crops of corn, sweet potatoes, and mandioca.

Fear that the world market for cotton, tobacco and soybeans will soon be glutted because of overproduction has led the policy planners of AID and the government of Paraguay to search for alternative cash crops. The search is concentrating on fruits and vegetables which may offer high yields per unit of labor and command profitable prices in international trade. The identification of crops appropriate for development is a basic step in this search.

To perform a market study in developing countries, it is insufficient to simply identify high value agricultural commodities for which there is a foreign demand. If the farmer cannot get his produce to the consumer, then the demand for that product is irrelevant. If there is no domestic demand to furnish a continuous incentive and to drain off surpluses, stability is lacking. Lack of a developed infrastructure such as highways, antiquated farming methods, and an ineffective marketing network hinders the ability of small farmers in emerging nations to meet consumer demand. Consequently, the market researcher must also consider national constraints affecting the production and sale of agricultural commodities in order to assess their potential for export.

The international trade in perishable commodities requires modern and efficient practices for market identification, production, and transportation, processing and storage.

Any substantial increase in the production of a perishable crop, without simultaneously providing adequate and timely capacities for transporting, storing and marketing the increased production could result in spoilage, reduced prices and, therefore, losses rather than profits for producers and middlemen. Our study was made with these principles in mind.

Assumptions on which the data gathering and analysis were based comprise Section II of this report. In Section III we explain how the data were gathered and used. In Section IV we discuss the general conditions which affect the production of fruits and vegetables in the Central Zone. In Section V we present a detailed analysis of the crops which were selected by our respondents as possibilities for development, including some they pointed out as past failures.

Following that is a summary of our findings together with our recommendations. A chart indicating the constraints on all of the crops that are produced in Paraguay, as reported by our respondents, and a chart showing the seasonality of the crops are included in this section. The last chart was used for determining which crops could produce employment for the farmers in the Central Zone during the off-seasons of the leading cash crops. The recommendations include the use of a systems approach toward further research, including a model for analysis of the marketability of fruits and vegetables which can be produced in the Central Zone.

The Appendix includes a detailed explanation of the model.

II. ASSUMPTIONS CONCERNING THE PRODUCTION AND SALE OF FRUITS AND VEGETABLES

Advanced and detailed planning is required to produce quality crops or agricultural commodities in quantity for a price that consumers can afford to pay and at a cost which allows the producers and intermediaries a reasonable return on their investments and risks. High perishability of fresh fruits and vegetables underlies the need for such planning. Typically when refrigeration is not available, crops must be harvested, graded, packed and shipped within a few days or even hours, regardless of prevailing conditions. This fact instills a high degree uncertainty into the system and points out the interdependence of the links in the agricultural chain.

The marketing system designed to handle these commodities must serve equally the interests and needs of both producers and consumers. A farmer will not be inclined to increase production if the crops do not move to the market and bring additional resources. And if the system does not bring the food to consumers when they need it, at prices they can afford, and at qualities they will accept, higher production will have little effect on consumption.[4/] With inefficiencies in the marketing network, neither the producer or the consumer will benefit.

[4/] United States Department of Agriculture, The Marketing Challenge--Distributing Increased Production in Developing Nations. Proceedings of a Conference in Washington, D.C. Foreign Economic Development Service, June 1970.

Production must be brought into appropriate balance with foreign and domestic demand. To be economically feasible for export or processing, a crop or agricultural commodity must be in demand in both the foreign and domestic markets. Typically, between 15 and 30 percent of a crop marked for export or for processing does not pass quality standards. If this surplus cannot be absorbed domestically, it represents a loss for whoever assumed the risks for the production of the crops -- either the producers or exporters and processors.[5/]

These assumptions must form the foundation of any program for the intensification of production of fruits and vegetables. Failure to do so will undermine the Project's expressed goal to increase the income of the small farmer.

5/ See Ray A. Goldberg, Agribusiness Management for Developing Countries--Latin America. Ballinger Publishing Co.: Cambridge, Mass. 1974.

III. METHOD OF APPROACH

A. MARKET STUDIES IN UNDERDEVELOPED COUNTRIES

Market studies usually rely on statistical data from which past and present consumption habits can be discerned and future trends can be projected. An assessment of the relative market shares of suppliers is another component of these studies, utilizing sales figures provided by local trade associations or federal commerce agencies. Interviews consumers are also frequently used to establish the reasons for these trends. That consumer demand can be met with production based on proper planning and adequate market information is the premise on which such studies are based.

The absence of statistical data on supply and demand is the biggest obstacle faced by the market researcher in emerging nations. A further problem is that published data may be based on educated guesses and therefore inexact to a degree or in a direction which is unknown. Even if it is accurate, however, market information does not by itself give an accurate picture of the sales potential of crops or agricultural commodities. Because of the relatively low degree of sophistication of, the internal marketing system, it must also be reviewed for its ability to match supply and demand to the satisfaction of those involved in the production and sale of fruits and vegetables.

B. A COMMODITY SYSTEMS APPROACH--AN OVERVIEW

For purpose of this study, a systems approach was used to the extent feasible to determine marketability of particular fruits and vegetables and to develop suggestions and recommendations for crop intensification.

A commodity systems approach is used to identify and relate to individuals and organizations engaged in the production, processing, transport, storage, financing, regulation, and marketing of the world's food supplies. In effect, agribusiness is a seed-to-consumer system composed of a series of closely related activities which enable agricultural produce to flow from the farm to the market place. By understanding the entire system in which they operate, the participants can relate and coordinate their individual operations. [6/] (See the Agro-industry Flow Chart on the next page.)

Such an analysis does not attempt to identify an ideal system, but rather to specify those actions which would lead to improved performance. No one understands the full system with which they deal. This approach is, consequently, designed to show where gaps in information or inputs exist so as to reduce the number of unknowns the decision maker has to confront.

Except for the largest and self-sufficient agricultural enterprises in emerging nations, the private sector requires an array of support services from public sector institutions to achieve an effective coordination in the production through marketing cycles. Yet the provision of support services, by itself, is not enough to maximize the performance

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6/ See James Austin, Agribusiness in Latin America. (Praeger-New York, 1974), and Gerald Horne, A Systems Approach to Agricultural Development in Ghana with Special Emphasis on Grain. (AID, May 1973.)

AGRO-INDUSTRY FLOW CHART

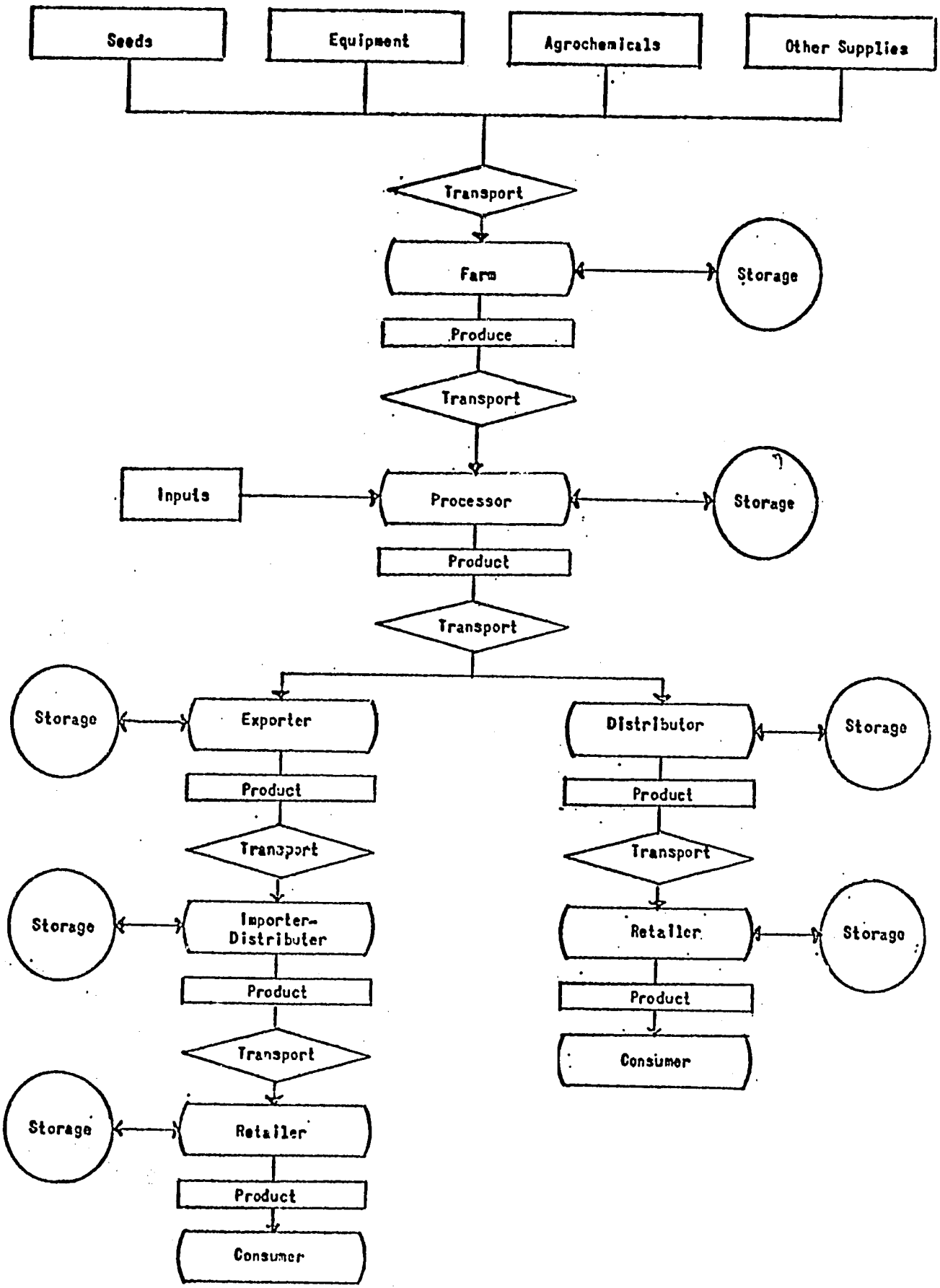

FIGURE 1

NOTE: Financing Inputs occur at each stage.

SOURCE: Agribusiness in Latin America by James Austin.

of the private sector. If these are not done in the right sequence, at the right time, and in the right amounts, they are less than effective. Consequently, a coordinating mechanism is necessary that can vertically integrate the management functions of the private and public sectors. To accomplish this, one must visualize who is involved in the production and marketing of fruits and vegetables and whose actions or inactions affect their quality and profitability. Levels of interaction and coordination must be assessed to identify breakdown in the marketing network. With this knowledge, one can formulate management requirements.

In other words, a system analysis can assist to:

- identify potential or actual problems or bottlenecks in various parts of the system and at particular points or time periods;
- mobilize and use the resources required to resolve such problems or bottlenecks in the appropriate sequence; and
- organize, control, evaluate, and improve the entire system so that it might function more effectively and so that the goal or objective may be achieved within the prescribed time frame.

C. APPLICATION OF SYSTEMS APPROACH

To JAR researchers, there was a two-fold purpose to the use of this approach. First it could account for Paraguay's status as a less developed country with little statistical data and an almost non-existent commercial infrastructure. Second, it could advance the stage of planning

AGRICULTURAL COMMODITY SYSTEM - LDCs - (Vertical Integration)

(Private Sector)	PRODUCTION	HARVESTING/ PROCESSING	STORAGE	TRANSPORTATION	MARKETING
(Management)					
PLANNING					
PROGRAMMING					
ORGANIZING					
BUDGETING					
COORDINATING					
IMPLEMENTING					
CONTROLLING					
EVALUATING					

(Public Sector)	RESEARCH/ ANALYSIS	FINANCING	TECH. ASSISTANCE	INFRASTRUCTURES	TRAINING	CONTROLS/ INCENTIVES

FIGURE 2

for the AID-sponsored Minifundia Crop Intensification Project by providing a methodology by which the three-to five-year endeavor could be organized.

The first task in our application of the systems approach was to identify certain diagnostic criteria by which all potential crops could be reviewed. These break down into the following categories:

- technical feasibility,
- economic feasibility,
- political acceptability,
- operational practicality, and
- social desirability.[7/]

In the review of the technical feasibility of a crop for production, critical variables include suitability of climate, incidence of disease, amount of fertilizer required, length of growing time required and seasonality of maturation and harvest, quality of seeds, and requirements for land and labor. Once it is demonstrated that a crop is suitable for a particular geographic region, it is necessary to review the economics of its production and sale. Is there an export or domestic demand that justifies its intensification as a cash crop? Will its sale provide a reasonable rate of return to the producers and intermediaries at an acceptable cost to consumers? If so, is the government ready to provide the support services necessary to promote its production through incentives, such as tax breaks.

7/ Ibid

Next it must be determined whether or not the growth and marketing of a crop are operationally practical. That is, is the marketing system developed to the extent that it can provide and coordinate the distribution from the farmer to consumer? If farmers are willing to grow these crops at the level of production necessary to meet market goals, and with the inputs, such as fertilizer, necessary for good quality and high yields? An obvious questions at this level would also be: can the small farmer in the Central Zone earn more from the production of fruits and vegetables than he can from the present leading cash crops, particularly cotton and tobacco?

JAR utilized the marketing component of the system model to analyze all available statistical data on the production and marketability of fruits and vegetables. The model provides a check list of data with which planners can determine the relative net profits of alternative crops. It tries to do this by presenting the effect of competition, the basic equation of the cost of production and other costs in the system, and prices. However, it does not purport to be a mathematical equation that will give the answers to questions about which crops to grow, which depend on factors not directly related to market prices. For this reason, the model is only one part of a commodity systemsanalysis, attempting to identify crops which it would be economically feasible to intensify for production.

The model is a product of a combination of planning techniques, such as PERT charts, and line of balance. Developed first for a pilot fresh

vegetable export project in Guatemala, the model is the creation of Dr. Gerard "Jerry" Horn, Food and Agriculture Officer for the Regional Office, Central America and Panama Affairs, USAID and who later became Deputy Chief, Rural Development Division, Washington, D.C. Dr. Horn has used the model in other countries including Guinea, Africa, where special emphasis was on grains.

The model owes its origin to Dr. Horn, but was revised by Mr. Bill Ross to account for the characteristics of Paraguay. Mr. Ross was recruited by the Harvard Staff of the Graduate School of Business Administration at INCAE (Instituto Centro Americano de Administración de Empresas) to study nontraditional export and import management practices and to write teaching cases for Central American use. Based on Dr. Horn's work, Mr. Ross researched and coauthored with Dr. James Austin of the Harvard Business School the Zapaca A and B cases, which were published in Austin's Book Agribusiness in Latin America. Mr. Ross part of the JAR project team in Paraguay.

In the time available under this contract, it was not possible to utilize the model to make a complete market study. To the extent possible, the model is filled in. But its use in further research is strongly recommended and suggestions on how to collect the necessary data appear in the Appendix.

D. METHOD OF DATA GATHERING

Collection of data took place in Washington, D.C. and Asunción, Paraguay.

The field team utilized a checklist derived from the marketing component of the model as the basis for gathering the statistical data on the production and marketability of fruits and vegetables. An analysis of the diagnostic criteria was performed through interviews with several Paraguayan nationals and reviews of all available resource materials.

Prior to leaving for Paraguay, the field team identified and contacted sources of statistical information on the fruit and vegetable commodity system in Paraguay. Government agencies and organizations contacted include: The World Bank; Department of Agriculture; Foreign Agricultural Service; Agency for International Development; Latin American Bureau; Department of Commerce, Market Information Service and Country Marketing Specialist; Department of State; Organization of American States; and the Fresh Fruit and Vegetable Grower's Association. This search proved helpful in uncovering statistical data on the agricultural sector in Paraguay and on the fruit and vegetable commodity system worldwide. However, little information was found on the specifics of the production and sale of fruits and vegetables in Paraguay.

In Asunción and its vicinity, interviews were held with a representative number of people from different fields connected with agri-business in the geographic area under study, including farmers; food processors; exporters; and government officials of Crédito Agrícola de Habilitación (CAH), Ministry of Agriculture; Ministry of Commerce, Export Office; Instituto Nacional de Tecnología y Normalización; and the Instituto

Agronómico Nacional. Those interviewed were asked to identify and rank those fruits and vegetables which had the best and worst possibilities for commercialization and to explain why they made these determinations.

The field team also reviewed all available data found in the offices of those interviewed, in the Central Bank of Paraguay, Embassies of Brazil, Argentina, Uruguay and the United States, and in the library of the Economic Mission of AID/Paraguay. A collection of newspaper clippings in the files was used to compare the results of JAR's interviews with discussions in the press of the problems affecting the development of the agricultural sector in Paraguay in general and in the Central Zone in particular.

IV. GENERAL CONDITIONS AFFECTING CROPS

A. GENERAL CONSTRAINTS

A number of constraints were apparent in the analysis of the marketing and production of fruits and vegetables in the Central Zone in Paraguay. First, Paraguay is at a disadvantage because it is landlocked and therefore has high transportation costs. These costs are caused by modes too inefficient to move goods to the market place. Only one highway exists within the country and it is not an all-weather road. When it rains, the road is impossible in many areas. The Paraguay and Paraná Rivers are used to transport goods to neighboring countries of Argentina, Uruguay, and Brazil and to their ports on the Pacific Ocean. However, low water levels during the dry season prevent these rivers from being reliable sources of transportation throughout the year.

The high cost and unreliability of transportation is probably the greatest single constraint with which the market potential of fruits and vegetables is faced. Most respondents agreed that these costs make Paraguayan fruits and vegetables uncompetitive in European markets.

A second leading constraint is the low demand for products within Paraguay. The domestic market, to which the export trade is tied, is limited by the small and mostly rural Paraguayan population of 2.4 million. Asunción represents the major domestic market, with a population of over one half million. After the capital city, there are only six towns with populations reaching 10,000. Over one half of the country's population

lives in rural areas and appears to be agriculturally self-sufficient. Furthermore, the majority of the domestic population have low incomes. It appears that the more costly, processed foods go beyond the budgets of domestic consumers, who generally buy low-cost food staples.

The advanced degree of industrialization enjoyed by two of Paraguay's neighbors, Brazil and Argentina, is in marked contrast to that of Paraguay. Both have substantial, diverse and, highly profitable processing industries for fruits and vegetables. Paraguay's capabilities are no match to those of its neighbors.[8/] Capital investment required to develop new industry in Paraguay is probably not forthcoming from private sources for any venture that must compete with neighboring countries.

B. SPECIFIC PROBLEMS

JAR's field survey indicated that most of the fruits and vegetables we reviewed could be grown in the Central Zone. Yet there was a wide difference of opinion among those interviewed as to which fruits and vegetables offered the best possibilities for crop intensification. However, all are affected by similar problems although by differing degrees of severity. These include:

- incidence of disease,
- lack of proper irrigation,

[8/] Stephen C. Ryner, An Overview of Food Processing in Paraguay. USAID of Colombia, TDY Assignment in Asunción, April 1977.

- lack of technical assistance to farmers in agricultural methods needed to increase production,
- lack of containers and processing plants,
- governmental requirements and procedures,
- competition by illegal imports,
- competition with other Paraguayan farmers,
- lack of cold storage and refrigerated transportation facilities,
- high tax system, and
- lack of vital information.

To what extent these problems can be eliminated and at what cost depends greatly on the provision of support services from the national government and the imposition of strict management controls. Disincentives to production for export are prevalent at the present time. The problems listed above are discussed below in more detail.

1. Incidence of Disease

The most important fruit crops in the Central Zone have been affected at one point or another by diseases. Some have been completely wiped out. For example, bananas were seriously affected in the mid sixties with a bacterial disease that devastated the industry. More recently the citrus industry has been devastated by another infestation reducing exports of one of the most important crops of Paraguay. Other examples will be discussed in the next section of this report.

2. Lack of Proper Irrigation

Although rainfall is heavy in the Central Zone, irrigation is necessary in order to maintain high quality standards of production and to protect the farmers from losses due to unexpected periods of drought. For example in 1977 the crops were seriously affected by a period of drought. Production of present cash crops, such as pineapples, is limited because of lack of sufficient water. Other potential cash crops, such as strawberries, require irrigation in order to produce these fruits in a marketable quality.

It was reported that at the present time only a handful of the small farmers use any type of irrigation, thus reducing the number of potential crops for intensification of production. The reasons for the lack of irrigation include lack of knowledge of irrigation methods by the farmers, lack of capital for development of those systems and lack of expertise in the installation and use of irrigation systems.

3. Lack of Technical Assistance in Use of Chemicals

Crop Intensification in the Central Zone requires that small farmers receive technical assistance in the application of fertilizers, insecticides and disease controls and in financing the purchase of the products needed for these chemicals. The concentrated use of Paraguay's land in the past depleted its minerals and affected its viability for crop intensification. Without the application of expensive agricultural chemicals, such as fertilizers, increased yields cannot be attained. Furthermore, insecticides are often misused. At present farmers are not discriminating

between the crops on which they should use insecticides, and are therefore poisoning themselves by their misuse. In many cases they are creating stronger mutations of insects by using improper concentrations of these chemicals. It does little good to furnish assistance for importing chemical agents without teaching the farmers how to use them. In addition, even with training, proper chemicals to control crop diseases would be too expensive for the farmers even if they understood their use.

4. Lack of Containers and Processing Plants

No cans or jars are produced in Paraguay. Producers of packaging materials as well as food processors agree that the present demand for cans and specialized containers is not sufficient to justify modern packaging plants.

The present high cost of imported containers is one of the most serious deterrents to increased export of fruits and vegetables. Containers are heavily taxed by the government (up to 25 percent of value) to the point where it is cheaper to buy imported canned goods than goods processed in Paraguay. This would be true at present container costs, even if the processing plants were available. Further specific aspects of this problem are included in the discussion of particular crops.

Exporters and government officials agree that due to unreliability and small volume of farm products, it is difficult to support processing plants. At the same time, if no facilities exist to process agricultural products, farmers see no point in growing crops, because without processing no export market is feasible. This impasse has to be broken through government incentives or subsidies.

5. Government Requirements

The paperwork currently required to certify sales increases the cost of Paraguayan goods and affects their quality. An average of 7 to 8 people are needed to process a single truck of produce, due to all the permits, stamps, Visto Bueno, etc. required. Governmental offices processing this paperwork are spread all around Asunción and therefore frustrate exporters and increase labor costs. The required paperwork and procedures are unrealistic for highly perishable products, or ones that are only saleable with very low distribution costs. It would appear that one desk for recording exports and issuing permits could be set up to accomplish the same purposes as the current system.

6. Competition by Illegal Imports

Asunción supermarket prices of imported goods are lower than dockside prices for the same products. The only explanation is that the food outlets are selling items that came into the country illegally to avoid taxation. Several newspaper articles have discussed this factor as it affects specific crops, for example potatoes. In the field interviews we were told often about the insidious effect of this problem on the national producers. Unless a serious campaign is carried out by the government of Paraguay to stop contraband, the growers and processors will always be at a disadvantage until they can lower their costs below that of foreign producers through the use of modern technology. However, the impact of dumping excess foreign production on the Paraguayan market will continue to exist as long as contraband fruits and vegetables can enter Paraguay in quantities.

7. Competition with Large Paraguayan Farmers

Competition with Paraguayan farmers using more advanced technology is a major constraint faced by campesinos in the Central Zone. Farming collectives operated by Japanese and German Mennonite colonies generally produce fruits and vegetables at costs lower than those of small farmers. This is the result of economies of scale achieved through better farm management, more advanced farm implements, e.g., chemicals and tractors, and larger tracts for cultivation. It is generally recognized that appropriate advances in technology for small farmers come from the successes of these collectives. Furthermore, these collectives feature some degree of vertical integration, with units for transportation and sale of farm products. Processors and exporters appear to prefer business with these collectives because of the reliability and quality of their supply.

8. Lack of Cold Storage Facilities and Refrigerated Modes of Transportation

Paraguay does not have modern refrigerated transportation equipment to take produce to the market. The lack of cold storage facilities is even more serious. At the present time crops cannot be stored for use the year around. Many crops have to be consumed immediately or they will spoil. For example, potatoes and onions can be preserved fresh for about two months, and the rest of the year they have to be imported. Cold storage would expand the domestic market for the Paraguayan farmers.

Moreover, this problem adversely affects the prices received by small

farmers. JAR staff read and heard stories of campesinos whose crops spoiled while they waited for buyers. If they can be sold at all, these crops do not command maximum value and leave farmers at the mercy of buyers.

9. High Taxes

One of the most harmful things affecting economic development of the agrarian sector as well as the industrialization of Paraguay is an inhibitive tax system. Taxes and fees levied on fresh fruits and vegetables when exported amount to an average of 12 percent of value. Removal of this cost might be just enough to make Paraguayan products competitive in the international markets, and serve to offset the serious and expensive transportation problems experienced by Paraguay as a result of its landlocked status. The exporting costs are further increased by the man-hours that exporters have to spend dealing with the bureaucracy that collects the fees and taxes.

Another damaging aspect of the tax system mentioned above is the high duty levied on imported containers, including jars and cans. As previously noted, these taxes are as high as 25 percent of value and greatly increase the cost of Paraguayan processed products.

10. Inefficiencies in Marketing System

According to the Small Farmer Subsector Assessment and Constraints Analysis published by USAID/Paraguay in 1976, the distribution and marketing systems

that presently exist to move fruits and vegetables from farm to consumer appear at all levels of the system to be composed of a large number of relatively small, independently operating units. They are further characterized by widely diffused decision making throughout, which is based on highly imperfect market information. Clearly, this has a negative impact on the small farmer. Information on prices and production levels are based on the personal experience and advice of the middlemen. Because most middlemen have a monopoly in the areas that they serve, there is no pressure to give prices which will allow the farmer a reasonable profit. Production contracting, whereby a processor or exporter contracts with the farmer for a certain level of production prior to the planting season, does not exist for small farmers. The risks for production and the decision on levels of production rest solely with the farmer. As a consequence, processors are not guaranteed a stable source of supply and farmers are not guaranteed a market. This breeds distrust among all participants in the agricultural chain.

11. Lack of Vital Information

Little or no information now exists on the flow of products from producers to consumers and the rate of product consumption within the national markets. A study of the flow of goods to the markets needs to be made before funds are committed to building cold storage depots and intensifying crop production. Who are the primary participants? How many are there? What is their volume of business? And what levels of coordination exist between them? One needs to know where to place storage facilities and what capacity

is required to store goods for the domestic market. Only then can a determination be made of what additional storage may be necessary to handle legal international trade or to wait for the most appropriate time to sell abroad.

Market information is also necessary to assess to what extent large-scale purchasers of goods, such as hotels and commissaries, rely on contraband. For example, canned fruits and vegetables from Argentina are widespread in the market, although it is recognized that much of this is illegally imported. There are buyers who could help to support a processed food industry in Paraguay. However, without a knowledge of their purchasing habits and needs, there is not enough information on which to estimate domestic demand.

Similarly, there appears to be little knowledge of the South American regional markets for export, such as those of Buenos Aires, Sao Paulo and Montevideo. Market information on supply and demand is not readily available. Our respondents agreed, however, that Argentina, Brazil, and Uruguay are the primary target countries for Paraguay's products. Again, without a knowledge of their purchasing habits and needs, there is not enough information on which to estimate this demand.

The establishment of production levels for fruits and vegetables would be a major result of market information on supply and demand for national and international consumption. AID is promoting the development of agricultural cooperatives to rationalize farm production and increase

farmers' income. Without estimates on required yields, the cooperatives cannot maximize their services.

V. FRUITS AND VEGETABLES: FACTORS RELATED TO PRODUCTION AND COMMERCIALIZATION

What follows is a review of the feasibility of intensification of production and commercialization of fruits and vegetables from the perspective of Paraguayan nationals whose occupations are closely related to the subject. As was stated in Chapter III, these people were asked to identify and rank those fruits and vegetables which they thought had the best and worst possiblities for development and commercialization. Other information from previous studies and articles on file at the AID/Paraguay library were used for supporting information or as a means to verify or nullify the information provided by our respondents.

AVOCADOS

This fruit grows well in Paraguay and the supply is plentiful. However, this crop has not been commercialized. Some avocados have been exported to Argentina, but no figures are available on the quantity or the rate of return. A recent market study showed that there is some export demand in the South American region for avocados and that Paraguay could capture ten percent of the Argentinian market.[9/] There is also demand for avocados in the European Common Market

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[9/] Ministerio de Agricultura, Estudio del Mercado Argentina Para la Exportación de Frutas y Hortilezas Frescas, Estudio Comparativo del Paraguay y La Argentina. Asunción Febrero, 1977.

countries. But better varieties are needed for the crop to be commercially feasible.

Dr. Daniel Levandowsky, a horticulturist who works in Miami, Florida, has introduced several new varieties of tropical avocados which can enable year round production. If it is possible to introduce multi-season varieties Paraguay could profit through exports to other countries, particularly during the off-season in other countries. Avocado trees are plentiful in the Central Zone and most farmers already have several producing trees on their farms. However, at present most of the fruit rots on the ground.

Avocados are a highly perishable fruit that needs to be handled with great care. Storage, transportation and handling of the unprocessed fruit seem to be possible under present modes, although transportation in refrigerated trucks would be better. Cold storage facilities would definitely be necessary before the fruit could be exported in quantity.

Avocados also seem to be socially desirable in fresh form. Many farmers grow them for their own use, although they are not as popular or used as often as in Mexico and the U.S. Southwest. Avocados can be used for guacamole, which is sold in cans. Yet there is no market in Paraguay or in the regional S.A. market for processed avocados.

In spite of the advantages, there appeared to be little enthusiasm for the export of this crop from the people whom we interviewed.

GARLIC

Garlic offers one of the best possibilities for the Central Zone. Small farmers produce most of the garlic crop at the present time. There is a great demand for the product in Brazil as well as in the world market. The Banco Nacional de Fomento (BNF) carried out a market study for Paraguayan garlic and came to the conclusion that the country could potentially export up to 2 million dollars worth annually, most of it to Brazil, and some to Argentina, Venezuela, and Colombia, where Paraguay receives special tax treatment through the Asociación Latinoamericana de Libre Comercio (ALALC). In 1971, Brazil imported garlic from as far away as Yugoslavia, Turkey, the United Arab Republic, Spain and Portugal.[10/] No more recent date on imports is available.

In addition to its market potential, this crop has the advantage of being able to be grown in the winter season when there is no other work available for farmers. Garlic can be sold fresh, dry, or in powder form. It is easy to process and store, and transportation is relatively cheap due to its relatively light weight.

Paraguayan farmers, however, had a bad experience with garlic recently when the Banco Nacional de Fomento provided seeds to the

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[10/] Banco Nacional de Fomento, Estudio de Pre-Factabilidad para la Producción y Comercialización del Ajo (August 1971).

farmers that were of a variety not suitable for the soil and climate. The entire crop was lost when the plants did not form a bulb. Some farmers, therefore, are now reluctant to take another risk with garlic.

Garlic seems to be a politically acceptable crop for development since CAH and BNF have both attempted to foment an increase in production. Exports are now almost non-existent but the domestic market demand is high, and it seems to be economically feasible to intensify production. Storage and handling are within present capabilities. There are no facilities for the processing of garlic into salt or other products. However, a potential export market exists for the product and the costs for establishment of a processing system are not as high as for other agricultural products.

SWEET POTATOES (BATATAS)

This crop is grown throughout Paraguay only for internal consumption; however export in processed form appears feasible, if a number of constraints are eliminated. Both Brazil and Argentina are good markets for Dulce de Batata, a paste-like candy made from sweet potatoes, although they both produce Dulce de Batata at prices with which Paraguay cannot compete at this time. Unfortunately, Paraguay does not produce suitable boxes or cans for this product, and as discussed previously, the cost of imported containers is high. Currently there are no processing facilities. Although feasible, the processed commodity does not command a high value. This is a poor crop for intensification.

ONIONS

This crop is targeted by the Paraguayan government for import substitution, that is, to replace imported onions with a Paraguayan onion crop. However, due to the lack of cold storage facilities, the Paraguayan onion crop is only sufficient to supply the national market for about two or three months. During the rest of the year onions are imported from Argentina. Several sources indicate that it is cheaper to import onions than to grow them in Paraguay under present conditions because of storage problems.

Mr. Charles Baker, Marketing Economist now in Uruguay on a Michigan University contract with AID, developed simple drying sheds to dry and store onions in the Dominican Republic a few years ago, according to Bill Ross of JAR's project team. We suggest a similar system could be implemented in Paraguay to increase the utilization of the national crop, and perhaps create a surplus for export. Under present conditions (without cold storage facilities or processing equipment for drying them) it does not appear feasible for small farmers in the Central Zone to grow onions in quantity. However the situation could change in the future if a solution to the storage problem is found.[11/]

STRAWBERRIES

Strawberries can be sold fresh or processed. Small volumes command high prices, an advantage for Paraguay because of the costs of

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11/ SHU-KU LEE, Informe Sobre la Experimentación can Ajo y Cebolla en el Paraguay. La Misión Técnica Agrícola de la República de China en el Paraguay, February, 1973.

shipping the national output to the international market.

Demand for Paraguayan strawberries exists in Argentina at the present time and Paraguay seems to have a comparative advantage in production. Due to soil and climatic conditions, Paraguay can produce almost double the output of Argentina per hectare.

HORTIFRUT, a small firm that grows several crops in the Central Zone, manufactures its own shipping boxes, and exports fruits and vegetables. It is now commercially growing strawberries on company land for export near Asunción. Based on the experience of this firm, great possibilities for expansion are estimated for strawberry products and sale. However, small farmers do not currently produce strawberries because technical skills, irrigation, dusting, and refrigeration facilities are essential for good results. The small farmers of the Central Zone do not have the skills and the resources to take advantage of the present market without technical and financial assistance, if strawberries are introduced as an intensified crop.

MANGOES

Mangoes offer great opportunities for the future. The fruit grows well in Paraguay, and in 1975, 83 million fruits were produced.[12/] There is a demand in the S.A. regional market, and the World Market. In fact, several Spanish and European Common Market importers have

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12/ Michael Jacquinot and Dr. Juan G. Silvero, Frutilla Congelada y otros Frutas Exóticas: Posibilidades de Exportacion a Europa. CEPEX 1977, pp. 31-32.

recently shown an interest in Paraguayan mangoes. There is limited internal demand for the fruit, however, because many households have their own trees.

Experiments are now underway to improve the crop with new varieties imported from the United States. The Instituto Agronómico Nacional has been successful with new varieties and is now providing the new plants to the farmers in the Central Zone.

Mangoes do not have to be refrigerated, although cold transportation and storage would preserve them better. They can also be processed and sold sliced or as juice or marmalade in cans or jars. The Instituto Nacional de Tecnología y Normalización (INTN) has been successful with new varieties and is now providing the new plants to the farmers. However, the high cost of containers makes it very difficult to commercialize the processed product, and at present there are no facilities for the processing of the crop. Fresh mango fruit is thus at this time the only form which offers possibilities for export.

BANANAS

After a few years without much demand on the S.A. regional market for Paraguayan bananas, Argentina is once again showing a market demand. Paraguay suffered a setback in the banana harvests between 1964 and 1966 as a result of a new disease that affected production. Before a solution could be found many producers went out of business and that part of the Argentinian market Paraguay traditionally

filled was lost to Brazil, whose bananas are larger than those in Paraguay. As a consequence, the Argentinian consumers now appear to prefer a larger fruit than the one which has traditionally been grown in Paraguay. However, this causes no problems. New varieties of larger fruit have been recently introduced in Paraguay from Brazil, including Conga and Robusta, and are being cultivated commercially.

Advantages of bananas include the fact that there is an internal demand for the fruit and there is plenty of room for more growers. Argentina is now importing over ten million dollars a year in bananas from Brazil. Paraguay could capture part of that market.[13/] The fruit can be picked, transported by trucks to a central storage place, and shipped on cargo vessels. Caution nevertheless should be observed because bananas require irrigation and dusting every three weeks and thus may be too expensive for the small farmers.

Careful treatment should be given to the seeds at the point of sale also. Nematodes and other soil diseases have spread throughout the growing areas of Central America and this could result in additional expense in chemicals if they are allowed to enter Paraguay through inadequate customs inspection.

If the Paraguayan government provided the level of assistance necessary to overcome the technical problems to production, bananas would be feasible for crop intensification.

13/ MAG, Estudio del Mercado Argentina...

ORANGES

Citrus fruits had been a good income crop for Paraguay and offered a great potential for the future until the recent infection of cangrosis that has almost completely wiped out the industry. It is now impossible to export fresh oranges because of quarantines. The potential for orange juice has not been significantly affected since the disease cannot be transmitted to other countries through processed oranges. However, many farmers have cut down many trees and have given up the fight. Only a small amount of juice is being processed for the national market. It will take several years to grow new varieties that are resistant to the disease.

Even before the problem with cangrosis developed, orange juice production in Paraguay was a difficult undertaking. Small farmers who had a few trees in their farms gathered the fruits, often overripe, and piled them on the side of the road until an acopiador or middleman passed by and purchased the oranges. Often the fruit sat on the side of the road for long periods of time. When the trucks of the middlemen arrived at the factory another delay was experienced as the trucks waited in line for long hours until the oranges were unloaded. The result was that many fruits spoiled and the quality of the juice was very inferior. One of the reasons for the poor quality of the product was the fact that several varieties of oranges were used and most of the fruits came from ungrafted (pie franco) trees.

GRAPEFRUIT

Like oranges, the grapefruit has been seriously affected by the bacterial plant disease xanthomonas-SPP that produces cangrosis now attacking the citrus industry. Although the country, especially the Central Zone, is rich in grapefruit, it cannot export the fresh fruits and the trees are either dying or have been cut down by farmers. No economically feasible remedy for this disease is known at present.[14/] It will take several years to rebuild this industry. Sanderson del Paraguay, the last processors of grapefruits, had to close down the factorynear Asunción, and the equipment is now sitting idle. The same problem that affected the production of orange juice affected the production of grapefruit juice.

The pink grapefruit, however, still seems to be commercially feasible because of high demand and high prices in the European Common Market. A higher price compared to the white grapefruit provides a margin that the growers can use to furnish more care to the plants and use expensive bactericides to control the disease. However, profits have been lowered and many growers have given up the fight after suffering great losses. Farmers do not appear willing to once again commit themselves to the production of grapefruit.

PEPPERS

If Paraguay can overcome the technical constraints to production and handling, there is a good regional international market in Argentina

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14/ Small Farmers Subsector Assessment and Constraints Analysis. USAID/Paraguay, 1976.

and some demand in the World Market. For Paraguayan peppers in both fresh and processed forms, domestic demand is also strong.

Peppers are grown by small farmers in the Central Zone, but they can only be grown effectively in the North above the Central Zone at the present time. The Central Zone is affected by bacterial diseases that attack the pepper plants and it has become too costly a product for the farmers to produce. Production is particularly difficult because of lack of irrigation and capital for dusting. Lack of cold storage facilities and refrigerated equipment for transport facilities adds to the cost of peppers.

Processing of sweet red peppers is not cost-effective at the present time due to the high costs involved. As we mentioned previously, Paraguay does not produce containers and a prohibitive 25% tax on imported containers, including those that arrive damaged, makes it impossible to compete with imported processed peppers. For example, we were shown a can of sweet red peppers made in Spain that sells in Asunción for 198 guaranies (₲ 126 = $1.00), and a can of peppers of the same quality produced by Instituto Nacional de Tecnología y Normalización (INTN) during our visit to that agency. It is estimated that it would cost between 250 and 300 guaranies to produce the same product in Paraguay.

POTATOES

Irish or white potatoes are a prime target for development for import substitution in several Paraguayan government programs sponsored by MAG,

BNF and CAH.[15] However, a number of problems make it very difficult to grow them successfully in the country. Potato seeds have to be imported at high cost every year and so far it has been impossible to produce them in Paraguay. Due to climatic conditions the potato cannot finish its full cycle unless it is irrigated and dusted, and often has to be harvested unripe, according to an agronomist of the Instituto Agronomico Nacional. Cold storage is also not available and thus the home grown crop is only good for about two to three months.[16]

Recently an attempt was made to use an old cold storage facility to store part of the crop at the Frigorífico Nacional, but the equipment failed and the potatoes were lost.

The Paraguayan consumers are also said to prefer the potatoes grown in Argentina because they "taste better and are not as watery." To make matters worse, output per hectare in Argentina is about 20 tons compared to 5 to 6 tons per hectare in Paraguay.

Another serious problem faced by the Paraguayan growers is the flooding of the Paraguayan market by contraband Argentinian potatoes,

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[15] ABC "El CAH Aproba un Programa para el Cultivo de Cien Hectareas "de Papa," (10-VI-1974).

[16] ABC "Papa Nacional Todo el Ano," (7-VII-74).

making it even more difficult to compete.[17/] Several articles have been printed in local newspapers on this subject and several sources have provided us details of the illegal traffic. Most sources believe that the government is not willing to take strong measures to deal with this problem.

PINEAPPLES

This is one of the most important cash crops for the small farmers in the Central Zone. The Paraguayan pineapples have a good internal and external market for both fresh and processed fruits. Practically all the pineapples are exported fresh or processed to Argentina. However, the principal market for pineapples is in Paraguay itself. The Instituto Agronómico Nacional is introducing new and better varieties and experimenting with new methods for seed production and reduction of time from planting to harvesting. The Government of the Republic of China (Taiwan) is providing technical assistance to Paraguay to achieve this goal. Pineapples grow very well in

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17/ La Tribuna "Venta de Papas Argentinas Perjudica Plan Nacional," (22-I-74).
Funcionarios técnicos de areas productoras de papas, manifestaron su preocupación por la fluencia de papas de producción Argentina en los lugares de venta y en los mercados municipales. Consideran que este hecho puede perjudicar los esfuerzos que se vienen realizando y solicitan medidas oportunas de las autoridades para evitar la comercialización de papas de procedencia extranjera.

Paraguay and they have become one of the leading export crops.[18/] The main problem with pineapples faced by the small farmers is the long amount of time needed from planting to harvest, which averages about two years. With new methods this time can be cut to about half that time, depending on the seed used.

Most people and reports proffered pineapples as the leading candidate for crop intensification. Several Argentinian firms have already invested heavily in the pineapple industry in Paraguay, including INCA, which is presently canning the fruit in Paraguay.

It may also be possible to expand Paraguay's international pineapple market to countries in the Northern Hemisphere if the costs of transportation can be reduced.

TOMATOES

Tomatoes are one of the leading cash crops for Paraguay but the risks involved are tremendous and the farmers and middlemen have suffered several bad experiences in the recent past. Although there is a very strong domestic demand, most of the crop is grown for export

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18/ A report prepared for AID by Adache Associates, Inc. in 1967, titled A Feasibility Study for Citrus Fruit and Vegetable Processing in Paraguay stated that the pineapple crop was plagued by viruses, bacterias, etc. and that the yield per hectare was very low. They added that there was no technical know-how, the plants were very small, the fruits very small, non-uniform in taste, size and quality. The report also pointed out that no irrigation, fertilizer, or dusting was used and until these methods were used the future for this crop was bleak. Since then the situation seems to have improved, although there is room for more improvement.

to Argentina during the Argentina off season.[19] It is harvested in August and September for shipment to Buenos Aires before the Argentinian crop is ready for harvest. There is another harvest in Paraguay between November and December mostly for national consumption.

A problem faced by the Paraguayan tomato industry is that while the Argentinian farmers are not affected by frost or other climatic problems (this has been the case in the past few years) they can supply the Buenos Aires market. At this time the border with Paraguay is closed and the tomatoes are not allowed to enter that country.[20] This has caused great losses. Mr. Ammatuna in his survey of the tomatoes market in Argentina (Footnote 19) also pointed out that another problem faced by the Paraguayan producers and exporters of tomatoes is their lack of knowledge of the laws and regulations on the exportation of tomatoes to Argentina. Their lack of knowledge affects their planning and this results in delays to shipments and

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[19] Ing. Agr. Eduardo Ammatuna, Tomate: Posibilidades de Comercialización en el Mercado de Buenos Aires. AID/MAG (Marzo 1976)

[20] Although Paraguay has an international agreement with the Argentinian Government, the federal form of government provides the Governors of Argentinian provinces with the power to stop imports that pass through their provinces under certain conditions such as evidence of disease. Paraguayan products, in this case tomatoes, compete with similar products produced in Argentinian provinces next to Paraguay. Thus, the provincial government uses strict measures or legal technicalities to protect their own producers. The competition for the Buenos Aires market of several million consumers is of great economic importance to all the parties involved and restrictive tactics are often used to beat the competition.

unnecessary losses. Another problem Ammatuna notes is the lack of standards and mixing of different grades of tomatoes in the same containers. Lack of cold storage and cold transportation, as well as high transportation costs, make it very difficult and not cost-effective to export to markets other than Argentina.

Another study of the production and marketing of Paraguayan tomatoes prepared by the Ministerio de Industria y Comercio in 1972 recommended that an effort be made to improve the quality of the tomatoes and to lower the costs. For example, it suggested that perhaps the boxes that are used for shipment to Buenos Aires could be recovered for recycling.

The study also suggested a lowering of the export taxes to become more competitive in the international market. However, it was concluded that Paraguay had a limited market in Argentina and that market would not grow over the next few years due to increasing pressure from Argentine producers in the North to curtail the importation of Paraguayan tomatoes. An increase in volume of exports to Buenos Aires, the study estimates, would only lower the prices and the profits.[21/]

The lack of facilities and high costs of processing or canning of tomatoes in Paraguay due in part to the high cost of containers also

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21/ Ministerio de Industria y Comercio (CEPEX) - El Tomate: Producción, Comercialización Interna y Externa (Asunción 1972)

adversely affects the market. Another problem starting to affect the tomato crops is increased damages from bacterial diseases and insects. As we have mentioned before, most small farmers cannot afford high priced dusting products.

We saw in several dispensas and at the Mercado 4 (Mercado 4 is the main outdoor market in Asuncion for fruits, vegetables and meats) canned tomatoes from Argentina. We were also told that some of the fresh tomatoes might have been from Argentina since we conducted the study during the off-season in Paraguay.

Steps have to be taken to correct the serious deficiencies in the system if this crop is to be intensified to capture a larger market and help the farmers to improve their standard of living. Corrective measures are for the most part of a general nature and common to other crops analyzed in this report.

The risks associated with the present system are too great to offer incentives to the growers to expand production. Nevertheless, everyone with whom we talked recommended tomatoes as a leading crop for intensification. Evidence of this enthusiasm is the large number of studies on this subject in the past.

APPLES, PEARS, AND TABLE GRAPES

Great quantities of apples, pears, and grapes were observed in the Asunción markets. All of these fruits were imported from Argentina but

prices are so high that only a limited number of consumers can afford to buy them. Due to climatic conditions these fruits are very difficult to grow in Paraguay (the weather is too warm). Grapes are grown, however, for the production of wine. We have tasted several Paraguayan wines and found them to be of good quality and moderately priced. There may be some potential for exporting to other countries. However, this crop is not grown in the Central Zone.

CABBAGE, CAULIFLOWER, LETTUCE, CARROTS, AND CUCUMBERS

The climate and soil of the Central Zone are not feasible for these crops without irrigation, fertilizing and dusting which is not available at the present time. The lack of cold storage and the high perishability of these crops make them a poor choice for intensification for export. Furthermore, except for cauliflower these are low value commodities and have little export potential because target countries are self-sufficient in their production. Nevertheless, these crops appear in great number and in good quality at the Mercado 4. But the stores and street vendors only carry enough for their daily sale since they do not have refrigeration.

OTHER EXOTIC FRUITS: GUAVA AND PAPAYA

Guavas grow wild in Paraguay but no serious attempts have been made to grow them commercially. In 1975, over 178 million fruits were produced in Paraguay with about 40% collected for processing into jellies and candies.[22/] But the quality of the fruit is not high

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22/ Jacquinot and Silvero, op cit p. 32.

enough for industrial processing for export to the European market. Experiments in domestication and improvement using imported varieties are presently underway at the Instituto Agronómico Nacional. Nevertheless, none of the agronomists, processors, or exporters we interviewed showed any interest in the commercialization of guavas.

We saw papayas growing in many households in Asunción as well as in the surrounding small towns, but the consumption of this fruit in Paraguay, according to several sources, is quite limited. The principal use of this fruit is for processing for candy and chunks in syrup. According to CEPEX the production of papayas in 1975 in Paraguay reached 8 million fruits.[23/]

Competition with Brazil, Cuba, and other industrial producers which have the advantage of low sugar costs[24/] and better access to the international market may make it difficult for Paraguay to compete with this product. However, further research should be done. Papayas are easy to grow and the crop does not require a long time to bear fruit. There may be a market for juice and other processed forms of papayas in the United States and Europe.

23/ Jacquinot and Silvero, op cit p. 32.

24/ A large amount of sugar is used for processing. Generally the green papayas are cut into chunks and boiled in water with a heavy sugar content to produce a syrup.

VI. SUMMARY OF FINDINGS AND RECOMMENDATIONS

It is clear that the majority of the crops reviewed under this contract effort can be grown in the Central Zone, given the proper allocation of resources to alleviate the existing problems in cultivation, industrial processing and marketing. But before any decisions to increase production are made, a series of steps need to be taken to solve some of the serious problems described in Section IV which presently affect the agricultural sector in Paraguay. These include:

- research on diseases,
- modernization of farming technology,
- improvement of business climate,
- coordination with other Paraguayan farmers,
- creation of cold storage facilities and refrigerated transportation,
- improvement of information base,
- development of recommended crops, and
- use of commodity systems approach.

A. RESEARCH ON DISEASES

The Central Zone has a long and continuing history of disease-infested crops. The international reputation of Paraguay's products currently suffers because of the quarantine on fresh citrus fruit. Paraguay can ill afford this reputation to spill over into crops that are marked for intensification. Research must be stepped up to find the causes

of and cures for diseases for any crops recommended for intensification. Special attention must be given to the unique soil and climatic conditions of the Central Zone as a possible factor in the proliferation of diseases.

B. MODERNIZATION OF FARMING TECHNOLOGY

The presence of an antiquated farming technology with little use of irrigation, fertilizers and dusting, as well as the lack of planning, justifies a significant increase in investment in technical assistance for the small farmers. For example, technical assistance and guidance in crop rotation would result in reduction of disease and depletion of soil nutrients. One of the reasons for the problem with bacterial and insect diseases is the growing of the same crops year after year on the same land. If this cycle were interrupted it would be easier to eliminate the problem, since many diseasesand insects would not survive if they were not afforded fixed locations for the annual life cycles. Crop rotation could also be used to replenish the soil with vital nutrients, diminishing the need for expensive fertilizers.

Multiple cropping is another important area to pursue. Low productivity characterizes the work of small farmers in the Central Zone. To increase their incomes this trend must be reversed. The selection of crops for intensification which can be produced and harvested on the same farm unit, at the same time, is one way to accomplish this goal. Although our study did not comprehensively address this question, the feasibility of multiple cropping should be studied. The chart at the end of

this section on harvest dates of respective crops gives a preliminary indication that multiple cropping can succeed.

The lack or misuse of chemical inputs is another problem that must be resolved. Technical assistance must be provided to overcome this problem.

The lack of mechanization also affects the productivity of small farms. For hundreds of years, oxen-drawn plows have done much of the hard work on the farm. The feasibility of community-owned tractors should be explored, under the auspices of farmer co-operatives.

C. IMPROVEMENT OF BUSINESS CLIMATE

The inherent constraints of high transportation costs make it difficult to attract private capital in order to develop export operations. But to further complicate matters, government policies generate a poor business climate. Taxes averaging 12% on export crops are believed to be the edge making Paraguayan products uncompetitive. The tax system needs to be evaluated and revised in order to offer incentives to farmers, industrialists and exporters to increase their level of activity. The present export taxes and fees levied on fresh fruits and vegetables need to be lowered or eliminated to make Paraguayan products more competitive in the international market. The high duties levied on imported containers should be reduced or eliminated until such time as they are manufactured in Paraguay, at which time they could be reinstated to protect national producers from foreign competition.

Paraguay is a dumping ground for competing Argentinian and Brazilian products. It would be unfeasible to invest large resources in the development of affected crops in Paraguay and particularly to help small farmers as long as this situation exists. As long as illegal imports can reach the Paraguayan market and undersell national producers it will be very difficult to stimulate the production of such crops as potatoes for import substitution.

Remedial action has to be taken by the Paraguayan government and the specific means for doing it are beyond the scope of this study. Perhaps if it is decided to intensify certain crops in the Central Zone, efforts can be concentrated on eliminating illegal imports of those crops. Our recommendation, therefore, is that action be taken to eliminate the illegal importation of any agricultural commodities for which crop intensification is undertaken.

The perishability of agricultural commodities requires an efficient and quick process to enable exporters to clear their produce for the foreign market. This does not now exist. The Paraguayan Government should be encouraged to take effective steps to eliminate or reduce the paperwork and time presently required for the export of fruits and vegetables by centralizing all licensing activities at a location or locations where exporters can comply with the law in a quick and easy manner.

D. COORDINATION WITH OTHER PARAGUAYAN FARMERS

Farming collectives with more advanced technology than that employed by small farmers, hinder the ability of the campesinos to compete in a world market. It is imperative that project planners meet with representatives of these larger units in order to ascertain their own plans for crop intensification. Otherwise, foreign demand could easily be met by large Paraguayan farmers and the initiative of small farmers would be undermined.

E. CREATION OF COLD STORAGE FACILITIES AND REFRIGERATED TRANSPORTATION

The highly perishable nature of fruits and vegetables requires that some form of refrigeration be available. This is necessary to store fresh produce for the domestic market or for future processing. Furthermore, to transport perishable goods to the market place, refrigerated transportation is essential. The preliminary analyses of particular crops in Section III indicate the extent to which such facilities are crucial. However, considerable money could be wasted if either were pursued without a knowledge of the flow of goods from the producer to the market place. It is therefore necessary to plan for the purchase, construction and location of cold storage facilities and the provision of refrigerated transportation.

F. CREATION OF A DATA BASE SYSTEM FOR AGRICULTURAL COMMODITIES

Market data is essential to fully analyze the export potential of fruits and vegetables. Before any final decision can be made to

increase production and invest resources to develop a particular crop, a substantial investment needs to be made in a system to develop information with a capability for frequent updating in order to have current information on domestic and regional South American market prices, domestic and regional market demand, production costs, national output, trends of imports from potential target markets, and forecasts of new technology that could affect the industry. A model is provided in Appendix B that identifies the necessary sources of information and explain how such data can be obtained. This comprises one part of the commodity systems approach recommended by JAR for the Minifundia Crop Intensification Project. An example of such a data tool used in the U.S. appears in Appendix C.

Regional South American processors and their needs for semi-processed fruits and vegetables should also be identified and approached to determine to what extent Paraguay could fill this market.

G. CROPS RECOMMENDED FOR DEVELOPMENT

The principal objective of the study was to identify fruits and vegetables which, despite any constraints and problems affecting adversely their production and marketing, could be developed into viable exports. Because of the lack of certain important national data, a lack which showed up clearly when JAR attempted to apply the model described in the Appendix, our recommended list of crops should be taken as tentative only. The recommended list is based on the specific findings

concerning each crop described in Section IV above, and in Tables 1 and 2 on the following pages and on the advice of professional agronomists well acquainted with the circumstances of Paraguay.

In Table 1 a summary of constraints to production of individual fruits and vegetables is presented. This table could be useful for policy planners to determine how resources should be spent to improve conditions in the agricultural sector. Table 2 shows the principal harvest dates for Paraguay and could be used to select crops for intensification that can be grown at a time when the farmers are not engaged in the production of other cash crops or in periods of high seasonal unemployment.

We recommend that the following vegetables not be further considered for crop intensification:

- cabbage,
- cauliflower,
- lettuce,
- carrots,
- cucumbers,
- apples,
- peas,
- table grapes, and
- sweet potatoes.

Based on information that we reviewed, Paraguay does not appear to enjoy a competitive advantage in these crops. Their export potential is limited, either because target countries are self-sufficient in their production or already have relatively advanced export industries with which Paraguay cannot compete. Furthermore, these crops face the most constraints in terms of the technical feasibility of their production and the operational practicability of their movement from farmer to consumer. Lastly, for those crops that might be able to overcome these constraints with the proper allocation of resources, their low value does not make them economically feasible for intensification.

It is unfortunate that the citrus fruits must also be rejected for immediate intensification. The climate of Paraguay is ideally suited for the production of these crops and there exists a strong world demand. However, little headway has been made in eliminating the diseases that afflict these crops. Until remedial measures are found, it would not be wise to rely on these crops as a means to increase the income of small farmers.

Based on incomplete market information, pineapples and garlic appear to offer the best possibilities for crop intensification. There is a strong regional and domestic demand for these crops. Pineapple offers a range of options for processing. And since they are high value commodities, the costs associated with overcoming their technical

and operational constraints appear to be economically feasible. Garlic are low weight, high value commodities and do not face the storage and handling problems to the degree that the more perishable crops do. These two options far surpass any of the other crops.

Tomatoes, peppers and strawberries also offer relatively good prospects for intensification. There exists a strong foreign demand for strawberries and an average to good demand for tomatoes and peppers. Planning to meet this market demand at the slack periods of other producing countries is essential. All have their major drawbacks. For tomatoes, it's the unpredictable policies of the countries to which they could be exported. Peppers have not thrived in the Central Zone because of bacterial problems, and strawberries face resistance by domestic consumers because of their high price. Nevertheless, the presence of a foreign market makes these attractive candidates.

Four additional commodities offer some opportunities for intensification, but deserve less consideration than those already mentioned. These are: onions, bananas, mangoes and avocadoes. Import substitution would be the advantage of intensifying the production of onions. There is no apparent regional market to which onions could be exported. Bananas could be exported to Argentina and perhaps Uruguay but the required technology is at the present time not feasible for small farmers. Mangoes have some regional market appeal, albeit limited, and can be processed. Avocadoes have a better market potential, but there is little enthusiasm to export the commodity.

H. THE USE OF A COMMODITY SYSTEMS APPROACH

Paraguay is afflicted by a number of geographic and economic constraints that have a great impact on the competitiveness of national products in foreign market. To overcome these constraints and command the highest possible price in the market place, policy planners must use a management tool that will facilitate the coordination of all actors in the agricultural commodity chain. A commodity systems approach is recommended to accomplish this goal.

Further research is necessary to identify the participants in the present commodity system, to determine their level and nature of interaction and to isolate areas in which further coordination is necessary. Areas for review can be taken from the Charts (Figures 3,4,5, and 6) on production, processing, storage, transportation and marketing, which appear at the end of this section. In addition, the marketing component, which appears in the Appendix, should be utilized to identify what essential statistical data is lacking and determine how it can be collected. The combination of accurate statistical data and precise coordination of agricultural participants can help point the way to the success of the Minifundia Crop Intensification Project.

TABLE 1

CONSTRAINTS ON GROWTH AND MARKETING OF FRUITS AND VEGETABLES IN PARAGUAY

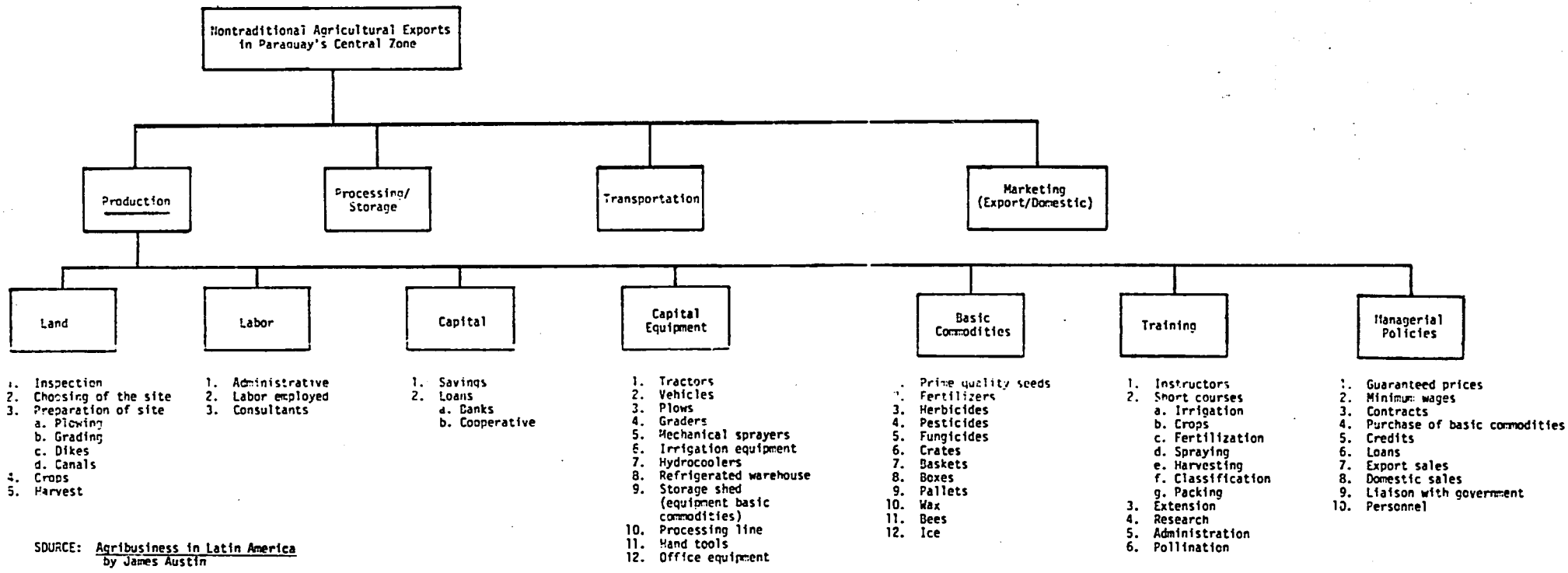
		AGUACATE (AVOCADO)	AJO (GARLIC)	BANANA (BANANA)	BATATA (SWEET POTATO)	CEBOLLA (ONION)	FRUTILLA (STRAWBERRY)	GUAYABA (GUAVA)	MANDIOCA (YUCA) (MANIOCA)	MANGO (MANGO)	MELON (WATERMELON)	NARANJA (ORANGE)	PALMITO (PALM HEART)	PIMIENTO (PEPPER)	PIÑA (PINEAPPLE)	MAMON (PAPAYA)	PAPA (WHITE POTATO)	TOMATE (TOMATO)	TORONJA (PINK GRAPEFRUIT)	TORONJA (WHITE GRAPEFRUIT)	UVA (TABLE GRAPES)	PERA ((PEAR)	MANZANA (APPLE)	LECHUGA, COL, COLIFlor (LETTUCE, CABBAGE, CAULIFLOWER	ZANAHORIAS (CARROTS)	CALABAZA, ZAPALLO (PUMPKIN AND SQUASH)	POROTOS (BEANS)	MANI (PEANUTS)	ARROZ (RICE)	PEPINO (CUCUMBER)	BERENJENA (EGGPLANT)
Technical Feasibility	Climate not suitable																?				X	X	X								
	Seeds can not be grown in Paraguay with present technology																X							X							
	Virus, insects or animals problem			X								X		X			X	X	X	X				X	X						
	Irrigation required and not available						X							X	X		X	X						X	X				X		
	Cannot be grown in winter months																														
	Highly perishable	X					X																	X	X				X	X	
Economic Feasibility	Small domestic demand (fresh)	X						X		X		X				X			X	X				?	?	?			?	X	
	Small export demand (fresh)								X			X				X	X			X				?	?	?			?	?	
	Small or no market for processed product (internal)	NA							NA	X	NA	X		X		X	NA	X		X				NA	X	X			X	X	
	Small or no market for processed product (export)	NA						X	NA		NA					X	NA	?		X				NA	?	X			?	X	
	Comparative disadvantage in regional market											X					X		X	X											
	Cheaper to import (presently)					X											X														
	High production costs											X		X		X	X		X	X				X	X				X		
	High processing costs				X					X				X		X				X											
	Depletion of supply												X																		
	High price of inputs for cultivation						X					X		X	X		X		X	X				X	X				X		
	High price of inputs for processing						X			X				X		X		X	X	X											
Political Acceptability	Contraband or illegal import competition					X											X											?			
	Difficult to receive credit	X			X			X	X	X	X	X	X	X		X			X	X				X	X	X	?	?	?	X	X
	Lack of government crop research				?	?		?			?						X		X	X				X			?			?	?
Operational Practicality	Need for mechanized cultivation methods																														
	Cold storage necessary and not available					X											X							X	X					X	
	Refrigerated transportation recommended and not available	X		X			X			X				X				X						X	X					X	X
	Processing facilities do not exist presently		X			X	X	X		X				X				X													
	Need for special packaging																														
Social Desirability	Perceived poor quality by domestic consumers									X							X							?					X		
	Perceived poor quality by international importers							X		X									?	X				?	?	?				?	?
	Previous bad experience		X	X		X						X					X	X	X	X				X							

Constraints to Production of Fruit and Vegetable by Small Farmers in Paraguay as expressed by Several Sources.

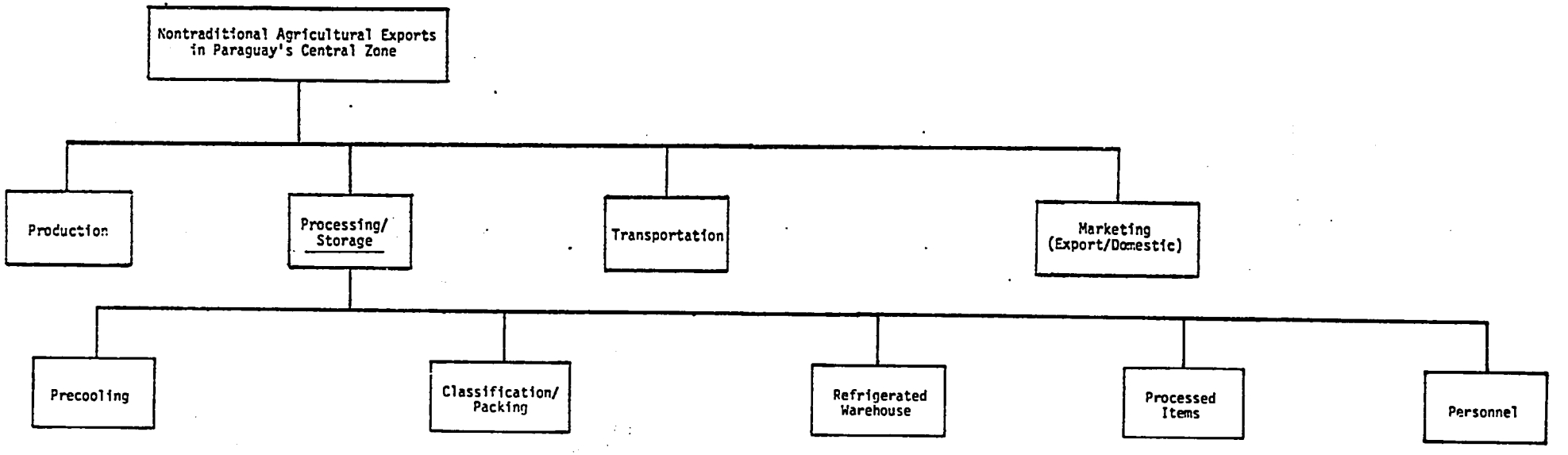
TABLE 2

PRINCIPAL HARVEST DATES IN PARAGUAY FOR POTENTIAL CASH CROPS OF SMALL FARMERS

Crop \ Month	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	Frost - Winter →						Hot - Summer →					
Avocados									xxxxxxxx	xxxxxxx	xxxxxxxx	xxxxxxxx
Garlic					xxxxxxxx	xxxxxxxx	xxxxxxxx					
Corn							xxxxxxxx	xxxxxxxx				
Bananas								xxxxxxxx	xxxxxxxx	xxxxxxx	xxxxxxxx	xxxxxxxx
Beans							xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxx	xxxxxxxx	
Batatas					xxxxxxxx	xxxxxxxx						
Onions					xxxxxxxx	xxxxxxxx	xxxxxxxx					
Cotton									xxxxxxxx	xxxxxxx	xxxxxxxx	
Strawberries		xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx							
Guayabas												
Mandioca	xxxxxxxx	xxxxxxxx									xxxxxxx	xxxxxxxx
Tobacco							xxxxxxxx	xxxxxxxx	xxxxxxx			
Mangoes								xxxxxxxx	xxxxxxxx	xxxxxx		
Lemons										xxxxxxx	xxxxxxxx	xxxxxxxx
Melons							xxxxxxxx	xxxxxxxx	xxxxxxx			
Peanuts							xxxxxxxx	xxxxxxx		xxxxxx		
Oranges	xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx							xxxxxxxx	xxxxxxxx
Peppers			xxxxxxxx	xxxxxxxx								
Pineapple							xxxxxxxx	xxxxxxx				
Papayas	xxxxxxxx	xxxxxxxx								xxxxxxx	xxxxxxxx	xxxxxxxx
Potatoes						xxxxxxxx	xxxxxxx					xxxxxxxx
Grapefruit	xxxxxxxx	xxxxxxxx	xxxxxxxx	xxx							xxxxxxxx	xxxxxxxx
Grapes							xxxxxxxx	xxxxxxxx	xxxxxxx			
Tomatoes			xxxxxxxx	xxxxxxxx		xxxxxxxx	xxxxxxx					
Rice										xxxxxxx	xxxxxxx	



SOURCE: Agribusiness in Latin America by James Austin



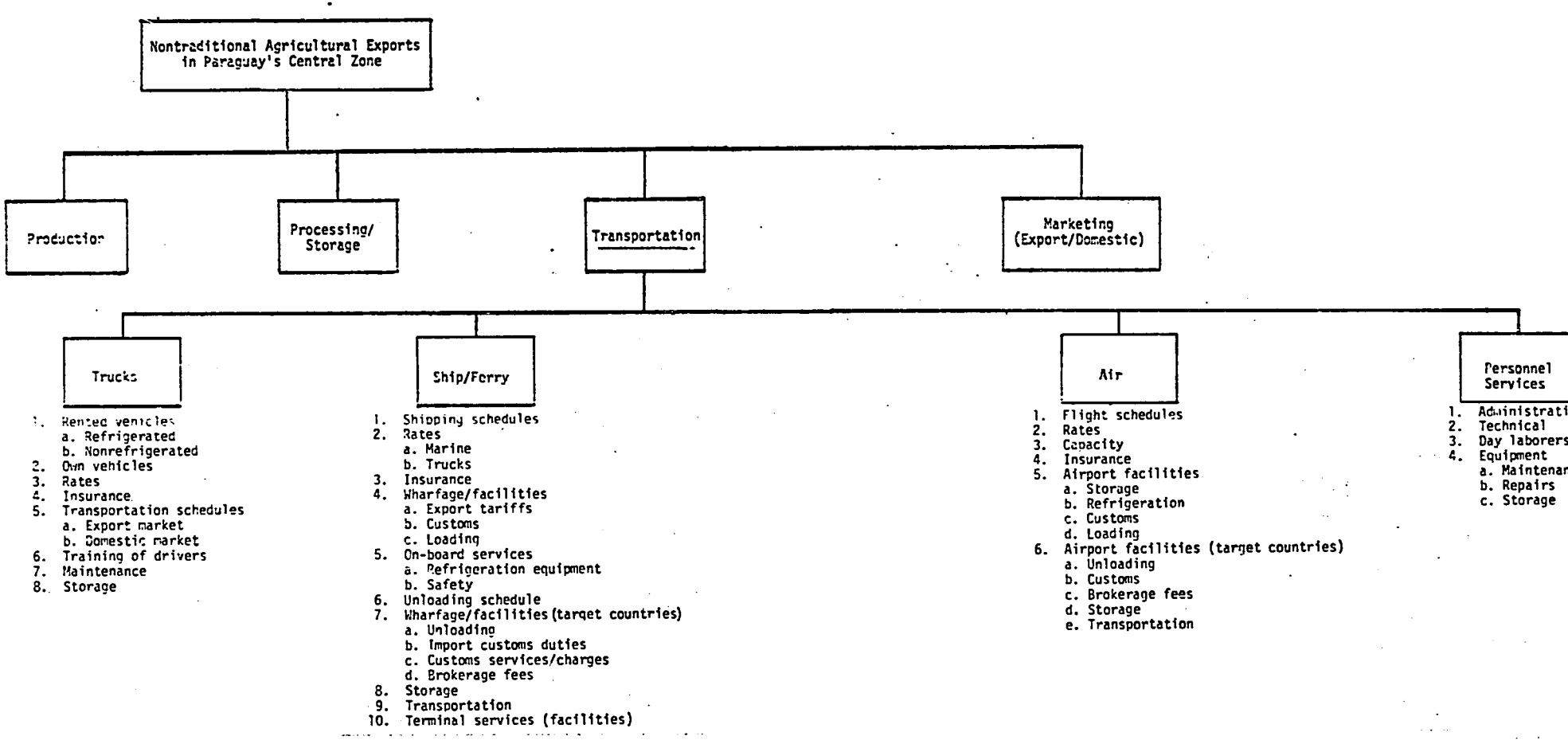
1. Equipment/basic commodities
   a. Vehicles
   b. Hydrocoolers
   c. Crushed ice
   d. Crates
   e. Boxes
   f. Baskets
2. Labor employed
3. Technicians
4. Training
5. Record programs
6. Refrigerated storage

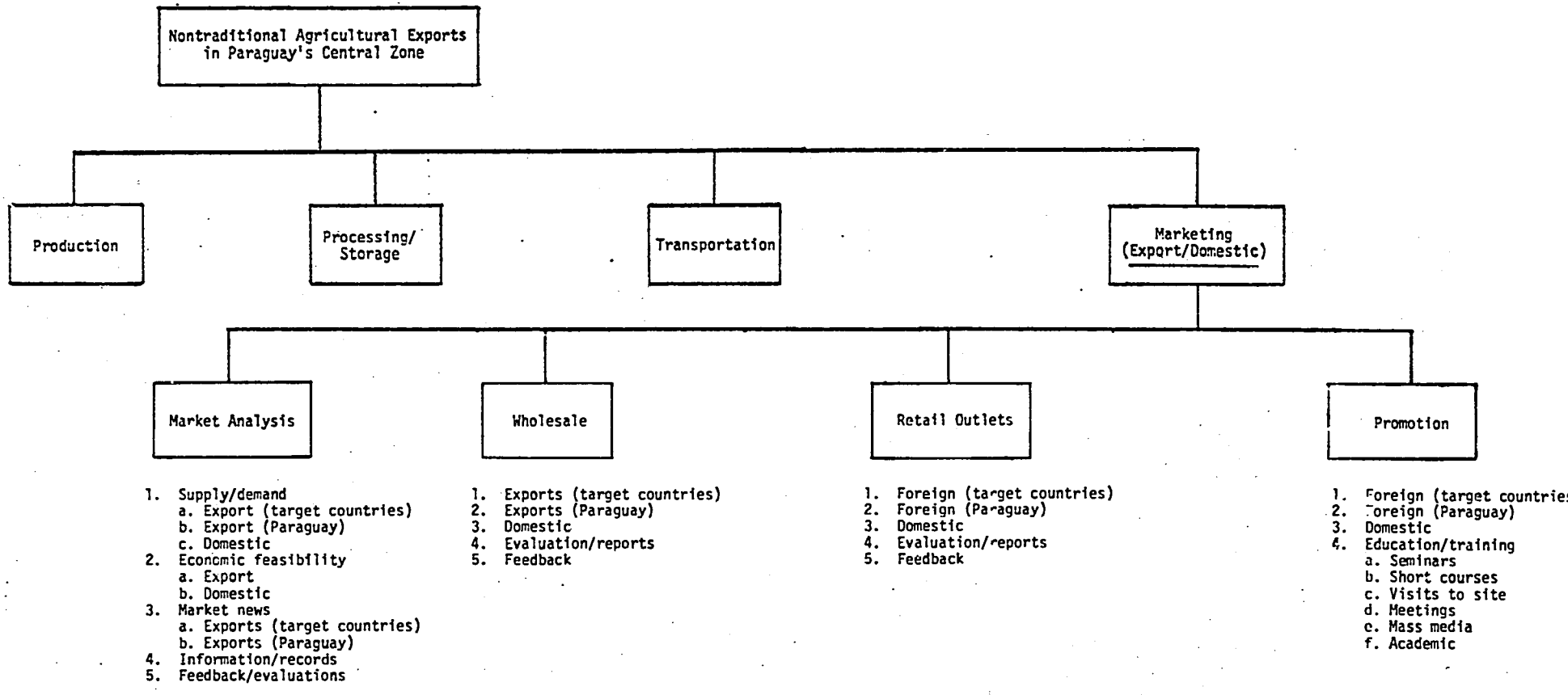
1. Class ication programs
2. Sorting lines
3. Waxing
4. Sorting
5. Sorting
6. Packing
   a. Crates
   b. Boxes
   c. Baskets
   d. Pallets
7. a. Sorting
   b. Packing
   c. Storage
   d. Transportation
8. Noncommercial items
   a. Animal feeds
   b. Waste

1. Refrigeration schedules
2. Storage
   a. Export market
   b. Domestic market
   c. Rent
3. Irventory control
4. Technical services
5. Supervisory/management

1. Frozen
2. Canned
3. Juice
4. Dry
5. Animal feeds
6. Other

1. Skilled
   a. Administrative
2. Semiskilled
3. Nonskilled





APPENDIX A

EXPORTS OF FRESH AND PROCESSED FRUITS AND VEGETABLES
DURING THE YEARS OF 1974 TO 1977

1974	FRESH FRUITS	NET KILO	U.S. $ VALUE
Tomato	Argentina	4.325.612	1.170.356
Red Pepper	Argentina	1.300.942	511.584
Pineapple	Argentina	3.213.358	556.521
Grapefruit	European Countries	451.875	14.460
Grapefruit	England	727.500	23.280
Strawberries	Argentina	43.673	21.437
1974	PROCESSED FRUITS		
Candied Grapefruit	Argentina	498.000	243.540
Natural Pineapple	Argentina	1.169.205	402.270
Pineapple Juice	Argentina	57.316	63.055
Grapefruit Juice	Argentina	352.000	127.600
Crushed Pineapple	Argentina	40.200	12.060
1975	FRESH FRUITS		
Tomato	Argentina	2.269.895	917.154
Red Pepper	Argentina	864.010	671.739
Bananas	Argentina	5.000	1.250
Pineapple	Argentina	1.896.700	750.892
Grapefruit	European Countries	969.250	48.463
Strawberries	Argentina	3.060	3.709
1975	PROCESSED FRUITS		
Candied Grapefruit	Argentina	425.896	318.760
Grapefruit Marmalade	Argentina	25.000	11.250
Natural Pineapple	Argentina	528.000	536.143
Grapefruit Juice	Argentina	115.000	66.240
Crushed Pineapple	Argentina	20.000	54.000
Candied Pineapple	Argentina	20.000	54.000

1976	FRESH FRUITS	NET KILO	U.S. $ VALUE
Tomato	Argentina	2.750.118	746.429
Red Pepper	Argentina	735.978	394.897
Pineapple	Argentina	1.408.860	398.064
Grapefruit	European Countries	465.000	23.250
1976	PROCESSED FRUITS		
Candied Grapefruit	Argentina	230.000	135.000
Natural Pineapple	Argentina	37.200	30.971
Sweetened Pineapple Preserves	Argentina	420.000	400.155
1977	FRESH FRUITS		
Tomato	Argentina	1.925.500	611.349
Red Pepper	Argentina	1.492.055	847.829
Red Pepper	United States	4.208	2.735
Pineapple	Argentina	1.263.600	331.927
Grapefruit	Argentina	70.000	3.500
Grapefruit	England	172.500	8.625
1977	PROCESSED FRUITS		
Candied Grapefruit	Argentina	537.000	285.240
Natural Pineapple	Argentina	340.676	316.693
Natural Pineapple Chunks in Syrup. For Industrial Use	Argentina	63.000	60.997
Grapefruit Juice	Argentina	199.000	90.650
Natural Pineapple Pulp, Unsweetened. For Industrial Use	Argentina	12.850	17.372
Sliced Pineapple	Argentina	127.900	110.019

EXPORTS OF AGRICULTURAL PRODUCTS - 1970 to 1976

Volume in Tons and Value in Thousands of Dollars

	1973		1974		1975		1976	
	VOLUME	VALUE	VOLUME	VALUE	VOLUME	VALUE	VOLUME	VALUE
TOBACCO	17,523	7,457	24,054	11,442	24,959	12,017	27,456	14,692
SEEDS FOR INDUSTRIAL USE	59,926	12,155	121,248	20,392	111,787	19,092	219,691	34,141
CORN	2,800	186	4,580	416	5,815	572	12,000	1,205
YERBA MATE	575	63	1,491	225	679	269	1,348	503
FRUITS AND VEGETABLES	5,472	569	14,246	2,646	38,663	5,744	6,679	1,673
COFFEE	2,858	2,667	4,025	3,987	5,935	8,718	3,559	7,810
OTHER AGRICULTURAL PRODUCTS								
COTTON FIBER	18,605	11,622	17,464	16,500	26,525	20,107	32,638	34,610
SUGAR	6,500	1,103	20,000	10,005	13,580	6,557	3,500	952
ALCOHOL AND CANE	1,391	246	132	94	153	157	94	105

APPENDIX B

APPENDIX C

The following model represents the marketing component of the commodity systems approach. The expected net profit of a particular crop is what one should be looking for with this model. It tries to do this by looking at the effect of competition, the basic equation of cost of production and other costs in the system, and prices. The model deals with demand in the world market in a limited way.

It is important to stress that this is a real world model and is difficult to thoroughly follow in developing countries where statistical data is limited. To design and conduct the research necessary to develop more reliable data is extremely expensive and time consuming. In fact the data is out of date at the time it is completed for purposes of its planning of next years' crop due to the "cobweb theory" of economics. What this teaches us is that a high price for this year's crop will bring excess production of next year's harvest and the prices will be lower. In specializing to increase production they may lower the cost per unit and increase the yield per hectare. These and other problems related to research technique and noncomparable times or conditions means almost total frustration for the planner who believes that he cannot work without accurate data.

One can accomplish one's objectives and gather the data much more quickly if one makes the best of what can be found. In statistics, it is said that the "law of large numbers" allows one to make pro-

jections or draw conclusions because when a great deal of information is collected the errors on the high estimate will cancel out the effect of the errors on the low estimate.

In any sense, one value of this model is that it lays out all known and available data in one place and identifies the source and date. It also calls for conversion to standard units of measurements. Those who work with it can continually challenge the assumptions or estimates on which calculations are made, providing the opportunity to replace data with new and best estimates. Consequently, as stated in the introduction, the dynamism of the model is one of its best qualities.

Both the private and public sectors can use this model. Comparisons between alternative crops, target export countries, and levels of agricultural technology can be performed to determine what crops to grow, where to export them and how much the country can or should produce. Exporters, processors and farmers' cooperatives can better coordinate their activities if they can share the same information base.

The Reyes contract team recommends that the model be used with stratification to fit the small farmers as the target group. The user of the Paraguay model must not change the frame of reference of the research of the market in mid stream. One must follow it out to its completion, keeping the small farmer as the frame of reference in

all decisions on modifications or in deciding which of the many differing sources of data to use to plug in statistics. For example, when production and costs with "modern technology" are indicated, it means the best farmer using the latest and best equipment found in the study area of Paraguay in the small farmer stratum.

When the model moves into the area of import substitution and export, the frame of reference changes. Modern technology may be changed to reflect the technology used by the largest and best farmer in the country with which Paraguay competes or in that which is being studied. For example, the model may have to be expanded to show Ecuador as the modern technology country for bananas and a new set of sections added to also reflect the most modern banana technology of the target country, Argentina. If Paraguay can fit its price FOB (with all transportation and marketing cost) somewhere under the FOB delivery price of Ecuador (assuming no quality considerations in bananas), it will prevent Ecuador from competing in the Argentina banana market. Obviously Ecuador or any other producing country is a competitor in Paraguay if it can export to Asunción more cheaply than Paraguayan producers can deliver their products to market; then, imports will push Paraguayan agricultural producers out of the market.

Import substitution can help the government improve its balance of payments. The model can be used for this purpose in mind. The frame of reference changes to make the adjustments needed in the model.

Most of the data stay the same with changes being principally in "Estimated Modern Technology" and "the world market price" may be substituted by the country that is penetrating Paraguay's market (e.g., "Argentina Modern Technology" and "Argentina market price" would replace the world as the frame of reference of the study of the model).

"Caution flags" go up when a new country appears in the Paraguayan marketplace of agricultural products. The new country may have developed a comparative advantage that will drive the Paraguayan product out of the market. "Alert flags" of opportunity to up when Paraguay sells to a new country. There may be a new export opportunity that is worth a study of the model -- adding the new country. The alert flags of opportunity go up when conditions change due to weather or other factors such as higher transportation cost changing the balance in comparative advantage favoring Paraguay or hurting Paraguay. Perhaps under this change new crops could be added to Paraguay's exports.

Each new crop that is added to the national model makes it easier to evaluate the new opportunity or new threat. The small farmer is a victim of the risks of nature, and good planning should lower his risk in the market place. The model can also be used for a single crop from small farm to national market.

The elements of the model are:

1. World market price

This is of interest because the producer in all the world who can reach the target market with the lowest Free on Board (FOB) sale price in that country is the producing country with a comparative advantage in the crop, if we assume there is no preference or qualify differentiation in the crop. If you want to study a specific target country, like Argentina, this means you enter data about Argentina only in a separate set of columns.

Market prices on crops sold in Regional South American countries are not readily available in Paraguay. Typical sources of information are the commercial and agricultural attaches of foreign embassies; international banks; importers and exporters; and trade associations in the U.S., such as the United Fresh Fruit and Vegetable Association. It is imperative that Paraguay develop the capabilities to collect and review this information on a regular basis.

2. Prices of local market at time of study

This is the market price in the area of a crop of average quality produced by the small farmers. The prices for products of the small farmers can be estimated by looking for the average to low quality product and taking the average price in the market place. Depending on the purpose of the study, one could use the price at each stage in the marketing chain: the farmer's selling price, the selling price of the acopiadores or middlemen, the wholesale market price,

and the price to the final consumer. These prices could be obtained by checking the closest market to the farmer, the biggest market near the farmer, Mercado 4 in Asuncion, city grocery markets and supermarkets. Prices over time could be obtained from the Central Bank of Paraguay and the Ministry of Agriculture, although prices obtained from these sources are probably only projections.

Care must be exercised to distinguish between crops grown in Paraguay and those imported from Argentina and Brazil. Prices of legal and illegal imports should be further distinguished. Conversation with retail sellers should quickly establish the origin of the produce or processed commodity. It is more difficult to establish the legality of imports. Comparisons between prices at dockside, where registered value is recorded, and those in the supermarket, is one way. Another way, requiring much more sensitivity, is to solicit the information from retail sellers.

3. Local market price estimated with modern technology

Modern technology can be used to make a comparison between existing technology in the stratum (farmer being studied) and the competitor with whom he will compete. This shows who has comparative advantage in the market place; e.g. Paraguayan farmer vs. Argentina or U.S. farmer or small farmer vs. Japanese farmer in collectives. This is either a crystal ball look into the future based on the best educated guess available or a way to show price rewards for improved quality

in today's market based on the highest quality grade produced by the target farm stratum. This may mean that flooding the market might reduce actual price, even with better quality. However, better roads, improved management and an efficient marketing system might, by avoiding over supply, increase profits to producers who are inefficient and pay rewards of higher net profits to those who are efficient users of modern technology.

Again, conversation with retail or wholesale sellers can establish the price differences. Once again, the market research must be careful that lower costs of foreign produce are actually due to modern technology and not to illegal imports.

4. Differences between world market price and local market price and between world market price and local price with modern technology

The first part of this shows whether the small farmer in the target stratum is at a comparative advantage or comparative disadvantage with the world or the target country being studied. For local price, one should use that of the crop of average to low quality. The latter figure tells you if you can compete at the highest and best technology of the small farmer. If the world is the target market or area studied, the modern technology affecting the price may be that of the very best producer in the world or the average total market price in the most efficient country.

5. Import price

This is possibly the most important part of all the model for several reasons. Cheap imports ruin the market if imported goods are lower priced than the market sale price of the small farmers target group. Also, there is always a danger of new technology giving another country a comparative advantage over Paraguayan farmers. At the first sign of a new foreign competitor, one should find out why it can grow and ship the product to Paraguay. If the imported market price is or appears to be permanently lower, Paraguay should stop growing that crop or close the border to the crop. This is a Free on Board price at Asuncion, Paraguay. It is the last price in the chain at the point being studied. Depending on purpose of the study, one can use the price from anywhere in the world or from a specific country. To determine this price, collect statistics on foreign country market price; to this, add: export cost in country of origin, transportation cost to Paraguay, import cost in Paraguay, and all other costs plus commission to the FOB buyer in Paraguay.

Sources to obtain this information include: Central Bank of Paraguay, Ministry of Agriculture, importer - exporter and U.S. government sources in exporting country, such as AID, Foreign Agricultural Science of the Department of Agriculture, and Department of Commerce.

Because of the problem with illegal imports, it is imperative to include these prices in this column. One could ask at the market or

ask an importer, where do their products come from and what do they cost; and if we were going to buy this illegally, how much would it cost?

6. Current production cost

This is the cost experienced by the average farmer in the stratum studied. In an economy where many different crops are grown on a farm, the small farmer will probably have no idea of costs separating one crop from another. To him, it is one unit cost -- that of the farm; also, it is difficult for the farmer to define cost of labor by the crop, especially when much of it is from the family; seeds are probably from the previous year's crop. In essence, there are probably not many out-of-pocket expenses, except for things like insecticides. Because of a lack of published information on the current production cost of the small farmer stratum, the researcher must estimate these costs by substracting or adding a weighted amount to any existing data. One of the fastest ways of estimating is to interview the average farmer of the stratum to find his current production cost. Acopiadores may also know. Sources of credit to farmers or local comerciantes should know. The interview answers should then be averaged.

A quick source is to get the market price at the farm gate and assure that no profit on the crop to farmers will be included. This may be the best source available. However, they are likely to underestimate costs, giving no value to management and labor. The most accurate

way is to study the work of the target stratum from planting to harvest, calculating the cost of each step. Although more precise, this requires more time than typically available.

7. Production cost estimated with modern technology

This is the production cost of the very best farmers using the latest and best equipment and technology actually found in the stratum. This assumes that the better one produces, the cheaper the crop is, owing to economies of scale and efficiency of superior management. If any strata have been studied locally, one can use those weighted with a plus or minus factor to show differences in the cost of technology. The quick method is to interview the best farmers in the stratum, and acopiadores and others who might be able to give a good estimate, such as the extension service representative. Average or use the best estimate.

In those cases where no modern implements are used, this would be considered the highest and best technology. Yet one instance of modern inputs utilized by the target ground or small farmer is enough to establish the level of technology.

8. Difference in cost between traditional and modern technology

This is to check the assumption that the cost of production per unit goes down due to better technology because of higher yields and improved quality. If the yield and the quality do not improve, it is conceivable that the equation would be changed to reflect higher

cost due to fertilizer, insecticides, etc. In this case, the equation would read 6C - 5C equals loss due to modern technology cost.

9. Production incentives allowed

Essentially, this is any good news that would lead to one's decision to grow a particular crop. In other words, what is the government doing to promote the production of this crop? By definition, if there is an incentive, someone wants to increase production. It is important to know why; it could be to increase the volume of production, or just to lower price to the consumer. If there is a loss, of course, the farmer suffers it.

An incentive may take many forms: credit to the producer who grows the desired crop; market news on a crop; technical assistance to those who grow the crop; free or cheap, improved and adopted varieties by seed; free shipping containers. Thus, it could mean non-currency figures. However, a value could be given based on an estimate of the worth.

The Ministry of Agriculture, the Bank of Fomento, and the Central Bank of Paraguay are but a few sources of this information.

10. Anti-incentives of production

This represents any restrictions to entry by the small farmer to produce the crop. These include things like export tariffs, taxes on inputs for production and marketing activities; disease that increases cost due to chemical treatment; laws that do not favor producer

interest; smuggled or contraband entry of direct competing crop or substitute for it; actions of other nations that adversely affect local producers; a monopsony or ologopsony, wherein there is only a single buyer or price fixer in the market; and any condition or act that increases the risk to the producer.

11. Total production cost using current strata technology

This is the actual cost after adding incentives and subtracting anti-incentives. Or in other words, the farmer's cost minus the good news plus the bad news equals the real cost. These should be calculated to include all incentives and disincentives in the entire commodity claim.

12. Total production cost with modern technology

This is the same as the above except calculated with cost of modern technology. Note that the incentives and disincentives might be different for those utilizing different levels of technology, e.g., access to credit.

13 and 14. Current national production: volume and value

This represents net yield after all losses in the system, not hectares planted. Comparative economic feasibility also depends on value of production. Crop A might have a lower per unit value than Crop B, but if it can be produced at a greater volume and there is a concomitant demand it might become a crop of higher value to the producer. One should be aware, however, that most published figures are not accurate. Illegal imports increase volume; illegal exports decrease it. Some production

is not accounted for, as in the case of avocados. And for many nontraditional fruits and vegetables, figures are not even maintained.

Published reports from the Ministry of Agriculture are the source with which to begin.

15 and 16. Estimated national production with modern technology: volume and value.

This is the summation of various strata and may be a crystal ball estimate. It includes modern technology of the small farmer stratum plus modern technology of the medium stratum, plus modern technology or best technology of large farmers. For comparisons one could use, best farmers or average farmers in target countries or the world.

17 and 18. Current imports: volume and value

The need for this information has already been established in number 4. This is to include legal imports plus estimated illegal imports. The farmer can be obtained from the Central Bank of Paraguay or the Customs Department; the latter can be obtained from talking to importers who might have an idea. Average the results.

19 and 20. Current exports: volume and value

This would include legal exports plus estimates of illegal exports. An alternative method is to take the estimate of the national production, minus national consumption, minus spoilage or loss, minus illegal exports. Central Bank of Paraguay maintains figures on legal exports.

21 and 22. Average current production per hectare: volume and value

This is the yield and its value enjoyed by the average farmer in the stratum for one hectare's production of a particular. This can be compared to the figures for the most modern farming technology and the most fertile farming areas with which sm. ll farmers in the Central Zone would compete. Comparative advantage for crop production can be reviewed from these comparisons.

One can ascertain this figure by asking a number of small farmers in the different states of the Central Zone what their yield is for this crop year then average the results. Such a study should be done at harvest time to minimize mistakes. This figure would change every year due to changes in the weather and in use of farm implements. Consequently, any results are good only for the crop year in question. A less precise way is to average the yield figures listed by state in the data book compiled by the Ministry of Agriculture. However, this is at best an estimate and does not factor out large farmers.

23 and 24. Estimated average production with modern technology: volume and value.

This is the yield and its value enjoyed by the farmer in the stratum, utilizing the most modern technology, for the production of a particular crop. This would enable planners to determine if by even using modern technology small farmers in the Central Zone can competitively produce a particular crop.

The Marketing Component of an
Agricultural Commodity System

for

PARAGUAY
CENTRAL ZONE

Target Stratum - The Smallest Farmers

CULTIVOS	This column can be used for notes, size of shipping container, point of origin or destination. Date information was collected, source page and telephone number, etc.
1. Fresh Tomato (Tomate Fresco) a. Canned (Enlatado) b. Paste (pasta)	
2. Fresh Garlic (Ajo Fresco) a. Dry Garlic (Ajo Seco)	
3. Fresh Sweet Pepper (Pimiento Fresco) a. Canned(Enlatado)	
4. Fresh Pineapple (Piña Fresca) a. Juice (Jugo) b. Canned(Enlatada)	
5. Fresh Strawberries (Frutilla Fresca) a. Frozen(Congelada)	
6. Fresh Onion (Cebolla Fresca) a. Dried (Seca)	
7. Bananas a. Carapé b. Oro	
8. Fresh Mango (Mango Fresco) a. Juice (Jugo)	
9. Fresh Avocado Aguacate Fresco	

126 ₲ = $1

World Market Price per Unit
(Precio del Mercado Mundial por Unidad)

(Researcher enters the price and common measure for the unit as found in the source. Later all units are converted to kilo unit or other standard measure of the country).

(Each crop must be broken down into all the forms of processing being studied. Each processing or elaboration or method of selling it is a new line item that is treated like a new one)

CROP (CULTIVO)	Weight-Reported Unit (Peso - Unidad de Medida)	Price Reported for Unit (Precio por unidad de medida)	Date (Fecha)	Price Source (Fuente del Precio	* Conversion to kilos and Price per kilo Convertir a kilos y el precio por kilo en ¢ y $		
					One kilo unit or other metric unit if volume or measure.	Price one unit in ¢ per kilo	Price one unit in $ per Kilo
1.	30 lb. ctn. large	$9.00	Feb. 18	U.S. Fresh Fruit and Veg. Assoc. market new		75.6	.66
2.	N/A						
3.	bu ctn.	8.25				76.2	.605
4.	5s carton	7.25					
5.	pint	.70				194.	1.54
6.	50 lb sack	3.75					.165
7.	40 lb. ctn.	8.00					.44
8.							
9.							

* Note: People who are accustomed to work in pounds and dollars would add columns for converting to dollars per one pound.

PRICES OF LOCAL MARKET IN TIME OF THE STUDY
Precio de Mercados locales en la actualidad
(List price as sold in unit as commonly sold and converted later to standard) (De la lista del precio de venta por unidad como se vende comunmente y convertido luego a standard)

Date Fecha	Commodity Crop Producto	Price Precio	Unit Unidad	Precio Convertido a Unidad Convertida Converted price to converted Unit				
				Guarani		Dollar		Converted other unit otra unidad
				Kilo	₲	Pound	$	
30 de marzo	1.	50 ₲	kilo					
	a.	30	247 g					
	b.	22	150 g					
	2.	170	kilo					
	a.							
	3.	110	kilo					
	a.	100	120 g					
	4.	100 each						
	a.	40	220 ml					
	b.	100	520 g w/o	liquid				
	5.							
	a.							
	6.	50 g	kilo					
	a.							
	7.							
	a.							
	b. oro	100	1 docena					
	8.							
	a.							
	9.							

1 docena = 1-1/2 kilo

SOURCE: Review of Prices at Mercado 4.

COMMODITY COLUMN	Difference - substract current local market price from world market price. (Diferencia- Restar precio actual del mercado local del precio del mercado mundial.)					
	World Market Price minus Current local Price			World Market Price minus Modern Technology		
	1 Column one	- 2 less column two	= difference.	1 Column one	- 3 less column three	= difference.
1.						
a.						
b.						
2.						
a.						
3.						
a.						
4.						
a.						
b.						
5.						
a.						
6.						
a.						
7.						
a.						
8.						
a.						
9.						
10.						

PRICE: LOCAL MARKET PRICE ESTIMATED WITH MODERN TECHNOLOGY (YEAR or RANGE Of YEAR)

PRECIO: PRECIO DEL MERCADO LOCAL ESTIMADO CON TECNOLOGIA MODERNA.

Date	Commodity Column	Precio por Unidad		Converted Price to Converted Unit Precio convertido a Unidad Convertida		
		Price	Unit	Guaraní	Dollars	Converted Unit
	1.					
	a.					
	b.					
	2.					
	a.					
	3.					
	a.					
	4.					
	a.					
	b.					
	5.					
	a.					
	6.					
	a.					
	7.					
	a.					
	8.					
	a.					
	9.					
	10.					

IMPORT PRICE
Precio de Importación

Date Fecha	Commodity	Price ¢	Price $	Unit	Standard Unit Kilo	Price ¢	Price $	Lb
	1.							
	a.							
	b.							
	2.							
	a.							
	3.							
	a.							
	4.							
	a.							
	b.							
	5.							
	a.							
	6.							
	a.							
	7.							
	a.							
	8.							
	a.							
	9.							
	10.							

CURRENT PRODUCTION COST
(Costo de Producción Actual (sumo)

Note: This is the cost experienced by the average farmer in the strata studied. Use same unit of production in actual group studied and convert to standard unit to facilitate research

Date Fecha	Commodity	Cost per Unit Local Measurement			Cost per Unit Converted to standardized Unit			
		Local Measurement	Cost per Unit Local Guarani	Dollar	Unit Standardized Kilo	Guarani	Dollar	LB Pound
1976	1.	40,000 kg./H						
	a.							
	b.							
	2.	4,000						
	a.							
	3.	20,000						
	a.							
	4.	112,000						
	a.							
	b.							
	5.	13,000						
	a.							
	6.	7,000						
	a.							
	7.							
	a.							
	8.							
	a.							
	9.							
	10.							

SOURCE: For cost data see: Ministerio de Agricultura, Proyecto de Diversificación Agrícola en el Departamento de Paraguarí. Banco Interamericano de Ciencieas Agricolas, 1976.

PRODUCTION COST ESTIMATED WITH MODERN TECHNOLOGY
Costo de Producción Estimado con Tecnología Moderna
Note: This is the production cost of the very best farmer using the latest and best equipment and technology actually found in the stratum.

Date Fecha	Commodity	Cost Per Unit Using Modern Technology			Cost Per Unit converted to Standardized Unit			
		Local Measurement	Guaraní	Dollar	Units in Standard	₲	$	Lb.$
	1.							
	a.							
	b.							
	2.							
	a.							
	3.							
	a.							
	4.							
	a.							
	b.							
	5.							
	a.							
	6.							
	a.							
	7.							
	a.							
	8.							
	a.							
	9.							
	10.							

Note: Research of literature may reveal that data are not accurate or If no data are available use U.S. Data in standarized units and convert to local measurement.

COMMODITY COLUMN	DIFFERENCE - Substract Column Six from Column Five DIFERENCIA - Restar la Columna Seis de la Columna Cinco									
	5 (c) Current Production Cost Average Farmer Costo de Producción Actual for farmer studied in strata				6 (c) Modern Technology Estimated Production Cost Costo de Producción Estimada Tecnología Moderna				Total Difference	
	Units converted to standard units	Cost per actual unit Converted to standard units	¢	$	Standard Units	Cost ¢	Cost $	=	Unit Cost K/¢	Unit Cost Lb/$
1.										
a.										
b.										
2.										
a.										
3.										
a.										
4.										
a.										
b.										
5.										
a.										
6.										
a.										
7.										
a.										
8.										
a.										
9.										
10.										

PRODUCTION INCENTIVES ALLOWED
Incentivos de Producción

Note: This column can be expanded to include non-currency figures (however a value could be given based on an estimate of the worth). Examples might be a column of special privileges for exporters

(9A) Subsidies			(9B) Price Supplement			(9C) Tax Benefits			(9D) Others			Total	
Describe Unit	¢	$	Describe Unit	¢	$	Unit	¢	$	Unit	¢	$	¢	$

ANTI-INCENTIVES OF PRODUCTS
Disincentivos de Productos

Note: This column can be expanded to include non-currency figures (however a value could be given based on an estimate of the worth) examples might be a column of special privileges for exporters

10(a) Export Tariff Aranceles-Exportac.			10(b) Taxes Impuestos			10(c) Others (Describe) Otros (Descripción)
Units	¢	$	Units	¢	$	Raw materials for processing

QUALS	TOTAL PRODUCTION COST USING CURRENT TECHNOLOGY OF STRATUM Costos totales de Producción con tecnología actual del grupo								
	Current Cost = 5 - 7 + 8 Costos Actuales de Producción = 5 - 7 + 8								
	mas + (5) add Actual Costs Costos Actuales de Producción			Menos - (7) substract Production Incentives Incentivos de Producción			mas + (8) add Anti Incentives of Produts Anti-Incentivos de Producción		
	Standard Units	Cost per Unit ¢	$	Standard Units	Cost per Unit ¢	$	Standard Units	Cost per Unit ¢	$

TOTAL PRODUCTION COST WITH MODERN TECHNOLOGY = 6 + 7 - 8 Costos Totales de Production con Tecnología = 6 + 7 - 8								
+ 6 ~~Production~~ Cost Estimated with Modern Technology			+ 7 Production Incentives Incentivos de Producción			- 8 Anti-incentives of Products Disincentivos de Productos		
~~Units~~ Standardized	Cost ¢	Cost $	Units Standardized	Cost ¢	Cost $	Units Standardized	Cost ¢	Cost $

CROPS Cultivos	CURRENT NATIONAL PRODUCTION Producción Nacional Actual				National Volumes Tons or Lbs.
	DATE Fecha	VOLUME (13) Volúmen	VALUE (14) Valor		
	1976		₡	$	
1.					
a.					
b.					
2.		1407 mt.	89386710	709,418	
a.					
3.					
a.					
4. abacachi		20,891,400 plants in production.	799304964	6,343,690	
a. cayena lisa		4,856,400	20095832	1,594,903	
b.					
5.					
a.					
6.		27,754 mt.	1179545000	9,361,468	
a.					
7.		8,617,000 plants in production	495802812	3,934,942	
a.		6,498,800	522108990	4,143,722	
8.					
a.					
9.					
10.					

SOURCE: Encuesta Agropecuaria por Muestro 1976. Ministerio de Agricultura y Ganaderia.

CROPS Cultivos	ESTIMATED NATIONAL PRODUCTION WITH MODERN TECHNOLOGY Producción Nacional Estimada con Tecnología Moderna				Volume tons or pounds
	DATE	VOLUME (15) Volúmen	VALUE (16) Valor		
			₡	$	
1.					
a.					
b.					
2.					
a.					
3.					
a.					
4.					
a.					
b.					
5.					
a.					
6.					
a.					
7.					
a.					
8.					
a.					
9.					
10.					

CROPS Cultivos	CURRENT IMPORTS Importaciones Actuales						
	DATE Fecha	VOLUME (17) Volumen			VALUE (18.) Valor		
		Legal	Illegal	Legal ¢	Illegal ¢	Legal $	Illegal $
1.							
a.							
b.							
2.							
a.							
3.							
a.							
4.							
a.							
b.							
5.							
a.							
6.							
a.							
7.							
a.							
8.							
a.							
9.							
10.							

CROPS Cultivos	CURRENT EXPORTS Exportaciones Actuales			
	DATE Fecha	VOLUME (19) Volúmen	VALUE (20) Valor	
	1977		₲	$
1.				
a.				
b.				
2.				
a.				
3.		1,496,263 K		850,564
a.				
4.		1,263,600 K		331,927
a.				
b.		445,426 K		505,051
5.				
a.				
6.				
a.				
7.				
a.				
8.				
a.				
9.				
10.				

TAKEN FROM: Data of Central Bank of Paraguay

CENTRAL REGION
Region Central

CROP Cultivos	AVERAGE CURRENT PRODUCTION (Per Hectare) Porcentage de Producción Actual (Por Hectárea)			
	DATE Fecha	VOLUME (21) Volúmen	VALUE (22) Valor	
			₡	$
1.				
a.				
b.				
2.		1,587 kg	94,920	753
a.				
3.				
a.				
4.				
a.				
b.				
5.				
a.				
6.		5,185.5 kg	211,309	1,677
a.				
7.				
a.				
8.				
a.				
9.				
10.				

SOURCE: Encuesta Agropecuaria Poe Muestro, 1976.

CENTRAL REGION
Region Central

CROP Cultivos	ESTIMATED AVERAGE PRODUCTION WITH MODERN TECHNOLOGY Producción Media Estimada con Tecnología Moderna			
	DATE Fecha	VOLUME (23) Volúmen	VALUE (24) Valor	
			₡	$
1.				
a.				
b.				
2.				
a.				
3.				
a.				
4.				
a.				
b.				
5.				
a.				
6.				
a.				
7.				
a.				
8.				
a.				
9.				
10				

The following Fact Sheet is included as an example of the type of data that would be required for crop development.

FACT SHEET

L-966

KEYS TO PROFITABLE PEPPER PRODUCTION

Sam Cotner, John Larsen, and Tom Longbrake*

The value of the Texas green pepper crop is approximately $5.5 million yearly, on an average of 6,000 acres. During 1969, the pepper crop in Texas accounted for 2.1 percent of the acreage and 5.9 percent of the value of the Texas vegetable industry.

Areas of Production

The principal area of pepper production in Texas is in the Lower Rio Grande Valley, with scattered production in the San Antonio-Winter Garden and High Plains areas.

Green peppers for the spring market are seeded in late December with most active planting in January. In the Lower Rio Grande Valley, harvest begins during the latter part of May and peak movement and harvest is during June.

Planting for the fall crop begins in May in the High Plains area and continues into August in the Rio Grande Valley. Harvest begins in early August in the High Plains and continues until frost. Production usually is available from South Texas until December or until a killing frost occurs.

Seasonal Movements

Figure 1 shows that peak movement of Texas green peppers to market occurs during May and June for the spring-planted crop and during October and November for the fall-planted crop. About 70 percent of the Texas pepper production occurs during fall and early winter.

Climatic Requirements

Peppers require about the same growing conditions as tomatoes and eggplant. Peppers succumb to a light frost and do poorly when temperatures are in the 40 to 60-degree range. The extreme summer heat in most areas of Texas is too high for fruit set to occur. Fruit that set at temperatures above 80 degrees usually are small or poorly shaped. Very little fruit set occurs at temperatures above 90 degrees. Best yields occur when temperatures range between 65 and 80 degrees during fruit setting.

Soil Type

Peppers grow well on most Texas soils. A loam or sandy loam soil which holds moisture fairly well and has a liberal supply of organic matter is ideal. Light-textured soils which are conducive to earliness are especially desirable where the growing season is limited by frosts. Peppers are not overly sensitive to soil pH, but highly acid soils should be limed to bring them into the 5.5 to 7.0 range.

Fertilizers

Ample nitrogen promotes rapid growth and prevents premature fruit set. Fruit set on small plants will stunt growth and results in small

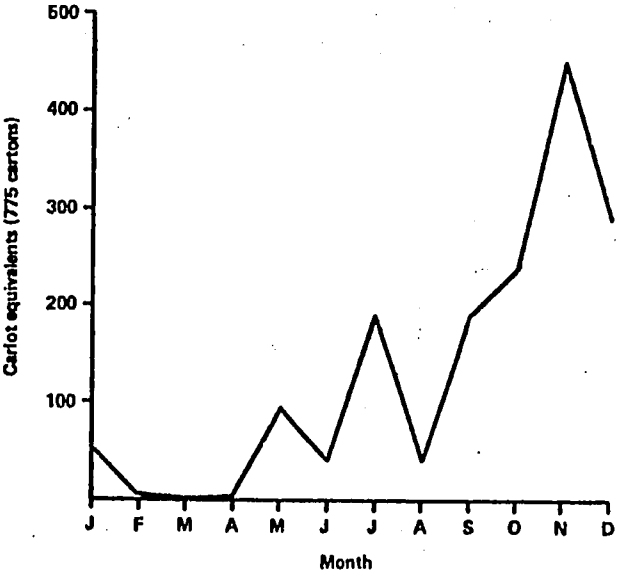


Fig. 1. Average Texas pepper unloads in carlot equivalents by months, 1965-69.

*Extension horticulturists, Department of Soil and Crop Sciences, Texas A&M University.

Texas A&M University • Agricultural Extension Service • John E. Hutchison, Director • College Station

peppers and low yields. Properly fertilized pepper plants normally drop many of their blossoms to prevent fruit set when the plants are too small. Apply about 80 pounds of phosphorus per acre before planting, in bands 2 to 4 inches below the seed. Side-dress with 25 to 30 pounds of nitrogen per acre as soon as a good stand has been established. Continued nitrogen side-dressing at 30 to 40 pounds per acre is recommended during early growth and fruit setting. Soils in most pepper-producing areas of Texas contain adequate potassium to produce good yields, although a complete fertilizer is necessary in East Texas. This will insure continued growth, development of fruit and fruit set. To prevent root damage and plant injury, apply later applications of nitrogen through irrigation water.

Varieties

Several varieties of peppers are grown in Texas. The principal varieties are Keystone, Keystone Giant, Yolo Wonder, Rio Wonder and numerous hybrids. Hot pepper varieties include Jalapeno, Floral Gem and Hungarian Yellow Wax.

Seeding Rates

The Texas acreage of green peppers includes both direct seeded and transplanted fields. Peppers are direct seeded in the field at a seeding rate of about 2 pounds per acre. The plants are thinned to a final in-the-row spacing of about 12 to 18 inches. Approximately ½ pound of seed is necessary to produce enough plants to transplant 1 acre. Transplants are set in the field with an in-the-row spacing of 18 to 24 inches. Between row spacing varies from 30 to 40 inches. Most peppers are planted in single rows, with an occasional field planted to double rows on single beds.

Irrigation

Adequate moisture is essential for production of peppers in Texas. Most of the Texas pepper production is grown under irrigation. The number and frequency of irrigations depend on soil type, humidity and prevailing temperatures. Generally, the pepper crop requires 24 to 30 acre-inches of water during the growing season, applied in six to eight irrigations.

Most of the peppers grown in Texas are furrow irrigated. Adequate soil moisture for optimum growth should be maintained since shedding of flowers and young fruit occurs during soil moisture stress. Peppers are slow to recover from anything that slows the growth of the plants.

Cultivation

As soon as the young plants become established in the field, cultivate shallow. Deep cultivation results in root pruning as well as loss of soil moisture. Avoid damaging the plants during cultivation. Peppers are extremely brittle and subject to damage.

Weed Control

Applications of Prefar at the rate of 6 pounds per acre incorporated 2 inches deep result in satisfactory control of most weeds. Prefar, Dacthal or Treflan applications after transplanting, but before the weeds emerge, also are recommended. Dacthal can be applied to the crop at the rate of 6 to 12 pounds per acre. It also can be applied as a post-emerge treatment directly over the top of the peppers. Apply Treflan only as a post-transplanting or post-thinning operation at the rate of ½ to ¾ pounds per acre and incorporate in the soil.

Pests and Diseases

The major insect pests of peppers in Texas are budworms, leaf miners, aphids, pepper weevils and cutworms. These insects can be controlled by timely applications of recommended insecticides. Cygon controls leaf miners and aphids. Sevin or Parathion provides good control of pepper weevils, budworms and cutworms. *Read and follow label directions before applying any pesticide.* See MP-675, *Texas Guide for Controlling Insects of Commercial Vegetable Crops* for information and recommendations concerning specific insect pests.

Damping-off can be a serious problem of pepper seedlings, especially during cool, wet conditions. Seed treatment, soil applications of fungicides or soil fumigation helps reduce losses from this problem. Bacterial spot often occurs during warm, wet weather. Rotation and the application of a fixed copper fungicide before the disease appears and at regular intervals usually give adequate control. Applications of maneb or zineb at recommended rate (1½ to 2 pounds per acre) result in satisfactory control of Cercospora leaf spot, anthracnose and Phytophthora blight. See MP-902, *Texas Guide for Reducing Vegetable Disease Losses* available from your local county Extension office.

Harvesting and Packing

Peppers normally are harvested when they are about full size and before they turn red or yellow. The peppers are picked in field baskets and hauled to the shed for grading and packing. Peppers are graded into classes such as U.S. Fancy, U.S. No. 1, and U.S. No. 2, according to characteristics, such as firmness, shape, size, color, insect injury, sunburn, diseases and mechanical injury.

Table 1. Estimated cost and returns per acre for Texas fall peppers in the Rio Grande Valley, 1970.

	No. of units and value per unit		Value or cost
Production receipts	350 cartons @ $ 3.47*		$1,214.50
Cash expense			
Tractor and equipment	15 hr. @ $ .80	$ 12.00	
Tractor labor	17 hr. @ 1.50	25.50	
Other labor (thinning, irrigation, hoeing)	70 hr. @ 1.40	98.00	
Seed	2 lb. @ 9.00	18 00	
Fertilizer 200-80-0	280 lb. @ .11	30.80	
Insecticide	10 app. @ 2.25	22.50	
Fungicide	4 app. @ 4.00	16.00	
Herbicide	1 gal. @ 16.00	16.00	
Irrigation water	8 app. @ 3.00	24.00	
Interest on operating capital, 8% for 6 months			$ 262.80
Land expense			$ 10.51
Taxes			
Interest on land investments, 6% $400 per acre	1 yr. @ 11.00	$ 11.00	
	1 yr. @ 24.00	24.00	
Overhead expense: (equipment, buildings, vehicles depreciation)			$ 35.00
Total production costs			$ 25.00
Harvest and marketing expense			$ 333.31
Harvesting (32 lb. carton)	350 @ .40	$140.00	
Packing (includes container)	350 @ 1.35	472.50	
Selling	350 @ .35	122.50	
Total harvesting & marketing cost	$ 2.10 per carton		
Total expense			$ 735.00
Return to management			$1,068.31
			$ 146.19

*Average price for Texas fall peppers for 1965-69 from Vg 2-2 (69), USDA Crop Reporting Service, 1969.

During the packing and grading process, take extreme care to avoid skin breaks and bruising the fruit. Injuries may result in the development of rots during transit or storage. A water bath with 500 ppm of chlorine at 128 degrees F. after grading, and before waxing helps to control intransit fruit rots. Most peppers are sprayed with a wax emulsion before packing.

Various kinds of containers ranging from wooden crates to paper cartons are used for packing purposes. The shipping container should be rigid enough to protect the fruit during the transit period.

Marketing

Texas-grown peppers are sold mainly f.o.b. the shipping point at the prevailing market prices. A small portion of the production is sold directly to chain stores or through local outlets.

Cost and Return

The estimated cost and return of Texas fall peppers is given in Table 1. Bell peppers have one of the highest production costs of Texas-grown vegetables. The total cost of producing, harvesting, packing and selling peppers per 32-pound carton as influenced by yield per acre is given in Table 2. The cash expense, land and overhead cost remain relatively stable. Harvesting and marketing costs per acre vary directly with yield. However, production cost per carton decreases with increasing yields, while harvesting and marketing costs remain the same.

Figure 2 shows the f.o.b. price per carton necessary to break even at various yields. A yield of 350 cartons per acre as indicated in Figure 2 re-

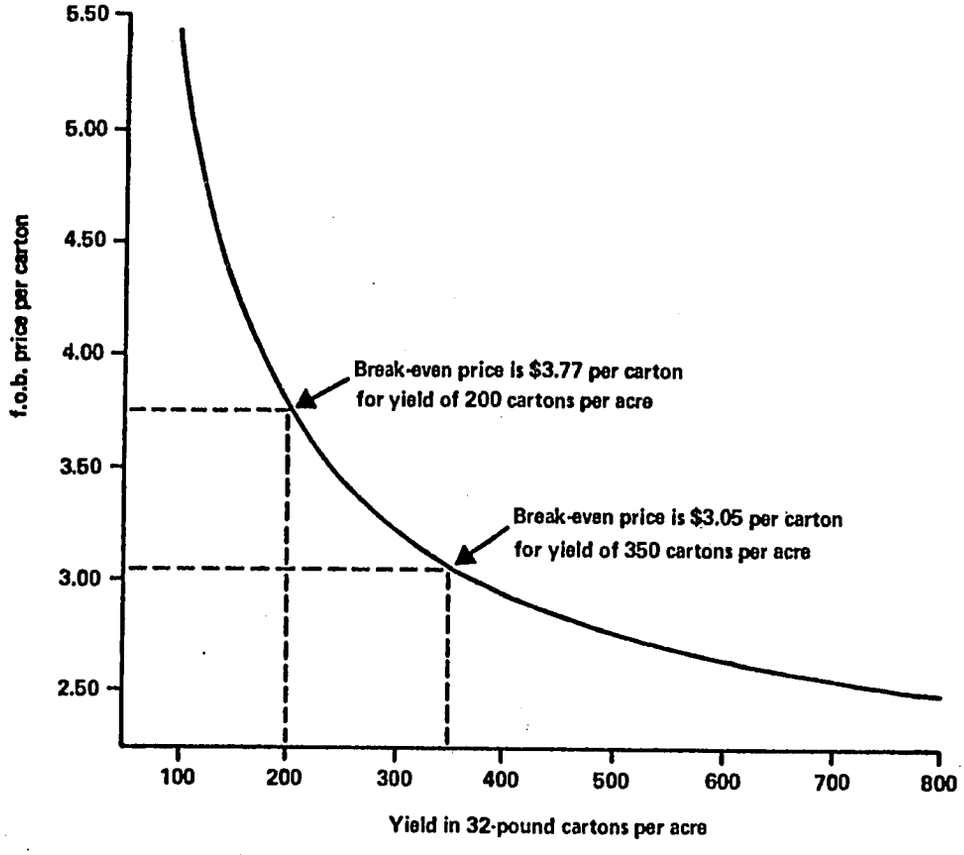
Table 2. Cost of producing and marketing Texas fall peppers as influenced by marketable yield per acre.

Marketable cartons/A.	Cost per 32-pound carton: Production costs[1]	Harvesting, packing, selling costs	Total f.o.b. cost
100	$3.34	$2.10	$5.44
200	1.67	2.10	3.77
300	1.11	2.10	3.21
400	0.84	2.10	2.94
500	0.67	2.10	2.77
600	0.56	2.10	2.66
700	0.48	2.10	2.58
800	0.42	2.10	2.52

Average f.o.b. price of Texas fall peppers for 1965-69 was $3.47 (Vg 2-2 (69), USDA Crop Reporting Service, 1969)
[1]Based on figures in Table 1.

quires a price of $3.05 per carton to break even. A yield of 200 cartons per acre requires a higher price of $3.77 per carton to break even.

The curve in Figure 2 can be used by individuals to estimate potential return based on expected yield or price.



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5M—12-71, Revised

APPENDIX E

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