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ANNUAL RESEARCH REPORT

Development of an Agricultural Diversification  
and Trade Program in Latin America

Contract Number AID/csd - 3632

North Carolina State University  
Raleigh, North Carolina

Fiscal Year April 1, 1972 to March 31, 1973

## REPORT SUMMARY

- A. 1. Project Title and Contract Number: "Development of an Agricultural Diversification and Trade Program in Latin America," AID/csd-3632.
2. Principal Investigator: Richard L. Simmons  
Department of Economics  
North Carolina State University  
Raleigh
3. Contract Period: April 1, 1972 to March 31, 1975.
4. Period covered by report: April 1, 1972 to March 31, 1973.
5. Total AID funding of contract to date: \$108,352.
6. Total expenditures and obligations through previous contract year: None. Current year is first year of contract.
7. Total expenditures and obligations for current year - \$54,919.20
8. Estimated expenditures for next contract year - \$110,734.00

B. Narrative Summary of Accomplishments and Utilization

The objective of this contract is to develop and implement a program for agricultural diversification and trade in Latin America. In accomplishing this objective, efforts are to be directed toward:

- (1) Evaluating the export potential of Guatemala and El Salvador to U. S. and Canadian markets.
- (2) Analyze alternative means and costs of transporting and distributing vegetables from the production zones to the market.
- (3) Hold workshops in Central America to ensure adequate coordination of the research.

To accomplish these objectives, three research subprojects were initiated during the year as follows:

- (1) Estimation of the supply of green peppers in Florida, and the demand for green peppers in the U. S. and Canada for the months of January through April. These estimates were used to evaluate welfare effects of alternative tariff levels on Mexican imports. The study was begun June 1972 and is in manuscript stage. Cooperation with the Food and Resource Economics Department of the University of Florida was established for this project.
- (2) Estimation of production costs and potential supplies of green peppers, cucumbers, and cantaloupes in two regions of Guatemala. Extensive farm surveys are underway to estimate costs of production and transportation to the Miami market for these commodities. This project was initiated in cooperation with the Instituto de Comercialization Agricola (INDECA) of the Government of Guatemala.
- (3) A research contract was sublet to the Food and Resource Economics Department of the University of Florida to estimate the potential of El Salvador to export winter vegetables. This work was started in January 1973, in cooperation with the Direccion General de Economia Agricola (DGEA) of the Minister of Agriculture in El Salvador.

In addition, cooperation was established with the Escuela Nacional de Agricultura of Mexico to coordinate and exchange information available from research recently completed by them on supply

potential in Sinaloa for traditional crops. This information will be reworked to analyze supply potential for winter vegetables.

A research workshop was held during two days in Antigua, Guatemala in August 1972. Representatives from North Carolina State University, Guatemala, and Mexico were in attendance and the groundwork was laid to develop the three research projects mentioned.

Reportable results at this point are only available for the Florida study of supply and demand for green peppers. Estimates indicate that a 1 percent increase in supply would tend to reduce the price by 1.3 percent. Supply elasticities of .65 for the short run and 5.4 for the long run were estimated for Florida production. Elimination of the tariff on Mexican green peppers would result in an estimated decrease of 5 percent of Florida production in the short run and 37 percent in the long run. Mexican exports would increase an estimated 21 percent in the short run and 54 percent in the long run. An increase in the tariff of 100 percent would cause an estimated increase in Florida production of 7 percent and 45 percent in the short and long runs respectively, related to a decrease of 21 percent and 60 percent decline in Mexican exports. In this case, transfers from U. S. consumers to U. S. producers could be about \$700,000 per year and social costs could be 1.5 million dollars.

Some effort was devoted during the year to outlining the theoretical basis for diversification and export expansion in underdeveloped countries. A paper by Hans Binswanger entitled "Problems with the Identification of Optimal Agricultural Export Diversification in Less Developed Countries in the Presence of Trade Distortions"

was written as a guide to the use of spatial equilibrium models across countries. Advantages and disadvantages of various general equilibrium approaches were presented. Also a study on induced innovation in technological change was done by Binswanger, in which he found considerable evidence to support the hypothesis that technological innovations were affected by relative factor supplies existing in the country adopting the change. This study was written as a Ph.D. thesis at North Carolina State University.

## ANNUAL RESEARCH REPORT

### A. General Background

Lesser developed Latin American countries often face difficulties in bringing economic analysis to bear on problems of agricultural export expansion and trade because of two reasons:

- (1) The interdependencies between countries make analysis of a single country's alternatives difficult, since options open to one country depend on actions taken by other countries.
- (2) Lack of trained research personnel in LDCs make it difficult to define and analyze economic alternatives in regard to policy choices.

For these reasons it was considered important that economic research institutions in Latin American countries be given the opportunity to work with a U. S. university in directing research to economic problems that were of mutual interest to two or more countries. Few such opportunities existed on an organized basis prior to the initiation of this contract.

A prior contract with North Carolina State University, AID/csd-3283, provided funding for six months with the objective of (1) defining a specific economic problem of mutual interest to two or more countries which was amenable to economic research on a coordinated basis, and (2) securing the cooperation of research institutions in the countries involved, including specific inputs and commitments for collaboration.

In selecting a particular economic problem on which to collaborate, priority was given to export expansion possibilities which would help

alleviate balance of payments problems, rural unemployment, low farm income for small and medium-sized farmers, and commodities which were currently being emphasized in development programs in the countries involved.

The focus of the project finally selected was an evaluation of the export potential of Central American countries for winter vegetables for U. S. and Canadian markets. Initial concentration was placed on Guatemala and El Salvador.

B. Objectives of Contract

Contract objectives include:

- (1) estimation of the demand for selected winter vegetables in U. S. and Canadian markets;
- (2) estimation of the supply potential for winter vegetables on small, medium, and large farms in the primary production areas of Guatemala and El Salvador, compared with competing areas of Florida and Mexico;
- (3) evaluation of domestic demand and consumption compared with export demand;
- (4) analysis of alternative means and costs of transporting and distributing vegetables from production zones to market;
- (5) summarization of all analytical data developed in (1) through (4) above by using appropriate analytical procedures and models;
- (6) the holding of an annual workshop in Central America to ensure adequate coordination of the research.

Collaboration was developed with the Instituto de Comercializacion Agricola (INDECA) in Guatemala and the Direccion General de Economia Agricola of the Ministry of Agriculture in El Salvador. INDECA has the responsibility for developing exports of vegetables in Guatemala. Also, informal cooperation was obtained with the Escuela Nacional de Agricultura in Chapingo and the Direccion General de Economia Agricola in Mexico for purposes of exchanging information on supply potential with Mexico so that comparisons could be made with Florida, Guatemala, and El Salvador. Finally, informal cooperation with the Food and Resource Economics Department of the University of Florida was developed through which exchange of information on production conditions in Florida will be facilitated.

C. Research Initiated to Fulfill Contract Objectives

1. A comprehensive study of costs of production of cucumbers, green peppers, and cantaloupe in three irrigated districts in Guatemala began in December 1972. Julio Hernandez Estrada, an M. S. student at Chapingo, was hired for six months to direct the study. Field production costs on these vegetables were obtained periodically during the growing and harvesting season in Zacapa, Las Manjau, and Abuncion Mita, three irrigation districts in Guatemala. Plans include using a linear programming model incorporating risk aversion restrictions to analyze the competition between the risky, export vegetables and the safer but lower-income domestic, traditional crops.

2. A sub-contract was let to the Food and Resource Economics Department of the University of Florida to accomplish the necessary research in El Salvador. Objectives of the sub-contract are:

- (a) Determine potential yields, costs, quality, and season of production for several winter vegetables, based on field trial and surveys of existing production.
- (b) Estimate the profitability of the crops for small and medium sized farms, and analyze feasible crop rotations of these crops with other alternative enterprises.
- (c) Estimate the competitive potential for exports of these crops against other Central American countries and Mexico. An M. S. student at Florida, David Zimet, was stationed in San Salvador in January 1973 to direct the work, in cooperation with the Direccion General de Economia Agricola.

3. Arrangements were made for a NCSU graduate student, Carlos Pomaredo, to be stationed at the Escuela Nacional de Agricultura in Chapingo, Mexico, during June, July, and August 1973 to adapt data and information available on resource use in Sinaloa for use in a supply estimation model for winter vegetables.

4. Roberto Castro, a Ph.D. student at NCSU, initiated thesis research in June 1972 on a supply-demand competitive model on winter green peppers from Florida and Mexico. Time series data were used to estimate a demand function for winter peppers in U. S. and Canadian markets and a supply function for Florida production.

D. Accomplishments to Date

(1) Demand for Peppers

The demand for winter green peppers in 41 U. S. and 5 Canadian markets can be characterized by the following demand function:

$$\ln P = 9.64 - 1.32 \ln Q + 1.12 \ln I$$

where P = price in cents per pound

Q = pounds unloaded in 41 U. S. and 5 Canadian markets, per capita

I = disposable income per capita

$R^2 = .95$  and the coefficient is highly significant. Price elasticity is  $-.75$  and income elasticity is  $.85$ . The price elasticity of  $-.75$  indicates that a 10 percent increase in quantities coming to market would depress the price by 13.2 percent.

## (2) Supply of Florida Peppers

There are two main areas in Florida which produce winter green peppers--the Southeast area and the Southwest area. The Southeast area is composed of Palm Beach, Dade, Broward, and Martin counties. The Southwest area includes mostly Collier, Hendry, Lee, and Charlotte counties.

Generally acreages have been decreasing in the Southeast area. Continuous cropping has led to increased disease problems, and alternative uses for land, principally for urban development, has increased rent costs. Alternative crops in this area are snapbeans, tomatoes, sweet corn, squash, and egg plant.

The type of production in the Southwest area differs considerably from that in the Southeast area. Peppers are planted on new land each year. After peppers are harvested, a different crop may be planted or the land may be put to improved pasture. Land rents are lower than in the Southeast area and disease problems less severe. Acreage planted to peppers has generally increased in this area.

Yields in both areas have fluctuated greatly due to weather and disease problems, but no noticeable trend in yield is present.

Because the two areas are apparently different in structure show divergent trends in acreage, an attempt was made to analyze the two areas separately and individually.

The objective of the analysis was to develop a model which would predict the response of Florida growers to specific changes in factors such as price, labor rates, etc. It was decided to use a regression model to try to explain the factors which affected past decisions about acreage planted in the hope that this model could be used as an indicator of the response to changes in future prices which might result from changes in imports.

The supply of winter green peppers in two areas in Florida was analyzed for the period 1954-1971. A mixed adaptive-extrapolative model was used to generate "expected prices," which was included as an independent variable in a single equation least squares regression analysis relating acreage planted to "expected total revenues" from green peppers and other variables.

Initial attempts to analyze the two areas separately were unsuccessful so an aggregate supply equation for the two areas was estimated.

The equation estimated was:

$$\ln Y = \begin{matrix} b_0^{SE}: -.60 \\ b_0^{SW}: -1.75 \end{matrix} \left| + .65 \ln X_1 + \begin{matrix} b_2^{SE}: .18 \\ b_2^{SW}: .32 \end{matrix} \right| \ln X_2 - .02 \ln X_3 \\ + .003 T + .88 \ln X_5 - .66 \ln X_6$$

where Y = expected acreage planted

X<sub>1</sub> = expected total revenue per acre

X<sub>2</sub> = weighted acreage total revenue from alternative crops

$X_3$  = proportion of acreage not harvested in time period  $t - 1$

$T$  = trend

$X_5$  = lagged dependent variable

$X_6$  = cost of production of green peppers

$R^2 = .90$  and the coefficients of  $X_1$  and  $X_5$  were significant at 95 percent confidence level, the coefficient of  $X_6$  was significant at the 90 percent confidence level.

The estimated short run supply elasticity was .65 and the long run elasticity was 5.42.

### (3) Estimated Effects of Tariff Changes

In order to estimate the effects of tariff changes on Florida production and imports from Mexico, the Mexican supply elasticity was assumed to be 10. (Insufficient data on Mexican supplies did not permit quantitative estimates of supply at this time.) With the estimates of demand and supply elasticities derived in the study, and with the supply elasticity of Mexican peppers set at 10, it was estimated that elimination of the 2.5 cents per pound tariff would increase Mexican exports by 54 percent in the long run. Florida production would drop by 37 percent. U. S. consumption would increase by 8 percent. An increase in the tariff of 100 percent would decrease Mexican imports by 60 percent in the long run. U. S. consumers would reduce their consumption 7 percent. The welfare costs of a 100 percent increase in tariffs would be as high as 1 1/2 million dollars.

These estimates will be modified when the results of research in Central America are available. Possible effects of Guatemala exports could be important.

While the organizational effort was getting underway in Central America, some attention was devoted to developing a theoretical framework for evaluating comparative advantage through spatial equilibrium models. Hans Binswanger, a Ph.D. student at North Carolina State University wrote a paper entitled "Problems with the Identification of Optimal Agricultural Export Diversification in LDCs in the presence of Trade Distortions." The paper recommends a procedure for correcting domestic input prices and product supplies for distortion due to protection. Using estimated supply elasticities, the "free trade production set" would be obtained. With estimated domestic demand elasticities, domestic prices could be estimated along with the trade flows associated with free trade. True comparative advantage cannot be estimated in the face of distorted input prices and this paper is useful in pointing out procedures for adjusting for existing trade distortions.

A second theoretical study by Hans Binswanger entitled "Testing the Hypothesis of Induced Innovation," was useful in evaluating options open to LDCs in terms of strategies for accelerating technological change.

In summary, work is underway toward fulfilling the objectives of the contract insofar as the evaluation of the export potential of Central America for winter vegetables is concerned. More detailed results will be available in August, 1973, when the initial study in Guatemala and the work in Mexico are finished.

E. Dissemination and Utilization of Research Results

Since the research has not yet progressed to the point of writing publications, no dissemination has been accomplished. However, since the research has proceeded under close cooperation with INDECA in Guatemala and DGEA in El Salvador, the results of the research are of immediate use to them as information becomes available. Publications will be issued by those indigenous organizations and disseminated as they see fit.

F. Statement of Expenditures and Obligations and Contractor Resources

During the first year of the contract, April 1, 1972 to March 31, 1973, expenditures were as follows:

Salaries	18,312.08
Fringe Benefits	997.58
Travel	4,789.95
Other Direct Costs	2,643.32
Supplies	147.64
Overhead	8,608.54
Sub-contract	<u>20,500.00</u>
TOTAL	55,999.11

G. Work Plan for Coming Year

(1) Continuation of Work on Supply Potential

Research underway in Guatemala and El Salvador on supply potential for winter vegetables will continue. Initial results will be available by late August 1973, at which time a workshop will be held in Central America to discuss and evaluate the results.

Also, in June, July, and August, work will be done in Mexico in cooperation with the University in Chapingo on adapting existing data to analytical supply models, so that supply potential of Mexico can be compared with Guatemala and El Salvador.

A further effort will be made to include data and analysis on supply potential in the Dominican Republic. A trip is planned to Santo Domingo in May, 1973, to determine to what extent cooperation can be obtained from institutions there.

Work will be begun in late 1973 on incorporating the estimates of supply potential of the various countries into a general model of spatial equilibrium and comparative advantage.

(2) Extension of Project Research in South America

Communications with the Oficina Nacional de Integracion (ONIT) in Lima, Peru, have established a basis for cooperation in an economic study of the development of the fertilizer industry of the Andean zone. Plans involve locating a NCSU Ph.D. student, Carlos Baanante, in ONIT for a period of one year, starting in June 1973 to direct the study. ONIT will provide office facilities and the help of assistants in the execution of the study.

(3) Research Workshop

A research workshop will be held in Central America in September 1973 at which time research results will be discussed and further work will be planned.

(4) Graduate Study for Students

The participant training component of the program will be intensified as new graduate students from participating institutions and countries are brought to North Carolina for graduate training. During the past year, efforts were made towards identifying potential graduate students, encouraging them to study English, and helping them apply for admission. During the second year of the

contract these efforts begin to achieve results as the candidates arrive on the scene to begin their study programs.

(5) Anticipated Budget for Coming Year

Salaries and Wages	52,688
Fringe Benefits	4,261
Consultant Fees	1,100
Workshops	3,000
Travel	
International	6,940
Domestic	1,825
Research Linkage	6,479
Telephone and Telegraph	800
Supplies	1,600
Computer Use	1,500
Publication and Field Research	3,000
Sub-contract	8,660
Overhead	<u>18,881</u>
TOTAL	\$110,734