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Termination Report
on
The Contract Program
of
The Tri-University Consortium
for
INTERNATIONAL AGRICULTURE IN URUGUAY
December 8, 1972-April 30, 1976

(Contract AID/1a 722)

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Title

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INTRODUCTION

When Hernado Arias of Paraguay early in the 17th Century shipped cattle and horses down river and released them on the east coast of the Rio de la Plata, he laid the foundation on an agricultural industry which flourishes yet today. The countless descendants of these releases became the resources of meat and hides that attracted settlers to the pasture lands of Uruguay.

The pastures and soils of Uruguay still are the chief resources of the country. Its welfare and its ability to earn foreign exchange for a wide variety of consumer goods are based primarily on the vagaries of the world markets for beef, hides and wool. The end of World Wars I and II and the great depression of the 1930's found Uruguay with agricultural commodities of little demand on world markets. As recently as 1973 when the cartel of oil producing countries suddenly raised petroleum prices and thereby reduced the foreign exchange most countries had available for other imports, Uruguay once again found its exports in low demand.

In the normal non-war years the demand for Uruguayan exports has not been active enough to prevent deterioration and stagnation of agricultural endeavors. The governmental needs for money to finance a highly developed social welfare program has necessitated the taxing of agricultural exports and agribusiness imports. Such taxes, as well as an embargo against the importation of some fruits and vegetables and a paucity of production and marketing information have permitted the development of a carelessness in pest control and other production practices that literally has priced domestic horticultural products off the world market.

Especially within the last two decades the government of Uruguay and its Ministry of Agriculture have tried to widen the spectrum of agricultural production in order to reap foreign exchange from other than the traditional exports of its pastures and soils. The studies with grain production at La Estanzuela and other regional experiment stations in the country have been intensified. The experiment station at Las Brujas serving principally the producers of deciduous fruit and vegetables and the station at Salto dealing with citrus crops have been organized.

The U.S. Agency for International Development has cooperated in encouraging the production and export of the non-traditional crops. Its program in Agricultural Production and Marketing, approved in 1966, has included several support activities, including the assignment of specialists to Uruguay and allocations for participant training. Until 1972 consultants were utilized as considered necessary or as available. U.S. specialists assigned to Uruguay between 1969 and 1972 by the International Development Service advised on agricultural credit, horticultural production, marketing and processing, meat packing, soil classification, commercial fishing, cheese manufacture and marketing and plant disease control.

In 1972 the cooperating agencies - the Ministry of Agriculture and AID - decided to narrow and delineate the procedures and objectives of the program, i.e. to hire an U.S. university to concentrate on increasing the country's export capability of fruit and vegetable products. The Pennsylvania State University was designated the prime contractor of a consortium with two other universities - The Michigan State University and The Texas A&M University. The PSU-AID Contract la-722 became effective over a three-year period from December 8, 1972.

The objective of the contract as detailed in Amendment 5 of the contract modification of 1975 was "to help achieve a substantial increase in non-traditional agricultural products as a base for over-all Uruguayan economic expansion. This project (the contract program) is related to three specific AID goals in Uruguay.

The first is to improve overall economic performance. The second is to upgrade the institutional capacity to implement development activities. The third is to assist in providing technological improvements in the areas of agricultural planning and research. The services to be performed are in two general project categories designed to interact to achieve the objectives." The two categories (Projects) are reported separately in title, objectives, and accomplishments.

I - PROJECT A - DEVELOPMENT PLANNING AND ADMINISTRATION

A. SPECIFIC OBJECTIVES.

1. To increase the economic planning input of the Ministry of Agriculture's Planning Office and the National Planning Office in the decision making process for the agricultural sector by assisting in developing a permanent analytical and communicative capability. This will enable the continuing use of practical and theoretical economic analytical concepts necessary to develop policy issues and recommendations for the Government of Uruguay.
2. To develop production and planning guidelines by means of advanced and appropriate economic model analysis, for the major agricultural production enterprises in Uruguay, to be used in planning and evaluating both at the micro and macro economic levels. The guidelines will represent the typical production systems found in Uruguay by size of operation, geographic location and systems using alternative technologies.

3. To develop a macro analytical model to evaluate alternative government policies with respect to such things as: 1) The market impact of increased agricultural production, 2) The effects on farm total and net income, 3) The change in foreign exchange earnings, 4) Productivity of capital in alternative uses, 5) Producer receptivity and adaptation rates for technology.

B. PROGRAM PERSONNEL.

Assignees:(all from Texas A&M University)

Dr. Clive Harston	February 1973
Dr. Ray Billingsley	February 1973
Dr. James McGrann	February 9, 1973 - April 30, 1975
Dr. Lonnie Jones	June 1974
Mr. Roberto Vasquez	January 1975
Dr. Clive Harston	March 16 - April 6, 1975

Counterparts:

Cr. Viviane Laffitte	May 1973 - April 1975
Ing. Agr. Gonzalo Pereira	May 1973 - April 1975
Cr. Bibiana Troncoso de Davrieux ^{1/}	January 1974 - April 1975
Cr. Alfonso Carluccio	January 1974 - November 1974
Ing. Agr. Lilian Sierra de Alburquerque	June 1973 - October 1974
Ing. Agr. Miquel A. Cetrángolo	October 1973 - August 1974
Sr. Carlos Rogberg	November 1974 - April 1975
Sr. Alejandro Digniero	November 1974 - April 1975

Other Associates:

Ing. Agr. Joaquin Secco, Inter American Institute of Agri Science	September 1974 - April 1975
Ing. Agr. Jose' Ma Ferrari, Inter American Institute of Agri Science	September 1974 - April 1975
Cr. Augustin Benzano OPP (National Planning Office)	March - September 1973
Sr. Alvara Machado, Bank of the Republic	September 1974 - April 1975

C. METHODS OF WORK U.S.D.

Most of the data collected, analyzed and interpreted under Project A were obtained through interviews with producers and research technicians at experiment stations. A standardized procedure for collection, analysis, interpretation and presentation of data was developed. Involved were questionnaire preparation, training of interviewers and the use of computers (for the first time in Uruguay) to identify, classify and analyze the data. Approximately 3/4 of the country's land area is represented in the data collected.

^{1/2} time.

D. ACCOMPLISHMENTS.

I. Publications and Reports: (Extracted from termination report of Dr. McGrann, April 30, 1975).

Technical Series Publications:

- a. Economic Analysis of the Traditional and Improved Production Systems in the Basaltic Area of Uruguay. MAP-DIEA. Technical publication No. 1. October 1974. Montevideo, Uruguay.
- b. Economic Analysis of the Traditional and Improved Production Systems in the Cristalino Area of Uruguay. MAP-DIEA. Technical publication No. 2. December 1974. Montevideo, Uruguay.
- c. Economic Analysis of the Traditional and Improved Production Systems in the Garzon Sub-zone Uruguay. MAP-DIEA. Technical publication No. 3.^{1/}
- d. Economic Analysis of the Traditional and Improved Production Systems in the Sandy Soils area of Tacuarembó, Uruguay. MAP-DIEA technical publication No. 4.^{1/}

Information Papers:

- a. Summary of the Linear Programming Analysis in the Basalto Zone of Uruguay. MAP-DIEA, Montevideo, Uruguay. June 1974.
- b. Economic Analysis of the Production of Lamb and Mutton in the Basalto and Cristalino Area of Uruguay. MAP-DIEA, Montevideo, Uruguay, July 1974.
- c. Linear Programming Analysis of the Dr. Severi Ranch, Durazno, Uruguay. MAP-DIEA, Montevideo, Uruguay, July 1974.
- d. An Analytical Methodology for Studying Summer Crop Pricing Policy. MAP-DIEA, August 1974.
- e. Economic Analysis of Systems of Production. MAP-DIEA, Information Paper No. 5. October 1974.

Conference Papers on Livestock and Crop Production Systems Analysis:

- a. Economic Analysis of the Production Systems in Young. Sociedad Rural de Rio Negro, Young, Uruguay. 1974.^{2/}
- b. Evaluation of a Cattle Breeding System: Economic Analysis of Beef Production in Sandy Soils. Estacion Experimental del Norte, Tacuarembó, Uruguay, 1974.^{2/}
- c. Economic Analysis of Production Systems. IICA Conference, Balcarce, Argentina, 1974.

^{1/} Publication completed and approved but not printed.

^{2/} Publication outside the Ministry of Agriculture's supported division (DIEA, SDEE).

- d. Economic Evaluation of the La Dehesa Demonstration Unit of the CREA, Florida, for the March 1973 to March 1974 Period. 6th National CREA Field Day, Florida, Uruguay, 1974.--

Termination Reports:

- a. Harston, C. R. and R. Billingsley (TAMU). End of Tour Report U.S. AID/Penn State University Project AID/1a 722. March, 1973. 6 pp. Appendices.
- b. Jones, L. L. Development Planning and Administration: A review of progress and recommendations for future activities. Tri-University Consortium-AID Contract 1a/722. Report #8, June 1974. 13 pp.
- c. McGrann, James M. & Clive R. Harston. End of Project Report of the Agricultural Economics Advisors for USAID/Tri-University Consortium in Uruguay. Tri-University Consortium-AID Contract 1a/722. Report #13. April 1975. 22 pp and Appendices.

2. Resume of Results.

Most of the results and conclusions presented in the above publications relate to 5 types of studies:

- a. Input-output relationships for different livestock enterprises at different levels of production technology in various sections of Uruguay;
- b. Economic evaluation through linear programming analysis of typical ranch units in different regions;
- c. Price analyses;
- d. Study of the wheat production sector; and
- e. The economic evaluation of some already established farm units designed for demonstrating improved production practices.

(a) From the study of the input-output relationships Dr. McGrann and Dr. Harston concluded in their termination report of April 1975 that the analysis of the data permitted an understanding of the costs structures of the various livestock enterprises. Variance of cost among producers was found to be relatively low; income variance therefore was best explained by variance in sales price. Small improvements in management and small purchases of off-farm inputs were associated with increased output. For example, only a small improvement in technique and supplies can be expected to improve the percentage of animals weaned to 20-25% above the national average.

(b) McGrann and Harston concluded that the feasibility of increasing livestock production in Uruguay was strengthened by the economic evaluation studies. Production and income could be doubled if

^{1/}Publication outside the Ministry of Agriculture's supported division (DIEA, SDEE).

key inputs (phosphate fertilizer, legume pasture-seed, fencing and water point equipment) were available. Any government action to insure ample availability of such items would be most stimulating to the livestock industry. The 35% rate of return made on purchases of these kinds of equipment in 1973 would seem to remove the need of any type of government credit for these purchases. If livestock growers were to utilize more off-farm inputs, as well as improved production practices, there would be many more demands for labor in both rural areas and in agribusiness establishments.

The economic evaluation of the production of cereal and oil seed crops revealed that improved production methods and utilization of a small amount of imported inputs "could produce a sizeable exportable surplus at prices competitive in the world market." (Note: In 1975 Uruguay is reported to have exported edible vegetable oil. Rice frequently is exported and wheat is sold abroad when the crop is ample and a market exists. CWH). McGrann and Harston suggested that the concentration of animal breeding in areas where improved technology could be utilized and fattening of cattle in improved pastures of a grain rotation plan could cut the beef production cycle by 1-2 years. This procedure alone would materially improve the ratio of cattle slaughter to cattle stock in Uruguay.

McGrann and Harston further concluded from the economic evaluation studies that price instability in livestock and livestock products and in cereals and oil grains had led to low investment by producers into improved practices, key inputs and diversification of production. "The studies point out the need for balanced, long-term agricultural policies for the livestock sector which would include coordination of credit, tax and pricing policy to stabilize income and encourage investments in the livestock sector."

- (c) They found the Price-Information publications to be readily accepted by growers and agricultural technicians because of their access to any long-term information of this type adjusted for inflation was very limited.
- (d) From the study of the wheat production sector McGrann and his counterparts found the sharply decreasing trend in production to be associated with decreasing prices, decreasing availability of farm credit, the increasing cost of farm tractors and adverse weather conditions. Although growers can be expected to respond positively to increased prices and credit availability, perhaps the greatest cause of acreage variation year-to-year is weather during the planting period. If wheat planting is unduly delayed by adverse weather, the growers shift to other crops.
- (e) The economic evaluation of the productivity of already established demonstration units provided growers a cost-income evaluation of the practices demonstrated. In one such evaluation of a pasture management trial near Young, Uruguay, it was shown that practices permitting a meat productivity 7 times that of the national average were economically feasible.

3. Participant Training.

Within Project A of Contract Ia/722 there were no provisions for any type of participant (counterpart) training. A responsibility assumed by Dr. McGrann and other Texas A&M assignees was to prepare their counterparts to manage an ever increasing flow of economic analyses and presentations. Special care was taken to see that the counterparts were trained in and participated in all aspects of the methodology used in the project studies. It is expected that the personnel now associated with the Sub Direction of Econometric Studies (SDEE) have the knowledge and experience in data collection and preparation, in linear programming and partial budget analysis, in computer processing and report preparation to finish the livestock and crop studies, to initiate econometric studies in the rice, dairy and horticultural industries and to analyze agricultural credit and specific cash-flow situations. Given proper support the agency can be expected to provide much of the econometric data and their analyses and interpretation, that will be basic to the development of recommendations and policy by the Ministry of Agriculture and Fisheries.

4. Equipment Procurement.

There were no provisions in Contract Ia/722 for the prime contractor or any consortium member university to purchase materials or equipment for use of personnel assigned to Project A. Transport, office equipment and computer rental were to be supplied by the MAP.

E. OBSTACLES WHICH RETARDED PROGRESS:

Several agencies of the Uruguayan Government were involved in the initial discussions leading to the activation of Project A. For a short time following Dr. McGrann's arrival in Uruguay his support was the responsibility of the planning and program section (OPYPA) of the Ministry of Livestock and Agriculture (MGA). The section of econometric analysis (SDEE) which housed the activities of Project A later became attached to the Direction of Agricultural Economics Research (DIEA). New budget allocations were slow so throughout almost the entire duration of McGrann's assignment support difficulties were encountered. First, lack of transport and office facilities were deterrents; then computer time could not be arranged or paid for, and counterparts were not assigned; later a shortage of printing paper became a problem.

In short the obstacles were those incidental to a project in which the governmental agency had an extreme shortage of resources and apparently an insufficient commitment for personnel and operating funds prior to undertaking the project. It is suggested that assurance of ample project support be made to a contractor before U.S. personnel are assigned to a country. This might require underwriting of certain portions of a project by AID to insure funding where not possible by the host country.

F. SUGGESTIONS FOR FUTURE ECONOMIC RESEARCH.

Although McGrann and Harston felt unable, at the termination of Project A, to place a priority on future economic research within the MAP or to make recommendations for personnel training and resource support, they did outline future research needs in agriculture economics in Uruguay.

Future Research Needs

1. As Continued Effort of the SDEE:
 - a. Finish livestock - crop area study;
 - b. Initiate the rice area study;
 - c. Initiate the dairy area study;
 - d. Serve as back-up to macro analysis being done at Texas A&M University;
 - e. Continue study of agricultural credit and cash flow analysis at the production level and
 - f. Offer support and to coordinate agricultural economic research activities of the CREA and SUL.

2. To Support OPYPA Functions:
 - a. Help coordinate data collection;
 - b. Plan and carry out study to determine machinery capacity and requirements;
 - c. Study the agricultural labor problem;
 - d. Strengthen price fixing basis for crops, consider methodological approach and policy evaluation;
 - e. Assist the supply-demand studies for inputs and agricultural commodities and
 - f. Strengthen methodology for collecting micro data for their projects.

3. In cooperation with the Centro de Investigaciones Agropecuarias (CIAAB):
 - a. Plan and evaluate demonstration units;
 Crop-livestock units: La Estanzuela, Treinta y Tres, Young
 Livestock systems: Tacuarembó, Basalto area
 Dairy system: La Estanzuela
 - b. Support economic evaluation of fruit and vegetable research;
 - c. Assist in statistical evaluation of research results such as is now in progress for forage fertilizer response work at Tacuarembó and
 - d. Assist in agricultural economics and farm management extension.

4. Assist the DIEA Statistical Division:

- a. In planning of census to obtain valuable information.

5. Serve the Plan Agropecuario:

- a. By assisting in planning and implementation of small farm economic and financial study;
- b. Through serving as a back-up to economic problems as they come up and maintain coordination of efforts and
- c. In coordinating efforts with the economic section of the Plan (SERPA).

6. New Areas of Agricultural Economics:

- a. Marketing, Distribution and Demand Studies;

- (a) Distribution, pricing and sources of the input factors of agricultural production;
- (b) Market structure and performance of agricultural products. Study of intermediaries, institutions, channels, regulations, controls, costs related to functions and profits, relative to the domestic marketing of agricultural products. The role of supermarkets, chain stores, voluntary chains, cooperatives, centralized markets, storage facilities, grading systems, market news service, multi-pricing systems, marketing orders and other market related variables should be studied.
- (c) Export demand, export pricing, merchandising of agricultural products in a competitive world market and the economics of imports of agricultural inputs should be studied in depth on a continual basis.

G. FINANCIAL STATEMENT:* (Preliminary)

Salaries and Wages	\$ 76,771.58
Overhead	34,507.24
Fringe Benefits	814.81
Equipment	-----
Allowances	11,621.63
Travel & Transportation	17,478.66
Other Direct Costs	<u>8,295.48</u>
TOTALS	\$149,489.40

* Includes \$134,940.34 of expenditures for Sub-Contractor (Texas A&M University).

II - PROJECT B - AGRICULTURAL PRODUCTION AND MARKETING

A. SPECIFIC OBJECTIVES.

The overall objective supported by this project is to achieve a substantial increase in agricultural exports as a base for overall economic expansion in Uruguay. This goal is closely associated with the second of three specific objectives of U.S. endeavors in the country, that is, to increase exports by five to ten percent per year.

More specifically, the cited purpose of this project is to increase the capabilities of the MGA and other agencies to stimulate production and to improve marketing of agricultural products. The paths of achieving this include (1) the improvement of agricultural research, particularly in non-traditional crops, (2) the development of those key ministry officials who, trained in modern production methods, understand their function in increasing agricultural outputs and (3) the promotion of improved coordination and the formulation of suitable agricultural policies to promote the efficiency of agricultural production.

B. PROGRAM PERSONNEL.

<u>Assignees by Name & University</u>	<u>Assignment Period</u>	<u>Speciality</u>
Hitz, C. W. (PSU)	December 1972-April 1976	Tree Fruit Physiology Post-Harvest Physiology, Chief-of-Party
Boyle, John S. (PSU)	January 1973-April 1973	General Plant Diseases Virus Diseases
Cintron, Rafael (TAMU)	February 1973-March 1973	Citrus Production and Propagation
Morse, Ronald (PSU)	July 1973-August 1975	Vegetable Physiology
Hatch, Anthony (PSU)	August 1973-November 1973	Peach Dormancy Growth Substances
Howitt, Angus L. (MSU)	October 1973-December 1973	Fruit Entomology
Stuckey, Richard E. (MSU)	October 1973-June 1975	Plant Pathology
Cintron, Rafael (TAMU)	November 1973-February 1974	Citrus Production
Mills, Wilford (PSU)	January 1974-March 1974	Potato Pathology
Taboada, Oscar (MSU)	January 1974-March 1976	Agr. Communications
Mahaffy, Stanley A. (MSU)	October 1974-January 1975	Agr. Communications
Hooker, William J. (MSU)	September 1974-December 1974	Potato Pathologist
Wells, Arthur (MSU)	January 1975-April 1975	Vegetable Entomologist

Cintron, Rafael (TAMU)	February 1975-April 1975	Citrus Production
McGrann, James (TAMU)	May 1975-July 1975	Economics
Noll, Charles J. (PSU)	July 1975-September 1975	Weed Control
Carlson, Robert F. (MSU)	August 1975-November 1975	Apple Root Stocks and Varieties
Wells, Arthur (MSU)	September 1975-December 1975	Potato Entomologist
Alexander, Samuel (PSU)	October 1975-November 1975	Fruit Pathologist
Thompson, Norman (MSU)	November 1975-November 1975	Potato Improvement
Boyle, John S. (PSU)	November 1975-February 1976	Virus Research
Powen, Hollis H. (TAMU)	December 1975-March 1976	Fruit Variety Testing Rest Period Studies
Thompson, Norman (MSU)	January 1976-February 1976	Potato Improvement
Croft, Brian (MSU)	January 1976-February 1976	Apple Mite Control

Counterpart and MAP Personnel:

Administrative -

Ing Antonio M. Saravia, Director, Center of Agricultural Research
 Ing Juan C. Curotto, Director, Las Brujas Experiment Station
 Ing Hector Mara, Director, Salto Experiment Station
 Ing J. Tucci, Former Director, Salto Experiment Station

Fruit Research -

Ing R. Talice
 Ing Oman Borsari
 Ing R. Menendez
 Ing A. Formento
 Sr Hugo Nicolini

Vegetable Research-

Las Brujas

Ing C. Crisci
 Ing C. Maeso
 Ing J. Izquierdo
 Ing F. Canale
 Ing J. Villamil

Salto

Senor Ruben Morales
 Senor Ruby Beretta
 Ing H. Mara

Plant Protection-

Ing J. Carbonell
 Ing Jorge Briozzo
 Ing Stella Garcia de Moscardi
 Ing Carlos Moscardi
 Sr E. Zamora

Agricultural Communications-

Ing H. Marrapodi
 Inga Laura D de Ipharraguerre
 Sr R. Martinez

Citrus Investigations (Salto)-

Ing J. Tucci
 Senor R. Mousques
 Ing H. Mara
 Dr. A. A. Salibe, Food and Agricultural Organization (FAO)
 Ing Muller
 Ing Campilla

Agricultural Economics -

Ing Roberts Casas

C. METHODS OF WORK USED.

Probably the primary requisites for improving exports of fruits and vegetables from Uruguay were: a) to determine the crops of greatest export potential; and b) to recognize and understand the production or marketing characteristics that restrained the entrance of the crops into international markets. Of great help in these needs were the several reports of specialists assigned to Uruguay during the IDS era (1969-72), the early assignees of this Contract Ia/722 and their counterparts.

Once a production deficiency was recognized - or needed better definition - a specialist from one of the participating universities was brought to Uruguay where he and his counterparts from the experiment station at Las Brujas or Salto would attack the problem(s) either on a short or long-term basis.

Through the three years of consortium activity in Uruguay there were many examples of significant progress resulting from the procedure but only one example will be given. A factor influencing peach productivity in Uruguay is insufficient cold during the winter to satisfy the rest requirements of many varieties. Dr. Anthony Hatch (PSU) was assigned to Uruguay early in the contract period because of his experience with this difficulty in his home in Mexico. Among his recommendations was an extensive test of low chilling varieties. To expedite the flow of such new varieties into Uruguay for test, Dr. Hollis Bowen, a peach breeder of Texas A&M, where lack of winter cold is an important climatic deficiency, was brought to Uruguay. His analysis of the rest (cold) problem and his promise to supply test varieties from his and other breeding programs should prove of inestimable value in providing selections ideally adapted to Uruguay.

At the date of contract termination 35 varieties of peach and nectarine had been especially selected by consortium personnel for test in Uruguay.

D. ACCOMPLISHMENTS.

1. Publications and Reports:

MAP Extension Leaflets (Hojas de Divulgacion) published in 1975 through Agricultural Information Service. (Listed are only those to which Consortium assignees participated to some extent: in the research, in counselling the preparation of the publication or in editing the manuscript, excepting the aid provided for all publications by Information Specialist Taboada).

Leaflet Number:

- 1) Tomato variety for Industry. C. R. Maeso.
- 2) Brown rot of Potatoes. Stuckey, R., C. Moscardi & S. Garcia.
- 7) Spray Calendar. J. Carbonell, J. Briozzo, C. Moscardi, S. Garcia.
- 9) Spray Calendar for Apple Orchards. J. Carbonell, J. Briozzo, C. Moscardi, S. Garcia.
- 10) Spray Calendar for Peach Orchards. J. Carbonell, J. Briozzo, C. Moscardi, S. Garcia.
- 11) Spray Calendar for Quince Orchards. J. Carbonell, J. Briozzo, C. Moscardi, S. Garcia.
- 13) Pesticide Application in Fruit Orchards. J. Carbonell, J. Briozzo.
- 14) Fertilization of Fruit Orchards. R. Talice, F. Canale.
- 15) Principal Diseases in Deciduous Fruit Trees. C. Moscardi, S. Garcia.
- 17) Principal Pests of Deciduous Fruit Trees. J. Carbonell, J. Briozzo.
- 20) Calibration of a Portable Herbicide Applicator. Charles N. Noll.
- 23) Apple Scab - Effects and Biological Cycle. S. Garcia, C. Moscardi.
- 24) Apple Scab - Standard Control. S. Garcia, C. Moscardi.
- 25) Apple Scab - Control According to the Mills Tables. S. Garcia, C. Moscardi.
- 27) Use of Pheromone Traps - The Time to Spray For Control of Caterpillars--Pears, Apples, etc. J. Briozzo, J. Carbonell.
- 29) Insect Pests and Diseases in Potato. Joaquin Carbonell.
- 30) Insect Pests of Potato - Aphids. J. Carbonell, J. Briozzo.
- 31) Insect Pests of Potato - Mites. J. Carbonell, J. Briozzo.
- 32) Insect Pests of Potato - Flea Beetles and Others. J. Carbonell, J. Briozzo.
- 33) Insect Pests of Potato - Grubs, Weevils, Wireworms, etc. J. Carbonell, J. Briozzo.
- 34) Beneficial Insects in Potatoes. J. Carbonell, J. Briozzo.

- 35) Spray Applications in Potato Crops. J. Carbonell, J. Briozzo.
- 36) Diseases of Potato - Soil Fungi; Scab. C. Moscardi, S. Garcia.
- 37) Diseases of Potato - Soil Fungi; Wilt. C. Moscardi, S. Garcia.
- 38) Diseases of Potato - Soil Fungi; Rot. C. Moscardi, S. Garcia.
- 39) Diseases of Potato - Diseases of Early Blight and Late Blight.
C. Moscardi, S. Garcia, R. Stuckey.
- 40) Diseases of Potato - Diseases of Viruses. C. Moscardi, S. Garcia.
R. Stuckey.
- 41) Diseases of Potato - Diseases of Virus: Leafroll. C. Moscardi,
S. Garcia, R. Stuckey.
- 42) Treatment Calendar. J. Carbonell, J. Briozzo, C. Moscardi,
S. Garcia, A. Wells.
- 46) Control of Brown Rot in Post-Harvest of Peaches. R. Talice,
A. Fomento, C. W. Hitz.
- 47) Manual Thinning of Fruit in Peaches. Omar Borsani.
- MAP Bulletin Senis (Boletin Tecnico)
Dotti, R. et al. Fruit Tree Fertilization. 1973.
- MAP Miscellaneous Publications:
Curotto, J., et. al. National Program for Improving Potato Culture.
July, 1975.
- Taboada, O., H. Marrapodi & L. Duran de Ipharraguerre. A Guide to
Writing Extension Leaflets. May, 1975.
- Manuscripts Published in the United States:
Izquierdo, J. & R. Morse. 1975. First Selection for Wilt Resistance
in Lentils (*Lens culinaris* Medikus) in Uruguay. *Lens* 2:20-28.
- Stuckey, R. E., S. Garcia and C. Moscardi. 1975. Chemical Control
of Apple Scab. *Fungicide and Nematicide Test Results* 30:34.
- _____, C. Moscardi & S. Garcia. 1975. Chemical Control of
Late Blight of Potatoes. *Fung. and Nem. Test Res.* 30:38.
- _____. 1975. Chemical Control of
Early Blight of Potatoes. *Fung. and Nem. Test Results* 30:82.
- Croft, B. A., J. Briozzo & J. Carbonell. 1976. Resistance to
Organophosphorics Insecticides in the Predaceous Mite. Submitted
to *J. of Envir Entomology* by the senior author in March, 1976.

Special Reports and Manuscripts:

1) To USAID. (Submitted during 1974).

Morse, R. Processing Tomatoes in Uruguay.

_____ Increasing the Productivity and Storage Capacity of Onions.

_____ Lentil-Research in Uruguay.

Stuckey, R. E. Apple Scab Research at Las Brujas.

_____ Experimentation with Early and Late Blight Diseases of Potatoes at the Las Brujas Experiment Station.

Hitz, C. W. Post-Harvest Control of Monelia and Rhizopus Rots of Peach in Uruguay.

_____ Fruit Shape of the Delicious Apple.

2) To Las Brujas Experiment Station (Possible for Publication).

Noll, C. J. & R. Morse. Chemical Weed Control in Horticultural Crops in Uruguay. August 1975.

Carlson, R. F. and O. Borsani. Nursery Propagation and Certification of Fruit Trees. November 1975.

Talice, R., J. Carbonell, R. F. Carlson and C. W. Hitz. Establishing a Fruit Orchard. October 1975.

Maeso, C., and J. Villamil. Obtaining Better Vegetable Transplants. 1974.

Izquierdo, J. and R. Morse. Muskmelon Growing in Uruguay. 1974.

Talice, R. and O. Borsani. Pruning of Peach Trees. 1974.

3) Other.

Stuckey, R. E. Report on Visit to Chile. March 1975.

Morse, R. & Casas R. A Report on Vegetable Production in the Salto Area. (Title may be incorrect) July 1975.

Hitz, C. W. & R. Talice. Post-Harvest Control of Peach Rots. Argentina Mycology Order. October 1975.

_____ Post-Harvest Control in Apples. Argentina Mycology Order. October 1975.

Termination Reports: (Numbered as Penn State University, Michigan State University and Texas A&M University Consortium in Uruguay, Contract AID/1a 722 Reports).

Cintron, Rafael (TAMU). Citrus Production & Research Problems. University Consortium Report 2. March, 1973. 19 pp.

The government of Uruguay has demonstrated an interest in expanding citrus production for export. Stressed toward this objective have been efforts to improve research facilities at the Salto Experiment Station. This area of Salto-Paysandu and Rivera is Uruguay's most favored production area. The greatest threat is wide-spread expansion of disease - especially the presence of viruses. Control of 2 common virus diseases, Psorosis and Exocortes, could be aided by a bud-certification program. The Salto Station can help producers also by formulating recommendations for grade standards, planting plans, and citrus soil management and nutrition. These require even greater attention to research facilities.

Boyle, John S. (PSU). Disease Problems in Deciduous Fruits and Vegetables. University Consortium Report 3. April, 1973.

Disease losses are estimated at 25% of the country's fruit and vegetable production. The many different fruits and vegetables grown in close proximity one to the other may augment the disease reservoirs. Some species should not be planted close to or follow in a rotation certain other species. A disease or virus latent in one species may be virulent in another. There are several diseases, especially viruses, in Uruguay that warrant special attention. Viruses prevail in peppers, tomatoes, potatoes and citrus. Greenhouse and laboratory facilities to study control methods of these diseases are warranted. An alarm system to aid control of apple scab is recommended. A listing of equipment and materials needed to initiate a Plant Pathology Service at Las Brujas was prepared, and research procedures were discussed with counterparts, Brille & Garcia.

Hatch, Anthony H. (PSU). Chilling Problems in Deciduous Fruit Trees. University Consortium Report 4. November, 1973. 17 pp.

The average yield of peach trees in Uruguay is reported only about 1/2 that of U.S. trees. A possible cause, evidenced by delayed spring budding and flower abortion, is insufficient chilling (below 7.2°C) during winter months. Data analysis revealed that many varieties growing and fruiting in Uruguay were experiencing less than 1/2 the cold they required elsewhere. Chemical sprays thought to substitute in part for cold were studied as were various methods of measuring effective cold. The chemical treatments were not particularly effective perhaps due to improper timing or too strong concentrations. Degree days, where both daily minimum and maximum temperatures are considered, provided a good concept of Uruguayan conditions. An extensive testing of varieties requiring 600-1000 hours of cold is recommended. Several hormonal treatments of apples were initiated or continued.

Howitt, Angus J. (MSU). Deciduous Fruit and Vegetable Plant Protection Problems with Particular Reference to Entomological Pests. University Consortium Report 5. December, 1973. 19 pp.

Sex-attractant (pheromone) Codling Moth traps caught 50 times as many moths as the nearby olfactory traps commonly used in Uruguay. Improving trapping of leaf rollers, Oriental Fruit Fly and Mediterranean Fruit Fly was demonstrated. Recommended are: 1) Wider use of pheromone and other improved attractants for use in alarm systems for fruit and vegetable production in Uruguay; 2) Greater grower participation in trapping insects for alarm systems; 3) Government purchase and distribution of trap attractants; 4) Installation of a government owned or leased pest control planting; 5) Increased representation in Uruguay of manufacturers of pesticides, and the seeking of funds from these manufacturers for testing such pesticides; 6) Increased entomology staff at the Las Brujas Station; 7) Use of a team approach to work out control of the virus problems in Uruguay and 8) Increased testing of systemic insecticides.

Cintron, Rafael (TAMU). Addendum to Report No. 2 in Citrus Production and Research Problems. February, 1974. University Consortium Report 6. 4 pp and attachment.

During this assignment Dr. Ary Salibe of Botucatu, Brazil was on FAO assignment to study virus diseases of the Salto area. The programs undertaken cooperatively with station personnel included a one-week training course for extension specialists; a two-day grower meeting at the Station; enlarging the bud-certification program including searches for virus-free wood to supply a bud-bank; and plans to continue Dr. Salibe's studies with "Marchitamiento" (decline). In addition a fertilizer test was planned and several discussions were held with individual growers and nurserymen regarding nursery and cultural practices.

Mills, Wilford R. (PSU). A Study of the Feasibility of Potato Seed Production in Uruguay. University Consortium Report 7. March, 1974. 9 pp.

The primary objective of the assignment was to determine the feasibility of certified seed potato production in Uruguay. Such seed is "certified" by a government agency to contain no or manageable levels of specified insects viruses and other diseases which are known to lower productivity drastically. Contrary to local beliefs in Uruguay certified seed imported from Canada was found to be very clean. The infection found in Uruguayan seeds occurs during the seed multiplication in Uruguay. If methods to control diseases and the virus vectors are utilized in plantings on new or disease-free soils, first or even second generation seed should show little infection. To a large degree self sufficiency in seed production is possible in Uruguay and it is recommended that the "Uruguayan government initiate a seed program." Enlarging of the potato variety trials at Las Brujas also is recommended.

Hooker, W. J. (MSU). Potato Disease Problems in Uruguay. University Consortium Report 9. December, 1974. 21 pp. Appendices.

The assignment was to survey the potato disease situation and to teach Uruguayan counterparts the laboratory and field methods of detecting and identifying potato diseases, particularly the virus diseases. Disease control is the primary problem in improving or certifying potato seed. Virological, serological, histological and symptomatic procedures were utilized in helping Uruguayan counterparts to identify diseases of potato caused by fungi, bacteria and viruses. A formal governmental program of seed certification should be delayed until growers and research personnel have more experience in improving seed. A step-by-step, seed-improvement program, involving seed selection, tuber-unit planting and periodic plant selection, is presented. The initial seed improvement is apt to be more successful with Kennebec than with Pontiac.

Mahaffy, S. A. (MSU). End of Tour Report. University Consortium Report 10. January, 1975. 33 pp. Attachment.

The assignment was to aid development of the Information Service primarily through surveys to determine the kinds of information most useful to producers of fruits and vegetables and to recommend the procedures the Information Service should utilize to meet such needs. Representatives of each Section at Las Brujas helped with the survey. Recommended was an assignment of a fruit specialist and a vegetable specialist to the Information Service at Las Brujas to help in writing simple directional publications (Example: How to Control Brown Rot of Potato); to transpose the information of foreign research to Uruguayan production; to relate grower problems to L. B. researchers; to organize informational meetings for growers and to encourage suppliers to coordinate product availability with Station recommendations. Procedures for disseminating information for growers through newspaper, radio and television releases and through public meetings were suggested.

Cintron, Rafael (TAMU). 1975 Addendum to Citrus Production and Research Problems. University Consortium Report 11. April, 1975.

Observations and recommendations made during this third assignment are listed. Nursery practices and erosion control have improved; high density plantings and chemical weed control are gaining popularity. Rates of nitrogen fertilization must be formulated soon but the experiments with other elements can await the determination of the proper levels of nitrogen application. The virus disease Psorosis, already prevalent at an unacceptable level, is a serious threat to the industry. The Salto Station should provide the leadership, the bud banks and the virus-free plants to improve control of the disease. The Station should encourage plantings to greater tree density (to 8M x 4M); should expedite the virus activities of FAO assignee Dr. Ary Salibe; should increase variety testing with oranges, in order to lengthen the export season, and with rootstocks to obtain disease resistance; and should encourage the adoption of size and grade standards.

Wells, Arthur. (MSU). The Insect Problems in Potato and Vegetable Production In Uruguay. University Consortium Report 12. April, 1975. 19 pp.

The assignment was to aid identification of insects damaging to the vegetable industry and particularly to the production of seed potatoes. Control methods for the several species of insects common to Uruguay are suggested, but it is important that trapping with black light and other type traps be increased all over the country in order to strengthen alarm systems against damaging insects. Probably the worst threat to the potato seed production is a species of aphid (the green peach aphid, Myzus persicae), not only for the damage its feeding causes but more because it is a vector of viruses. Granular systemic insecticides which make entire young plants poisonous to aphids and leaf hoppers were imported and tested. New insecticides need testing as substitutes for those to which resistance develops. Misuse of insecticides that encourages early development of resistance must be avoided i.e. full concentrations should be recommended. The over-wintering sites of the green peach aphid should be sought; a synoptic collection of local insects would aid identification and stimulate grower interest.

Stuckey, Richard E. (MSU). Plant Pathology at CIAAB, Las Brujas: Progress and Evaluation. University Consortium Report 14. June, 1975. 23 pp.

Primary emphasis and effort of this newest discipline group at Las Brujas were on identification and control of diseases of economically important fruit and vegetable crops. Included were fungicide and other control evaluation for apple scab; peach tree diseases; Botrytis Rot of grapes; early and late blight and viruses of potato; viruses in pepper and wilts in lentils. Studied in detail were alarm systems for apple scab and late blight of potato. For both alarm systems spray schedules with applications as signalled by various alarm indices were compared one with another, with weekly applications and with no-spray treatments. Specific indices for each crop yielded as good control as weekly applications but with 40% fewer sprays. Recommended are expanded studies of the alarm systems; of root rots of fruit trees; and the wilt diseases of lentils. Counterpart training in virus identification opens the field of virus studies once greenhouse facilities are completed. Attention is called to the overload of present station personnel and possible loss of all research skills if the husband-wife team is lost. Designation of an experimental orchard and the initiation of a diagnostic laboratory are recommended also.

McGrann, James M. (TAMU). An Appraisal of the Need for an Agricultural Economic Research Service for the Fruit and Vegetable Experiment Stations in Uruguay. University Consortium Report 15, July, 1975. 14 pp. Appendices.

The primary objectives of the assignment were to assess the needs of economic research in the horticultural industries of Uruguay and to initiate those studies of greatest priority for continuation by Ministry personnel.

It was planned that the Consortium would furnish help in the interpretation of the continued studies prior to the end of Contract Ia/722. Most promising for study would be a determination of the competitive position of the horticultural products of Uruguay on Brazilian markets; the impact of improved productivity and marketing of horticultural products on the agricultural sector; illustrating the "systems" approach to a new horticultural product; and the economic evaluation of specific, newly introduced horticultural practices. The latter would include for example; the commercial utilization of herbicides and growth substances; size-control root stocks; high-density plantings; off-season planting (potato seed, onions); new post-harvest handling methods; fertilizer application, etc. Although research with peaches and onions was started it was not completed before or after termination of the assignment. It would seem of rich return to the horticultural industry if these studies could be continued in the near future. A systems analysis for dehydrated onions is presented.

Morse, Ronald (PSU). Research in Vegetable Production. University Consortium Report 16. August, 1975. 22 pp. Tables.

In short the assignment was to become totally involved in vegetable production at the Las Brujas Station in contributing to fulfillment of Consortium objectives in Uruguay. The vegetable industry has these problems: low productivity; low market quality; limited markets; relatively high cost of purchased inputs; and inadequate technical assistance available to growers. In attacking the problems personnel at Las Brujas conducted throughout the country a program greatly expanded from that of the early 1970's. (Assigned technical personnel and number of projects have at least tripled). Among the more than 50 experiments conducted 1973-75 are variety testing in ten different species (the general adoption of the pear type (Roma) tomato for processing is a citation for the project); fertilizer experiments (35 with potatoes alone; tomato response to increments of nitrogen and phosphorous have been spectacular); planting dates (onions planted earlier than customary yield better); plant spacing (early planted onions need to be at greater-than-normal density to prevent oversizing); and chemical weed control (cost-income studies are needed to "sell" herbicides to Uruguayan producers). Discussed in recommendations are: further improvement of vegetable research and its facilities; expanded grower education and assistance; training Las Brujas personnel abroad and at home; studies of export markets; and making station-recommended material and equipment available to growers.

No11, Charles J. (PSU). Research in Vegetable Production--Evaluation of Winter Crops in Salto and Expanding the Use of Chemicals for Weed Control. University Consortium Report 17. October, 1975. 20 pp.

The assignment was to aid in an analysis of the problems of vegetable production in the northern part of Uruguay and to demonstrate weed control techniques to the Salto and Las Brujas Experiment Stations. An important deterrent to the highly profitable vegetable production in the North is unstable markets. Export marketing or marketing to processors could provide a secondary outlet

for a vegetable produced in Salto but whose transport cost makes it non-competitive in the markets of Montevideo the instant its harvest commences near that city. Even during normal marketing there seem to be insufficient buyers to bid prices to satisfactory levels. Deterrents of productivity and satisfactory levels of costs of production include: poor insect and disease control; poor quality varieties; lack of irrigation; incorrect fertilization; and the need to construct quinchas (lean-tos) for protection against cold. Help was given in planning weed control experiments in onions, tomatoes, carrots, potatoes, citrus, and grapes. New studies initiated were concerned with improving plant vigor in strawberries (through blossom removal the first season) and with tomato hybridization (crossing imported, high quality varieties with the local Cuarenton of high disease resistance).

Alexander, S. A. (PSU). An Evaluation of the Deciduous Fruit Tree Diseases of Uruguay. University Consortium Report 18. November, 1975. 14 pp.

The assignment was to strengthen the operation of the apple-scab alarm system to be operating in 1975-76; to identify diseases of fruit trees which require attention and to assist the general plant pathology effort. It was recommended that scab-spray be limited by indices additional to those used previously. A leaf-wetness meter and ascospore readings on over-wintering leaves are thought to provide timing information superior to that from dew recorders. At the end of the assignment (about time of petal fall) the alarm was operating well and providing protection at a savings already of two applications. Black Rot Canker (Physalospora obtusa) was positively identified as the Canker disease found most commonly in the Las Brujas orchard and others in Uruguay. Twig Canker (Fusicoccum amygali), generally mistaken for Brown Rot Canker, was identified on peach as was Valsa Canker. The plant pathology staff was aided in studies with fungicide evaluation with apple scab and peach leaf curl. Warnings were voiced regarding the bare adequacy of the station number and equipment available for the scab alarm system; the generally poor spray coverage in the country; the danger of the tree canker diseases; and the inadequate size of the plant protection staff at Las Brujas.

Carlson, Robert F. (MSU). An Evaluation of Fruit Tree Rootstocks and Orchards, and Suggestions on the Future Fruit Production in Uruguay. University Consortium Report 19. November, 1975. 12 pp.

The primary assignments were to evaluate the potential adaptability of size-control rootstocks and high density apple plantings in Uruguay and characterize the requirements of a nursery tree certification program for the fruit industry. Size-control trees -- i.e. apple trees grown on roots (rootstock) of specific varieties to yield mature plants of predictable size -- are being planted in high density plantings throughout the world. This procedure for lowering production costs is not widely employed in Uruguay. The requisites for successful utilization of this modern culture include: conscientious nurserymen knowledgeable of propagating material and its management to provide quality planting stock; planting site selection (soils with good surface or sub-surface drainage are necessary); rootstock selection (some rootstocks are more tolerant to poor conditions than others); orchard soil management (avoid

deep plowing near tree); training and pruning (a leader system is usually used); and tree density. The report contains a table predicting the size at maturity of several stock-scion combinations. The requirements for organizing a tree-certification program are presented in a separate manuscript.

Boyle, John S. (PSU). A Study of the Problems to the Control of Virus Diseases in Uruguay. University Consortium Report 20. February, 1976. 8 pp.

The purpose of the assignment was to assist in developing programs of virus-disease control, especially with potatoes, tomatoes and peppers. The still incompleated greenhouse facilities prevented efficient step-by-step guidance of virus isolation and identification so that assay procedures were mostly verbal or written. Emphasized is the need of nearly perfect virus control in any national program of self-sufficiency in the production of seed potatoes. Such control is dependant upon positive identification of virus; the control of insect or nematode vectors and the eradification of weeds or plant species which alternately host the virus. To handle the additional duties of a national seed program, more plant pathologists are needed. The symptomology of the virus believed more prevalent in tomato is spotted wilt. Difficult control of vectors make the use of resistant varieties the most promising corrective for producers. Testing of such varieties from Argentina and other sources should be continued. Researchers and others who frequent pepper, tomato and potato fields should ever be alert for plants apparently resistant to the virus infections surrounding them. From such selections strains resistant to a virus disease could be developed.

Thompson, N. R. (MSU). A Study of Potato Production Emphasizing a Seed Production Program. University Consortium Report 21. February, 1976. 8 pp.

The assignment was to assess the overall program of potato improvement of Uruguay and to expedite the integration of the potato programs at Las Brujas and at the International Potato Center in Lima, Peru. Recommendations supplemental to the national potato improvement program would include: a survey of potential seed areas to identify sites infected with Brown Rot, Pseudomonas solanacerum (These are avoided for seed production); use the survey as an educational program teaching disease identification, rogueing procedures, sanitation, etc. (Radio programs can be excellent teaching aids); Las Brujas could support small demonstrational plots where modern seed production practices are used and could conduct seed-evaluation tests before seed is sold; variety testing should be continued, concentrating mostly on seed introduced from the International Potato Center. Compared are the advantages of government-operated seed farms and of smaller seed operations managed by individual growers. A system for multiplication of improved seed is presented.

Croft, Brian A. (MSU). Integrated Mite Control in Apple Orchards in Uruguay. University Consortium Report 22. February, 1976. 6 pp. Plus manuscript for publication: Resistance to Organophosphores Insecticides in the predaceous Mite, Amblyseius Chilensis (7 pages, tables).

The objectives of the assignment were to identify phytoseiid mites, Amblyseius

chilenensis, occurring in commercial orchards and to study their response to the insecticide spray schedules used in these orchards; and to determine the research necessary to insure a successful development of an integrated mite control program which could significantly reduce production costs in Uruguay. Mounting and taxonomic techniques were demonstrated in confirming the identification of phyto-seiid mites collected from 4 orchards or collected in previous seasons. A design for sampling and determining orchard populations of damaging mites, principally Panonychus ulmi (Red Mite) was perfected. Collected and reared for research uses were colonies of phyto-seiid and other predaceous mites. The series of toxicological experiments conducted to determine responses of A. chilensis to commonly used insecticides revealed that it is sufficiently resistant or can develop enough resistance to the insecticides used against chewing pests to be effective in an integrated program. A rearing and distributing program should be immediately established for these mites. Study of the resistance of the mites to orchard pesticides and their integration into miticide spray schedules should be continuous.

Bowen, Hollis (TAMU). Some Factors Influencing Peach Yield and Cultivar Evaluation in Uruguay. University Consortium Report 23. March, 1976. 21 pp.

The purposes of the assignment were to examine the causes of irregular yields of peaches in Uruguay; to propose for testing those varieties that would extend the export season; and to integrate this variety testing with the breeding program at Texas and other locales. None of the recognized methods of measuring effective cold during dormancy completely explained the cropping situation that occurs in Uruguayan peaches. The performance of selected U. S. varieties in Uruguay indicates 700-800 hours of effective cold during dormancy. The hours of chilling below 7.2°C are seldom above 600 and sometimes drop below 400. It is suggested, based on observations of the crop this year and from past winter temperatures correlated with crop yields, that tree vigor as affected by pruning, thinning and nutrition influences tree response to winter cold and is more important than cold in influencing yields, especially those of varieties with low chilling requirements. The latter tend to become biennial under poor cultural conditions. Varieties requiring around 750 hours of effective cold are likely to be ideally suited for Uruguay. Some 40 of the 150 varieties under test at Las Brujas are of this requirement, are named and are of recognized merit in areas climatically similar to Uruguay. Some of these, mostly U. S. varieties, should benefit Uruguayan production.

Toboada, Oscar (MSU). Progress and Development of Information Services of The Centro de Investigaciones Agrícolas "ALBERT BOERGER" (CIAAR). University Consortium Report 24. March, 1976. 21 pp. Appendices.

This assignment involved the total immersion, as an advisor and participant, into the activities of an Information Service newly invigorated to deliver station-oriented information to producers. The main thrust was to the clientele of Las Brujas - the fruit and vegetable growers. An important activity was the encouragement of the publication of Information Leaflets, a "how-to" type publication first printed in 1975. Of the 50 publications of this type made that year, 36 were prepared at Las Brujas. At Director Curotto's request a series of meetings were

planned to be held at Las Brujas and elsewhere. Over 1000 growers attended 20 such meetings and participated enthusiastically in discussion of station activities and recommendations. The use of radio for delivery of grower-oriented, station-originated information increased greatly during the assignment. Starting only with spray alarms, radio is now approved for spot news announcements of station origin and these are expected to increase in 1976.

Hitz, Chester W. (PSU). Improving Production of Fruit for Export. University Consortium Report 25. March, 1976. 31 pp.

The purpose of this assignment was to advise and participate in the pomological activities at the Las Brujas Experiment Station, especially as they related to the over-all objectives of USAID in Uruguay. Noteworthy accomplishments of the fruit specialists during the assignment include: the studies on the influence of winter temperatures (rest period) upon fruit tree productivity; the expanded variety testing to allow variety selection to correct under adaptation to climate as well as to improve export quality and to lengthen the export season; the demonstration of the benefit of a mulch system in Uruguayan fruit culture; the perfecting of post-harvest handling of peaches to lengthen their transport and marketing period without rot; the recommendations for post harvest treatments of apples to increase protection against storage rots and breakdowns; the studies with growth substances for regulating growth, fruiting and fruit form in apples and the several other fruits at Las Brujas. It is suggested that attention be given to investigating the wastage of fruit resulting from careless harvesting and post harvest handling; that the role of pollination in relation to apple and pear productivity be investigated; that orchard land at Las Brujas be utilized to full efficiency; that more orchard cultural practices become demonstrable to growers and that post harvest studies that will improve export quality be continued.

Wells, Arthur. (MSU). The Insect Problems in Potato and Vegetable Production in Uruguay. University Consortium Report 26. April, 1976. 11 pp. Attachments.

The primary emphasis of this assignment was the preparation and publication of insect control leaflets and to assess the current research projects. During the assignment 10 leaflets on insect biology and insect-transmitted diseases were completed by Plant Protection personnel. From observations and studies made during the assignment, these suggestions are made: 1) The black-light traps should be put into immediate use in order to follow the emergence and flight patterns of army worms, of cut worms and other insects important to agricultural production; 2) The thrips trapping program should be expanded into San Jose and Salto. An early publication on the biology, movement and control of onion thrips is warranted; 3) The flight studies and leaf population counts of potato aphids should be modified and improved to permit understanding of aphid movement and to determine best planting time and control attacks; 4) Granular, systemic insecticides promise the best control of potato aphids. They must be made available to potato seed growers and their use should be under constant test and demonstration; 5) All insecticides should be handled with extreme care to prevent their loss of effectiveness and to safeguard human life.

2. Resume of Results:

Among the activities of assignees just described there were several research results which could advance almost immediately the efficiency of fruit and vegetable production in Uruguay. But unless all agencies involved in improving such efficiency implant the advanced techniques, the research or recommendation is without value.

In Entomology the introduction of pheromone traps and the grower's participation in trapping permit cheap but efficient monitoring of insect populations. The utilization of granular systemics could lead to drastically improved control of virus vectors in potatoes, perhaps to aid materially toward national self sufficiency in seed production. The positive identification of the phytoseiid mite and the increased understanding of the procedures for rearing and distributing this predator and of its tolerance to common insecticides could reduce materially the miticide purchases the orchardists need make annually.

The specialists in Plant Pathology, the discipline organized at Las Brujas only at the onset of Contract Ia/722, have introduced spray alarm systems for the control of apple scab and late blight of potatoes, thus permitting control with fewer sprays and at less cost. The positive identification of many diseases, including those of fruit tree cankers, is the first step toward their control or eradication. Pesticide testing, as practiced by both Plant Pathology and Entomology, can lead to pest control at competitive cost.

From work at Salto comes the warning that the Citrus industry is suffering unacceptable tree losses and decline from virus attacks. Unless the bud-bank of Psorosis and Exocortis-free wood, initiated in 1973, is supported and expanded, only greater tree mortality and reduced exports can be expected. The recommendation that nitrogen is the only fertilizing element that citrus growers need apply can lead to reduced production costs. The recommended abandonment of the citrus plantings at Las Brujas would lower the station's operating costs or make some prime land available for more rewarding investigations.

Among the many contributions of the Vegetable researchers and the Consortium assignees are included the increasing popularity of the pear (Roma) type tomatoes for processing and the probable introduction of Argentine varieties resistant to spotted Wilt, a virus common to Uruguayan tomatoes. The inclusion of phosphorus in the starter fertilizer for tomatoes speeds the plants' early development and thus becomes a cost-reduction procedure. Varieties, and most of the production methods, are ready for any onion dehydration industry which might develop. The tomato hybridization studies initiated at Salto, could lead to local utilization of a variety as highly disease resistant and of better quality than the commonly grown Cuarenton.

The potato team composed of specialists from Plant Pathology, Vegetable Production and Entomology published "National Program for Improving Potato Culture" which provides guidelines for improving the national self sufficiency in production of the crop.

From Fruits research the station recommendation of fastest adoption and most impressive improvement over standard practices concerned the control of the post-harvest diseases of peaches. Over 1200 tons of peaches and plums received a post-harvest, dip treatment of BenlateTM and BotranTM prior to their export to Brazil, mostly in bulk boxes of 20 kilos each, in 1975-76. Not a single complaint of spoilage was received. The additional disease-free days of life the treatment provides lengthens the sales life of peaches and widens their export possibilities. The value of mulch as a cultural system for apples was demonstrated at Las Brujas and is being tested by one commercial grower. Trees are likely to respond with increased productivity to this system. The expanded fruit variety testing should yield varieties which can be selected to overcome adverse climate (insufficient winter cold) as well as to lengthen the list of exportable varieties.

The contributions of the Information Service are best represented by the number of manuscripts they nursed through publication in 1975 and the number of meetings they sponsored where growers learned of the work and recommendations of Las Brujas. Unless recommendations are prepared and disseminated, research at Las Brujas is of little value to the welfare of the nation.

3. Physical Plant and Technical Staff:

During the 3 years of Contract operation in Uruguay there was marked expansion of station facilities at Las Brujas. In 1973 re-modeling commenced upon a well-built shop building on the station grounds to convert it to an office-laboratory building. Until the occupation of the building in September, 1974 the staff and library were housed in various offices in Montevideo where laboratory and library facilities were inadequate. The new quarters provided small office spaces for the staff members, some laboratory-type work areas for each discipline and much enlarged library space. Two large barns also were constructed - one to house grading facilities for fruits and vegetables, a walk-in cooler and an air-conditioned work area for post-harvest studies. Construction of greenhouses (donated by AID prior to 1970) commenced in 1973 also. Although electricity was taken to Las Brujas in 1974, no more than a limited supply of non-potable water was available at the termination of the Contract. Neither was construction completed on the greenhouses, the facilities for grading fruits, nor the post-harvest facilities.

The technical personnel at Las Brujas, including the Consortium assignees, the station administration and USAID all were involved in efforts to improve the library facilities. The administration obtained and installed library furniture and assigned Srta. Eladia Hernandez, trained in library science, as full-time librarian at Las Brujas. Books and periodicals additional to

those owned in 1971, were obtained through contract purchases; from MAP libraries and other exchange organizations, as publications available from the participating universities; and as gifts from organizations (The U.S. Information Service for example) and individuals, directly or indirectly.— Some 100 books and 20 subscriptions were secured as part of the AID grants. Unfortunately many of the subscriptions were expiring at the termination of the contract and there was little provision available for their immediate renewal.

Between December, 1971 and December, 1975 there was about a 50% increase in the number of Uruguayan technical specialists assigned to Las Brujas. Most of the increase in numbers was in vegetable production, including potato research, from 2 to 6 people and in plant pathology from 0 to 2. In 1970 no specialist possessed an advanced degree (but Ing. Talice was studying for a M.S. in Chile). There were 2 people working with M.S. degrees at Las Brujas in late 1975 and there were 2 students studying in the U. S.; one for a M.S. degree and one M. S. studying for a Ph.D. Only a small portion of the expenses of the advanced training was underwritten by AID and none of the training was at a participating university.

During the same time interval, 1971-75, there was an increase and modernization of research activities. Exactness of comparison between the dates is difficult because of modification in the Las Brujas' nomenclature and classification. But in fruit research, for example, 30 active projects were listed in March, 1976. Eighteen are known by the writer to have been initiated or revised since 1971. In vegetable production 19 of the projects active in 1976 are known to have been initiated or revised since the earlier date. Of the 21 separate experiments listed by Plant Pathologists in 1976, none, of course, was operative in 1971. Consortium assignees made significant contributions to the planning for almost every project initiated or revised at Las Brujas.

4. Participant Training:

There were no provisions in Contract Ia/722 for the Consortium Universities to have responsibility for participant training. This type of AID training for Uruguay was budgeted separately from the technical aid contract. AID periodically asked the Consortium assignees to make suggestions or requests for AID support for counterpart training, especially that of a short-term nature in near-by countries. The assignee-sponsored training included:

<u>Date</u>	<u>Personnel</u>	<u>Discipline</u>	<u>Where & Purpose</u>
Feb. 1974	Garcia, Stella Maeso, Cesar Formento, Antonio	Plant Path. Vegetables Fruits	Argentina Experiment Station to observe research procedures and results.
Aug. Sept. 1974	Garcia, Stella		LaConsulta, Argentina to study virus diseases

^{1/} The Penn State University donated to the Las Brujas library a set of volumes of Phytopathology it had relieved from Dr. W. Mills and that part of the personal library it had received from Dr. C. W. Hitz. Several other consortium assignees made small contributions of periodicals, books and various other publications directly to the library.

Dec. 1974	Maeso, Cesar Villamil, Jòse	Vegetables "	To Pelotas, Brazil to study research programs of vegetable production.
Dec. 1974	Borsani, Omar Talice, Rodolfo	Fruits "	To Pelotas to observe breeding and other peach research.
1974-75	Menéndiz, Ricardo	"	AID provided partial support for M.S. program at Washington State.
1974-76	Muller	Citrus	To University of Florida on a M.S. program.
1975-77	Izquierdo, Juan	Vegetables	New Mexico State University for a M.S. program.
Feb. 1975	Moscardi, Carlos Briozzo, Juan	Plt. Path. Entomology	To Campinas, Brazil, potato pest control.
Feb. 1975	Villamil, Jòse	Vegetables	To University of Sao Paulo, Brazil, breeding & cultivation of peppers.
March 1975	Carbonell, Joaquin	Entomology	Santiago, Brazil to observe research especially that of tree-fruit insects.
June 1975	Menéndiz, Ricardo	Fruits	To visit fruit production areas and research in Penna. & Michigan.
July 1975	Maeso, Cesar	Vegetables	Santa Maria, R.G.S. to attend meeting of Brazilian Oler-cultural Society.
Sept. 1975	Marrapodi, Heber	Information Service	USA to observe agricultural communications in USDA, in Michigan and Penna.
Feb. 1976	Menéndez, Ricardo	Fruits	To Rio Negro Valley, Argentina to observe fruit handling and research.

Also, through conferences, public meetings, joint participation in projects, demonstrations and daily conversations, the counterparts had opportunity to absorb from the learning and experience of Consortium assignees (and vice versa). The most apparent differences between pre and post-consortium participation in Uruguay - due to changes in Las Brujas personnel and to improved equipment and facilities as well as the daily contact with Consortium assignees would be: better designed experiments and faster analyses of experimental results; greater interest in problems of production and a greater willingness to write and to communicate with the public.

5. Equipment Procurement:

Even prior to the initiation of Contract Ia/722 personnel of AID/Uruguay were most cognizant that the Las Brujas Station possessed few facilities for the conduction of modern research. A responsibility the prime Contractor (PSU) was asked to assume was to help select, to order and to ship to Uruguay (within budgeted amounts) the equipment and material necessary to initiate and maintain the research fulfilling AID objectives in the country.

The standard operating procedure in equipment procurement was for the PSU representative in Uruguay (COP) to ask the Station Administration to prepare a priority list of equipment needed and its estimated cost. The COP discussed the list with other assignees and with the AID Rural Development Officer prior to seeking price and specification information (mostly a function of the campus representative) and prior to entering a requisition through normal departmental procurement channels of the University.

Title to the equipment and material received in Uruguay was transferred to the Las Brujas Station (a MAP agency of the Government of Uruguay) by signed receipt. The Station Administrator assigned responsibility for each item as it was withdrawn for use by a specialist. The specialist periodically reported through inventory on the location and condition of the items assigned to him. On March, 1976 the COP inventoried all equipment and materials delivered to Las Brujas and remarked on its condition. His notations, as confirmed by the equipment clerk at Las Brujas, are found on the receipt transferring the item to the Station. The original receipts are in AID offices in Montevideo and copies are in possession of the Director of International Agricultural Programs at The Pennsylvania State University.

The system worked well especially considering the difficulties of obtaining accurate information on product specifications and prices from suppliers constantly modifying their products and raising prices in their own difficulties with inflation and considering also the distance in space, time, persons and language between the supplier and the specialist initially desiring the item.

The contract budgets for the periods 12/8/72 - 3/7/74, 4/1/74 - 3/31/75 and 4/1/75 - 3/31/76 allotted \$108,107.00 for the purchase and transport of equipment and materials to Uruguay. Contract Amendment Modification #9 raised this to \$116,147.00. By March 31, 1976, \$116,252.13 had been spent for equipment and its transport and a few transport costs remained unpaid.

The equipment and materials purchased included those for transportation (5 pick-up trucks, tires and some gasoline); for field use (sprayers, mower, small tractors, hoes, pesticides); for the laboratory (colorimeter, ovens, balances, reagents, glassware); for the packing house (sizing and grading equipment, air conditioners, walk-in cooler); for communications (camera, slide projectors, composer); for the library (books, periodicals and library aids); for offices (files, typewriter, calculators, pencil sharpeners); and for the shop (drill, anvil, other tools).

Many items of equipment and materials were donated to the Las Brujas Station through the Consortium Universities and their assignees. These included pesticides, reagents, insect traps, applicators of insecticides and books. Each gift advanced the Consortium cause in Uruguay and was (is) gratefully acknowledged by the recipients.

E. OBSTACLES WHICH RETARDED PROGRESS.

Probably the greatest retardant of the program was the lack of greenhouse facilities at Las Brujas. The absence of these facilities prevented the successful demonstration of methods for identification and isolation of virus diseases by assignees Hooker, Stuckey and Boyle. The training that Ing. Garcia received in Argentina and Villamil in Brazil could not be fully applied without controlled growth conditions. The program for control of viruses in potato, tomato and pepper would have been accelerated had the methods been tried and perfected under the direction of consortium-assigned experts. They could have demonstrated early signals of normal or unexpected symptoms had they been present during the trial period. It is imperative that viruses be recognized and their spread be prevented in any national program of potato seed improvement (certification). The lack of greenhouse facilities also decreased the effectiveness of Dr. Carlson's demonstrations of the propagation of cuttings of varieties of apple rootstocks.

Another difficulty that had some effect on the program was the delay in getting information needed for amendments associated with annual financing of the program, and in getting these amendments signed. These amendments particularly affected the short-term assignments and equipment requisitions and there tended to be a bunching of assignments and requisition of equipment at certain periods which made the management of the program more difficult. These difficulties could have been prevented if it had been possible to have had initial financial commitment for the entire period of the contract period of the program rather than funding of the program on an annual basis.

There were some shortages of materials and equipment which were to be supplied by the Ministry, that delayed progress. The most serious of these probably were shortages of transport and fuel which reduced the number of trips taken for gathering data for the insect and disease alarms and for various experiments. Assignees voluntarily did more car pooling than the diversity of their assignments readily permitted. Tires for vehicles were in short supply and finally were obtained under the AID equipment budget. Vehicle maintenance tended to be slow and incomplete. The shortage of paper for printing caused delays and postponement of publication of many manuscripts prepared by Las Brujas personnel. This shortage was alleviated somewhat by utilizing some contract funds for purchase of paper. The shortage of printing facilities, chronic throughout most of the contract, was corrected upon the obtaining of a Selectric Composer late in the contract period.

Loss of APO mail privileges for Consortium Contract personnel in mid-1975 resulted in increased communication difficulties for all consortium personnel. This precluded use of parcel post for Consortium personnel, increased the time for

receiving and getting mail to its destination in the U.S. and increased the uncertainty of written communications being received. The obstructed flow of communications slowed the decision and implementation process particularly regarding equipment and selection of short-term nominees. International telephone and telegraph had to be utilized to a greater extent for administrative purposes leading to higher communication costs for the program.

The plans for the final contract year included the assignment of Dr. McGrann (TAMU Economics Specialist) and a MAP economist to study problems of interest to researchers at Las Brujas and to producers of fruits and vegetables. These studies were to be continued by McGrann's counterpart Roberto Casas upon McGrann's departure. A second assignee from Texas A&M University was to be assigned to Uruguay late in the contract year to aid in interpretation and presentation of the results. Neither McGrann nor Casas was able to spend full time on the Las Brujas assignment. Although studies of cost of production inputs for onions were completed and had been started for peaches prior to McGrann's departure, the results of the studies had not been reported by March 31, 1976. Soon after McGrann's departure, Casas was removed from the study in order to participate in a training course in the U.S. He did not renew immediately the Las Brujas studies upon his return to Uruguay. The assignment of a Consortium Economics Specialist late in the contract year was cancelled as there had been little progress in the economic studies at Las Brujas and a counterpart to work with the Specialist was not available. The role of an economist at Las Brujas is extremely important as many recommendations could be strengthened (or perhaps discarded) when judged by economic returns.

F. RECOMMENDATIONS AND SUGGESTIONS ^{1/} FOR FUTURE PROGRAMS.

Almost every assignee in his termination report has offered recommendations relative to the unfinished work in his field of expertise. Many reports call for increased numbers of experiments and additional assignments of technicians to Las Brujas. Fulfillment of these recommendations no doubt would advance rapidly the influence of Las Brujas and would encourage greatly increased production of fruit and vegetable crops for export.

Concern is expressed that the Alberto Boerger Center of Agricultural Investigations (CIAAB) and the Program of Agricultural Investigations and Technical Assistance (PIATA), not blessed with affluence for the support of fruit and vegetable research, may find it politically expedient to invest most of their resources in the fields of the country's most massive farm income. It is hoped that lessening of support in the production of non-traditional crops by AID and other international agencies will be followed by increased MAP interest in Las Brujas and its area of influence.

It is observed that farm income per acre world-wide is highest for the crops of the most intensive agriculture. The production of fruits and vegetables is an intensive type of agricultural production. With the frequent and presently deep stagnation in the international beef markets and the general instability in world grain prices, the potential profitability of exporting fruits and vegetables and the resultant benefit to Uruguay should be encouragement for the CIAAB to continue its active support of production for export.

^{1/} In this section more than in any other part of the report, the COP, Dr. Hitz is relating his beliefs—not those of any participating university or assignee. They result from 5 years of study and personal contact and cooperative activity with growers, fellow researchers and administrators in Uruguay.

Regardless of the pressures exerted by other agricultural groups in Uruguay, it is recommended that the administrators of CIAAB should support and encourage at Las Brujas:

1. The completion of construction already started.
2. Investigations which promise to lower costs of production of fruit and vegetable crops and thus permit their competitive pricing in world markets.
3. Investigations which improve export quality of such crops.
4. Investigations of export markets for fruits and vegetables and the expediting of participation in such markets.
5. The perfecting of agricultural communications and information.
6. Maintenance of sources of information for the staff.

For most of the duration of Project AID/1a 722 assignees and their counterparts were awaiting the completion of construction mostly finished at the station or were utilizing facilities less than ideal. It is recommended that high priority be given to finishing the incomplete greenhouse and post-harvest facilities. This completion would entail bringing potable water to the station; procurement of glass for the unglazed part of the greenhouse; the installation of benches, work areas and heating and cooling facilities of the greenhouse; and the installation of fruit and vegetable grading equipment on hand as well as shelves, benches, the air conditioner and lights in the work areas for post-harvest research.

Although the adoption of many research results can be expected to lower the growers' unit cost of production, some investigations at Las Brujas offer high promise of increasing productivity or quality without comparable increases of grower inputs, thus permitting profitability at prices competitive on world markets.

Variety testing serves to select those varieties most productive, most resistant to disease and of best export quality, be the crop peaches, strawberries, tomatoes (although the export potential of this crop and its products appears limited), onions or other crops. Unless expensive breeding programs are initiated, such testing is the only means for discovering those varieties best suited for Uruguayan soils, climate and markets.

Even small breeding programs with limited objectives could prove rewarding. The tomato hybridization studies initiated recently at Salto could yield an improvement over the low-quality, highly disease resistant Cuarenton now grown. Stability of yield and a firm flesh and attractiveness for exporting could result from crossing the high yielding Melilla peach with Rey del Monte. Resistance to viruses of peppers perhaps could be introduced into commercial production from a local breeding program.

Pesticide testing, to keep growers abreast of the chemical and integrated programs permitting low production costs and high market attractiveness is imperative in order to decrease production costs and increase international competitiveness.

Other investigations probably leading to improved productivity and, or market competitiveness include pollination studies with fruit trees and fruit thinning; plant density studies; and fertilizer and soil management studies. Studies of procedures to reduce soil turnings and manipulations could be particularly rewarding.

An example of a procedure improving export quality resulted from the studies with post-harvest rots of peach. The several days of additional life the Las Brujas recommendations provide against rots have greatly improved the exportability of Uruguayan peaches, whether packed in consumer cartons or in bulk. Peach exporters may need credit to install the fruit dip equipment providing the fruit with enough exposure to fungicides (perhaps heated) to insure protection. The equipment would be adaptable to apple and citrus packing as well.

Perfecting the procedures to make the Delicious apple more "typical" of the variety would improve the fruits' competitiveness on the Brazilian market.

Improving the competitiveness of other fruits and vegetables can be attempted as soon as investigations of export markets reveal the barriers to export sales. The Office of Programming and Planning (OPPYA) in MAP and AID have encouraged several such market studies since 1968. These should be continued and expanded in depth to yield almost a crop-by-crop analysis of the potentialities of exporting the produce or product to Brazil and other countries. The reports should include information on market desirability of the produce (product) and competitive crops in the importing country; the conditions limiting export from Uruguay; and such other information pertaining to a decision to sponsor production and export of the crop.

Impressive to all assignees, accustomed to the urbane awareness of American producers to their experiment station and the agricultural information it releases, was the eagerness of Uruguayan growers to have information regarding the Las Brujas Station, its people and its recommendations on all phases of production. Without doubt the Information Service and the CIAAB are aware of the credulity the publications and grower meetings have won for Las Brujas and will continue the help the Uruguayan producers so badly need. To do less is to permit the Station to slip again into the impotence it once suffered.

A significant advancement at Las Brujas in the past half decade is the widening of the sources of information for its staff members. The contributions of AID, of CIAAB administrators and of the universities and their assignees during this period have been cited. Of alarm was the expiration of periodical subscriptions as the contract was terminating. The CIAAB is urged to budget sufficient monies - seeking the help of AID and other international organizations if necessary - to maintain the flow of (1) periodicals and (2) books to the library at Las Brujas.

Another building stone of professional knowledge, strongly sponsored by Consortium assignees, was staff visits or special course training in neighboring experiment stations and universities. This mode of training also was greatly expanded during the duration of the contract. Participants found the visits informative and stimulating. The CIAAB should support to its greatest capacity the continuation of this program - again seeking the support of outside agencies if possible.

Advanced degree training in foreign countries is still another building stone to improve staff knowledge and capability. At the termination of this contract, many of the personnel at Las Brujas were concerned their opportunity for such training had passed. It is recommended that CIAAB and MAP continue to support the researchers in fruit and vegetable production in the future and provide them with the same opportunity to earn advanced degrees as for personnel in other disciplines.

G. FINANCIAL STATEMENT.

To be provided as soon as outstanding commitments are billed and processed.

H. ACKNOWLEDGEMENTS.

On behalf of all Consortium assignees who served in Uruguay I want to thank the directors of CIAAB and especially the entire administrative staff at Las Brujas for the great courtesy shown each of us and for your very sincere efforts to supply us our needs, thereby helping us fulfill our individual and joint missions. To our counterparts our thanks for allowing us to live so close to you, for teaching us much and for accepting so willingly our suggestions and the added loads we gave you. To the administrators and staffs of AID and particularly to the Rural Development Officer we thank you for your interest in our problems, your counsel and your participation in the program.

I want to thank the campus representatives and their staffs for their parts in facilitating the movement of supplies and talent to the project. It was the high quality of the personnel assigned that permitted the accomplishments recorded in this report. And thank you too for taking care of our daily living, our travels and our dependents.

Last and most important I want to thank each assignee for the dedication to instruction and participation he demonstrated to his counterparts and other Uruguayans. It is hoped that the experience and knowledge passed to them will long stand them well.

C. W. Hitz