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REPORT TO ICMRD

TITLE: Food Technology at the University of the Azores

DATE: June 13, 1983

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1. Scope of Work

In May of 1979, food technologists from the University of Rhode Island, Dr. S.M. Barnett and Dr. A.G. Rand, Jr., visited the Azores with J.F. Ponte Tavares, who was on leave from the University of the Azores while completing a Ph.D. in Food Science at URI. This group prepared a report surveying the Azorean food industry and recommending development of a food technology program at U.A. Dr. Tavares completed his Ph.D. in 1981 under Dr. Rand's direction and returned to the Azores to initiate food technology as a scientific discipline at UA.

The plans for development of a food technology program at UA have now been initiated and some of the basic equipment required has been purchased, ordered, or identified. Thus, Dr. Rand was requested to spend two weeks in the Azores to help finalize program development, assist in preparation and setup of new equipment, and to develop some long range plans for UA/URI cooperative research in Food Science and Nutrition.

II. Daily Activities

A. May 31 - arrived in Terceira at 11 a.m.

1. Met by Dr. Ponte Tavares and Dr. Young Amaral.
2. Check into Hotel Angra, lunch, rest.
3. Visit UA-Terra Cha for tour and review.

B. June 1 - UA Food Technology Laboratories

1. Assist in plans to develop the food science research laboratory.
2. Setup IEC refrigerated centrifuge.
3. Put the LABCONCO Freeze Dryer into operation.

C. June 2 (holiday) - UA Food Technology Laboratories

1. Continue work on the freeze dryer.
2. Setup Ainsworth analytical balance.

- C. 3. Setup the YSI sugar analyzer for lactose analysis and establish the application for milk, whey, and wine measurements.
- 4. Put the Corning Model 12 Research pH meter into use.
- 5. Discussed possible sabbatical plans in the Azores with Dr. Tavares.
- D. June 3 - UA Food Technology Laboratories
 - 1. Utilized the freeze dryer to process some milk.
 - 2. Assembled the Dixie Blancher.
 - 3. Reviewed how the Dixie Exhauster works.
 - 4. Discussed how the Dixie equipment could be used in the pilot plant for canning and freezing.
 - 5. Put the fibrometer unit into operation to measure enzymatic coagulation of whole, raw milk. Mixed results, so prepared a skim milk substrate.
 - 6. Put the Ohaus balance into operation.
- E. June 4 - UA Food Technology Laboratories
 - 1. Worked on the fibrometer and improved the process. Needed further development.
 - 2. Discussed layout of the pilot plant area. Determined basic functions and needs.
 - 3. Reviewed instrumentation available for greenhouse/hydroponics research as cooperative effort.
 - 4. Reviewed the number of changes at UA-Terra Cha since 1979.
- F. June 5 (Sunday) - Met with Dr. Tavares at the Hotel Angra.
 - 1. Discussed some of the equipment needs at UA for future research and teaching.
 - 2. Discussed the problem of lactose intolerance.

- F. 3. Reviewed the equipment which would be needed in the pilot plant to focus initial efforts on cheese processing.
 - 4. Discussed Dr. Tavares' plans to conduct research on plant and animal enzymes which can be produced in the Azores.
 - 5. Considered the need for chromatography equipment to isolate and study plant and animal enzymes.
 - 6. Traveled into the mountains to review the natural sources of unique gravel and peat which are available as valuable support material for hydroponics.
- G. June 6 - Met with Dr. Tavares at UA.
- 1. Power out. Worked on developing equipment needs for the food technology pilot plant and research lab - including types of chromatography equipment and refrigerated cold rooms.
 - 2. Discussed a plan on how to utilize the fibrometer instrument for testing milk coagulation.
 - a. formulated possible substrate and enzyme ratios.
 - b. checked substrate concentrations.
 - 3. Evaluated UA yoghurt production. Suggested some adjustments in the formulation.
 - 4. Toured new greenhouses, now being wired to operate automatically.
 - 5. Reviewed storage facilities for chemicals, acids and solvents.
 - a. Reviewed supplies available for food technology research.
 - b. Considered adequacy of current procedures.

H. June 7 - UA Food Technology Laboratories.

1. Worked again on fibrometer for enzymatic coagulation of milk.
 - a. used new substrate.
 - b. did not work well.
 - c. recommended contacting A.J. Foss to obtain information on their unit.
 - d. made suggestions which would have to be tried in an effort to utilize fibrometer.
2. Discussed the possibility of a loan from the Dutch to provide UA with equipment for milk/cheese processing.
 - a. UA must submit proposal.
 - b. UA must set up a pilot plant to receive equipment.
3. Discussed the possibility that Dr. Tavares may have to assume complete administrative responsibility for UA-Terra Cha.

I. June 8

1. Travel from Terceira to Sao Miguel.
2. Settled into hotel.
3. Toured the Pontu Delgada Agricultural Station and UA-Ponta Delgada.
4. Reviewed changes at UA since 1979.

J. June 9 - Dr. Tavares' office at UA.

1. Discussed UA current programs of study and plans for a new option in food technology.
2. Discussed "Irish Report on the Development of the Grassland and Livestock Industry in the Azores", particularly recommendations that UA train quality control technicians and conduct research on S. Jorge cheese.
3. Discussed methods for cheese research on S. Jorge products.
4. Discussed possible research project on cold sterilization/preservation of cheese milk.

- J. 5. Reviewed Dr. Tavares' paper on tuna enzymes from his dissertation.
Has a good draft, will submit through URI to Journal of Food Science.
6. Toured Salsame Meat Processing Co. and a pineapple plantation.
- K. June 10 (holiday) - Dr. Tavares' home in S. Vincente.
1. Discussed Salsame Co. - have interest in:
 - a. production of enzymes from hog & beef stomachs.
 - b. sausages from fish.
 2. Discussed preparation and manufacture of milk coagulating enzymes from hog & beef stomachs for queigo branco and pasta mole soft/short hold cheese. Could try on S. Jorge cheese, but will need development research when new facilities in pilot plant are available.
 3. Toured several agriculture stations to review facilities for milk production and milking parlors.
- L. June 11 - went to Dr. Tavares office at UA.
1. Roughed out a draft for a second paper from Dr. Tavares' dissertation on bovine pepsin research which will be for Journal of Food Science.
 2. Discussed equipment development for enzyme extraction from meat processing by-products in the Azores.
 3. Developed a rough outline for a joint research proposal on obtaining milk coagulating enzymes from fish waste.
 4. Developed an outline for a second joint research project on enzyme preservation and cold sterilization of milk for S. Jorge cheese manufacture.
 5. Discussed additional research projects which could involve Dr. Barnett:

5. a. Hydroponics - an important area which can be significant to both Rhode Island and the Azores.
 - b. Biomass conversion of animal and green manures to energy to make the UA research farm self-sufficient for heat and electricity.
 6. Discussed nutritional problems in the Azores. Urgent need for information on the nutritional status and food habits.
- M. June 12 (Sunday) - met with Dr. Tavares at his apartment in Ponta Delgada.
1. Drafted a report to ICMRD.
 2. Discussed the report and recommendations.
 3. Considered a report from the National Laboratory of Engineering and Industry/Dept. of Food Technology in Lisbon:
 - a. provided suggestions to improve S. Jorge cheese.
 - b. determined there were 3 basic needs - Hygiene/Quality, Technology, and Commercial support.
 - c. UA could help with all of these.
 4. Reviewed Dr. Tavares' trip to Budapest last year where he presented a paper on his research at URI concerning tuna enzymes for cheese manufacture.

III. Identification of Potential Areas for UA/URI Cooperation.

- A. Nutrition - badly need a nutritional assessment of the Azorean population & study of their food habits.
- B. Agriculture - hydroponics
 - biomass conversion for waste utilization & energy production.

III. (cont.)

C. Food Science - cheese manufacture

- identification of microorganisms involved in cheese manufacture.
- cold sterilization of cheese milk.
- enzymes for milk coagulation.
- antibiotic detection in milk.
- training and education of plant and quality control personnel.

IV. Suggestions for possible funding modes.

A. AID Program in Science & Technology Cooperation (PSTC).

1. UA submissions w/URI consult. & collab.
2. URI submissions w/UA linkage.

B. NSF International Cooperative Programs.

C. Sea Grant International Program.

D. Fundação Gulbenkian

E. Instituto Nacional de Investigação Científica

F. RIAES/UA - institutional support.

V. Summary of Status

A. UA - Terra Cha has made good progress since 1979 toward developing food technology under the direction of Dr. Ponte Tavares. Changes which have occurred in the last 4 years include:

1. Dr. Tavares is now the administrator in charge of Plant Technology and Food Technology programs, and shares overall responsibility with Dr. Young Amaral.
2. Most of the faculty is young, Azorean, and slowly upgrading in degrees to M.S. toward Ph.D.
3. IUA has become UA.

V. (cont.)

4. Greenhouses have been established and are being utilized for studies, as well as producing food, such as tomatoes and peppers.
 5. Animal herd facilities are being upgraded with new barns, milking parlor and research facilities.
 6. The land around UA has been cleared and developed for food production.
 7. There is a planned program of beautification underway with plantings of trees, shrubs, and flowers.
 8. A cafeteria and lounge is now in operation for students and faculty, utilizing food produced on the UA grounds as much as possible.
 9. UA cows are producing quality raw milk for faculty and students.
 10. UA milk is currently being processed into yoghurt and queigo branco cheese for use in the cafeteria.
 11. Vasco Mendez and Ester Gradil have been head of the Microbiology lab and left.
 - a. Raquel Costa e Silva, working in plant tissue culture, will now head up the Micro Lab. She has industrial experience in milk microbiology.
 - b. Mrs. Gradil's position will be filled by a UA graduate.
 12. Duarte Ponte is on leave in Holland studying for a Ph.D. with an emphasis on fish processing. He will be gone at least another 2 years.
- B. Food Technology has been established at UA-Terra Cha.
1. Space has been identified for this program which includes:
 - a. Microbiology Lab
 - b. Dairy Quality Lab
 - c. A lab which can be converted for research.
 - d. A large room and 3 adjoining small rooms to be developed as a

pilot plant complex.

- e. office space.
- 2. Consideration is being given to developing a curriculum.
- 3. Some staff is already available with support technicians.
- 4. A good start has been made in obtaining the basic equipment needed for research and food processing.
- 5. There is initial development of some support programs:
 - a. for industry
 - b. food service in the UA cafeteria.
 - c. food processing for the UA cafeteria.
- 6. Recently, UA received word of approval for a loan from the Dutch Government to purchase processing equipment for a milk/cheese pilot plant. UA administration must now submit a proposal through the Regional Government and National Government to the Dutch Embassy.

VI. Recommendations

A. University of the Azores

- 1. UA should continue the development of a research laboratory for Food Technology.
 - a. Some of the essential large equipment has been received or is coming.
 - b. The designated room must be developed to house the equipment.
 - c. This laboratory will need sufficient electricity and power points to handle the heavy demand for equipment.
 - d. The laboratory must be equipped with benches, cabinets, shelves, drawers for working and storage space.
 - e. Sinks, drains, and hot and cold water should also be provided for this laboratory and the adjacent dairy quality lab.

23

- VI. 2. UA should provide funds for the purchase of chromatography equipment in support of food technology research.
 - a. This essential equipment should include a continuous flow absorbance monitor, fraction collector, pump, columns, recorder and the necessary accessories.
 - b. The equipment will be vital to support the plans for an extensive research program which will study the utilization of enzymes for cheese processing. These enzymes will be obtained from sources which can be produced in the Azores; such as pineapple, papaya, figs, horse radish, fish waste, bovine waste and porcine waste.
3. UA must provide funds to renovate the designated room complex into a food technology pilot plant.
 - a. This facility should have mobility and versatility for at least 3 planned functions:
 1. Research utilization - initially this will be directed at cheese.
 2. Teaching - for food technology classes.
 3. Processing - preservation of UA food production.
 - b. Needs for this facility include:
 1. floor drains
 2. service units, either around the walls or down the center, which contain - water proof power points
 - hot & cold water outlets
 - steam outlets
 3. large capacity hot water heater
 4. steam generator

VI. 3.b. (cont.)

5. walk-in refrigerator
 6. walk-in freezer
 7. cheese aging room with temperature control
 8. small quality control/sensory evaluation laboratory
 9. stainless steel tables
- c. Some future needs for this facility should include:
1. pilot scale plate freezer
 2. pilot scale ultrafiltration unit for cheese manufacture and whey processing.
4. UA should process the proposal to obtain a loan from the Dutch Government. These funds would be for the purchase of milk and cheese processing equipment to initially outfit the pilot plant.
5. UA should consider establishing facilities for Controlled Atmosphere storage of fresh fruits and vegetables.
- a. This research capability would permit studies on the development of better systems to preserve fresh produce.
 - b. UA could then determine what conditions work best for Azorean products.
6. UA must improve the storage facilities for chemicals, acids and solvents.
- a. A separate building should be constructed at Terra Cha, with ventilation, to hold solvents and acids.
 - b. Chemicals stored on shelves in the present store room should be restrained in the event of another earthquake.

7. UA should provide additional staff support for Food Technology, since it appears Dr. Tavares may have to assume additional administrative responsibilities.
 - a. Additional administrative responsibilities for Dr. Tavares could slow the development of food technology, with Duarte Ponte away for at least two years.
 - b. The University should move quickly to fill all vacant staff positions in Food Technology.
 - c. At least 2 additional technician positions should be created in support of the food technology research lab and the food technology pilot plant.
 8. UA should plan to hire at least 2 new food technology staff in the near future, with one position in human nutrition.
- B. University of Rhode Island
1. URI should establish research linkages with UA in several project areas involved with food technology.
 - a. Hydroponics - research project on large scale food production employing new facilities being developed at URI and the new greenhouses at UA. URI Faculty - Barnett/Hull.
 - b. Milk coagulants - joint project on identification and extraction of enzymes from fish waste for utilization in cheese manufacture. URI Faculty - Rand.
 - c. Cold Sterilization of Milk - joint project on the enzyme/hydrogen peroxide treatment of milk for S. Jorge cheese. URI Faculty - Rand.
 - d. Nutritional Assessment - develop a research project to determine the nutritional status and food habits of Azoreans. This could be a potential sabbatical leave possibility in 1984-85. URI Faculty - Caldwell.

2. Establish consultancies and collaboration in the following areas:
 - a. Biomass conversion - utilization of animal and plant manures for energy production on the UA research farm. URI faculty-Barnett.
 - b. Animal rennets - develop the processing and utilization of porcine and bovine stomach tissue for industrial production of enzymes for the manufacture of queigo branco and pasta mole (short hold) cheeses. URI faculty - Rand.
 - c. Training Programs - development of short courses and slide/tape presentations for the training dairy industry technicians in quality control and food plant personnel in sanitation and hygiene. URI Faculty - Cosgrove.
 - d. Antibiotic Detection Program - development of methods and procedures for detecting the presence of antibiotics in the Azorean milk supply. URI Faculty - Cosgrove.