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FINAL REPORT

BY

WESTERN INSTITUTE FOR SCIENCE AND TECHNOLOGY

ON THE

BAHAMAS AGRICULTURAL, RESEARCH, TRAINING AND DEVELOPMENT PROJECT

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## A. GENERAL BACKGROUND

The BARTAD program had its origin in an official request from the Commonwealth of the Bahamas to the United States Agency for International Development for assistance in establishing a cattle industry in the Bahamas. At the time of the request, over 85 percent of all agricultural commodities and beef were imported; as a matter of fact, no beef cattle were being produced.

In 1972, the Agency for International Development, in conjunction with the U. S. Department of Agriculture, entered into a project agreement with the Bahamian Government to establish an agricultural research, development and training program in the Bahamas Islands devoted primarily to the problems related to the production of livestock. Since the inception of the program, the perimeters of the ProAg have been greatly expanded into highly diverse areas of not only livestock production, but also tropical fruits and vegetables. For example, fifty-eight research projects were explored, including seven in Agricultural Economics, eight in Agronomy Field Crops, sixteen in Agronomy Forage Crops, fourteen in Animal Science, twelve in Fruits and Vegetables, and one in Agricultural Engineering.

A policy decision was made by AID that this program would not be administered by direct-hire AID personnel but instead by private independent contractors who would be responsible for designated areas of development in regard to the BARTAD program. Specifically, in this regard, Pennsylvania State University was selected to provide the professional expertise in the research areas. A contract was entered into in June, 1973, between AID and PSU to effectuate these objectives.

WIST's involvement in the BARTAD program actually started several months prior to the signing of a contract when the Bahamian Government requested the assistance of WIST on a consulting basis, in determining the best site for the project. In arriving at this conclusion as to the best location, WIST was guided by the following criteria:

1. Consideration was to be given only to Crown Land,
2. The location must allow for expansion beyond the 2,000 acres designated for the project,
3. Selection of the best tillable land,
4. Location of the project site over the maximum depth of the fresh water lens, if possible, and
5. Accessibility to airport and shipping facilities.

Upon completion of the consulting services, AID entered into a contract on April 9, 1973, with the Western Institute for Science and Technology, a non-profit, educational corporation. Under the terms of the contract, WIST was assigned responsibility for providing administration of the technical and logistical services to the BARTAD program in five distance areas:

1. All logistical support to the program, including the purchase of equipment, vehicles, supplies, and commodities,

2. All student vocational training at the Project station and at WIST-selected educational institutions in the United States or a third country,
3. Provide project with support personnel, business and administration management,
4. Sub-contract with architectural and engineering firms to provide building plans, designs and construction contract administration, and
5. Be responsible for construction of buildings on Project site and satellite farms.

Under the terms of this agreement, WIST was made directly responsible for the administration of the program through the employment of a Resident Director who would be permanently located at the Project station on Andros Island. In addition, a business manager was also located on Andros. The domestic support for the BARTAD Project came from the WIST Waco, Texas, office, being staffed by a Campus Coordinator and a Campus Administrator. Further, a Senior Scientist was provided by the contractor as a support adviser to the project to assist the Resident Director in the general operations of the program and to identify all existing and/or potential problems that might occur in the research aspects of the program, and notify the AID Project Manager in Washington, D.C. in regard to the same.

It became evident to all concerned after several months of involvement in the BARTAD Program that having the Project Director located in Washington, and the Resident Director 1,000 miles removed in the Bahamas, did not lend itself to the most efficient administration of the program. It was, therefore, decided to delete the positions of Resident Director and Senior Scientist from the WIST contract and to place, on station, a direct-hire AID personnel in the form of the Project Manager to be responsible for the administration of the program. This arrangement has proved to be quite satisfactory and had given the program the necessary cohesiveness and direction needed so that the objectives of the ProAg would be accomplished within the time frame of five years.

Subsequent to the initial contract, WIST was authorized to locate a Training Director on station who was responsible for all local training, and the selection of Bahamian students for technical education in the United States.

## B. STATEMENT OF PROJECT OBJECTIVES AS STATED IN THE CONTRACT

The technical assistance provided under this contract will assist in the development of a livestock and agricultural research project in the Commonwealth of the Bahamas. This program established in the Bahamas an agricultural research, development and training center devoted primarily to the problems relating to the production of livestock and a wide variety of tropical agricultural commodities. This program was established under rather primitive, underdeveloped conditions on Andros, one of the outer islands in the Bahamian Chain. It is hoped that the results will be beneficial to other developing nations with similar tropical climate and topography which do not possess sophisticated technology in livestock and agriculture.

One project objective was to gain useful knowledge relating to the development of agricultural programs based upon livestock production in non-traditional cultures and environments. The activity utilized economic, sociological, and agronomic expertise supplied by specialists under contractual relationships with AID. A livestock production system, as part of the pilot project, was established to demonstrate the various means of implementing livestock production in the environment of a less developed country.

An area of approximately 2,000 acres was developed over a five-year period as a demonstration area. This area consists of a central station used as a research and training center, and a contiguous section utilized for satellite demonstration farms. Farm families were selected to occupy these properties based upon their ability to relate to and interest in agricultural and livestock production.

This general goal was accomplished by obtaining the following objectives:

1. Research activities were conducted to determine the best type of grass and legumes for the local situation. An attempt was made to develop a standard system for screening grasses and legumes under actual grazing conditions. Fertilizer applications were investigated with special attention given to the rate of application of N, P, and K plus the time of application and frequency required. An attempt was also made to evaluate sulfur-coated urea (SCU) under the semitropical conditions found in the Bahamas. Special attention was given to identifying the most appropriate fruit and vegetable crops that could be grown as part of the system that would utilize livestock as a main source of income. Different methods of land preparation were evaluated. Comparisons were made of land preparation costs, and future yields were evaluated to determine the best method to preserve the natural fertility.
2. The economic aspects of livestock production were also studied. These included marketing and production costs and systems. The cost of production and the value of the goods that could be produced were established and the size of the satellite farms determined in terms of an adequate family income. Various alternative means of marketing were studied and recommendations made as to the best course of action.
3. Sociological research was conducted to develop a profile of the family types and characteristics best suited to inhabit the farms to be established. This included the possibility of bringing people from other islands. Criteria was developed for the final selection of the

recipients of the land. Measures were also established to judge the effectiveness of the individual farmers and the lengths of the probationary period before long-term possession was granted. Factors affecting motivation of non-traditional livestock producers were identified.

4. The best and most economical means of bringing land into production under Andros Island conditions were determined. Various types of machinery and clearing systems were studied in terms of their relative cost-benefit ratio.
5. Research was conducted to determine the best type of pastures and feed resources. Information available at the International Center for Tropical Agriculture (CIAT) in Colombia, in Florida and areas of the Caribbean was utilized.
6. The most suitable breed of cattle for the Bahamas was selected based upon experience under similar conditions in other countries. The proper husbandry practices were identified and the way to train non-traditional livestock workers was determined.

All activities were so structured as to make the information obtained at the Center, on the demonstration farms and elsewhere in the Bahamas transferable to other non-traditional livestock production areas of the world. The feasibility of such transfer was tested in the Bahamas through technical and capital assistance to farmers not directly related to the Center or the satellite farms.

Although not stated in the ProAg, one of the objectives of the project was to demonstrate whether or not a project of this nature could be conducted and operated by utilizing private contractors to provide the technical and professional skills relating to logistical and project support services, and in addition provide overall general business administration for the project.

#### 1. General Characteristics of Project Location

The assignment of responsibility to a private contractor to provide logistical and general business administration support to an overseas AID financed project was an innovative concept which was utilized in the BARTAD Project. In addition, WIST was also assigned total responsibility for securing, either through their own resources or by contractors, consulting services for engineering and design of project facilities, management of the construction, maintenance of facilities, participant training, and supplying professional and technical consultants. In providing the supporting logistical and administrative services it was necessary for the contractor to rely solely upon their own resources as no U. S. or Bahamian support facilities were located on the Island. Further, the closest AID facility available for advice or guidance was located in Washington, D.C. Despite the fact that the Bahamas Islands are relatively close to the mainland United States it is difficult to imagine the degree of isolation from regular transportation facilities and the almost total lack of communications facilities to the outer islands of the Bahamas. Further, there was no regularly scheduled sea transportation service from the mainland U. S. to Andros' island. The sea transportation from Nassau to Andros was sporadic and unreliable using small craft which were generally unsafe and unsatisfactory for use by the Project.

Air transportation to and from the U. S. mainland was listed on a published schedule but never became operational. Air transportation between Nassau and San Andros was provided by small aircraft with passenger but no cargo capacity. Further, there was no scheduled transportation on the Island, either passenger or freight. Taxis operated from the airport to the hotels but were not available for general service. Telephone service was similar to that found in many locations in Africa and other underdeveloped nations. The telephone communication equipment was antiquated and the service notoriously unreliable. Delays in transmissions of up to 48 hours were not uncommon. Further, connections were of such poor quality when established that the communications were often unintelligible.

These above referenced conditions and others required up-grading by WIST before effective and reliable services could be provided to the Project.

## 2. Procedures Instituted by WIST in Order to Effectuate its Contractual Obligations

### a. Logistical Support to the Project

Under the terms of the above referenced contract, WIST was responsible for the procurement of a broad spectrum of commodities, vehicles, machinery, heavy equipment, livestock, and all other supplies requisitioned by the Project. Virtually all purchasing was done on a competitive bid basis through sources of supply which the contractor had established, and in some instances through the General Services Administration. The Institute was responsible not only for procuring the supplies, but also insuring their delivery in the most expeditious manner possible. Initially, all procurement and delivery schedules were administered through the Waco, Texas office and the employment of a shipping agent in Miami, Florida. However, it soon became apparent that this arrangement was unsatisfactory for a variety of reasons such as untimely delivery, lack of adequate record keeping by the shipping agent, and mis-shipment of supplies. It was therefore, decided that in order to rectify these procedural defects, to establish a small logistical support office in a shipping terminal in Miami, Florida. This office has been of invaluable assistance to the Project, not only in expediting the flow of materials to the Project, but also as a base for emergency procurement needs. The available transportation facilities to the out islands were unreliable in the early phases of the program and WIST personnel worked diligently to secure adequate transportation to Andros using both sea and air services.

## 3. Construction of Project Facilities

An additional obligation under the April 9, 1973, contract with AID was the duty to construct all Project facilities. The 1.2 million dollar construction budget includes office buildings, repairs and maintenance facilities, seed storage and warehousing structures, staff and farm houses, a dormitory-classroom building, and an eight-unit apartment complex. The problems encountered in fulfilling the construction obligations under the contract have been substantial; however all 33 permanent structures have been completed and accepted by AID Engineering and Project Management.

WIST was responsible, with Project Management, or preparing the initial specifications and selecting, on a competitive bid basis, architectural/engineering firms for the development of specifications and plans for all structures. WIST employed both Bahamian and U. S. architectural and engineering firms in this regard.

WIST was also responsible for selecting, on a competitive bid basis the contractors to erect all facilities. WIST employed architects administered and supervised the actual construction.

The problems encountered in constructing facilities in a remote area such as Andros were numerous. Problems in regard to performance bonds, mechanic's and materialmen's liens, transporting supplies to a remote island, securing interim financing for the construction, insurance, locating skilled labor, competent local contractors and insuring adequate housing for the construction crews, were just a few of the many problems confronted by WIST in effectuating its construction obligations under the contract. WIST was able to master all problems to the satisfaction of AID's Contracting, Engineering, and the Office of the General Counsel.

#### 4. Participant Training in the United States and on Site

The on-going success of the BARTAD Program for the Bahamian people after the termination date of the ProAg will be largely dependent upon the training and education of the Bahamians in technical and professional skills. All technical education, and some professional and administrative education, for the Bahamian participants was the responsibility of the Western Institute. The Institute selected and enrolled for training forty-four Bahamian participants in various colleges and universities in the United States for professional degrees, and technical institutes for vocational training in non-degree areas. The fields of training included: Laboratory Technology and Field Clerk; Seed and Grain Technology; Agricultural and Industrial Equipment Mechanics; Agri-Science Plant Science Technology; Engineering; Business Administration, Home Economics; Auto Parts Specialist; Livestock and Ranch Management; Construction and Heavy Equipment Operations; Horse shoeing; General and Farm Mechanics; Farm Foreman Training; Meat Processing and Slaughterhouse; Automotive Parts, Pricing, Stocking and Inventory; and Lab Assistant. Only five of the forty-four participants returned to the Bahamas without completing their planned curriculum. Inadequate academic background was the reason for one, and discipline problems were encountered with the other four students. Considering their poor academic background it would be unrealistic to expect 100 percent success for all participants. (For a comprehensive report in regard to the educational activities of WIST on the BARTAD Project see Attachment A, Final Training Report by Phillip R. Gupton, Project Training Director for the Western Institute for Science and Technology.)

To administer the participant training phase of the program. WIST assigned a training director to the Project station who was responsible for the selection of student candidates. Upon arrival in the United States, the students were met by a member of the WIST Waco staff or WIST Miami staff. Throughout the time the students were in the United States, they were under the sponsorship of the Western Institute. Housing, transportation, medical care, vocational counseling, curriculum planning, maintenance allowances and other financial needs, as well as "day-to-day" incidentals were taken care of by WIST personnel.

Areas of training for the forty-four students ranged from a one month course in horse shoeing to two year courses in seed and grain technology. (For the full range of curriculum offerings see attached report by the Training Director). For example, academic curriculums in agricultural engineering, agronomy, veterinary science, agricultural economics, and home economics; and technical training in farm and heavy equipment mechanics, welding, automotive mechanics, food processing, slaughterhouse management, and farm and livestock management. WIST, in cooperation with the schools and colleges, tailored the curriculums to specifically fit the needs of the BARTAD Program. This approach offered better training in a shorter time frame than the normal general curriculum would provide.

Another area of education for which WIST was responsible was the on-site training courses under the direction of the WIST Training Director. WIST conducted surveys among the Project employees and the local population to better determine the level and direction the training program should follow. Areas of training included shop procedures and operation of farm and heavy machinery.

#### 5. Technical and Professional Consultant Services

During the BARTAD Program, the Western Institute arranged for the services of some thirty separate consultants in a minimum of fifteen divergent areas. For example, services were provided in the following areas:

Water Research	Colorado State University
Pasture Development & Utilization	Louisiana State University University of Florida
Entomologists	University of West Indies University of Florida Texas A&M University
Agricultural Economist	Michigan State University
Heavy Equipment Specialists	Texas State Technical Institute
Sociological Survey	Colorado State University
Rice Research	Louisiana State University
Agronomy	Purdue University
Meat Processing	Texas State Technical Institute
Soybean Research	University of Illinois
Land Potential	United Kingdom
Swine	University of Florida
Slaughterhouse Management	Texas State Technical Institute

Consultants were employed upon the recommendations of AID and PSU, and contacts established by the Western Institute personnel with numerous colleges, universities and technical institutes throughout the U. S. where technical and professional expertise is available.

It might be added at this point that WIST provided a range of services and expertise which cannot be easily compartmentalized under one of the above headings, for example:

- a. WIST had personnel knowledgeable in analysing and recommending appropriate irrigation systems and equipment.
- b. WIST investigated communication systems, located equipment and assisted in installation of the systems.
- c. WIST participated in the planning and design of a power distribution system for the BARTAD Project site.
- d. The security services for the Project were planned by WIST.
- e. Bus transportation for local staff and project employees by local businesses was arranged by WIST, as there were no public transportation facilities on the island.
- f. During the early stages of the Project, WIST supervised agricultural research and development of agricultural research projects.
- g. WIST personnel have participated in all mid-level and senior-level management groups consisting of representatives from AID, PSU, Bahamas Ministry of Agriculture and the U. S. Embassy in planning objectives and methods for obtaining Project goals.
- h. Aircraft and ships have been inspected by WIST for possible purchase.
- i. Surplus and excess property for use on the Project have been inspected by WIST personnel.
- j. WIST has been involved in the planning and drilling of wells for irrigation and water supply.
- k. WIST has prepared surveys relating to utilization of modular homes, mobile homes and other building designs.
- l. WIST has provided personnel administration, including recruitment of local staff and Project personnel, selection, hiring, and termination. In coordination with Bahamas Ministries of Labor and Agriculture, developed wage schedules and benefits for local employees.
- m. Planning and scheduling of commodity requirements has been provided by WIST.
- n. WIST has provided motor vehicle and heavy equipment operation, maintenance and repair.
6. Establishment of Inter-relationships between WIST, Private Contractors and Government Agencies (U.S. and GCOB)
  - a. WIST - AID, Washington

Our relationship with the Technical Assistance Bureau and the Contracts Office was exceedingly good. Our lines of communication were always open,

and our knowledge and understanding of the personnel with whom we were working was of great benefit in the expeditious administration of project affairs. We never encountered any serious difficulties in conferring with individuals who were responsible for the decision making process.

b. WIST - AID, Bahamas

Our relationship with the Project Manager has been satisfactory. We have at times had disagreements, but that simply is inevitable in the operation of any business, especially in view of the fact that our contact with him has been virtually on a daily basis for over three and one-half years. It is appropriate to state that we each understand capabilities of the other and have been able to work together to effectuate project objectives in compatible form.

7. WIST Acquired Practical Expertise from Participation in the BARTAD Program

WIST has experienced and learned from:

- a. The many problems involved in shipping to foreign countries.
- b. The security required to protect shipments.
- c. The difficulties of unloading ships at poorly equipped ports.
- d. Customs regulation, both U.S. and Bahamian.
- e. The problems encountered with unscheduled air cargo carriers.
- f. The requirements to expedite and ship critical spare parts, many of which are located and shipped in 24 hours.
- g. The importance of training, both initial and continuing for maintenance and equipment operators.
- h. Establishing communication facilities.
- i. Dealing with local contractors.
- j. Accommodating AID regulations with local laws and regulations.
- k. Working with the local Ministry of Works on permissible building designs and building codes.
- l. Working with local power company to design and establish electrical distribution systems.
- m. Working with the local telephone company to establish communication system and even having to locate sources of supply for some of their equipment.

### C. ACCOMPLISHMENTS TO DATE

The performance of the Western Institute for Science and Technology has demonstrated under unique operating conditions that supporting services to a professional and technical contractor can be provided in a highly efficient manner. In fact, these supporting services enhance the ability of the professional contractor to meet the obligations of its contract more effectively and efficiently.

One of the unusual aspects of the Project has been that it was conducted in a country where no AID office or staff existed and the U.S. Embassy was unable to provide any supporting services to the project itself. Therefore, the Project could not rely on any entity other than itself for assistance or support, as it pertains to administration, program or logistical support on site. AID Washington provided direction and guidance to the project through the Project Manager, who was at first stationed in Washington with frequent trips to the site and was later assigned to Nassau, the capital city, which was on an island adjacent to the island location of the project.

In implementing the project, it was decided that the Agriculture Office of the Technical Assistance Bureau in Washington would monitor the program from the technical point of view because of the potentially broad significance of the research to be applied in the project. The situation was also viewed as an opportunity to test a different approach to project management. In addition to contracting out the technical portions of the project, the Agency decided to provide the administrative and project support through contractual arrangements.

Contracts were made with two institutions to conduct and operate the project in the Bahamas, Pennsylvania State University to provide the technical expertise to implement a livestock and agricultural research and production plant in the islands. The specialists from the University were to be supplemented from other sources as required. The Western Institute for Science and Technology was assigned primary responsibility for general business administration.

#### 1. Principal Accomplishments and How They Relate to the Final Outcome of the Project

It is impossible and perhaps even unwise to attempt any brief summary of the many accomplishments of the Western Institute in their five years of participation in the BARTAD program. By necessary implication, literally hundreds of important functions will be excluded and only the more important general topics can be discussed. There follows a listing of WIST's primary accomplishments:

a. The Institute has established sources of supply for commodities, vehicles, machinery, heavy equipment and farm equipment, and livestock and has purchased these items at the lowest possible price to the U.S. Government.

b. WIST has arranged the most expeditious methods of transporting the above mentioned items purchased from vendor to Miami, then on to Andros by air and sea.

c. It is almost a truism that without the above capabilities, an agricultural and livestock program such as the BARTAD which lends itself

to a seasonal operation, would have been greatly impaired; crops must be planted, fertilized and cultivated within a brief specified time frame; cattle must be cared for on a daily basis, thus a failure to provide timely delivery of food, medicines and other essential supplies could have proved disastrous.

It is not an oversimplification of our functions to assert that our ability to perform these obligations has contributed substantially to the success of the BARTAD Project.

d. Construction: WIST contracted for the construction of thirty-three buildings, at a total cost of \$1,252,194:

- Administration and Laboratory Building
- Maintenance Building
- Warehouse Building
- Forage Drying Building
- Fertilizer and Seed Storage Building
- Dormitory - Training Center
- Eight - unit Apartment Complex
- Eight Staff Houses
- Sixteen satellite farm houses
- Administration and warehouse building for Co-Operative
- Slaughterhouse (Renovation of existing building in Nassau)

e. As mentioned earlier in this Survey, the training and education of the Bahamian people is vitally necessary for the survival of this BARTAD program after the termination date. The Western Institute can present an encouraging list of educated Bahamian participants for which the Institute has been responsible. The attached report by Philip Gupton, WIST Training Director, provides the details of the WIST participant training procedure.

f. Input provided by the professional and technical consultants employed by WIST for research and consultation relating to a broad variety of areas in regard to the BARTAD program has been invaluable to the process and success of the program. This area of WIST responsibility is more thoroughly discussed above and will not be repeated in this summary paragraph.

The utilization of contractors in the conduct of a technical assistance program has been a device for evaluating the effectiveness and efficiency of utilizing contractors in lieu of direct-hire personnel for implementing a project operation and in meeting support needs. Although the theory had been discussed for many years within the Agency, it had not really been tested in an area where necessary resources for use in meeting project needs, from a technical and logistics point of view, were so scarce or totally lacking.

The experience obtained has demonstrated that the use of contractors for these services is feasible and in many instances permits greater flexibility in operations than is normal when operating within the more rigid government entities. The findings of this contractor as outlined in this report support this statement. It is a further belief that the efficiency and cost effectiveness of contractual support is greater than the traditional use of within house field support mechanisms. This last statement is difficult to completely support as it has not been possible to obtain specifics on operating costs for support to projects when provided by

Missions and Embassies overseas. The following statement of findings and accomplishments are provided as they relate to defined contractual responsibilities principally by categories designated within the contract.

1. Logistical Support to the Project, Including the Acquisition of Equipment, Vehicles and Supplies:

In meeting this requirement, the Western Institute identified the personnel within WIST responsible for assuring that services, support, commodities, materials and supplies were provided. The following tasks were accomplished:

a. Sources of supply through the General Services Administration and non-governmental were identified for obtaining a broad spectrum of commodities, vehicles, machinery, equipment, livestock and various materials and supplies.

b. Internal project procedures were established governing the issuance of purchase orders and contracts for the acquisition of the above indicated items. Necessary follow-up and monitoring arrangements established to assure compliance with the issued orders and contracts.

c. Took appropriate steps to assure that necessary transportation services for the movement of shipments to the project were provided.

d. Organized and located a branch office in Miami for the purpose of monitoring, consolidating, coordinating and expediting commodity and supply shipments from the United States to the project, both by sea and air as priorities required. This office also obtained emergency procurement and repair services when necessary.

As stated earlier one of the features of this project was specified funding and a predetermined time period which would not be altered. It was, therefore, essential that commodities, supplies, materials and contractual arrangements be provided in a timely manner. Undue delays or exaggerated lead times could not be tolerated and where necessary, alternate sources or methods were utilized in order to meet the technical needs of operations on the project. In meeting these requirements, the Institute took the measures outlined under items a. and d. and implemented all actions to assure that all supporting elements were available to enable Pennsylvania State University to meet its contractual responsibilities and assure the successful completion of the project.

2. Design and Construction of Project Facilities

a. WIST was responsible for the construction of all on-site project structures including office building, repair and maintenance facilities, seed storage building, warehousing, staff and farm houses, dormitory and classroom building and a small apartment building.

b. In effectuating this obligation the following actions were taken;

i. Through conferences and discussions with project management and technicians identified project construction needs and priorities

ii. Selected, on a competitive bid basis, architectural and engineering firms, from the United States and the Bahamas, for the development of specifications and plans for all structures.

iii. In cooperation with personnel of the Bahamas Ministry of Works insured compliance with local building code requirements.

iv. Selected on a competitive bid basis construction contractors for all project facilities.

v. WIST clarified all aspects of local law to insure that all contracts comply with Bahamian law and at the same time accommodate AID contract regulations.

vi. WIST-employed architects and engineers were responsible for the supervision of all project construction and assuring that the construction conformed to contract design and specifications.

In this phase of operations were found many of the complications and difficulties encountered in construction that would be present in more isolated areas of the world. The range of building and renovations completed included the use of pre-fabricated building materials for administration offices and laboratory building, maintenance facility for vehicles, farm equipment and machinery and heavy equipment, fertilizer warehouse, parts storage, drying building, co-op warehouse and office, masonry construction was used for the training center-dormitory classroom building, apartment complex, farm houses and staff houses. In addition, there was the complete renovation and re-equipment of the government abattoir in Nassau.

In accomplishing this portion of the contract a design competition was held for the farm houses which was won by an employee of the Ministry of Works. The design was attractive, represented local experience in family housing requirements and utilized materials and a design permitting a construction cost which would be affordable by future farmers.

3. Practical Training - Both at the Project Site and at Suitable Training Institutions in the United States or a Third Country

a. The Western Institute was responsible for providing both professional and vocational training to student participants in the BARTAD Project. The students were selected and assigned to colleges and universities in the United States for professional degrees and to technical institutes for vocational training in the non-degree areas.

b. To administer the training program a Training Director was assigned to the project site with responsibility for selecting student candidates for professional and technical training. The technical curriculum included parts and supplies, inventory management, automotive and heavy equipment mechanics, farm machinery maintenance, welding, food processing, slaughterhouse management, farm management, and various other skill courses. The Training Director was also responsible for selecting students who will attend colleges and universities in such academic fields as agricultural engineering, agronomy, veterinary science, agricultural economics, seed and grain technology and other related fields.

c. Conducted surveys among the project employees and the local population to better determine the level and the direction the training program should follow.

d. Selected and trained persons to be located at the on-site demonstration farms.

e. Established on-site training courses utilizing qualified persons on the site as instructors; i.e., shop procedures and operations, and the operating of farm and heavy machinery.

4. General Business Service and Program Support

a. There was provided a full range of financial services including: establishment of accounting reporting procedures, property accounting systems, jointly with the Bahamian Government an imprest fund for local payroll and on-site local expenses, a revenue fund to receive income from sale of animals and proceeds from off-site use of project equipment, and other normal accounting and management services including reporting on status of funds to the Project Manager on a monthly basis.

b. There was a wide range of general administrative services provided, such as vehicle maintenance, project transportation, port and customs clearance, secretarial assistance, reproduction facilities, office space, local procurement of supplies and equipment, payroll services and the full range of personnel services.

c. Consultant and expert services have been provided by contractual arrangements to supplement services available on a regular basis from Pennsylvania State University. The supplemental services as provided were required in fields of water research, pasture development and utilization, entomology, agricultural economics, heavy equipment specialties, sociological surveys, rice research, agronomy, meat processing, soybean research, land potential, swine, agricultural credit, agricultural co-operative, pasture planting, architectural feasibility studies.

d. Miscellaneous Services - In addition, the Western Institute staff has provided a range of services and expertise which does not easily fall into the categories listed above.

i. Investigation and recommendation of irrigation systems and equipment,

ii. Investigating communication systems, locating equipment and assisting in installation of the systems.

iii. Participated in the planning of a power distribution system for the Project site.

iv. Planned and provided security services for the Project.

v. Arranged bus transportation for local staff and Project employees by local businesses as there were no public transportation facilities on the island.

vi. During the early stages of the Project, supervised agricultural research and developed agricultural research projects.

vii. Participation as members of mid-level and high-level management groups consisting of representatives from Pennsylvania State University, Bahamas Ministry of Agriculture and the United States Embassy in planning objectives and methods for obtaining Project goals.

viii. Inspecting aircraft for possible purchase.

ix. Inspection of surplus and excess property for use on the Project.

x. Involved in the planning and drilling of wells for irrigation and water supply

xi. Prepared surveys relating to utilization of modular homes, mobile homes and other building designs.

xii. Provided personnel administration, including recruitment of local staff and Project personnel, selection, hiring, and termination. In coordination with Bahamas Ministries of Labor and Agriculture, developed wage schedules and benefits for local employees.

xiii. Provided planning and scheduling of commodity requirements.

xiv. Provided motor vehicle and heavy equipment operation, maintenance and repair.

xv. Provided warehousing and property management.

xvi. Leased office space and housing as required.

xvii. Provided port/customs clearance for Project commodities, as well as, administrative materials and personal effects.

The fact that both participating parties (WIST and P.S.U.) in the administration of the project were separate contractors is unusual. The services provided by each contractor were complementary to the other, thus reducing operational difficulties and loss of time. The one theme which is apparent is the harmony evidenced in the contractual relationships and the complete understanding of what must be done by both principals.

Another element which is considered unusual is the use of a detailed length-of-project PERT chart. This chart was the guide for establishing and identifying specific actions required by each party to the project giving nature of action and timing for initiation and completion. The Chart has been an effective instrument in establishing joint planning and is, in effect, a commitment for all parties for action in the conduct of the project.

The provision of logistic, program and administrative support services under contractual arrangement has generally proven to be a most satisfactory method of supplying these services. As indicated in the preceding statement the range of services scheduled under this contract has been broad and has carried with it very specific responsibilities not normally identified with an AID financed contractor.

The arrangement for conducting a project with separate contractors with specified areas of responsibility, i.e., one for the technical/professional aspects and another for the support services, operating with an AID Project

Manager located at the project site has proven to be most satisfactory. All participants in the project have been kept fully informed of project plans and requirements which has enabled services to be provided in a knowledgeable and timely manner.

The creation of a senior level planning committee consisting of the Minister of Agriculture, U.S. Ambassador, TAB representative, Project Manager and the senior representative from each of the contractors, (with their decisions being implemented by a mid-level management group consisting of representatives from Ministry of Agriculture, co-Managers of Project, representatives from each contractor and key technicians as required) has been a most successful planning, coordinating and implementing device. The use of this procedure has allowed involvement of the contractors at all steps of the project and enabled them to respond more positively and directly than is usual.

One of the more significant elements of providing support to the project concerned developing sources of supply and services, as well as methods and procedures to be used in obtaining them in a timely and efficient manner. By assigning to WIST the responsibility for obtaining all commodities, supplies, materials and consulting services, there was minimal time lost as sometimes occurs when submitting requisitions from the post to either Washington or an organization such as AAPC in New York. The advantage is that the supporting contractor has been a part of the decision making process through the senior and middle level and is familiar with technicians' requirements. The association is closer than normally exists in a Mission operation and instead of submitting a PIO/C to another entity for procurement, the original requisition with specification is sufficient to start the procurement process in motion. Using this process of direct participation has reduced procurement time and has enabled the contractor to better supply needed commodities within agreed upon time frames.

In evaluating the effectiveness of the services provided under the contract there are several observations:

- The assignment of the complete staff of the professional contractor to the project site in the beginning stages had several benefits to the supporting contractor (WIST) in that it permitted on-site observations and enabled both the professional and the supporting contractor to make adjustments in estimates of needs and types of equipment. This joint on-site participation of the two contractors was beneficial in the development of plans for operations and research.

- The decision to relocate the Project Manager from Washington to the project site should have been made earlier as this would have given the project firmer direction and guidance and have encouraged more Bahamian Government involvement at an earlier date.

- If the high level policy group and the middle level management group had been established and organized at an earlier date there might have been more direct Ministry of Agriculture involvement and interest in project direction and operation than was evidenced. At the beginning it is recognized that certain local political interests had to be dealt with in the early months of the project which necessitated some delays in implementing such direct participation as eventually came about on the project.

- The PERT plan which was developed would have been a very useful management and programming tool if developed in 1974 instead of 1975. Many

of the complications in program direction might have been resolved earlier thus permitting movement forward at a more rapid pace than actually occurred.

- If the above had taken place, the Ministry of Agriculture's role in the project would have been more clearly defined and might have encouraged the Ministry to participate more actively by assigning personnel to work on the project and to identify/select young persons for training in areas of identified need so that those persons could become involved in the operations of the research station and satellite farm operations while the contractors were still in place at the site.

- When there is no U. S. Government entity available and the contractor has been assigned the responsibility for all project procurement and contracting the same authority and responsibility normally given to the AID entity should be transferred to the contractor, i.e., the monetary limitations for procurement and contracting normally given to the Mission Director or other senior AID official should apply. The contract assigning the responsibility and authority should clearly outline limitations but should not delay obtaining necessary items or services as occasionally occurred in this contract.

- In a contract of this nature, general administration, procurement, logistical and training, it is possible to point to items of completion with some substance. The buildings were constructed and made available for use by the project, the listing is given here of buildings completed, at a total cost of \$1,252,899:

1. Administration and laboratory building (pre-fab metal)
2. Vehicle and heavy equipment maintenance shop (pre-fab metal)
3. Warehouse and generator building (pre-fab metal)
4. Seed drying building (pre-fab metal)
5. Water pump and system
6. Training and dormitory building (concrete block and masonry)
7. Parts storage building (pre-fab metal)
8. Apartment complex (concrete block and masonry)
9. Farm houses (concrete block and masonry)
10. Staff houses (concrete block and masonry)

- In the training area there were one hundred-sixty four persons who received vocational, technical and degree training in various institutions and on-site as set out in section 3 of this report. The majority of those receiving training will have returned to the project prior to the end day of the contract and will be engaged in project activities. The report of the Training Director is contained in Appendix A and gives full details of the training program and the returned students utilization, actual and planned.

- The equipment element consisted of various categories including farm machinery, office equipment, laboratory equipment and supplies, heavy equipment, vehicles, communication equipment, fertilizer and livestock. The amount of \$1,300,000 was included in the budget and the procurement has been completed.

The logistical services provided to the project were made available at the project site, from the headquarters office in Waco and since late 1974, the logistics office in Miami, Florida was principally responsible for supporting services and emergency procurement. Until the establishment of the Miami operation, the logistical supporting services were provided solely at the project, Business Managers office, and the headquarters staff in Waco, Texas. Appendix "B" summarizes the volume of commodities and supplies forwarded to the project.

The general business administration of the project, as well as project support, financial management, and general administrative services, vehicle operation and administration, local procurement and services, fiscal services, payroll preparation and general personnel administration were conducted on-site at the project. See Appendix "C" for organization chart.

- During the life of the contract there were several changes made which effected the operations conducted by the Western Institute. In 1974, by agreement with the Technical Assistance Bureau and the Ministry of Agriculture, two positions were dropped from the contract. One, the Senior Scientist who served as a special advisor to the project resolving operating and development problems and, two, the Resident Director who was responsible for the day-to-day activities relating to the development and operation of the Center and for the development of the satellite farms. With the departure of the incumbents in these positions, the AID Project Manager moved from Washington to the Bahamas working as a Co-Manager with the Ministry of Agriculture designee in supervising center operations and the development of the satellite farms. This change took WIST out of the operational aspects of the project leaving to them the role of support, program, logistical and administrative.

In 1975, there was established the position of Training Director to better enable the Western Institute to fully meet the project's responsibility for the training of participants from the Commonwealth of the Bahamas. This change was necessary to ensure proper selection of candidates for academic training and to develop a more comprehensive short term vocation and technical training courses on-site, third country and in the United States. The refinement of the selection process not only improved the quality of the participants but also helped to remove many of the political overtones involved in the selection of earlier candidates for short and long term training.

In order to assure the use of revenues for project operation and development, as well as encourage host government participation in funding of local expenses, there were established an Imprest Fund with contributions from the project and the Bahamian Government to meet local operating expenses and a Revenue Account for the receipt of monies generated by the project and the use of project equipment and personnel on farms outside of the project site. These two actions came at the right time, increasing their involvement in project operations and the associated operational responsibilities, also making them aware that project actions could generate income as well as provide agricultural research benefits to the Bahamian farmers and potential farmers.

##### 5. Narrative Summary of Accomplishments and Utilization

The primary accomplishments of WIST were in the providing a full range of program and administration support services to an agricultural project in

a country where there was no AID office and no operations infrastructure to provide support assistance. In addition, there was little or no traditional agriculture, no livestock operations and no host country entity to provide services beyond very basic technical services.

Simply stated, the agricultural expertise would be provided by the Pennsylvania State University with all construction, administrative and logistical support responsibilities being assumed by the Western Institute for Science and Technology (WIST), in addition to the technical training of students and the recruitment and provision of specialized consultants not available from the University.

WIST established a capability to obtain and deliver to the project site a wide range of commodities, materials, supplies and services. This required the establishment of sources of supply utilizing non-governmental vendors as well as the General Services Administration and others. Through close working relationships with individual businessmen on the island there was developed a transportation service for the movement of workers to and from the project site which had not existed previously. Through the establishment of an office in Miami, Florida, shipments were consolidated and expedited to the project.

WIST was responsible for and successfully completed the design and construction of \$1.2 million in facilities for the BARTAD project. This included a broad range of structures such as dwellings for staff and farmers, a complete renovation of the existing slaughterhouse. A total of thirty-three separate permanent structures were furnished.

A major component of the supporting activities was the design, development and administration of a technical and vocational training program. This required the selection, preparation and assignment of participants to colleges, universities and to technical institutions. A significant aspect of training dealt with the preparation, development and establishment of on-site training courses directly related to operational needs and potential farmers to be located on demonstration farms as a part of the research center operations.

In order to supply a full range of support services to BARTAD, it was necessary to establish an on-site headquarters based competence in the general administrative and financial management fields. To accomplish this there was located at the site a Business Manager responsible for general administrative services including property management and fiscal operations. At the beginning these services also included the full range of personnel operations and services for local project staff. These services included:

- a. Reporting and accounting systems including fiscal and property
- b. Establishment of an Imprest Fund
- c. Establishment of a Revenue Fund
- d. Monthly analyses of project operating costs and,
- e. Vehicle and heavy equipment operation and maintenance

The Institute participated in developing host country personnel in management responsibilities during the course of the project so that there

would be experienced personnel available to continue the effective operation of research center operations upon completion of the contract. These services can be expanded to meet a broader range of support to agriculturally related operations at a later date if the Bahamian Government should later decide to broaden the range of services provided by the Ministry of Agriculture. In general, all of the operations have been adapted to meet the conditions of the local scene and can be useful if they will be utilized by the host government in the continuation of research center and demonstration farms activities.

If the Government of the Commonwealth of the Bahamas should continue the project, the administrative, logistical and program support structure would require some adjustment and modification. The basic administrative structure on the site should be continued but the logistical and program support elements would be changed to reflect procurement from normal sources utilized by the Bahamian Government as they would no longer have to conform to AID regulations and they could use their own procurement channels. As the bulk of the equipment and supporting items would already be on hand the logistic elements would no longer be required. The program support would come from the Ministry of Agriculture, hopefully, modified to accomodate the requirements of the Center and the satellite farmers.

The training program as developed should serve as a guide, not only to the Ministry of Agriculture, but also, to the Government of the Bahamas. The theory and concept has been demonstrated to be a practical and most satisfactory method of providing qualified persons both to take up food production as farmers, and those required in associated activities to assure processing and delivery of products to the consumer.

#### D. DISSEMINATION AND UTILIZATION OF RESEARCH RESULTS

1. The Bahamas Department of Agriculture and Fisheries have had their extension agents visit the BARTAD Project to obtain information which would be useful in their field work on other islands. Serious consideration is also being given to publishing research bulletins from BARTAD Project which would be available at no cost to Bahamian farmers. These research bulletins would advise the farmers as to improved farming methods, including types of seeds and fertilizers to use, livestock health care procedures, and even business management.

2. One of the more significant responsibilities of WIST in meeting stated objectives was to develop, establish and place in operation an administrative and logistical support organization which would demonstrate efficiency and effectiveness in support management. As stated in other sections of this report, people were assigned, facilities established, and procedures utilized in demonstrating how supporting operations could be conducted.

The project administrative and logistical support operations were established on the following bases:

1. The administrative and logistical support organization should be simple, eliminating unnecessary elements.
2. The participation of the supporting elements in all phases of Project planning, development and implementation, with direct inputs into the final decision.
3. Having responsibility and authority to take prompt and appropriate actions to assure supporting services.
4. Maintaining close working relationships with all elements of the Project.
5. Understanding the need to have all support operations geared to meet Project requirements promptly and responsively.

In developing the supporting operations there was a need to train Bahamian personnel in the various phases of personnel administration, procurement of commodities and supplies, property management and control, vehicle operations and maintenance, as well as the receiving and accountability of commodities for the Project. As a part of this concept of development and continuation of supporting services the Ministry of Agriculture selected and assigned Mr. Glenwith Dean to serve as the Bahamian Business Manager on the Project. Mr. Dean worked closely with the WIST Business Manager and the Project Manager remaining on the Project when the contract with WIST terminated.

On various occasions the Permanent Secretary for the Ministry of Agriculture and the Director of Agriculture asserted their intent to continue supporting services in a manner similar to that in operations under the contract. How this will actually be accomplished remains to be seen. It was also the intent of the Director of Agriculture to utilize experience in support services to BARTAD in other agriculture activities being conducted within the Bahamas.

3. In addition to the above, the Bahamian government intends to hold seminars at the BARTAD Project and invite agriculturists from other Caribbean countries to participate. Through this medium, area nations can share research results which may be beneficial to all.

The Bahamas is a member of the Caribbean Development Bank and the Inter-American Development Bank. Membership in these organizations provides contacts with other countries whose agricultural development far exceeds that of the Bahamas, as well as with countries whose agricultural development is near that of the Bahamas.

Penn State University is now beginning a one-year extension of its contract, in order to provide another year of technical assistance to Bahamian professional agricultural personnel. Possibly during this additional year, the Agency for International Development can assist the Bahamian government in establishing contacts with research networks of other countries. A solid core of Bahamian professional counterparts has been trained for the BARTAD Project, including a highly competent Business Manager. With guidance from AID during this first year of Bahamian control of the Project, we believe that the BARTAD Project and Bahamian agriculture in general stand an excellent chance of success.

The Bahamian Director of Agriculture has indicated that they may move the School of Agriculture of the College of the Bahamas to the BARTAD Project site. Such action would give the Project a sense of permanence and would be a good move both for agricultural and for business reasons.

E. STATEMENT OF EXPENDITURES AND OBLIGATIONS AND CONTRACTOR RESOURCES

1. First Year of Project - January 18, 1973 to January 18, 1974

Although the Project Agreement ran from January 18, 1973 to January 18, 1978, the WIST contract with AID was not signed until April 9, 1973. From the contract signing date until January 18, 1974, a total of \$529,540 was expended under the contract, as follows:

Salaries and fringe benefits	\$ 67,750
Contracted services	26,545
Travel, transportation and per diem	27,426
Supplies and materials and operating expenses	63,581
Buildings and equipment	323,553
Indirect costs (administrative)	<u>20,685</u>
Total	\$529,540 =====

During this period to January 18, 1974, the four WIST personnel assigned to the Project were the Project Director and Project Business Manager, on-site on Andros Island, and the Campus Coordinator and Campus Administrator, at the WIST home office in Waco, Texas.

The first group of buildings was started during this period. This group consisted of the administration and laboratory building, the maintenance shop building and the spare parts and tools warehouse. All were pre-fabricated metal type buildings.

Major items of equipment purchased during the period were a D-8 and D-5 Caterpillar tractors, two diesel-powered field tractors, two four-ton spreaders, a hinge-type disk plowing harrow, two large mounted irrigation pumps, a diesel electric generator, a diesel power welder, and several smaller pieces of farm equipment. Also purchased were four forty-foot vans for use in shipping fertilizer by boat from Miami to Andros Island. Through the use of these vans, a truck could be used at each point to put the vans on the boat or unload them.

Major activity centered around land-clearing, which was no small feat. The land was primarily coral rock covered in pine trees and thick underbrush. In the process of clearing the land, large rocks were left on the surface, which were crushed with a large grid roller rented from an Andros-based affiliate of a large U. S. company.

Other important activities were grass seeding for pastures and research plots, fence building for the soon-to-arrive livestock, and collecting of forage samples for yield tests. A forage harvester and two forage drying ovens were purchased for use in the latter activity.

2. Second Year of Project - January 18, 1974 to January 18, 1975

During this year expenditures under the WIST contract totaled \$984,776, as follows:

Salaries and fringe benefits	\$106,663
Consultants	72,754
Travel, transportation and per diem	47,059
Supplies and materials and operating expenses	131,263
Equipment	90,431
Buildings	77,958
Allowances	21,419
Participant training	7,942
Local costs	351,678
Indirect costs	<u>23,865</u>
Total	\$984,776 =====

Major items of equipment purchased were a D-4 Caterpillar tractor, four additional forty-foot trailers for fertilizer storage, a truck-tractor to move the trailers from the dock to the Project site, a fork-lift to facilitate movement of fertilizer and large items and with the completion of the first group of three permanent buildings, a 55-KW generator for electrical power. Several items of lab equipment were purchased, including soil testing equipment, cabinets, and two microscopes.

During this year a major change was made in WIST's personnel assignments. The positions of Project Director and Senior Scientist were deleted from the WIST contract, and the AID Project Director assumed administrative control of the Project. In addition, the position of Materials Expediter was added to the WIST contract, to be stationed in a WIST branch office in Miami. The Materials Expediter had the responsibility for receiving incoming shipments from vendors, preparing export documents and consolidating the orders for shipment to Andros Island. He also performed emergency procurement when requested by Project Management.

3. Third Year of Project - January 18, 1975 to January 18, 1976

Expenditures during the third year of the contract totaled \$914,134, as follows:

Salaries and fringe benefits	\$117,179
Consultant costs	46,355
Travel, transportation, and per diem	44,418
Supplies and materials and operating expenses	176,421
Allowances	7,664
Participant training	27,937
Buildings	135,492
Equipment	179,822
Fertilizer	18,827
Livestock	4,268
Local costs	65,118
Indirect costs (administrative)	<u>90,633</u>
Total	\$914,134 =====

The position of Training Director was added to the WIST contract during this year, and he reported for duty on June 1, 1975. His responsibilities included selection of trainees for professional and technical training in the United States, as well as designing and implementing training programs for Project personnel and satellite-farmer trainees.

WIST was also given additional responsibilities of procuring all livestock and fertilizer remaining to be purchased for the balance of the Project. The WIST contract was increased to \$5,476,920.

A fertilizer and seed warehouse and a forage drying building were completed in January, 1976. The forage drying ovens purchased in the first year of the contract were installed in the new building.

With plans underway to construct several additional buildings, a 90-KW generator was purchased, since the additional power requirement would have overloaded the 55-KW generator. Construction of the first year satellite farm houses was begun in November, 1975, and three additional tractors had been purchased in May and June, 1975, to be sure that an adequate number were available for Project and satellite farmer use.

Additional planting equipment was also purchased during this year, as well as additional equipment for the repair and maintenance shop. In addition, the large grid roller, which had been used on a rental basis since the beginning of the Project, was purchased. The grid roller is one of the most important pieces of equipment on site, since it is necessary to break down the rock to a tillable state.

An Imprest Fund was set up effective March 1, 1975, and all payroll costs for Bahamian personnel were paid from the Imprest Fund after that date. Contributions from AID and the Bahamian government went into the Imprest Fund. Although the WIST Business Manager kept all records pertaining to the Imprest Fund, no WIST contract monies went into the fund.

#### 4. Fourth Year of Project - January 18, 1976 to January 18, 1977

During the fourth year of the Project, WIST was awarded an additional contract in the amount of \$250,000 for the procurement of supplies and construction of a building for the establishment of the North Andros Agricultural Co-Operative. Funds expended under the two WIST contracts were \$1,363,853 for the BARTAD contract and \$5,905 for the Co-Op contract as follows:

##### BARTAD

Salaries and fringe benefits	\$ 130,886
Consultants	27,469
Travel, transportation and per diem	31,119
Allowances	11,431
Participant training	40,356
Supplies and materials and operating expenses	327,661
Equipment	85,817
Buildings	504,528
Fertilizer	93,581
Livestock	34,170
Indirect costs (administrative)	76,835

Total

\$1,363,853  
=====

CO-OP

Salaries	\$ 2,479
Supplies and materials	1,585
Indirect costs (administrative)	<u>1,841</u>
Total	\$ 5,905 =====

Building construction activity was at its peak during the fourth year of the Project. Eight houses for Project staff members were completed, as well as the first nine satellite farm houses. In addition, the dormitory-training center was approximately fifty percent completed. Numerous problems arose in the use of Bahamian contractors. Due to the remote nature of the location, they encountered problems with skilled manpower; in addition materials were sometimes difficult to obtain. They sometimes exhibited an acute lack of business judgment and had great difficulty in conceptualizing the time deadlines set out in the contracts. A great deal of time was spent by WIST personnel in assisting the contractors to secure performance bonds, financing, insurance, materials and transportation to move materials to the site.

What had originally been planned as a beef cattle project was now changing to a research project for various other types of agriculture as well: various types of vegetables and fruits, as well as smaller types of farm livestock were included in order to determine their economic feasibility under Bahamian conditions. Forty head of beef heifers, seventeen head of swine, and additional sheep and goats were purchased to bring the research station nearer to its livestock capacity and to have animals available for seed stock for the satellite farms. The first four farmers were given their choice of cattle, swine, sheep or goats for seed stock, and each farmer chose a different type of livestock, giving the research center an opportunity to test the profitability of each.

Reflecting the rise in the production capabilities of the Project, additional harvesting equipment was purchased in October and November, 1976. A hay rake, a mower-conditioner, and a baler were procured in addition to a corn picker and a combine.

Additional purchases for the satellite farms including irrigation pumps, seed, trees, etc. were also made during the fourth year and continuing into the fifth year.

WIST's staff remained unchanged during the fourth year, until January 1, 1977. Because of the decline in administrative responsibilities during the terminal phases of the contract, the duties of the Campus Coordinator were reduced. Therefore, in order to conserve government funds, WIST recommended to the Contracting Officer that the Campus Coordinator position be reduced from a full time to sixty percent. This reduction permitted a savings of about sixteen thousand dollars with no reduction in the contractor's effectiveness in performing its duties.

5. Fifth Year of Project - January 18, 1977 to January 18, 1978

During this final year of the Project, all remaining funds in the two WIST contracts were expended, as follows:

BARTAD

Salaries and fringe benefits	\$ 116,786
Consultants	31,315
Travel, transportation and per diem	43,646
Allowances	9,936
Participant training	41,014
Supplies and materials and operating expenses	452,131
Equipment	117,361
Buildings	534,921
Fertilizer	237,764
Indirect costs (administrative)	59,838
Livestock	9,825
Total	<u>\$1,684,617</u> =====

CO-OP

Salaries and fringe benefits	\$ 13,653
Construction, supplies and equipment	260,962
Indirect costs (administrative)	<u>11,480</u>
Total	<u>\$ 286,095</u> =====

All remaining buildings were completed at the BARTAD and Co-Op sites during the fifth year of the Project, and except for the last seven farm houses, all buildings were in use. In addition, almost \$100,000 was spent for renovation of the abattoir in Nassau, since it was not economically feasible to build a new slaughter facility on Andros.

Six new vehicles were purchased to replace units whose condition had deteriorated so badly that it was neither practical nor economically sound to repair them. Rust, collisions, and the extremely harsh operating conditions (rough terrain and a poor road to the Project) had left the used vehicles in poor condition. These vehicles were sold to local people on Andros and the proceeds refunded to AID, since the original group of vehicles was not purchased from WIST contract funds.

CLOSING REMARKS

Over the life of the project, \$202,000 was expended for short term consultants to supplement the expertise of the Pennsylvania State University staff. Each of these consultants made a significant contribution to the success of the BARTAD Project. For instance, of particular importance to the Bahamians was the protection of the fresh water lens on Andros. Regular tests by Mr. David McWhorter, Hydrologist, indicated that the fresh water lens had not suffered at all from the irrigation usage by the Project. In another instance, Mr. Kenneth Ragle, of the Texas State Technical Institute, went to Nassau for a month to instruct abattoir personnel in the use of new equipment as well as the importance of proper sanitation methods. These are but two of the forty WIST-employed

consultants, all of whom played an important part in the Project.

Throughout the five year contract period, the key word for the Project was planning. A PERT Chart, or Life of the Project Plan, as it was called, was prepared for the planned duration of the Project, and Project Management followed the PERT chart closely in planning of activities. Thus the progress of the Project was measured against a quarterly timetable. Expenditure of available funds was also measured quarterly against the timetable, to be constantly sure that remaining funds would cover the cost of all intended research. We feel that Project Management did an excellent job of monitoring the progress of the Project, and planning, in advance of each quarter, consultants to be used, equipment to be ordered, etc.

Project Management also exhibited ingenuity in the daily operations of the Project. Several special purpose farm implements were made up from pieces of other implements. Implement sheds were built by Project personnel, and several of the forty-foot vans were converted into office space and a class room before the training center was completed. Such ingenuity saved several thousand dollars and showed the Bahamians a practical and economical approach to farming.

## APPENDICES

FINAL TRAINING REPORT

Phillip R. Gupton

December 1, 1977

Some 164 persons have received training by the BARTAD Project in at least one of the following categories of training:

1) degree, 2) non-degree, 3) technical-vocational, 4) farmer training courses, and 5) on-site on-the-job.

(Appendix I is a list of those persons trained in each category).

Degree Training

Fourteen have received some training towards their associate, bachelor, or master degrees. Twelve of these were at the Pennsylvania State University and two were at Miami-Dade Community College. Two trained for associate degrees, eight for bachelor degrees and four for master degrees. Seven were agronomy, three in livestock, two in agricultural economics, one in pre-engineering and one in pre-business administration. Of the seven in agronomy, one specialized in pest control, five in field crops and one in soils. Of the fourteen only three did not complete their training and were terminated by the end of 1977. These three were training in agronomy. Of the other eleven, three have successfully completed their training and the other eight are progressing satisfactorily.

Non-degree Training

Seven persons received short term non-degree training in the U.S. Five of these trained through the Western Institute for Science and Technology, and two through the Pennsylvania State University. One trained in management of cooperatives, one in shipping procedures, one in agricultural credit and four in supervision. One of the supervisors specialized in farm foreman training. All were successful in their training programs.

### Technical-Vocational Training

Twenty-three persons received technical-vocational training in the U.S. Their sixteen areas of training included horse shoeing, livestock and ranch management, livestock and ranch operations, meat processing and marketing, abattoir operations and supervision, animal technology, laboratory assistant, laboratory technician and field clerk, maintenance, heavy equipment operation, agricultural and industrial equipment mechanics, maintenance of heavy, automotive, and agricultural equipment, home economics, seed and grain technology, agri-science technology in the plant science option, and automotive parts specialist. All were trained through the Western Institute for Science and Technology. Three trained at Abraham Baldwin Agricultural College in Tifton, Georgia. Twenty trained at Texas State Technical Institute in Waco, Texas. Only five did not complete their training programs and were terminated by the end of 1977, and six of the twenty-three are progressing satisfactorily. The other fifteen successfully completed their training.

A special abattoir training course, twenty-five days in length, was conducted in Nassau by Mr. Ken Ragle of TSTI. Seventeen persons participated in the training, plus two from BARTAD for two weeks of the course.

### Farmer Training Courses

One objective of the BARTAD Project was to establish 16 pilot test farmers on farms adjacent to the research station proper. There being a shortage of bonafide farmers on Andros Island and throughout the Bahamas, it was obvious that training would be necessary to reach the objective. Therefore, a Farmer Training Course was developed to train Bahamians with some farming experience or suitable background in agriculture.

The following qualifications were to be met by applicants for the course:

- 1) be between 25 and 50 years of age and in good health,
- 2) have Bahamian citizenship,
- 3) have a family,
- 4) have at least three years farming experience or specialized training in agriculture,
- 5) be prepared to settle on a test farm at the BARTAD Project site on North Andros,
- 6) be able to read and understand written instructions,
- 7) be able to furnish at least three references, and
- 8) be willing to attend the 12 weeks training course at the project.

Advertisements were released through the press and by radio, and applications were made available through the Ministry of Agriculture and out-island commissioners. (Appendix II is a sample of the application). Whenever possible, applicants were interviewed prior to acceptance for the course.

The Farmer Training Course consisted of 104 hours of lecture and 72 hours of laboratory training. Areas of instruction were designed to meet the needs of the Bahamas and included animal science, vegetable production, farm mechanics, soils and fertilization, pesticides, farm management, marketing, fruit production, pasture management, and field crops. (Appendix III is an outline of subject matter areas and time allocation). Course instruction was conducted by the BARTAD research staff.

Farmer trainees were ranked according to their course scores, and in addition they were evaluated and ranked by the course instructors during the course. Items taken into consideration for this evaluation were a knowledge of general farming, alertness, decision making, management assessment,

problem solving, cooperativeness, and overall performance. An interview committee interviewed each of the trainees eligible to be placed on farms. (Appendix IV is a sample interview form). Trainees were then ranked according to performance on interviews. The final ranking was obtained by averaging these three rankings, interview, instructor evaluation and course score.

The top candidates were recommended to the Ministry of Agriculture for approval and placement on the test farms.

At the end of one year the first four test farmers were evaluated by project management and the decision was made to allow three to continue as farmers on their own. The probationary period of the fourth farmer was extended for six months. The other test farmers will not complete a year of probation before January, 1978. A complete report of the pilot test farm program was published as final reports # 49, 51 and 52.

Although no evaluation form was used in the evaluation of the test farmers at the end of their probation period, one could have been used. (Appendix V is a sample evaluation form by Dr. Don Crider that could be used).

Three farmer training courses were conducted on-site with a total of forty-seven successfully completing the courses. Seven of the participants were from Central Agricultural Station, New Providence and two from the Prison Department in Nassau. Eight were placed on pilot test farms on-site. One manages the produce shed on Andros Island, one is agriculture representative on South Andros. One is agricultural extension agent on Cat Island. Two were employed by BARTAD, one to operate pest control equipment and one in the general crew. One has contracted fencing and construction jobs for BARTAD. One is deceased. Three received Crown land grants off-site.

Nineteen have returned to their own farms, this figure excludes the nine pilot test farmers at BARTAD.

On site, On-the-job Training

Ninety-four persons have received on-the-job training on-site. The skills taught by various staff members are numerous.

Some of the skills learned are as follows:

- 1) operation of vehicles;
- 2) operation of D-4, D-5, and D-8 Caterpillar tractors with angle blades, multipurpose rakes, discs, and grid roller;
- 3) operation of wheel tractors;
- 4) operation of fork lifts;
- 5) planting with row crop equipment, drill, Brillion seeder, and transplanter;
- 6) Fertilizer application with Gandy, Webster and row crop side dresser;
- 7) haymaking using haybine, rake, and bailer;
- 8) mowing with rotary and sickle mowers;
- 9) operation of spray equipment for weed, insect and disease control;
- 10) operation of plot harvestors;
- 11) operation of combine and auger;
- 12) operation of corn picker and elevator;
- 13) operation of irrigation equipment; including "big gun" and "drip" equipment;
- 14) silage making;
- 15) proper handling of cattle, sheep, goats, horses, and hogs, including methods of castration, vaccination, docking, ear tagging, worming, spraying, assistance at parturition, ringing, dehorning, shoeing, selection, and palpation;
- 16) fencing with barbed and woven wire;
- 17) pole barn and shed construction;
- 18) post selection, cutting and treatment;
- 19) farm electrification, including installing breaker box, wiring, and installation of switches, lights, and outlets;

- 20) installation of mobile and base radios;
- 21) assembly, maintenance, and repair, of farm equipment on-site;
- 22) welding, arc and oxyacetylene, brazing and cutting;
- 23) maintenance and repair of vehicles, and tractors on-site;
- 24) calibration of fertilization, planting, and spray equipment;
- 25) accounting, bookkeeping, procurement and receiving;
- 26) warehouse procedures, including receiving, stocking and deposition;
- 27) pruning fruit trees;
- 28) harvesting fruit and vegetables, and packing;
- 29) tire repair;
- 30) conducting seed germination tests;
- 31) use of pH meter with several types of electrodes;
- 32) mixing of simple solutions used in pH and specific ion determinations;
- 33) collecting water samples from lysimeters for use in water quality determinations;
- 34) use of still to distill water for solutions;
- 35) use of analytical balance to weigh chemicals used in solutions;
- 36) use of grain moisture meter to determine moisture percentages in grain samples; and
- 37) operation of office equipment, including copiers, mimeograph and spirit master.

#### Problems Encountered

A few problems in training are worthy of listing. They are as follows:

- 1) availability of suitable participants for degree training;
- 2) method of selection of participants for U.S. training - possibly a pre-test would have helped in screening participants;
- 3) availability of farmers from the other islands to participate in the farmer training courses;
- 4) reluctance by farmers to resettle on Andros Island;

- 5) reluctance of people to leave employment to become farmers; and
- 6) reading and comprehension level of some participants probably due to a low educational attainment.

Reccomendations;

Reccommendations for improvement of training are as follows:

- 1) require pre-test prior to future employment of all personnel;
- 2) the Scholastic Aptitude Test (SAT) should be required, as it is administered in Nassau, prior to selection of future participants for post secondary training;
- 3) a pre-test in the future selection of farmer training course participants should be utilized, as this could be useful in eliminating those unsuited for training to be farmers; and
- 4) a teacher training course should be held on site during each summer for agriculture teachers. An additional course should be held in the fall for agricultural extension agents in order to boost their knowledge of agriculture and gain a better understanding of modern farming in the Bahamas. Attendance in these courses by all current agriculture teachers and extension agents should be a requirement for certification to hold their positions.

APPENDIX I.

<u>Degree</u>		<u>Date of Completion</u>
Michael Brennen,	B.S. Agronomy Crops	terminated
Valerie Carey,	M.Ag. Agronomy in Pest Control	November, 1977
Arnold Dorsett,	M.S. Animal Science	June, 1978
Charles Maillis,	B.S. Agri. Eco.	June, 1979
Simeon Pinder,	B.S. Agronomy crops	December, 1978
Stan Smith,	B.S. Agronomy crops	terminated
Lewis Symonette,	B.S. Agronomy soils	terminated
Earl Deveaux,	M.Ag. Agri. Econ.	August, 1977
Themely Cathopoulos,	B.S. Animal Science	November, 1976
Aryett Lightbourne,	B.S. Animal Science	March, 1978
Jeffrey Collins,	A.A. Pre-engineering	December, 1978
Everette Strachan,	A.A. Pre-business adm.	September, 1978
Roger Smith,	M.Ag. Agronomy crops	December, 1978
Camilla Thompson,	B.S. Agronomy crops	August, 1980

Non-degree

Basil Strachan,	Supervisory, farm foreman	March, 1976
Benjamin Rahming,	Management, Cooperatives	August, 1977
Didymus Smith,	Supervisory	May, 1974
Nemiah Wilson,	Supervisory	May, 1974
Bernard Brown,	Supervisory	May, 1974
Charles Culmer,	Agricultural Credit	September, 1976
Clenwith Dean,	On-the-job shipping procedures	August, 1976

<u>Technical - Vocational</u>		<u>Date of Completion</u>
Bernard Brown,	Horse Shoeing	June, 1974
Arthur Edwards,	Livestock & Ranch Management	August, 1977
Andy Evans,	Lab assistant	terminated
Cedric Evans,	Meats processing	August, 1976
Arnold Fowler,	Auto parts specialist	November, 1976
Gary McDonald,	Horse shoeing	April, 1977
Milton Newton,	Auto parts specialist	November, 1975
Junior Riley,	Horse shoeing	March, 1975
Leroy Riley,	Meats processing	May, 1976
James Russell,	Livestock & Ranch Operations	terminated
Peggy Russell,	Home economics	terminated
Filmore Russell,	Seed & Grain technology	March, 1978
Sandy Scott,	Agricultural & Industrial Equipment Mechanics	May, 1976
Jeffrey Collins,	Maintenance of heavy, auto and agri. Equipment	August, 1975
Philip Symonette,	Meats processing	terminated
Timothy Wallace,	Maintenance and Heavy equipment Opr.	November, 1976
Jonathan Woods,	Lab technician and Field Clerk	March, 1978
Alfred Colebrooke,	Agri.-Science Technology in plant science option	June, 1979
Willard Saunders,	" " " "	June, 1979
Tyrone Williams,	" " " "	June, 1979
Wayman Burnside,	Animal Technology	terminated
Jen Russell,	Livestock & Ranch Operations	November, 1976
Arlington Brennen,	Agricultural & Industrial Equipment Mechanics	March, 1978

Farmer Training Courses

Octavia Colebrooke	Charles Rolle
Enoch Marshall	Martha Rolle
Bernard Evans	Henry Russel
Edward Sargent	Nathaniel Wallace
Lloyd Martin	Wesley Burrows
Wendel Gaitor	Prescola Campbell
Richard Sands	Kaphie Cooper
Vivian Deveaux	Paul Cumberbatch
Joseph Rolle	Caleb Evans
David Pennerman	Patsena Johnson
Bertell Stubbs	Brendamae Knowles
Leroy Riley	Alice LaFleur
Anthony Miller	Joseph Marshall
Glenville Farquharson	Charles McCurdy
Verlim Duncombe	Whalen McCurdy
Gregory Bowe	Prudence Miller
Mildred Brown	Alfred Neymour
Clifford Burrows	John Rodriquez
Kenneth Clark	Benjamin Saunders
Joseph Ferguson	Rudolph Turnquest
Anthony Gibson	
Leana Johnson	
Robert Johnson	
Wilfred Mackey	
Cleavland Murphy	
Samuel Murphy	
Milton Newbold	

Approximate average cost per student per course was \$800.00.

On site, On-the-job

Levitt Brown	Timothy Wallace
Andy Evans	William Wallace
Buster Evans	Melrose Wilson
Bertram Evans	Nemiah Wilson
Cedric Evans	Jonathan Woods
Lockwood Evans	Richard Brown
Lloyd Fowler	Henry Russell
David Hutchenson	Anthony Smith
Gary McDonald	Bernard Brown
Emmett Miller	Rose Pickstock
Clarence Murphy	Basil Strachan
Gordon Outten	Milton Newton
Horace Pierre	Arnold Fowler
Godfrey Rahming	Michael Brennen
Junior Riley	Valerie Carey
Harold Rolie	Arnold Dorsett
James Russell	Arthur Edwards
Jen Russell	John Hedden
Osley Russell	Charles Maillis
Peggy Russell	Simeon Pinder
Filmore Russell	Stan Smith
Sandy Scott	Lewis Symonette
Jeffrey Collins	Themely Cathopoulos
Vivien Scott	Jenniemaie McKenzie
Didymus Smith	Lilliemaie Brown
Clea Storr	Hariam Munroe
Everette Strachan	Arlington McIntosh
Philip Symonette	Mr. Storr

On Site, On-the-job (cont'd

Gregory Armbrister	Leroy Riley, Jr.
A.J. Rolle	Edward Sargent, Jr.
Mrs. Griffith	Ken Cartwright
Roosevelt Finlayson	Clifford Riley
Winston Strachan	Mr. Colebrooke
Carl Smith	Albert Cartwright
Clyde Hanna	Dextor Rahming
Mariena McDonald	Chris Smith
Melony Stockdale	Maria Balliou
Jerome Henfield	Jerry Colebrooke
Theodora Nairn	Michael Romer
Cyril Peet	Livingston Smith
Kevin Russell	
Audley Greaves	
Earl Deveaux	
Robert Taylor	
Ray Smith	
Ezra Cleare	
Junior LaFleur	
William Wallace	
Leroy Riley	
Edward Sargent	
Joe Rolle	
Enoch Marshall	
Ralph Butler	
Chester Marshall	

APPENDIX II

Applicants are asked to supply the following information:

Name \_\_\_\_\_ Mailing Address \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Age \_\_\_\_\_

Nationality \_\_\_\_\_ Phone Number \_\_\_\_\_

Do you have a family \_\_\_\_\_

If yes, number and ages of children \_\_\_\_\_

Your Educational Attainment: Primary School \_\_\_\_\_

Secondary School \_\_\_\_\_ High School \_\_\_\_\_

Other \_\_\_\_\_ Health \_\_\_\_\_

Do you own a farm \_\_\_\_\_ if yes give location \_\_\_\_\_

Farming Experience: Have you farmed \_\_\_\_\_

Number of Acres \_\_\_\_\_ Crop Experience \_\_\_\_\_

Experience with Livestock \_\_\_\_\_ Type \_\_\_\_\_ Number \_\_\_\_\_

Can you drive a tractor \_\_\_\_\_ Have you built fences \_\_\_\_\_

Have you used fertilizer \_\_\_\_\_ Have you used pesticides \_\_\_\_\_

Are you and your family interested in resettling on North Andros \_\_\_\_\_

How would you finance your farm \_\_\_\_\_

Do you keep records \_\_\_\_\_

\_\_\_\_\_

Why do you like to farm \_\_\_\_\_

What type of agriculture are you most interested in: livestock (type)

Crops (kind) \_\_\_\_\_

What income would you expect as a farmer \_\_\_\_\_

What attracts you to agriculture \_\_\_\_\_

Provide Name and References: Bank \_\_\_\_\_

Business \_\_\_\_\_

Other \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

Return this application to either of the following addresses:

Bahamas Agricultural Research,  
Training and Development Project,  
San Andros Post Office,  
Andros, Bahamas.

Ministry of Agriculture, Fisheries  
& Local Government,  
P. O. Box N-3028,  
Nassau, Bahamas.

APPENDIX III.

Farmer Training Course III

May 2 - July 21  
(12 weeks)

7-8 Daily - Creative Study

	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F
	May															June									
	2	3	4	5	6	9	10	11	12	13	16	17	18	19	20	23	24	25	26	27	30	31	1	2	3
8-9	ORIENTATION															HOLIDAY									
		A	→			A	→				A	→				A	→				A	→			
9-10		B	→			B	→				B	→				B	→				B	→			
10-11		C	→			C	→				C	→				C	→				C	→			
11-12		D <sub>1</sub>	→			D <sub>1</sub>	→				D <sub>1</sub>	→	D <sub>2</sub>			D <sub>2</sub>	→				D <sub>2</sub>	→			
Lab 1-4	↓	A	B	C	D <sub>1</sub>	A	B	C	D <sub>1</sub>	A	B	C	D <sub>1</sub>	X	A	B	C	D <sub>2</sub>	A	B	↓	C	D <sub>2</sub>	A	↓
	6					13					20					27					July				
	7	8	9	10	14	15	16	17	21	22	23	24	28	29	30	1	4	5	6	7	8				
8-9	FINALS																								
	A	→			E	→			E	→			E	→			E	→							
9-10	B	→			F	→			F	→			F	→			F	→							
10-11	C	→			G	→			G	→			G	→			G	→							
11-12	D <sub>2</sub>	→			H	→			H	→			H	→			H	→							
Lab 1-4	B	C	D	X	E	F	G	H	E	F	G	H	E	F	G	H	X	E	F	G	H	E	F	G	
	11					18					Courses										Hrs. of				
	12	13	14	15	19	20	21											Lecture - Lab							
8-9	HOLIDAY					FINALS																			
		E	→		E	→																			
9-10		F	→		F	→																			
10-11		G	→		G	→																			
11-12		H	→		H	→																			
Lab 1-4	↓	H	E	F	G	H	X																		
											A Animal Science										26 - 18				
											B Vegetable Production										26 - 18				
											C Farm Mechanics										26 - 18				
											D <sub>1</sub> Soils & Fertilization										13 - 9				
											D <sub>2</sub> Pesticides										13 - 9				
											E Farm Management										26 - 18				
											F Fruit Production										26 - 18				
											G Pasture Management										26 - 18				
											H Field Crops										26 - 18				
											X Special open labs on-site, off-site farms, coop										0 - 12				

A. Animal Science (26 - 18)	<u>Hrs.</u>	
1. Breeds and Selection of Livestock	<u>5</u>	
a. Breeds of Beef Cattle		1
b. Breeds of Swine		1
c. Breeds of Sheep and Goats		1
d. Poultry and Rabbits		1
e. Selecting Livestock		1
2. Handling Livestock	<u>9</u>	
a. Handling, Restraint, Castrating		3
b. Dehorning, Branding, Ear Notching, Tattooing		3
c. Tagging, Docking, Sheep, Injection Procedures		3
3. Anatomy and Physiology	<u>4</u>	
a. Digestive System		2
b. Circulatory, Respiratory, Skeletal, and Muscular Systems		2
4. Nutrition	<u>7</u>	
a. Feed Nutrients		2
b. Classes of Feed		1
c. Feed Additives		1
d. Rations		3
5. Disease	<u>2</u>	
a. Bacteria, Viral, Nutritional, Fungal, and Miscellaneous Diseases		
6. Parasites	<u>2</u>	
a. External		
b. Internal		
7. Animal Evaluation	<u>5</u>	
a. Live		3
b. Carcass Quality		
c. Performance and Production Testing		2
8. Animal Reproduction	<u>7</u>	
a. Genetics		1
b. Reproductive Systems		2
c. Breeding systems		1
d. Methods of Breeding		1
e. Care at Parturition		2
9. Livestock Facilities	<u>3</u>	
a. Planning Working Areas		
b. Equipment		
c. Types and Construction of Confinement Areas.		

	<u>HRS.</u>	
<b>B. Vegetable Production (26 - 18)</b>		
1. Identification and Selection of Vegetables	<u>2</u>	
2. Plant Breeding	<u>2</u>	
a. Pure Lines & Hybridization		1
b. Plant Reproduction Methods, Sexual and Asexual		1
3. Plant Growth	<u>2</u>	
4. Seed Bed Preparation	<u>13</u>	
a. Disposing of Previous Crop Residue		3
b. Land Preparation		3
c. Application of Fertilizer		3
d. Irrigation		4
5. Planting	<u>7</u>	
a. Seed Selection		2
b. Equipment and Methods Used in Planting - Seeding Rates and Spacing		5
6. Insect and Disease Control	<u>6</u>	
a. Identification and Control of Insects		3
b. Identification and Control of Diseases		3
7. Weed Control	<u>6</u>	
a. Mechanical		3
b. Chemical		3
8. Harvesting	<u>6</u>	
a. Methods and Equipment		3
b. Handling, Grading, Packing		3
<b>C. Farm Mechanics (26 - 18)</b>		
1. Farm Tractors	<u>18</u>	
a. Operation		12
b. Maintenance and Adjustment		6
2. Farm Implements	<u>9</u>	
a. Use		
b. Operation		
c. Maintenance and Adjustment		
3. Small Engines	<u>4</u>	
a. Use		
b. Operation		
c. Maintenance and Adjustment		
4. Fences	<u>4</u>	
a. Post and Treatment		
b. Corners		
c. Wire and Fasteners		
5. Farm Electricity	<u>3</u>	
a. Simple Circuits		
b. Motors		

C. Farm Mechanics (26 - 18) (cont'd)		<u>HRS.</u>
6. Farmstead Planning	<u>5</u>	
a. Water Systems		
b. Buildings		
7. Farm Level	<u>1</u>	
a. Setting Up and Use		
D <sub>1</sub> . Soils and Fertilization (13 - 9)		
1. Nature and Properties of Soils	<u>3</u>	
a. Components		1
b. Properties and Classification		1
c. Sampling		1
2. Conserving and Controlling Soil Water	<u>3</u>	
a. Importance, Kinds, and Losses of Soil Water		1
b. Water Requirements of Crops		1
c. Salinity and Alkalinity		1
3. Improving Soil Fertility	<u>9</u>	
a. Basic Soil Nutrients		3
b. Uses of Fertilizers and Fertilizer Materials		3
c. Importance of Organic Matter		1
d. Recognizing Soil Deficiencies		1
e. Secondary Elements and pH		1
4. Land Evaluation	<u>2</u>	
5. Managing Soils	<u>5</u>	
a. Basic Considerations		1
b. Economic Importance		1
c. Fertilizer Application		3
D <sub>2</sub> . Pesticides (13 - 9)		
1. Types of Chemical Pesticides	<u>5</u>	
a. Herbicides		1
b. Insecticides		1
c. Fungicides		1
d. Rodenticides		1
e. Nematicides		1
2. Toxicity Levels of Pesticides	<u>1</u>	
3. Safety in Mixing and Application	<u>1</u>	
4. Safe Storage and Transportation	<u>1</u>	
5. Use and Maintenance of Proper Equipment, Calibration	<u>3</u>	
6. First Aid Treatment for Poison Victims	<u>1</u>	
7. Selection of Proper Pesticide	<u>2</u>	

	<u>HRS.</u>	
D <sub>2</sub> . Pesticides (cont'd)		
8. Application Methods, Spraying, Dusting	<u>8</u>	
a. Field Crops		2
b. Vegetables		2
c. Pastures		1
d. Fruit Trees		2
e. Stored Crops		1
E. Farm Management (26 - 18)		
1. Importance of Good Management	<u>2</u>	
2. Basic Decisions in Agricultural Management	<u>2</u>	
3. Principles of Economics	<u>4</u>	
a. Supply and Demand		
b. Other Economic Considerations		
4. Agricultural Finance	<u>3</u>	
a. Importance of Credit		1
b. Credit Sources and Instruments		1
c. Principles of Borrowing		1
5. Agricultural Planning	<u>10</u>	
a. Planning a Farm Business		4
b. Major Farm Costs		1
c. Planning Equipment Purchases		1
d. Investment Planning		1
e. Specialization		1
f. Diversification		1
g. Planning for Improvement		1
6. Agricultural Records	<u>11</u>	
a. Purposes and Types		7
b. Enterprise Analysis		4
7. Marketing	<u>9</u>	
a. Livestock and Livestock Products		4
b. Crops, Field, Vegetables, Fruits		
8. Agricultural Services and Programs	<u>3</u>	
F. Fruit Production (26 - 18)		
1. Identification and Selection of Fruit	<u>3</u>	
2. Plant Breeding and Reproduction Methods, Budding, Grafting	<u>5</u>	
3. Plant Growth	<u>2</u>	
4. Land Preparation	<u>13</u>	
a. Disposing of Previous Crop Residue		3
b. Land Preparation		3
c. Application of Fertilizer		3
d. Irrigation		4

F. Fruit Production (cont'd)

HRS.

5. Planting	<u>5</u>	
a. Selection of Healthy Stock		2
b. Planting Rates and Spacing		3
6. Insect and Disease Control	<u>6</u>	
a. Identification and Control of Insects		3
b. Identification and Control of Diseases		3
7. Weed Control	<u>4</u>	
a. Mechanical		2
b. Chemical		2
8. Harvesting	<u>6</u>	
a. Methods and Equipment		3
b. Handling, Grading, Packing		3

G. Pasture Management (26 - 18)

1. Identification and Selection	<u>4</u>	
a. Grasses		2
b. Legumes		2
2. Plant Breeding and Reproduction Methods	<u>2</u>	
3. Plant Growth	<u>2</u>	
4. Seed Bed Preparation	<u>18</u>	
a. Disposing of Previous Crop Residue		3
b. Land Preparation		6
c. Application of Fertilizer		6
d. Irrigation		3
5. Establishing Pastures	<u>11</u>	
a. Seed Selection		2
b. Equipment and Methods Used in Planting - Seeding Rates and Spacing		9
6. Insect and Disease Control	<u>2</u>	
a. Identification and Control of Insects		1
b. Identification and Control of Diseases		1
7. Weed Control	<u>2</u>	
a. Mechanical		1
b. Chemical		1
8. Harvesting and Utilization	<u>3</u>	
a. Harvesting and Utilization		1
b. Grazing Practices, Stocking Rates		1
c. Reseeding and Maintaining		1

H. Field Crops (26 - 18)	<u>hrs.</u>	
1. Identification and Selection of Field Crops	<u>3</u>	
2. Plant Breeding and Reproduction Methods	<u>3</u>	
3. Plant Growth	<u>2</u>	
4. Seed Bed Preparation	<u>18</u>	
a. Disposing of Previous Crop Residue		3
b. Land Preparation		6
c. Application of Fertilizer		6
d. Irrigation		3
5. Establishing Crops	<u>11</u>	
a. Seed Selection		2
b. Equipment and Methods Use in Planting - Seeding Rates and Spacing		9
6. Insect and Disease Control	<u>2</u>	
a. Identification and Control of Insects		1
b. Identification and Control of Disease		1
7. Weed Control	<u>2</u>	
a. Mechanical		1
b. Chemical		1
8. Harvesting and Utilization	<u>3</u>	

APPENDIX IV

Questionaire for Farmer Training

1. Name \_\_\_\_\_
  2. Family size: Boys \_\_\_\_\_ Girls \_\_\_\_\_
  3. Will family work on a farm? voluntary \_\_\_\_\_ forced \_\_\_\_\_
  4. What was your family's reaction to your wish to participate in this course?  
\_\_\_\_\_
  5. How will you finance a farming operation? \_\_\_\_\_
  6. Do you have access to credit? \_\_\_\_\_ type \_\_\_\_\_
  7. Would you plan your farm? \_\_\_\_\_
  8. How will you decide what to farm? \_\_\_\_\_
  9. How important are financial records? \_\_\_\_\_
  10. Could you farm successfully without advice or help from the BARTAD project or Ministry of Agriculture? \_\_\_\_\_
  11. Will you still farm if unsuccessful in obtaining a pilot test farm?  
\_\_\_\_\_
  12. Will you apply for Crown Land? Yes \_\_\_\_\_ No \_\_\_\_\_
  13. Would you live on your farm? \_\_\_\_\_
  14. How will you maintain customer satisfaction as a farmer? \_\_\_\_\_  
\_\_\_\_\_
  15. What is your attitude toward exporting crops? \_\_\_\_\_  
\_\_\_\_\_
  16. What makes a farm successful? \_\_\_\_\_  
\_\_\_\_\_
  17. If you knew there was a new kind of crop, how would you find out more about the crop? \_\_\_\_\_  
\_\_\_\_\_
- Would you use the new crop? \_\_\_\_\_

18. Does pot hole farming pay? \_\_\_\_\_
19. How would you harvest a crop, hand or machinery? \_\_\_\_\_  
Why? \_\_\_\_\_
20. What do you hope to gain from this course? \_\_\_\_\_
21. What is your attitude toward a Farmer Cooperative? \_\_\_\_\_  
\_\_\_\_\_
22. What services would you like to see the coop or extension service provide?  
\_\_\_\_\_  
\_\_\_\_\_
23. What would you do with a profit from farming? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
24. To what extent would you expect the BARTAD Project to make your farm  
successful? \_\_\_\_\_  
\_\_\_\_\_

APPENDIX V.

Evaluation of BARTAD  
Pilot Test Farmers

Farmers # \_\_\_\_\_ (Name) \_\_\_\_\_

1. Is the farmer eager to learn?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
2. Does the farmer seek information?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
3. Does the farmer ask for help?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
4. Does the farmer take suggestions?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
5. Does the farmer work well with others?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
6. Can the farmer supervise the work of others?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
7. Does the farmer use family members to help with farm work?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
8. How would you characterize the farmer's work habits?  
/1/ lazy                      /2/ disinterested                      /3/ takes initiative at times  
/4/ independently industrious.
9. What is the farmer's attitude in the face of adversity?  
/1/ blames others                      /2/ easily discouraged                      /3/ seeks solutions                      /4/ persistent
10. What is the potential of this farmer to manage and handle livestock?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
11. Does the farmer maintain farm records?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent

12. Does the farmer supply records when asked?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
13. Does the farmer make efficient use of time?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
14. Does the farmer make economic use of supplies?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
15. Does the farmer keep farm equipment in good repair?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
16. Does the farmer keep farm buildings clean and in good repair?  
/1/ poor                      /2/ fair                      /3/ good                      /4/ excellent
17. Is the farmer involved in off-farm activities or interest?  
/1/ home                      /2/ few                      /3/ good balance                      /4/ too much
18. Can the farmer handle more than one responsibility at a time?  
/1/ one at a time only    /2/ not more than two together    /3/ several together  
if each is simple                      /4/ no problems copes easily.
19. Is the farmer sensitive to market demands for produce?  
/1/ pays no' attention to the market, just grows crops.  
/2/ talks about market possibilities, but does nothing to meet demands.  
/3/ sensitive to the market and keen to meet demands.  
/4/ takes undue risks in speculating on market demands.
20. Does the farmer take pride in his profession?  
/1/ does not like to be classified as a farmer.  
/2/ defers to spouse' interests: in farming because of spouse.  
/3/ doesn't mind being a farmer.  
/4/ enthusiastic about farming with his/her family.

21. Does the farmer take pride in the appearance of the farm?

/1/ pays no attention to appearance.

/2/ pays little attention to appearance.

/3/ pays much attention to appearance.

/4/ pays too much attention to appearance.

22. In general, how do you consider farmer prospect for success?

/1/ poor

/2/ fair

/3/ good

/4/ excellent.

Additional Comments:

Signed: \_\_\_\_\_ Dated: \_\_\_\_\_

WESTERN INSTITUTE FOR SCIENCE AND TECHNOLOGY  
Bahamas Agricultural, Research, Training and Development Project  
Schedule of Procurement of Commodities

<u>Contract AID/CM/TA-C-73-27</u>	
Caterpillar tractors (3) and equipment	\$ 193,655
Farm tractors (6) and equipment, including plows, planting equipment, fertilizer spreaders, and harvesting equipment	124,603
Laboratory equipment, including soil and water testing equipment	40,421
Forage plot research equipment, including forage harvesters, laboratory mill, and drying ovens	33,747
Vehicles	80,963
Generators - One 55KW and one 90KW	21,574
Abattoir equipment	14,360
Farm wagons and trailers	50,383
Fork-lifts (2)	17,137
Motor grader	3,783
Irrigation systems and pumps	51,248
Shop equipment, office furnishings and equipment, and miscellaneous farm equipment	<u>162,611</u>
Total equipment	794,485
Fertilizer	350,172
Livestock - Cattle, swine, sheep and goats	48,263
Feed, seed, fencing, spare parts, fuel, and general supplies	<u>1,204,441</u>
Total Procurement	<u>\$2,397,361</u>

<u>Contract AID/ta-C-1369</u>	
Farm tractors (5) and equipment	\$ 74,258
Hay equipment	9,236
Farm wagons and trailers	4,604
Vehicles	16,223
Irrigation equipment	14,175
Shop equipment, office equipment, miscellaneous small equipment, and supplies for resale to Co-Op members	<u>87,509</u>
Total Procurement	<u>\$ 206,005</u>

Note: The above schedules do not include the cost of building construction or the cost of local payroll or supplies purchased locally prior to establishment of the Imprest Fund.

WESTERN INSTITUTE FOR SCIENCE AND TECHNOLOGY  
Organization Chart  
Contract No. AID/CM/TA-C-73-27  
and Contract No. AID/ta-C-1369

