

**BANGLADESH AGRICULTURAL RESEARCH PROJECT PHASE-II**

**Analytical Equipment and  
Instrumentation**

A CONSULTANCY REPORT

BY

**Dr. Leonard R. Mattick**

Cornell University



BANGLADESH AGRICULTURAL RESEARCH COUNCIL  
INTERNATIONAL AGRICULTURAL DEVELOPMENT SERVICE

June, 1984

Consultancy Report

To

Bangladesh Agricultural Research Council  
(BARC)

On

Analytical Equipment and Instrumentation

May 17 - June 19, 1984

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Dr. Leonard R. Mattick

Cornell University

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## Acknowledgements

This consultancy was made possible by a contractual arrangement between IADS and Cornell University. The assignment could not have become a reality without the permission of Dr. Don F. Splittstoesser, Chairman of the Department of Food Science and Technology at Geneva, New York.

During the term of this consultancy, I received support from many individuals; not only in Bangladesh, but also in the Office of International Agriculture Development at Cornell University.

While in Bangladesh, I would particularly like to express my appreciation to Dr. Sam Portch for his assistance, council, and kindness. He was always available to share his experience and expertise with me.

My appreciation is expressed to Mr. Harvey Carr., Maintenance Specialist of IADS, for taking the time to explain and exhibit the inventory system he is initiating for the vehicles and farm equipment of BARC affiliated institutes.

I wish to expressed my appreciation to Mr. Abdur Rajjak, a local consultant, who worked with me. He is a very learned and capable person.

My gratitude is also expressed to a host of other scientists at the many government institutes who served to coordinate work or worked with me during my consultancy.

Dr. David Daugherty and the IADS staff, are to be thanked for their logistic support.

Abbreviations used in this report and the corresponding organization:

BARC	-	Bangladesh Agricultural Research Council
BARI	-	Bangladesh Agricultural Research Institute
BAU	-	Bangladesh Agricultural University
BJRI	-	Bangladesh Jute Research Institute
BRRI	-	Bangladesh Rice Research Institute
DU	-	Dhaka University
IADS	-	International Agricultural Development Service
INA	-	Institute of Nuclear Agriculture
RAIS	-	Regional Agricultural Research Station
STRI	-	Sugar Training and Research Institute
USAID	-	U.S. Agency for International Development

## Observations and Recommendations

The following observations and recommendations were made during this consultancy:

1. The recommendations in the consultancy report of W. Ronald Clayton dated March 4 - April 8, 1983 are STILL current and valid, and merit prime consideration.

They are important aspects of instrumentation operation, maintenance and repair. For that reason they are REPEATED below.

- 1.1 Inter-institutional training sessions should be held to teach scientific officers and other laboratory personnel new, as well as established, procedures for doing analytical work. Sending scientists abroad is very costly and is limited in scope. Perhaps this money would be better spent having a consultant or manufacturer's representative visit Bangladesh to teach dozens of people in a classroom/laboratory situation.
- 1.2 Monies made available through USAID for short term consultancies should be used to provide properly trained and qualified engineers for the installation and maintenance of laboratory instruments. It will take at least five years to develop this capability within the participating institutes and, in the interim, nationals and expatriates should be hired to fill this very important function.
- 1.3 Instruments must be located in an environment where humidity and dust are minimized. This could be achieved by

an air conditioner and frequent (daily) cleaning of floors and work/storage areas.

- 1.4 Where possible, consolidate equipment to minimize duplication and the greater number of problems resulting from many instruments getting infrequent use and maintenance.
- 1.5 Encourage each laboratory supervisor to instill a sense of pride in his subordinates so they will take an active role in keeping their laboratory, and its equipment, clean and orderly.
- 1.6 As additional scientific equipment is added to a laboratory, ensure that necessary electrical, water, gas, air and venting requirements are met.
- 1.7 Foster greater cooperation between laboratories and institutes by showing a willingness to share equipment and information.
- 1.8 Raise the level of awareness with regard to safety and health hazards in the laboratory through training sessions and posters.
- 1.9 Develop a central purchasing unit coordinated by BARC. This will facilitate ordering and expedite procurement of goods and services.
- 1.10 Enlist the services of nationals and expatriates to act as liason between scientists and equipment suppliers. This would help fit the equipment to the application and avoid problems associated with having sophisticated, specialized equipment that is not tailored to the requirements of the job. This would involve people in Bangladesh and the US,

with frequent visits by the US based specialist to interface the application with the design and manufacture.

2. A central inventory system for BARC under the supervision of a Maintenance Section should be initiated. A prototype is described and discussed in the text of this report. This system can help alleviate duplication of purchasing and in cases of emergency divert equipment or users to a needed site.
3. Together with the Central Inventory, a central purchasing unit in BARC should be established. This unit would work as an integrated function of the central inventory. It will facilitate ordering and expedite procurement of goods and services. It will minimize duplication of equipment within an institute or section; reducing the number of problems and maintenance costs resulting from infrequent use of instruments. It will also be responsible to assure that the instrument selected will do the job for which it is purchased.
4. Centralization of instrumentation at the various institutes is imperative. Except for service laboratories, a single instrument room should be established for each institute, containing all electronic instrumentation under the supervision of one individual. This person would be responsible to assure proper instruction of persons using instruments and to report to the Maintenance Section any problems, so that proper repair personnel can be dispatched to the site.
5. Humidity control, emergency electric, and voltage stabilization as described in the text of this report for the Soil Science



Laboratory, BARI Joydebpur should be installed for instrument rooms of each institute.

6. The lack of operation manuals of instruments deter repair, maintenance, and operations. These manuals "disappear" between the point of shipment and the final destination. In order to overcome this problem, a standard policy should be inaugurated that operational and service manuals of the instruments are not shipped with the instrument, but sent to IADS/Arlington and these in turn be sent to IADS/BARC. Other donors should implement similar procedures. These manuals should be photocopied and a copy placed on file with the BARC Maintenance Section.
7. The majority of repairs conducted during this consultancy could have been performed by local personnel. A list of competent repair persons should be prepared. This should include electronic repair for instrument and other transistorized controllers, electrical repair for ovens, motors, generators, and related power equipment, and mechanical repair for air conditioners, refrigeration, centrifuges, motors other than electrical, and pumps. These individuals should be utilized for repair as soon as possible, since the longer an instrument remains idle, the greater the damage due to infrequent use. This service could be accomplished on a contract-by-job basis through the BARC Maintenance Section. The Central Instrument room concept in recommendation 4 would facilitate and expedite this service.
8. The acquisition of spare or replacement parts for instruments and laboratory equipment is hampered by lack of part identification by the manufacture's part number. This usually appears

in service manuals for the instruments or unit. Those units which presently have service manuals should be ascertained and service manuals purchased for those which do not have them at this time. All manuals should be photocopied and copies kept on file in the BARC Maintenance Section. This operation can be accomplished along with recommendation 2 (Central Inventory).

Most large companies have telex facilities and many have overseas subsidiaries. If the part number of a defective or replacement part could be identified it could be ordered direct by telex and routed through nearby subsidiaries. The final step; however, is probably the most difficult. An agreement between BARC and the Bangladesh Customs will have to be reached to expedite delivery so that parts do not deteriorate due to humidity and/or rodent damage while waiting to clear customs.

9. Following humidity, dirt and dust rank as enemy number 2 to instrumentation. Mr. Clayton also referred to the effect of these two factors. Good housekeeping techniques within the laboratory can result in less costly instrument repairs. Daily cleaning of laboratory areas are not only good for the instruments, but it is standard operating procedure in any quality analytical laboratory. It is impossible to obtain accurate and precise results under conditions that allow foreign matter into the sample. A program to keep the laboratory and equipment clean and orderly by daily cleaning should not only be initiated but insisted upon by BARC. This is more easily attainable using

the central instrument room concept as described in recommendation 4.

10. A basic course for the individuals using instruments and laboratory apparatus should be presented. This course should include the proper analytical chemistry techniques as well as the care, treatment, and use of a analytical apparatus. The need for this course surfaced during the instrument repair of this consultancy. Instruments and balances repaired and operating satisfactorily were again malfunctioning in a matter of a few days due to improper use by Scientific Officers. The lack of operational manuals also adds to this problem. This course should first be taught to the Scientific Officers and they in turn should instruct their laboratory personnel.
11. The various organizations supplying laboratory instrumentation and apparatus to the many institutes of BARC should coordinate their effort. The dispersement of this equipment should be based on proven need rather than availability. In many of the laboratories visited, equipment was received which was not requested and no immediate need was anticipated. This unit would remain unpacked or unused until finally deterioration due to moisture and/or rodents resulted. The other case would be instrumentation totally incompatible with the natural environmental conditions would be purchased. Again, rapid deterioration would occur. This is not only a waste of funding which could be used more productively, but it is a deterrent to the program. The coordination of the program could be done through a Board of Review, which could be composed of an appointed member from each of the sponsoring organizations, or a completely neutral group of scientists acquainted with instrumentation laboratory requirements.

## 1.0 Introduction:

The consultancy was scheduled for a five week period to follow-up on the previous consultancy of W. Ronald Clayton of March 4 - April 8, 1983. This five week period was programmed to allow visitations to most of the agricultural institutes to repair instruments, prepare a list of parts needed for repair, evaluate the repair and maintenance situation, and make observations with recommendations for corrective measures.

The mission was largely completed. Activities and visitations are listed in the appendix of this report.

The older wet chemical analysis previously used in analytical chemistry have been almost completely replaced by instrumental techniques. Analytical instrumentation allows the determination of minute concentrations of components and/or elements previously not attainable by wet chemical methods. These instruments are very sophisticated and delicate electronic structures whose care and treatment can spell success or failure for the present day analytical laboratory. Care must be taken that the instrument selected will be the proper unit for the desired purpose. Then, its installation and maintenance are of paramount value for its actual use.

This report makes several recommendations classed as preventive maintenance for the care and upkeep of instruments, that will, reduce the incidence of breakdown and expedite repair, thus, reducing inoperative time of an instrument.

## 2.0 Scope of Consultancy:

The consultancy had eight major phases.

2.1 Repair and put into operation all repairable equipment.

- 2.2 Prepare a list of additional parts needed to repair other equipment and assist IADS/Arlington in the purchase of materials.
- 2.3 Follow-up on the BARC list of equipment provided by each institution and determine if some of these should be removed from inventory.
- 2.4 Make written suggestions as to replacement equipment that should be purchased.
- 2.5 Wherever possible train local technicians in equipment maintenance.
- 2.6 Advise BARC on a system to maintain and procure spare parts that will work within the constraints of Bangladesh.
- 2.7 Assess local repair personnel.
- 2.8 Prepare a written report of activities, observations and recommendations.

### 3.0 Activities:

The initial day of the consultancy was spent with Dr. Sam Portch being oriented on the mission of this consultancy and the organization of BARC. A visit to BARC was made, where a meeting with Dr. M.A. Mannan, a coordinator of this consultancy and a Member-Director of BARC, was held. This was followed by visits to BRRI and BARI at Joydebpur.

#### Central Inventory System:

A system for a central inventory of instruments and apparatus will take time to develop. The accumulation of data may take several months to years. It will be a slow moving operation, but will be worth the effort and time. The main point to be emphasized is that a start has to be made.

The first steps would require the inventory of all existing instruments and laboratory apparatus in the institutes of BARC. This is a monumental task which will require the cooperation of all individuals of the institutes. The simplest and most direct method would be a request to the Principal Scientific Officer to have each of the Scientific Officers inventory the equipment in his particular section. Any new equipment purchased or donated would be automatically inventoried. If the request for inventory does not yield satisfactory results, the equipment could be inventoried when it was repaired. This plus new equipment inventory would be used with a complete inventory being attained over the years through attrition.

The following information would be needed for this inventory:

1. Name of Instrument or Apparatus
2. Model Number
3. Manufacturer, and Country of Manufacture
4. Serial Number
5. Date of Purchase if Available or Approximation
6. Location - Institute, Section, Geographic location,  
Laboratory
7. Does it have an Instructional and/or Service Manual
8. Its Operational Status

This information can be placed on file in a Computer. Mr. Harvey Carr, Maintenance Specialist of IADS, has a program which can accomodate this type of data. This program is being employed in the overall maintenance program of BARC. If the data is on file, it will be an easy operation to search and recall any combination of data. This type of data can be

used to ascertain if a duplication of instrumentation will occur or if an instrument already exists within the make up of BARC which can be used for short period experiments rather than purchasing a complete instrument. In many cases, when the time necessary to receive a new instrument is considered, it will be more expedient to use existing instrumentation to analyze samples on short term contract research. If duplication does exist and a shortage at another location occurs, this is a rapid method of filling the need.

This can be used to predict future purchases of instrumental time despendable accessories (i.e.: A.A. Lamps or pH electrodes).

BARI, Soil Science Laboratory, Joydebpur

The following four days were spent at the Soil Science Laboratory, BARI at Joydebpur. The activities in instrument repair and associated duties are noted in appendix II. The Soil Science Laboratory of BARI at Joydebpur is making tremendous headway to overcome natural deterioration effects on electronic instrumentation. The greatest enemy of electronic components is moisture or high humidity. Although most instrument manufacturers are double spraying the circuitry with lacquer of those instruments shipped to the tropics, damage by moisture, which usually occurs with the growth of mold and/or mildew, still results. The damage to a single circuit board by a "short" can cause damage to other boards in adjacent and supporting circuits. This damage can become exceedingly expensive and frustrating, since parts will have to be ordered and a loss of time and productive work results.

Bright into this problem has been shown by placing all electronic instruments into a single instrument room. This room is air conditioned;

however, it was noticed that the air conditioner was not emitting water on hot humid days. Upon examination, the water condensed from the atmosphere was found in the base of the unit. This inhibited the action of the air conditioner to act as a dehumidifier, since water was being recirculated into the air stream. Two- $\frac{1}{2}$  inch holes were drilled in the base to allow the water to drain freely.

The doors leading to and from the instrument room would not remain closed unless bolted. This was impractical with people coming and going. This defeated the dehumidifying effect of the air conditioner. Self closing devices were mounted on each of the doors of the room. This produced a closed room where humidity could be controlled. However, to be on the safe side, the relative humidity should be monitored to determine the efficiency of the operation. This can be accomplished by a recording Relative Humidity meter, which will also give a permanent record.

Another factor which can cause problems is turning the power to instruments off when they are not in use. This effect is two-fold. The initial effect occurs when an instrument is turned on repeatedly; these surges of electrical current across the components can cause abnormal wear compared to a steady, even flow of current while the instrument is in the "on" position. The second effect is complimentary to humidity control. An instrument in the "on" position generates a certain amount of heat, which will reduce the chance of moisture condensing within the circuit. An instrument in the "off" position will allow cooling and condensing of moisture in the circuits. The use of voltage stabilizers are required because of the fluctuation in voltage occurring in the electrical supply.



The previously described methods are positive steps toward a humidity control system in a tropical laboratory instrument room provided that the system is kept in constant operation. The frequent power failures at the laboratory can result in an inoperative air conditioner/dehumidifier and an instrument shutdown which could be damaging to the instruments. These power failures defeat the integrity of the system. To overcome these failures, an emergency system for the instrument room circuitry is a necessity. This unit should vary dependent upon the load of the circuit. The instrument room at the Soil Science Laboratory, BARI at Joydebpur would require at least a 10 KW (220 VAC; 45 amp) generator with a diesel engine as its prime mover. It should be equipped with automatic activation and deactivation controls based on voltage drop. This system would insure a constant power source for the instrument room. Such a unit has been delivered for installation. Mr. Rajjak is designing and constructing an automatic control system for it.

BARI, Potato Research Center, Joydebpur:

One-half day was spent with Mr. Lyle Sikka at the Potato Research Center, BARI, Joydebpur. They had several pieces of equipment in need of repair. These are listed in Appendix II. Mr. Sikka also had questions concerning a Growth Chamber which had been constructed, but was not operating properly since temperature and humidity could not be controlled satisfactorily. Examination of the unit, the volume of the room, and the installation of the unit has led to the following conclusions:

The refrigeration unit, to be used for temperature control is too small for the size of the room and the heat load. This unit is a 1.5 ton refrigeration unit. A unit at least double its capacity (3 ton) would be the minimum to do the job. It is suggested under the conditions that a

50-60% safety factor be inserted because of poor door seals, insulation, and other leakage, which will add to the drain on the unit. Therefore, a 5 ton forced air refrigeration unit should be installed. The present system allows the condensate of the coils to drain into the room. This arrangement will only allow 100% relative humidity for the temperature of operation and will not allow for an adjustment of relative humidity to a lesser value. The condensate should be drained outside the room. A humidifier with adequate controls should be installed to allow the investigator to control both temperature and relative humidity.

Mr. Sikka had a room set aside for tissue culture. The original room (on the left corner) was too small for the intended purpose of tissue culture. Another room on the right corner of the building would be more appropriate. This room should be scrupulously cleaned before painting the walls. The color should be white. The windows should be sealed, double paned glass. The room should be air conditioned with recirculating filtered air. This is a necessity for controlled tissue culture studies. The entrance into the room should be preceded by an anti-room with self closing doors in each direction. The room should be maintained under positive pressure to keep as clean an atmosphere as possible. The main room should be divided into two separate areas; one for culturing and one for growing.

Both the recommendations for the Growth Chamber and the tissue culture room have been transmitted to Mr. Sikka via letter.

BJRI, Dhaka:

The Bangladesh Jute Research Institute in Dhaka was visited and Mr. Phani Mondal was the local coordinator. The laboratory instruments and

apparatus repaired and checked at this institute are listed in Appendix II.

A very important point of instrument and apparatus repair surfaced pronouncedly at this institute. No service or instructional manuals were available for any of the instruments. A major deterrent to efficient instrument and apparatus repair as well as operational techniques results from the lack of service and instructional manuals. Eighty-five to ninety per cent of the repairs performed during this consultancy was achieved because of past experience or good fortune in isolating the problem. Inquiries into the fate of manuals found a unanimous response, "They did not come with the instrument". Somewhere between the point of shipment and the final destination, they "disappeared". This problem must be overcome. I would suggest that when an instrument is ordered a stipulation be attached to the order that all manuals be sent to IADS/Arlington and that they in turn ship them to IADS/Bangladesh via diplomatic pouch. If in the case of donors of nationalities other than U.S., the manuals should be sent to their local representative in Bangladesh. These manuals should be photocopied and a copy placed on file with the Maintenance Section of BARC.

A frequent occurrence at this and other institutes was the request to repair laboratory instruments or apparatus that upon examination revealed that it was operating satisfactorily. On checking further, it was found that Mr. A. Rajjak had been contacted and had repaired it. The instrument was working perfectly unbeknownst to the person who ask for the repair services. This emphasizes the need for having a single person responsible for the instruments within an institute and the single BARC Maintenance Section responsible for contracting repair work to be done.

BARI, RARS, Hathazari:

Seven instruments were repaired, checked, and/or the malfunction isolated for replacement parts. These can be viewed in Appendix II. Five of the seven instruments appear on the records with the same malfunction in the consultancy report of W. Ronald Clayton, 1983. I asked if they had requested the services of Mr. Rajjak. They did not know of whom I was speaking. A check of the itinerary of Mr. Clayton indicated that Mr. Rajjak did not accompany him to Hathazari. The laboratory personnel in Bangladesh or in the United States are not equipped or capable to repair instruments. The fact that this service is available through IADS and BARC should be publicized to the various institutes and stations of BARI after an appropriate list of competent repairmen has been compiled.

BARC, Dhaka:

At the request of Dr. Ekramul Ahsan, Member-Director of BARC, a public address system donated to BARC by FAO was inventoried. All pieces were found to be present. The unit was installed and operation checked in the conference room on the third floor of BARC, Dhaka. Difficulties were encountered during the set up. Some of the manuals were written in Japanese and placed us, Mr. Rajjak and myself, at a disadvantage since neither spoke or read Japanese. We were able to deduce the proper connections and test the operation. It operated to Dr. Ahsan's satisfaction; however, it was the general opinion that the unit should be installed in the Auditorium. The unit was disassembled and stored until some No. 18 AWG wire could be obtained for the permanent speaker hook-up and 75 ohm coaxial cable obtained for the antenna wire. Mr. Rajjak is familiar with

the operation and installation of this unit and can install it, when he is contacted.

Dr. Dorsey Davy, Training Specialist of IADS, informed me of a Xerox Photocopying Machine which was broken. This unit was badly needed. Mr. Harvey Carr., Maintenance Specialist of IADS, and I examined the unit diagnosed the problem as being in the drive system of the motor. The motor was removed and a gear was found to be stripped. This was repaired and the motor replaced. After a few minor adjustments to the "inking" system, the unit was operable and useable. This unit still requires cleaning and adjustment by a competent service person. We do not have manuals or specifications to accomplish this type of service.

#### Soil Science Department - Dhaka University, Dhaka:

Following my activities of instrument repair, I had the opportunity to visit with the members of the Soil Science Department at Dhaka University. The faculty and the students have an awareness of analytical instrumentation and know and practice the principles of their use. I had the opportunity to observe some students in a laboratory session. They were well trained in the fundamentals and handled themselves in a professional manner.

They have a Pye Unicam atomic absorption spectrophotometer, model SP190, which has never been operated. This instrument is beyond repair due to rotent and humidity damage. The cost to repair this instrument would be more than a new instrument of a similar type. An atomic absorption spectrophotometer is a necessity to a soil science program. Prior to the purchase of another unit, a proper instrument room as previously described (BARI - Soil Science Laboratory, Joydebpur) is essential.

Institute of Nuclear Agriculture - Mymensingh

The apparatus repaired is listed in Appendix II.

The instrument laboratory was cleaner than the usual laboratories visited. It appears they take the time for some housekeeping chores by dusting the instruments and the immediate laboratory area. The other analytical laboratories in this institute should do the same. The instrument laboratory is air conditioned; however, examination shows that the base is full of water and it is not serving a dehumidifying purpose. The doors to this room are often open which would indicate that self closing devices installed on these doors are a necessity. Again the Soil Science Laboratory of IARI at Jodhpur should be used as a model.

In this instrument room, an infrared spectrophotometer was on the bench top. This unit has sodium chloride optics. A test spectra of polystyrene indicated that resolution was lacking. The optics are fogged and pitted. This instrument will require extensive service. An instrument this delicate should have been placed in a dry box with constant attention being given to the condition of the dessicant. Recommendations for an infrared Spectrophotometer is a maximum of 40 percent relative humidity. The organizations leasing instrumentation must take at all the aspects of the effect of the environment on the instrument. Without proper precautions, this instrument will never be productive.

The Institute of Nuclear Agriculture has a person who has spent twelve months at the University of Vermont in Burlington, VT., MA studying instrumentation. His name is Mr. Snafiq - Ullah. Although he has had training in instrumentation and maintenance, he is not being utilized to the fullest extent by the Institute. This can be shown by the repair record of this consultancy; seventeen instruments and apparatus were examined, repaired,

or diagnosed. With an efficient repair and maintenance program, this figure should have been one or two.

Bangladesh Agricultural University - Mymensingh

The laboratories of Dr. M. Saqub of the Soil Science Department were very impressive. His instrument room was exceptionally clean and well tended. The instruments although used regularly were bright and clean as the day they were bought which showed they were subjected to very fine care. The room was air conditioned and he was pleased to receive advice about drains for the water from the base of the unit. The doors are self closing. The room was well lighted and all the desk tops were neat and orderly. All instruments were in perfect working order. It was obvious that care had been taken to maintain the instruments in peak shape. The Soil Science Department of BAU, particularly Dr. Saqub, has an instrument repair and maintenance person under the title of Senior Laboratory Technician. His name is Mr. Azizul Islam. His prime and only duty is to maintain and operate the instruments.

The fact that these instruments were all working indicated the spare and replacement parts were acquired. Dr. Saqub volunteered the information when asked the method of attaining these parts. He has a contract with the Alexander Von Humboldt Foundation located in West Germany. He has standardized on West German equipment. When a spare or replacement part is needed, he contacts the Foundation by Telex. They, in turn, purchase the part and send it by "Pouch" to the West German Embassy. They immediately forward it to him. This prompt repair and constant care of the instruments is paying dividends in the productivity of his laboratory.

The other Departments and Laboratories at the University do not have a maintenance program. A Bausch and Lomb Spectronic 20 received in 1980 was still

in the packing box and rodent and natural deterioration had occurred. Other equipment had been received and not set up, parts were lost, and it was rendered useless. This shows a need for a maintenance and repair program for instrumentation. It also shows that need should be a prerequisite before equipment is purchased and sent to these institutions.

BARI - RARS - Jamalpur

This is a small Regional Agricultural Research Station. The local coordinator was Mr. Timothy Kelley, Associate Production Agronomist IADS. He is a very conscientious person who showed an interest in the operations of the laboratory. He requested training for the Scientific Officers and Laboratory Personnel on small laboratory operations.

They had very little equipment to be repaired. Much of the large apparatus, Mr. Kelley had repaired by local personnel. The major repair was a Precision Low Temperature Incubator. This is the second such unit which although recently purchased is malfunctioning. This one will require a replacement temperature control board. Perhaps, the vendor of this type of equipment, which has a record of malfunction, should be informed and asked to clarify the situation.

The other duties involved the assembly of equipment, such as a Barnstead still and Torsion balances. One of the Torsion balances had to be brought to Dhaka to repair a weight cam, since we did not have the material to repair it with us. This will be returned to Jamalpur before the termination of this consultancy.

This laboratory was also the recipient of equipment and apparatus not requested. This is previously described in this report.



BARI, RARS, Jessore:

The need for training of personnel in simple instrument installment, maintenance, and operation was very evident at this station. A pH meter whose electrode was broken was not diagnosed by a scientific officer as the apparent reason the unit ceased to function. Further, it was learned that the pH meter was previously used without the aid of a buffer. Therefore, it would be impossible to standardize the instrument. Accurate and precise results can only be obtained when the instrument is properly calibrated or standardized with a buffer of known pH. This would cast doubt on the validity of the results reported by a laboratory not using proper calibration procedures.

Very poor housekeeping was practiced and it was shown in the appearance of the apparatus. While cleaning a condenser on a deep freeze unit, a broom or suitable cleaning instrument was requested. This could not be located. Basically, the laboratory is too large for the laboratory function performed. It may be advisable to reduce the size of the laboratory and separate it from a product processing area. At least half of the laboratory bench space is utilized for grain drying and storage. This will attract rodents which will play havoc with scientific instruments and/or apparatus.

BARI, RARS, Ishurdi:

This was one of the better regional stations visited from a housekeeping viewpoint. The majority of the laboratories were clean and orderly. It

appeared that cleaning chores were first on the Agenda of each day. The microbiology area was particularly impressive.

The laboratories have an acute shortage of electrical outlets. There are one to two outlets/laboratory, and these are on walls away from the bench area, where they are needed. The instrument room has a single outlet and an air conditioner and dehumidifier have been received for installation in this room. There should be a minimum of six outlets/laboratory properly spaced about the bench area and at least two on the walls clear of the bench area. The instrument room should have at least ten outlets for instrumentation and two extra outlets (one for the air conditioner and one for the dehumidifier).

The need for training in simple instrumentation installation, maintenance, and operation again surfaced. A great deal of time was spent at this station installing and preparing simple instruments for use. These were still in the shipping cartons. In several cases, the installation consisted of unpacking the unit, filling the electrode with electrolyte, and installing the electrode in a pH meter.

Equipment was received by this laboratory which was not requested or needed. One and a half hours was spent explaining the equipment received and its purpose and use. Again it was still in the original boxes. Two pH meters were received; a bench top unit and a portable unit; however, no buffer to standardize the instrument accompanied the instrument. A minimum/maximum thermometer was in the shipment, except it was calibrated in degrees Fahrenheit. A Bosch balance was received six months ago; it was wrapped in plastic with tape on the doors. If this balance was not installed or used for another four months, it would have required extensive repair. The weight lifting arms are Aluminum and were beginning to coat and stick. They were cleaned and the balance operated satisfactory at this time. If that balance is not used periodically, it will require repair.

These examples have been used to emphasize that a need must be exhibited before instruments, equipment, or apparatus are sent to these laboratories.

STRI, Physiology and Nutrition, Ishurdi:

This laboratory was well organized. The local coordinator was Md. Akbar Ali Sarker. After arriving at the laboratory and formalities of introduction were completed, he presented me with a list of the equipment in his laboratory and the present condition of each unit. Those small instruments requiring service were neatly arranged on a laboratory bench, while the location of the larger pieces was noted. This made the job of maintenance very simple. The work was completed in three hours. This was also aided by the fact that instruction manuals were available for all units. This cooperation should not go unnoticed and should be commended.

Animal Nutrition Laboratory, Dhaka:

At the request of Dr. Aftab Hossain, Member-Director of BARC, the Animal Nutrition Laboratory was visited. This visit occurred on the last day of this Consultancy in Bangladesh. Dr. Hugh Henderson, Livestock Specialist of IADS, served as the local coordinator. Several balances and instruments were examined, adjusted, and repaired.

Proposed Future Consultancy:

Any future consultancy should not be concerned with actual instrument and apparatus repair. Local personnel are well qualified to perform adequately provided they are informed of and dispatched to the site where needed. They are also familiar with local commercial enterprises which can be utilized for parts. Mr. Abdur Rajjak is a good example of one of these individuals. He holds a

Baccalarate from Dhaka University in Electronic Engineering and a Master's degree from the University of Budapest in Hungary in Electronic Engineering with a specialty in Instrumentation. He has demonstrated his ability and has shown that he is a capable and ingenious person. There are more individuals of this caliber in Bangladesh, but one must discover them and document their ability.

The need exists for preventative maintenance within a laboratory. This can only be accomplished by educating the Scientific Officers in the proper utilization, care, and operation of scientific instruments and apparatus. This should be a "Domino - effect", which will result in the Scientific Officer passing on this knowledge to the other persons working in the laboratory. A proposal for a future consultancy is advanced to offer a course which will involve the fundamentals of analytical chemistry and elaborate on the instrumentation utilized in this branch of science. The course would be presented in Bangladesh, probably at PARI in Joydebpur. The curriculum of the course would embrace the basic concepts of analytical chemistry beginning with the balance and the gravimetric methods through the volumetric procedures and the proper installation, maintenance, and operation of the basic instruments. This would also include trouble shooting techniques based on common symptoms to accomplish simple repairs. The course would be of a one week (6 day) duration and would be given twice in two successive weeks. Each session would be limited to fifteen (15) participants.

Lectures, demonstrations, and laboratory sessions would be presented in English. However, it is possible that a totally english course would lose its effect in as much as many of the Scientific Officers are uncomfortable in rapid interpretation of English. They would feel more at ease in their native

tongue, Bengali. Therefore, an interpretation from English to Bengali will be done to achieve the maximum learning potential. Mr. Rajjak could perform this translation as he has previously done during the present consultancy.

The course will require reference material. This material will have to be prepared in advance of the course. A text with appropriate illustrations and diagrams printed in English and Bengali will be prepared. This undertaking will take time; therefore, a minimum lead time of six months would be required with eight months being preferable.

The consultancy would be for a period of four to six weeks. The itinerary is shown in Appendix III. The first two weeks would be involved in actual teaching, while the third and fourth weeks would provide time to visit with the participants in their own laboratory and evaluate the effect of the course in a laboratory situation. This would also allow an evaluation of the effectiveness of the 1983 and 1984 Instrument repair and maintenance consultancies and to determine if proper utilization is being made of the repair personnel.

Appendix I.

REVISED ITINERARY: DR. L. MATTICK

17th May to 19 June, 1984

<u>Date*</u>	<u>Location</u>	<u>Description</u>	<u>Local Coordinator</u>
<u>May</u>			
17	Dhaka	18:35 Arrival	
18	Dhaka	Free	Dr. Portch
19	Joydebpur	BARI-BRRI	"
20	Joydebpur	BARI	"
21	Joydebpur	BARI	"
22	Dhaka	BARC-BJRI	"
23	Joydebpur/Dhaka	BARI-BARC	"
24	Dhaka/Joydebpur	Purchasing for BARI	"
25	Dhaka	Free	"
26	Hathazari	BARI	"
R.27	Dhaka	BARC	Dr. Ahsan
R.28	Dhaka	BJRI	Mr. Phani Mondal
29	Dhaka	DU	Dr. Z. Uddin
R.30	Dhaka/Joydebpur	BARC/BARI	Mr. Carr.
R.31	Dhaka/Joydebpur	BJRI/BARI	Mr. Phani Mondal/Dr. Portch
<u>June</u>			
1	Dhaka	Free	Dr. Portch
R. 2	Mymensingh	INA	Dr. Habibullah
R. 3	Mymensingh	INA	"
R. 4	Mymensingh	BAU	Dr. M. Haqub
R. 5	Mymensingh	BAU	

<u>Date*</u>	<u>Location</u>	<u>Description</u>	<u>Local Coordinator</u>
<u>June(cont'd):</u>			
R. 6	Jamalpur	BARI	Mr. T. Kelley
R. 7	Jamalpur	BARI	"
8	Dhaka	Free	Dr. Portch
R. 9	Joydebpur	BARI	"
R.10	Joydebpur	BRRI	"
R.11	Jessore	BARI	Mr. P. Villegas
R.12	Ishurdi	BARI	Dr. A. Islam
R.13	Ishurdi	STRI	Dr. A. Islam
R.14	Ishurdi/Dhaka	BARC Debriefing	Mr. Carr.
15	Dhaka	Free	Dr. Portch
16	Joydebpur	BARI-BRRI	Mr. Carr.
17	Dhaka	Report Writing	Dr. Portch
18	Dhaka	Report Writing	Dr. Portch
19	Dhaka/Depart	Report Writing Departure 20:15	Mr. Carr. Mr. Carr.

\*Dates preceded by the letter R indicates dates and locations when Dr. Mattick will be accompanied by Mr. Abdur Hajjak, Repair Specialist of Technotrade International, Dhaka.

BARI, Joydebpur - Soil Science

Mettler balance H31AR. S/N 329349.

Repaired 10 gm wt release and tightened knob.

Readjusted knife edge, suspension system and adjusted for accuracy.

Ainsworth balance Type 10N S/N 59921

Relevelled and checked for accuracy.

Bausch and Lomb Spectronic 20 S/N 0617456E

Would not zero. After allowing to warm up. The Instrument operated normally. Probably due to Humidity should be kept on at all times.

Bausch and Lomb Spectronic 21 S/N 01007162

Operation checked. Operates normally.

Fisher Isotemp oven 400 Series Model 418F S/N 247

Cat. No. 13-245-419F

Needs manual, buss connector, and control.

Fisher Accumet pH meter Model 600 S/N 220

Replaced Plug, Operation checked.

Turner Flame Photometer Model 510 S/N 41153

Control Unit Model 510 S/N 21153

Rodent damage to unit. Replaced Ignitor. Prepared Unit for use.

Air Conditioner in Instrument room.

Water not draining out of unit - drilled two drains for proper operation of air conditioner.



Air Conditioner in Dr. Portch's and Dr. Islam's office

Repaired outlet and plug. Low voltage - wiring should be checked for resistance.

Perkin Elmer AA Spectrophotometer Model 2280 S/N 125168

Needs new digital board and Keyboard/display.

Dr. Portch has been give the part numbers for these circuit boards.

This instrument should still be under Warranty. The date on the Label is August 1983.

Marvel Refrigerator. S/N 001469.

Will not cool down - lacks refrigerant - Apparently, this has happened previously and it was filled. It should be checked for a refrigeration leak. This can be done locally in Dhaka.

Instrument Room Door.

Installed self closing latches on both doors leading into the instrument room.

Installed mounted and set up the second electrode washing system.

Connected both the first and second electrode washing system to the distilled water line.

Connected line from the Distilled Water reserve system (reverse osmosis pump, and storage system) to general distribution plumbing of the laboratory. The Male Connector which was on the pipe was missing. A make shift unit prepared and it was found the line had been broken when the connector was removed. Suggest that new line be put in place and that an elbow raising it to the connector be made. This will facilitate easier book up. Leaks were removed from the basic pump system.

BARI, Joydebpur - Plant Pathology

Wild Heerbrugg Microscope S/N 145204

The focusing mechanism was jammed. The teeth on a portion of the engaging system were completely stripped. Temporary repairs were made to allow the microscope to be utilized; however, a new part should be ordered.

Reichert Microscope S/N 274138.

The stage positioner was sticking. It was loosened and repaired to work freely.

Newclave Autoclave Model HL36E

S/N 79025054. (Hirayama Manufacturing Corp., Tokyo, Japan). Needs a new connector for the pressure gauge. Present one leaks.

BARI, Joydebpur - Potatoe Research Center

MSE Fisons Hi - Spin 21 Centrifuge

S/N SL 2264

A whine when the rotor was getting up to speed was caused by scratches on the rotor. This causes harmonics. It can be alleviated by cleaning the rotor chamber and polishing the rotor with a Silicon Wax.

Olympic System Microscope Model BHC

S/N 390990

Fuse was blown. Caused by a shorting of the blocking capacitors. Needs 0.45 amp of design for this instrument; regular buss fuses will not fit it. It will require Mr. Rajjak to put in the capacitors, they are two - 82000 JF capacitors across the line.

LH Engineering Refrigerated Shaker

No S/N

Adjusted meter zero. Checked operation.

Mettler P163 pan balance

S/N 755430

Leveled and Zeroed. Checked operation. The reason for the erratic readings occurring was due to the flexibility of the laboratory bench. A person leaning on, placing pressure on, weight added to the laboratory bench would result in unleveling the balance and erroneous readings would result.

Consultation on Growth Chamber requirements

Letter written to Mr. Lyle Sikka

Consultation on Tissue Culture room

Letter written to Mr. Lyle Sikka

BARI, Hathazari

Precision Low Temperature Incubator Model 815

GCA Corp Cat. No. 31212 S/N 21AK10

The compressor is running; however, the temperature is not dropping. It appears that it lacks refrigerant. This can be done locally in Chittagong.

Steinlite Electronic Moisture Tester 400. S/N 27136G

Bulb was loose, checked operation. Worked fine.

Torsion Balance Model DLM2 S/N 168747

Check balance, adjusted. Main reason for erratic reading it was not level.

Torsion Balance Model DWM5 S/N 168805

Unpacked, placed weights in proper place after finding manual, and checked. Main reason it did not work was shipping restraints were still in place, and cams misaligned.

Lambrecht Thermo - hydrometer

Thermometer bulb broken. Discard and take off inventory cost to replace less expense than to repair.

Scotch Pak Pouch Sealer. Model 9062

The directions specifically state "Use Scotch - Pak Heat Sealant Bags only" Wrong plastic was used and was melting. I'll send some bags via Mr. Jarvis upon returning.

Electronic Instrument Limited pH Meter or Kent pH meter Model 7020

S/N 7020/4277

Needs electrolyte filling solution for electrode order from Electronic Instrument Ltd. Chertsey Surry, England Part No. 33-1117-300.

Needs combination electrode model 1160-200 order from Electronic Instrument Ltd, Chertsey Surry, England Part No. 33-1160-200.

BJRI, Joydebpur

Mettler top loading balance. Model PL200

S/N 747201 ES-43702

This unit was sent to the US for repair. When returned it was non-operable. The coupling was broken. No parts manual for part number will have to obtain part number upon return to US.

Ionmiser Model 3C in exchange unit

S/N 7916

This resin in the unit is exhausted. It has been used with tap water. This unit is obsolete and to obtain the resin cartridge would be impossible. I recommend the unit be replaced with a Corning ion exchange unit. The unit should not be run from the tap water but should be run from distilled water tank for maximum purity.

Pye Unicam AA Spec. Model SP2900 S/N 275900

Needs service manual.

Muffle furnace Thermolyne Corp., Subsidiary of Sybon Corp., Dubuque, IOWA.  
Model No. FA1730 S/N 08508858 240V. 24 Amp. requires operational manual, also it will require a lead in of. No. 10 AWG to the furnace for hook up.

W+W Recorder Model 1107

S/N 55-6933. Repaired paper feed, adjusted gain, and checked operation.

Gallenkamp refrigerator. S/N PP5493/53.

The refrigerant is low and requires recharging. This can be done locally.

Mettler Balance Model PC180 S/N 41485

Checked operation, leveled

Needs manual

Gallenkamp Germinator

Requires replacement humidity and heat control. (both are Sunvic Simmerstat Type TYX-8 15 Amp. 200/250V AC only).

Drying Cabinet. No S/N.

Was repaired by Mr. Rajjak. They had been using the dial in a clockwise direction. The dial reads counter clockwise.

Jute Drying Oven Model CH307

S/N 5/80

Temperature control switch malfunctioning suggest replace temperature Switch with thermostatic control for better temperature control. This part can be obtained locally. Mr. Rajjak is aware of the situation.

Cecil Instruments phosphorus determination apparatus Model CE404-2 automatic sample changer S/N 03330

Model CE404 Colorimeter S/N 01774

Flow through cell was slanted in the light pathway after zeroing instrument. It was required to realign the cell after zero. They

were operating the unit and determination before minimum detectible quantities. Explained methodology and appropriate action to allow proper determination.

Shander drying oven S/N 621

Replaced plug. Mercury Switch defective (Part Juno Switch Type GKT15-0 220V - 15A.) This oven is over 1968 vintage. If part can be found locally to repair, then repair, if not, Remove from inventory.

Fisher Isotemp Ovens.

Two ovens were checked. The heating elements were open. These instruments are designed for 115 VAC. 5 Amps. They were placed across 220V AC. Heaters are blown. Major repair. Remove from inventory.

Udzwig Balance (Polish) Type WA-34 S/N 64773

This is a relatively new balance. However, the manufacture of this unit is poor. It lacks the stability and ruggedness of the other balances. I would not recommend the purchase of any of these balances in the future.

BARC, Dhaka

Public Address System - Donated by FAO

Inventoried, assembled, and checked. It was in good working order. Will be installed in the Auditorium in the future.

Xerox Photocopying Unit - Training Office.

Mr. Carr and I diagnosed the problem as being in the reduction gears of the motor. Motor was removed and stripped gear repaired. Minor adjustments were made. Machine was operable. Still requires cleaning by competent service person.

Soil Science Department, Dhaka University, Dhaka

Pye Unicam Atomic Absorption Spectrophotometer Model SP190 S/N 213332

Wavelength indicator missing, Mirrors duty, fogged and pitted.

Wavelength drive to grating rusted and sticking. Optical system would have to be replaced to make this unit operable. Circuit board is missing. This unit is beyond repair, and should be replaced.

Mettler Pan Balance Model P 1210 S/N 636129

Repaired the 100 gram knob and drive. Adjusted and checked operation.

Corning pH Meter Model 7 S/N C46243

Meter operates satisfactory. Needs new glass and reference electrode.

Electronic Instrument Ltd. (Kent) pH Meter 7020 S/N 7020/3902

Set up and checked operation.

Coleman Junior II Spectrophotometer Model 6/35 S/N H3300

Adjusted and checked operation.

Corning pH Meter Model 7 S/N C46218

Checked operation against buffer.

Pye Unicam pH Meter Model 291 Mk 2 S/N 178001

Needs new electrodes (glass and reference)

Mettler Balance Type H16 S/N 181599

The gram indicator did not operate. The beader string drive was broken. Made temporary repair. New beader string drive required.

Otago Balance Model DT6160 S/N 79500

Mirrors and light source out of alignment, realigned and checked for accuracy.

Mettler Balance Type H16 S/N 181598

Light source was loose, tightened. Checked operation and leveled.

INA - Mymensingh

Jarrell Ash Dial Atom III Model 82/760

S/N 21671. High voltage supply is intermittant. The five volt stabilizer is overheating and the circuit is "cut-off" with the thermal protection circuit. Suggest that all three printed circuit boards (logic, analog, and power supply) be sent to Jarrell Ash for check and replacement of defective parts. If a letter of permission to export these parts can be obtained by the time I depart, I will take them with me.

Pye Unicam SP1000 Infrared Spectrophotometer.

S/N 64317 Defective compression spring in the advance and disengage wavelength drive. Rust on the optical null system in the reference side. If rust is present here, the optics are probably pitted and fogged and will require repolishing. The optics are sodium chloride; therefore, this instrument should be in an area of less than 40 percent relative humidity. The fact that the optics are fogged is indicated by the poor resolution obtained with the polystyrene standard. An instrument this delicate should be in a "dry box".

Fisher Isotemp oven Model No. 104 S/N A103

Reason it would not operate was due to the receptacle it was plugged into was not connected. However, the fan motor for forced air needs to be replaced.

Gallenkamp Muffle Furnace Model FR520 S/N 4A2082B

Replaced cord and plug.



Mettler H311 Analytical Balance S/N 666859

Realigned light source, cleaned mirrors, adjusted.

Will Wetzlar KA Microscope S/N 606431

Adjusted and tightened stage.

Phillips refrigerator S/N Tag removed

Needs defrosting for proper operation

GEC refrigerator/freezer S/N Tag removed.

Door seal completely destroyed. Discard and remove from inventory.

Labor Heaters Type LR-901 No S/N

Total of 5 heaters; 3 function normally; 2 have open heating elements.

PZO Warszarvo (Polish) Microscope S/N 14341

This microscope is in working condition; however, it needs a good cleaning. Dirt and dust are in objectives and ocular as well as other parts.

Beckman 25 Spectrophotometer Model No. 1331 S/N 100050H

Chopper motor not operating - Needs new chopper motor; vibrating mirror is held in intermediate position. Needs source mirror lever.

Orion Research Specific Ion meter. Model 407A

S/N 40113. Meter in good operating Condition Electrodes are bad.

Single junction reference electrode - Orion No. 90-02-00

Ammonia specific ion electrode - Orion No. 95-10-00

Nitrate specific ion electrode - Orion No. 93-07

Bausch and Lomb Spectronic 20 S/N 0816645D

Operates normally

Bausch and Lomb Spectronic 20 S/N 0917966R

Light not working. Corroded contacts cleaned; operation Ok.

ELL (Kent) Portable pH meter Model 3030 S/N 3030/3018

Needs 9 volt battery Type PP9 or equivalent.

Mettler E1000 pan balance S/N 592720

Incorrect readings - Adjusted for accuracy.

Electric Drying oven (Chinese) Model 202-2

S/N 03820176

Not holding temperature correctly defective thermostat needs to be replaced.

Bangladesh Agricultural University - Mymensingh

Soil Science Department

Corning Megapure System D-2 S/N 191

Have two 3508-A Cartridges need a 3508-0 cartridge to put in operat

Plant Science Department

Fisher Accumet Model 230 pH/Ion Meter S/N 1187

Needs both Glass (pH) and reference Electrode

Electrodes from Fisher Scientific Co.

Glass electrode Cat No. 13-639-3

Reference electrode Cat No. 13-639-51

Fisher Accumet Model 230 pH/Ion Meter S/N 1184

Needs electrodes - Same as previous Unit

Industrial Instruments Conductivity Bridge Model RC 16B2. S/N 36521

Null indicating tube defective. Used for parts on next unit. This unit and the next one are at least 20 years old. Parts can't be obtained. Delete from inventory.

Industrial Instruments Conductivity Bridge Model RC 16B2. S/N 32447

Two decade resistors defective. Used parts from the previous unit. Also a Cold solder joint at the terminal. Repaired and working.

Monodial Projection Balance Model 921 S/N 1200

Aligned light source, leveled, focused light source and adjusted for accuracy.

VWR Scientific pH meter S/N 2009

Needs new electrode.

Parasitology Department

Virtis homogenizer Model 7-109-AF S/N 3142

New - however, received several years ago. Parts missing. Can not install.

Bausch and Lomb Spectronic 20 S/N Tag missing.

New Unit - Purchased in 1980 was not placed into use. Meter deterioration. Will require new meter. Also has rodent damage.

Projection Microscope MP-3 PZO (Polish) S/N 2525

Bulb is broken. Instrument needs a good cleaning.

Ten Microscopes were examined.

Three are not repairable, Seven were repaired. The repairs ranged from reassembly of the objective turrets to repair of stages and light sources. These microscopes will require a thorough cleaning.

Agricultural Chemistry Department

Pye Unicam pH Meter Model 9418/30 S/N 3236

Needs new Electrode

Pye Unicam pH Meter Model 9418/30 S/N 3263

Needs new Electrode

BARI - RARS - Jamalpur

Barnstead Still Model A1007 No S/N

Changed from 110V to 220V prepared for use. Following parts needed because destroyed by rodents (2) Gasket, Evaporator Steam Cover - Part No. 06271,  $\frac{1}{2}$  inch tubing and  $\frac{1}{4}$  inch Tygon tubing.

Precision Low Temperature Incubator (GCA Corp.) Model 815 S/N 21A8D0

Work has been done on this instrument. It appears to be a make shift job. It will require a Temperature control Board (part No. 538319) which is defective.

Torsion Balance Model DWM5 S/N 170874

Assembled and adjusted. The 20 gram weight cam is slipping. Brought back to Dhaka to repair. Will send it back after final adjustment.

Torsion Balance Model DWM5 S/N 168407

Assembled and adjusted. Fixed cams in correct order and tested.

EIC (Kent) pH Meter 7020 S/N 7020/4276

Requires combination Electrode, Buffer solns, operation manual and electrolyte for electrode part numbers appear under this appendix in the Hathazari section. Hathazari has an operation manual which can be photocopied and sent to Jamalpur.

BARI, RAKS, Jessore

LEC Refrigerator Deep Freeze Model LT386 S/N SLT 316/OA

Was out of adjustment, adjusted. This unit was charged previously. The lowest temperature which can be achieved is  $-4^{\circ}\text{C}$ . Apparently, wrong refrigerant was used. The top unit should be charged with Freon R-13 to 130 psi. and the bottom unit with Freon R-22 to achieve,  $-70^{\circ}\text{C}$ .

Avery 40 pound scale. No Model No. No S/N

Broken linkage. Fixed temporarily, must subtract six pounds from weight for actual weight.

Torsion Balance Model DWM5 S/N 163974

New. Forty gram cam out of adjustment and the stop cam loose. Adjusted cams and checked operation.

Gallenkamp Hot Box. Oven Size one.

Cat No. OVD 300-010 S/N 9D3428E

Temperature control out of adjustment - adjusted and checked.

EIL pH Meter 7020 S/N 7020/4275.

Electrode is broken. Meter performs satisfactorily. Needs new electrode.

Olympus Zoom Scope S/N 276626.

Would not go to full zoom. The mechanism was binding. Elevated the binding and checked operation.

BARI, RAKS, Ishurdi

Fisher Accumet pH Meter Model 600 S/N 255

Unpacked, Installed electrodes, and checked operation.

Fisher Centrifug Centrifuge Model 224 S/N 163.

Timer would not work. Repaired timer.

Ainsworth Pan Balance. Model 3000 S/N 86-4890

Unpacked, prepared for use. Although the name plate states 115/230 VAC operation, this unit has a 115 VAC transformer and should only be used on 115 VAC.

American Optical Microscope Model one-fifty S/N 1980.

Unpacked and prepared for use. Bottom plate specified 115 VAC. The only part required to change it to 230 VAC was the lamp. A check revealed this had been done at the factory. Changed plug to 230 VAC. Ready to use.

General Electric Dehumidifier Model Sakara 30 S/N HR.

Unpacked, assembled, and checked operation.

Fisher Digital pH meter 107 Model 607 S/N 711215.

Unpacked, filled electrodes, checked operation.

Krauss biscope S/N 193927

Loose drive. Was greased and allowed no friction. Cleaned drive, which repaired the defect.

Bosch Analytical Balance Model 2000 S/N 12798

Unpacked, set up, freed weight lifting rods, leveled, adjusted, and checked operation.

ORPI, Pathology, Ishurdi

Chinese oven. Model and S/N in Chinese

Same type as at INA. Was purchased locally at a price. Thermostat is defective and should be replaced with a more reliable thermostat.

Laboratory Thermal Equipment Ltd. Incubator S/N 24110

Thermostat is shorted. Temperature keeps on rising with no control.

Requires new thermostat.

Low Temperature Incubator.

Compressor and thermostat working. Not cooling. Condenser coils are cool to touch. Needs to be recharged. Can be done locally.

Four Microscopes

Require cleaning. Mold growth inside of objectives and ocular. This can and should be cleaned by the laboratory personnel.

SPRI, Physiology and Nutrition, Ishurii

TOA Electronics, Ltd., Tokyo pH Meter Model HM5A S/N 069765F

Needs new discharge tube (OA-2) VR - 150 MP but the other tubes should also be replaced; those in the amplifier section of the meter. It will require. 2 - 12A x 7 and 1 - 12BH7A. If possible get Industrial type tubes.

Electric drying oven Model 202 No S/N

This unit was repaired by an institute electrician. The motor was disconnected as well as the thermostat and several other wires. The switch was by-passed and the elements placed directly across the line. The unit will need a complete re-wiring which should take one to two days. It will also need a new thermostat. This unit is useless in its present state and since they have another oven. Remove from inventory.

TPS pH Meter, Model P51 No S/N

Meter operates satisfactorily. Electrode needs replacing.

Gallenkamp Muffle Furnace. Cat No. T841T S/N C8436

Thermal couple has melted. No indication of temperature in the furnace.

Colorimeter Japanese, Model EA-1, No S/N

Bulb was loose and the contact was dirty. Cleaned contact replaced  
bulb operation checked.



### Appendix III

#### Itinerary for Proposed Consultancy

- Week 1. 1st Session of Course for S.O. from areas outside of Dhaka and Vicinity.
- Week 2. 2nd Session of Course for S.O. from Dhaka and Vicinity
- Week 3.
- Sat. Mymensingh INA, BAU
  - Sun. Jamalpur/Dhaka
  - Mon. Hatlhari/Dhaka
  - Tues. Jessore (RAKS) Khulna
  - Wed. Ishurdi BARI and STRI
  - Thurs. Dhaka
- Week 4.
- Sat. BRRI
  - Sun. BARI, DU
  - Mon. Comilla/Dhaka
  - Tues. BARI, Joydebpur
  - Wed. Report writing
  - Thurs. Report writing
  - Sat. Debrief
  - Sun. Depart