9364054

PD-AAW-099

PN-51621

Report of the Midterm External Evaluation of the International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT) Project

29 September to 4 October 1985

Contract No. AID/DAN 4054-C-00-2071-00
University of Hawaii, Honolulu, Hawaii

Prepared by

C. Fred Bentley
Consulting Agrologist

Raymond E. Kitchell
Development Management Consultant, Team Leader

J. R. McWilliam
Director, Australian Center for
Agricultural Research

Dale N. Moss
Oregon State University and
President-elect of American Society of Agronomy

Edward J. Rice
Agriculture Research, Asia Bureau
Agency for International Development

Foreword

The International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT) Project is one of several soil and water projects supported by the Renewable Natural Resources Division of the Office of Agriculture within the Bureau for Science and Technology of AID. These related projects focus on subject matters ranging from soil management and rainfed agriculture to biological nitrogen fixation and tissue culture. It is clear that soil, water, weather, and germ plasm are key ingredients of all these AID projects.

IBSNAT, a prototype project of the Renewable Natural Resources Division, is designed to deal with these key ingredients in a holistic manner. It was established to further AID's continuing efforts to link related projects through a systems-based research strategy that enables project outputs to predict, and therefore control, the outcomes of decisions made by government planners and the farmers. The central concept of systems-based research is that the whole system must be understood in order to evaluate changes in any single component. This innovative approach of IBSNAT Project brings together existing knowledge of the farming system, identifies major components and processes and their interactions, and seeks to identify the bottlenecks to improve performance.

AID has taken steps to maintain the momentum of its systems-based research strategy by (1) establishing Agrotechnology Transfer, a triannual newsletter which aims at reporting on the progress achieved through shared efforts of the related projects; and (2) creating a coordinating committee which consists of Principal Investigators from the various soil and water projects. IBSNAT provides the structure and mechanism to link soil, water, weather, crop, and management research projects into a coherent, problem-solving instrument. This instrument is called the IBSNAT Decision Support System for Agrotechnology Transfer, and consists of: (1) the minimum soil, water, weather, crop, and management data needed to simulate crop performance; (2) a data base management system; and (3) several crop simulation models that predict and display the consequences of taking alternative management practice actions.

This Report of the Midterm External Evaluation of the IBSNAT Project provides AID with recommendations to strenghten its systems-based research strategy.

TABLE OF CONTENTS

Page

Executive Summary 7

I. Introduction

Purpose of Exercise 14
Project Background 14
Evaluation Methodology 14

II. Assessment by Outputs

Introduction 15
Outputs 16
Data Base Management 16
Models 19
Capability 24
Network 27
Communicate 33
Management 35

III. Current Validity of Development and Project Hypothesis

Probability of Producing Outputs 44
Validity of Project Approach 45
Development Hypothesis 45
Overall Assessment 47

IV. Recommendations 48

V. Appendices

No. 1 - Evaluation Terms-of-reference 52
No. 2 - Replies by University of Hawaii to issues included in Terms-of-reference 54

No. 3 - List of Participants 59
No. 4 - Evaluation Schedule 62
No. 5 - IBSNAT Staffing Pattern 66
No. 6 - Acronyms 70

Executive Summary

PURPOSE

This summary is a part of, and not intended as a substitute for, the full report by the External Evaluation Team on the comprehensive midterm evaluation of the International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT) Project. It is a highly summarized version of selected observations, conclusions and recommendations cast in the framework of the three primary purposes of the exercise, viz: (a) to assess performance to date; (b) on the basis of assessment, to project the probability of successfully achieving the project purpose; and (c) in the light of changes since project approval, to review the development hypothesis (i.e., justification) the project approach.

ASSESSMENT OF PERFORMANCE AND CURRENT PLANS

The team chose to organize its assessment of performance around the six major outputs which had been redefined and published earlier in the year. 1/ A brief summary of their findings and conclusions follow:

Data Base Management System (DBMS)

After reviewing the requirements for a DBMS, and noting the time and cost saved in using a commercially available data base management software program, the team concluded that performance to date has been more than satisfactory.

Establishment of the minimum data set (MDS) concept was an important accomplishment for IBSNAT. IBSNAT also prepared software that interfaces the data base and the models, most of which has already been distributed to collaborators.

The team believes it would be useful if future progress in obtaining quality MDS were categorized by those data acquisition activities which are needed to: (a) validate models; (b) verify models in specific countries or locations; or (c) are related to application and demonstration of the models to on-site problems. Specific plans are needed to strengthen data acquisition efforts on genetic coefficients for crop cultivars. The end-of-project fate of the DBMS also needs to be addressed soon.

Crop Models

The models for wheat, maize, and soybeans which were in existence before IBSNAT have been modified to utilize the DBMS and to run on the IBM-PC. Validation efforts for tropical environments are well under way and serious problems are not likely. These models can be considered operational.

1/ Refer to "Design Elements for the IBSNAT Project," January 1985.

Models for both rice and sorghum are under development and should be available for testing and use in the second half of next year. Groundnuts and beans are being developed by modifying the SOYGRO model, and the groundnut model is ready for validation. Progress with the root crops has been slower with little prospect of cassava or aroids model being developed in the near future.

The present crop models do not consider the impact of diseases or insects on crop production. Neither has work been started on a more comprehensive general agricultural management model(s) to predict crop yields using alternative management practices, including multi-cropping farming systems. There is justified hope, however, that these additional functions can be coupled to the base crop model more rapidly than originally anticipated.

There have been some problems in the quality of MDS received from collaborators which should be a matter of some concern to IBSNAT management. Otherwise, performance to date has been outstanding, involving some of the most talented modelers in the world, and is generally on schedule.

Much remains to be accomplished. More effective "hands-on" training of collaborators in the preparation of MDS and use of models is required. More management emphasis and visibility is needed to be added to the management practice components for the DBMS and models. It may also be necessary to provide special assistance and encouragement to selected collaborators in developing the cassava and aroids models. At this point in time, the team believes it would be more effective to add millet to the selected crops and if necessary, postpone actions on aroids.

Developing Country Capability

Developing country participation in IBSNAT began with the first symposium in 1983 and has continued. A two week workshop for model users was held in Venezuela in 1984, and a second workshop will be held in Jordan in November 1985. The SMSS, while assisting in the characterization of soils at all collaborator sites, has also trained a cadre of collaborators in soil taxonomy. Venezuela, Guam, Zambia, Panama, Burundi, Thailand, the Philippines, and Syria are all participating in field experiments and Malaysia has recently joined. There are no "case studies" under way at this time although PCARRD of the Philippines wants to use the wheat model to find suitable sites for production, and Venezuela will attempt to simulate management practices.

While performance to date can be characterized as satisfactory, this output can be expected to increase in importance as the project progresses. Actions which can be taken to overcome developing country collaborator constraints include: training in MDS trials; training in usage of the DBMS and models; and more site visits by IBSNAT staff, both at policy and technical levels. Case studies, on-site applications, and demonstrations are crucial for model validation and their use by developing countries.

IBSNAT needs to give more attention to their selection, methodology and its own role in their development.

Network

IBSNAT has been very successful in attracting the interest and active collaboration of national, regional, and international agencies as participants in the project. Twenty of the 29 collaborators represent developing countries or regions--a remarkable achievement in that IBSNAT has not provided material inducements. Several regional IBSNAT networks are evolving, e.g., IBSNAT (Oceanic) and (ASEAN). The ACSAD network is developing and possibilities also exist in central and southern Africa. During the evaluation exercise, the first meeting of the Collaborators' Advisory Panel (CAP) took place. It will advise the Principal Investigator (PI), inter alia; on collaborator constraints, training needs, and opportunities to involve national or regional organizations in the formation of regional networks; and will serve as a communication link to inform other regional and international sponsoring agencies about IBSNAT. Performance to date has been very successful and the activation of the CAP is very desirable development.

The prospect for additional networks and collaborators will increase as the project matures and seems to be in hand but the team believes training is a special need requiring more emphasis. This includes: an increase in "hands-on" workshops; assistance to regional networks to increase their role in planning and providing training; and creation of support teams for collaborators to demonstrate sustained IBSNAT interest and provide support.

Communication

IBSNAT has an active publications program including widely distributed general and technical publications. The Benchmark Sites News and the SMSS Soil Taxonomy News have recently been combined into the Agrotechnology Transfer news with a mailing list of over 3000. Technical publications include guides on MDS collection, use of the DMBS, handbooks for collaborators, etc. Several more handbooks, guidelines, and instruction sets are being prepared. Performance to date has been adequate.

However, the team believes there is now a need for additional and more timely activities including "user-friendly" material and the use of other media. Other bioscientists and nontechnical people need to be reached. Anything that contributes to greater awareness of the nature and tremendous potential of IBSNAT's activities will benefit society as a whole--as well as IBSNAT!

Management

AID has involved the University of Hawaii and a group of subcontractors such as the ARS, the SCS, and the Universities of Florida and Puerto Rico in

IBSNAT. Through AID funding, cooperative activities have also involved the SMSS, the IFDC, and Michigan State University. Informal agreements have also been developed with CSIRO, DSIR, and with nine developing countries; approximately 30 more countries are expected to participate in the near future. The contractor has little direct control over most of the collaborators and must rely on leadership, persuasion, and the self-interest of the participants.

In late 1984, the major project design elements were redefined (and added where missing). A life-of-the-project work plan and schedule was developed. This was an important achievement and very helpful to the team in providing an objective framework for the evaluation. At that time it was also decided to create an Executive Management Committee (EMC) and the CAP. This was in addition to the Technical Advisory Committee (TAC) which the PI appointed early in the project.

The TAC has played a very important role in helping the PI guide the modelers and the supporting activities. The team agrees with the PI (without depreciating his own role) that, to a large extent, the TAC is responsible for project success to date. On the other hand, the EMC, which is advisory to the PI and includes only IBSNAT staff except for the ex officio attendance of the AID Project Monitor, has not yet proven effective. Progress reporting has been delinquent and deficient regarding nontechnical aspects of the project. The more detailed scheduling of sub-output activities has not yet taken place making selective and objective monitoring difficult.

An outstanding project staff has been assembled in IBSNAT headquarters but most are also assigned to other AID-funded projects and sometimes appear hard-pressed. The physical space provided by the University of Hawaii is very inadequate in quality and size and is adversely affecting work efficiency.

Notwithstanding these problems, based on the accomplishments to date in a very difficult and complicated project, management performance must be judged as above average--a situation in which IBSNAT, its collaborators, and AID should all take due credit.

The flexibility afforded the contractor by AID is a contributing factor in project success to date and should be continued. Nevertheless, the project is definitely moving from the conceptualization to an operational phase and soon must plan for the final or utilization phase. This will require a closer collaborative involvement with AID/S&T and field missions, and more effective coordination with related projects, particularly TropSoils and FSR/E. The EMC mechanism does not seem up to this task. Rather, the team concludes that a new mechanism called the Management Review Group (MRG) should be established with the PI and AID Project Monitor as equal members (with ad hoc representation of others when required), and be concerned with strategic decisions, multi-year work planning, annual changes in program

priorities and major resource allocations and reallocations, coordination with other AID projects, monitoring of progress, and AID and university support.

Given delays in publications, reporting, and other difficulties, plus increased staff attention to training and networking as recommended by the team elsewhere, at least two full person-years of additional staff time needs to be provided. Resources should also be made available to provide some basic equipment (e.g., weather instruments, PCRs) for those critical collaborators in developing countries who are experiencing difficulties.

Finally, there is a very direct relationship between this and other AID-funded agricultural research projects and the objectives of the University of Hawaii and the State of Hawaii. A major reorganization of the university is in progress which affords the international and research dimensions a greater role in its academic programs. IBSNAT is recognized as a "daring" and "stimulating" project which is having an impact on the university, including its collaboration with the USDA. The timing is excellent for the university to consider ways to increase its support to this and similar AID-funded projects. Specifically, the team believes UH should: increase the amount of overhead being returned to the appropriate department(s); provide new space for the IBSNAT and TropSoils staff; and take a more active role in coordination and accountability.

ASSESSMENT OF DEVELOPMENT AND PROJECT HYPOTHESIS

Probability of Achieving Project Purpose

In the full report, the team gives its best estimation of when each output will be fully produced, running from 1987 for the DBMS through 1991 for others. It is obvious that all outputs cannot be provided by the end of the current contract term, i.e., 1987. While there undoubtedly will be some schedule slippage in model development and validation, e.g., root crops, advances in technology may shorten the time required to develop the general agricultural model. The project approach, adjusted as these advances in modeling and information technology take place, remains valid. There is absolutely no reason to believe that the project objective (purpose), as spelled out in Design Elements, will not be achieved within the frame of time and resources recommended.

Justification

The development hypothesis, also specified in Design Elements, which relies on "transference by simulation," and its impact on agricultural productivity in the developing world, also remains valid. In fact, the potential is breath-taking in its sweep. Crop models that are coupled with management practice components and "expert systems" can enable many developing countries to leap across the existing, wide, technological gaps and obviate the time and cost for extensive on-site trial and error experiments. It is

sure to affect AID's approach to farming systems research and other agricultural research and development activity.

OVERALL ASSESSMENT

In response to the purpose of the evaluation as included in its Terms-of-reference, the Evaluation Team finds the following.

- Performance to date ranges from satisfactory to outstanding.
- The probability of successfully achieving the project objectives (purpose) remains high. The team is not sanguine, however, that this can be adequately accomplished by 1987.
- With the accelerating changes in systems and information technology, the expected impact of IBSNAT results has not only remained valid but has increased.

SUMMARY OF RECOMMENDATIONS

The full team report, both in its body and concluding chapter, includes many detailed suggestions for maintaining and improving the quality and type of activities required for each output until project completion. They are intended to stimulate IBSNAT and AID management to look ahead to the utilization and phase-out stages. A few of the more important recommendations are summarized as follows.

- Data acquisition activities should be separated and reported by function, particularly those "critical" activities necessary for model development and validation. Special attention needs to be given to genetic coefficients for crop cultivars.
- Millet, an essential crop in much of Africa and parts of Asia, should be added to the crops selected for modeling, with less priority afforded to the root crops, particularly aroids.
- A new sub-output should be created for crop models which provides appropriate emphasis and priority to the impact of diseases and insects on crop production.
- IBSNAT should quickly establish "collaborator support teams" to assist collaborators in "hands-on" training for experiment layouts, MDS collection, data input, etc.
- On the basis of a resource survey of each developing country project collaborator, IBSNAT should provide additional training to overcome institutional constraints in conducting experiments and in the use of models.

- The IBSNAT budget should be adjusted or augmented to (i) provide at least two additional person-years of staff time for site visitation and training, and (ii) to ensure that each developing country project collaborator has at least one personal computer (PC) and weather station.

- IBSNAT, in cooperation with AID/S&T, should develop a specific plan for the selection and design of "representative" case studies as the principal means for demonstrating crop and site-specific applications.

- IBSNAT should continue to encourage and support the creation of regional networks.

- More attention needs to be given to "user friendly" publications targeted both for other bioscientists and lay audiences.

- A Management Review Group (MRG), consisting of the PI and AID Project Monitor with the ad hoc participation of others, should be established and concerned with (i) approval of strategic decisions, (ii) life-of-the-project work planning and progress indicators, (iii) annual changes in program priorities and resource allocations by outputs, (iv) coordination with other AID projects, (v) progress monitoring and reporting, and (vi) university and AID support.

- The University of Hawaii should seek additional opportunities to support IBSNAT and, in particular, provide it with adequate on-campus space as soon as possible.

- The IBSNAT Project and contract with UH should be extended until 1991, with increasing attention given to tying in the system analysis approach to other AID-funded agricultural development projects.

I. INTRODUCTION

A. Purpose of Exercise

In accordance with Agency for International Development (AID) requirements for a midterm evaluation, an External Evaluation Team was assembled to:

- o assess the performance to date;
- o on the basis of this assessment, project the probability of successfully achieving the project purpose within the frame of time and resources provided; and
- o in the light of changes since project approval, review the development hypothesis and project approach.

The Terms-of-reference supplied to the Evaluation Team, and the several issues it was instructed to focus on, is included in Appendix No. 1. The formal reply of the University of Hawaii to these issues is attached as Appendix No. 2 and is an integral part of this report.

B. Project Background

In the late 1970s and early 1980s, the AID-sponsored Benchmark Soils Project demonstrated for the first time that agrotechnology can be successfully transferred on the basis of the SCS soils taxonomy and the FAO land evaluation scheme, i.e., "a transference by analogy." This project involved the Universities of Hawaii and Puerto Rico, supported by the Soil Management Support Service (SMSS) of the Soil Conservation Service (SCS). The IBSNAT Project was conceived as an attempt to bring the components for successful transfer together using a systems approach of "transference by simulation."

The project was approved, and a contract was executed in August 1982 for a five year period at a total estimated cost of $5,100,000. As of 31 August 1985, $3,500,000 had actually been made available to the University of Hawaii. The University has subcontracts with the University of Puerto Rico and the Agricultural Research Service (ARS) Grassland, Soil and Water Research Laboratory in Temple, Texas. Through AID support, agreements have also been entered into with the Soil Management Support Service, and the National Soil Survey Laboratory of the SCS.

C. Evaluation Methodology

Given the unique collaborative nature of this project--involving a primary contractor, several subcontractors, and a large group of volunteers and unpaid collaborators from both the developing and developed world--it was arranged for many of them to be present in Maui for the evaluation exercise as well as to conduct other project business. Accordingly, the team had the

opportunity to hear presentations and enter into dialogue with members of the Technical Advisory Committee (TAC), the newly formed Collaborators' Advisory Panel (CAP), the Executive Management Committee (EMC), representatives of collaborating research institutions, the Agriculture Research Administration, the Soils Management Support Service, and officials of the University of Hawaii.

In addition to the documentation supplied to the Evaluation Team prior to the exercise and a team briefing by the AID Project Monitor, the first two days of the on-site portion included IBSNAT presentations on the following subjects:

- o project concepts and rationale;
- o overview of project progress;
- o model development, verification, and validation;
- o data base management system;
- o regional networks; and
- o SMSS and IBSNAT Projects.

A field trip was also arranged to visit experimental sites of the MauiNet Project situated along an elevation transect on the slopes of Mt. Haleakala at Kuiaha, Haleakala Station, and Olinda. During the third day, the team met with individuals and groups to discuss selected subjects in more depth. On the fourth day, in closed sessions, the team met to develop a consensus which was accomplished with little difficulty. The existence of a recently redefined project framework 1/ considerably facilitated the task for the team. The first draft of much of the report was prepared on-site.

Appendix No. 3 provides a list of all participants in the exercise and Appendix No. 4 provides information on the schedule and briefings.

II. ASSESSMENT BY OUTPUTS

A. Introduction

Given the recent redefinition of the major project design elements, and the emphasis on outputs included in the AID-supplied issue statements, the team has organized most of its report by the expected results or intended outputs of project activities. For presentation purposes, (i) a statement of the output is given, followed by (ii) a review of performance to date, and (iii) a discussion of plans for the future, existing or potential problems, and team conclusions.

1/ "Design Elements for the IBSNAT Project," January 1985.

B. Outputs

1. Establish an operational agricultural data base management system.

a) Performance to Date

Requirements

A key element in reaching the project objective is the process of deriving and validating crop growth models for the crops of interest. To do this:

- an accurate and extensive data base is required, and the data base must contain information on important soil, weather, and crop performance variables;
- the data base must contain high quality data;
- specific data must be available from the tropics, both to validate the models generally and confirm that validity for specific countries;
- data acquisition must be arranged;
- data transfer from the user to the data base (and vice versa) must be worked out;
- data must be accessible to the user and the modeler, and its format must be compatible with the model input needs;
- various reports (hard copy, statistical summaries and analyses, etc.) must be obtainable;
- the Data Base Management System (DBMS) must be flexible to allow for corrections to the models, to new submodels, and for the changing state of the art in data processing; and
- indexing must be available so that users and modelers will know what is in the data base.

All of the above factors were considered by the IBSNAT Principal Investigator, with the advice and assistance of the Technical Advisory Committee, as the data base format was being established. At first, they planned to program a data base management system; however, in 1984 the decision was made to use a commercially available data base management software program which would perform all of the necessary actions. The Ashton-Tate dBASE III system was chosen. This software has English-like commands, allows great flexibility in modifying the

structure of a data base, and has good sorting, indexing, and reprinting capabilities. This choice saved IBSNAT much time and expense and is commended by the Evaluation Team.

MDS

Within the capabilities of dBASE III, it was then necessary to determine the structure of the data base. The crop simulation models provided many essential elements which were required in the data base. In addition, IBSNAT staff and TAC members and collaborators chose to include additional elements which would likely be needed in the future. (For example, wind travel is not essential to crop models, but was included because it is often a part of commercially available weather station packages. It is used in calculating pan evaporation for evapotranspiration studies, and will likely be used in crop disease models.) Out of these deliberations grew the concept of minimum data sets (MDS) that contains the information for a site which is necessary to run the crop simulation model.

The establishment of the MDS concept is an important accomplishment of IBSNAT. Forms were designed which contain blank spaces for all of the information required in a MDS for a selected crop. These forms with carbon papers have been assembled in a loose-leaf, bound volume and are the vehicle by which a collaborator sends his data to IBSNAT for entry into the data base. This assures that all the data which is collected is in a format that can be entered into the data base. Alternatively, a collaborator can enter the data to his micro-computer on site and send a copy of the data to IBSNAT via a magnetic diskette. The data collection process has been described in detail and copies of the forms are contained in Technical Report No. 1, Experimental Designs and Data Collection Procedures for IBSNAT.

Software

IBSNAT has prepared software which interfaces the data base and the models. This software has been distributed to collaborators. After a collaborator's data has been entered into the central data base, a copy is made and returned to the collaborator. The collaborator can then run a crop model, print reports, and view graphic displays of his real and simulated data. A more detailed manual on how to run the experiments necessary to obtain the MDS is in preparation.

Modifying the structure of the data base, should it be necessary to accommodate future simulation needs, poses no technical problems for the current system.

Plans have been made to fine-tune the structure of the data base, the data collection forms and instructions, to index the data base, and to disseminate information on the data base content. In brief, performance to date has been more than satisfactory.

b) Adequacy of Current Plans

No problems are apparent with the data base management system per se. All the necessary steps and precautions seem to have been taken. Flexibility has been considered at the design stage and plans are to modify the data base structure as needed. However, availability is limited in some instances by lack of hardware at some collaborator sites. The number of MDS (minimum data sets) in the data base is quite limited at present, but the IBSNAT staff expects them to increase sharply within the next year. The Evaluation Team feels that IBSNAT may need to select and support a few particular collaborators' efforts in order to obtain quality MDS to derive or validate certain models. It was obvious that most of the developing country collaborators felt a strong need for more training in how to access and use the data base.

Future progress would be easier to verify, and communication of progress to the AID would be easier if IBSNAT work plans separated those data acquisition activities which are:

- needed to validate models;
- needed to verify models in specific countries or locations;
- related to application and demonstration of the models to on-site problems.

The Evaluation Team concludes that specific plans should be made to strengthen data acquisition efforts on genetic coefficients for crop cultivars, and to establish a timetable for work on submodels to consider disease and insect impacts on crop production.

The end-of-project fate of the data base needs to be addressed and specific plans drawn up. This unique and valuable resource will need a permanent home after IBSNAT ceases as a project. UH may wish to consider this opportunity in its own institutional planning.

2. Completely or partially develop, test, and validate crop simulation models for wheat, maize, rice, sorghum, soybeans, groundnuts, beans (P. vulgaris), aroids, cassava, and potatoes.

Develop an operational general agricultural management model that combines crop models for mono- and mixed-cropping systems with soil erosion, pest management, economics, and other factors for tropical and subtropical conditions for use in agroproduction policy planning and decisionmaking at the farm level.

a) Performance to Date

Criteria

A series of steps are involved in the development of a crop simulation model as follows:

- o establish design criteria;
- o conceptualize the model;
- o quantify the model coefficients;
- o write the complete program;
- o calibrate and test the model against detailed field data;
- o validate the model against independent field data; and
- o model becomes operational.

1) Crop Simulation Models

The following models to be developed by IBSNAT are at various stages of development based on the above criteria.

Existing Models

Models for wheat, maize and soybeans were in existence prior to the development of IBSNAT and have been modified to operate on the minimum data sets and to run on the microcomputer (IBM-PC). The CERES wheat and maize model have been extensively tested using independent data, and both give accurate predictions of crop development and yield. Efforts have also been made to validate these models with data sets from tropical environments to improve prediction under these conditions. Performance to date in this respect, while limited, is encouraging and it suggests that this modification will not present any particular problems. Apart from some fine-tuning and expansion of the

range of genetic coefficients, especially in the case of soybeans, these three crop models are now operational and available for crop prediction.

Models Under Development

The two other cereal models for rice and sorghum are both under development. Dr. Joe T. Ritchie, who is involved in developing these models, indicates that they will be completed more rapidly because of the experience gained in constructing the last two CERES models for wheat and maize.

The sorghum model is more advanced than rice as it is being adapted, with the assistance of ICRISAT, from an existing model. By the time it is modified to be operated in the DBMS, a number of data sets should be available in the data base for testing.

The rice model is at the stage of calibration and is a more complex model to construct because it must incorporate both flooded and dryland conditions, and cope with the problems of denitrification and general nitrogen dynamics.

Both the rice and sorghum models should be available for testing and for use by the collaborators in the second half of 1986, possibly sooner in the case of sorghum.

The remaining two grain legume models, groundnuts and Phaseolus (beans), are being developed by modifying the SOYGRO model, and in particular by changing the crop parameter data files to represent the particular morphological and developmental responses of groundnuts and beans.

The new groundnut model is operating and ready for validation. It could be ready for incorporation into IBSNAT's data base system in early 1986. The Phaseolus model can be developed fairly rapidly by using data from CIAT in Colombia. It is estimated by Dr. J. W. Jones that it should be available by May or June 1986.

New Models

The root crops have been slower and no model is yet available. Dr. Ritchie has accepted the task of developing a potato model, and for this reason there is a good probability that a reliable model will be developed, possibly in 1986. At present there is little prospect of a cassava or aroids model being developed in the near future.

2) Crop Disease and Insect Submodels

The present crop models do not consider the impact of diseases or insects on crop production. Yet these factors determine which cultivars can be grown in many cropping situations. A necessary next step is to derive submodels for these factors.

3) General Agricultural Management Models

Expanded Models

The development of a more comprehensive simulation model or models to predict crop yields using alternative management practices and thereby to develop management strategies is under consideration but they have not been developed in the program at this time.

One of the crop simulation models, SOYGRO, is already operating and provides a more comprehensive list of options. These additional application-specific packages enable the user to make irrigation and pest management decisions about the crop, to forecast yield, evaluate investment decisions, and predict problems such as erosion. The rate at which these additional functions can be coupled to the base crop model suggests that this phase of the program will probably develop more rapidly than anticipated.

The advantage of having collaborators actively developing management models for their local conditions is that the models can be modified readily for use in IBSNAT's system. For example, at the Grassland, Soil and Water Research Laboratory in Temple, Texas, a series of management models have been developed, including EPIC, which simulates soil erosion and aspects of soil fertility for single crops or complex crop rotations; SWRRB which manages soil and water resources in rural catchments; and EPIS, an economic policy model which considers the long-range impact of erosion on productivity and nutrient requirements, and ultimately predicts alternative agricultural policies for a region.

Macro-Models

The development of more comprehensive agricultural management models is scheduled to begin in 1986-87 and to continue through until 1991. The "Expert Systems" approach should be considered in this respect to make those models more accessible to researchers in the field, an intention already mentioned by UH in Appendix No. 2.

The existing management models which have limited objectives may provide a useful starting point for IBSNAT's more comprehensive models. The coupling of some of these elements to the existing crop models will be required, in addition to social and economic components to ensure that the technology transfers have a sound socioeconomic basis.

4) Generation of Data Sets by Collaborators

A key role of IBSNAT's collaborators is to generate minimum data sets for crops in IBSNAT's mandate and enter these into the DBMS to be used to test and validate the models, and to provide an adequate crop data base with which to test the performance and adaptability of similar crops in their own region.

Some minimum data sets have come in from the experienced collaborators (See Table 1) but the quality of those from the majority of the collaborators is not high and in a number of cases they have not materialized because of problems with the experiment or lack of essential recording equipment. This should be a matter of some concern to IBSNAT management.

Table 1. Minimum data sets (MDS) received from IBSNAT collaborators.

Collaborator	Wheat	Maize	Soybeans	Taro	Total
Philippines	4	-	-	-	4
New Zealand	2	-	-	-	2
Syria	2	-	-	-	2
Venezuela	0	4	-	-	4
Guam	0	2	-	-	2
Zambia	0	1	-	-	1
Univ. of Florida	0	0	4	0	4
Univ. of Hawaii	0	5	1	1	7
Univ. of Iowa	0	0	1	0	1
TOTAL	8	12	6	1	27

b) Adequacy of Current Plans

The program for developing a series of ten simulation crop models is on schedule in most respects. Three models for wheat, maize, and soybeans are operational and are incorporated in the data base management system.

Four other crop models for rice, sorghum, groundnuts, and Phaseolus beans will become available in 1986. The first root crop model potato may also be available then.

If IBSNAT wishes to accelerate the production of cassava and aroids models, it may be necessary to provide some assistance and encouragement to appropriate persons with the necessary skills and access to data to develop these models. The team believes it may be desirable to concentrate any support on cassava because good data and skilled scientists are available, and to leave the task of modeling the aroids until a good opportunity emerges.

To replace aroids in the near future, it would be desirable to bring millet (Pennesetum) into the IBSNAT list of crops. Dr. Joe T. Richie is developing a model of this crop with assistance from ICRISAT and it will provide an important crop for the semi-arid region of Africa which is included in the AID Africa Bureau research strategy.

As already stated, the quality of data sets that are sent by collaborators to IBSNAT for incorporation in the DBMS could be improved by more effective "hands on" training of collaborators both at special workshops and in-country at the site of the collaborator's experiment. This might involve one or more trainers guiding the collaborator through the process of experimental design, establishment, and data collection. At a more advanced stage it would involve guidance in data entry and running models on the computer. It may also require, in some cases, providing additional motivation to sustain the interest of developing country collaborators through the validation and into the application phases.

Model development in the IBSNAT program represents a highly innovative approach to the utility of practical simulation models of important world crops. The concept of minimum data sets and the development of simple models based on them is a remarkable achievement and cannot be matched anywhere else in the world. Much remains to be accomplished, e.g., to derive models for insect and disease impact on crop production, augmentation of cultivar data files, a users manual on genetic coefficients, and experimental instruction. However, it may be useful to introduce a new sub-output under this category to provide management emphasis and more visibility to the addition of management practice components such as pest control to the DBMS.

IBSNAT is fortunate in having a very dedicated and able research group at the Hawaii headquarters and also to have contracted three very talented groups at Michigan, Texas, and Florida. These scientists are unique in that they are extremely skilled modelers who are supportive and interested in continuing in this field, and

are prepared to devote their efforts and enthusiasm to the task of developing the operational tools for IBSNAT. Without them, the team suspects that much of IBSNAT's crop prediction and ultimately technology transfer objectives would not be possible.

3. Establish the capability to use crop models for predictive purposes in a least five collaborating developing countries.

Demonstrate the crop models through case studies.

a) Performance to Date

The ingredients needed to establish the capability to use crop models are:

Criteria

- MDS for each crop;
- a DBMS corrected by local data;
- hardware, software, and adequate staff that are familiar with the models;
- soil-climate-cultivar inventories; and
- training to understand and accomplish the above steps.

Results to Date

Among the more significant events are the following.

- Potential developing country collaborators participated in the design of MDS at the first IBSNAT symposium in 1983.
- At the second IBSNAT symposium in 1984, collaborators observed maize, soybean, and wheat models being run on microcomputers.
- IBSNAT conducted a two week course in 1984 on systems analysis and crop simulation for agrotechnology transfer for model users.
- In November 1985, a clinic will be conducted in Jordan on the maize and wheat crops involving the principles of modeling, orientation to the DBMS, running data through the model, and demonstrating the importance of collecting quality data. Clinics for grain legumes, rice, and potato will be held in 1986 or 1987.

- SMSS has characterized the soils at all collaborator sites and has trained a cadre of collaborators in soil taxonomy.

Progress of Collaborators

- Venezuela began six experiment sites in July 1984 for testing the CERES Maize Model. The model simulated the effects of climate, water stress, and nitrogen on growth and performance of the maize cultivar. Corrections for deficiencies were made and the model now provides a reasonable prediction of crop yields. Venezuala is the only developing country collaborator to establish operational capability to date.

- Guam has installed IBSNAT field experiments to collect data for maize and cassava crop models. They have plans to submit their MDS to IBSNAT for model validation. Guam has an IBM microcomputer and expects to upgrade the software in order to run the model.

- Zambia became a collaborator in July 1984 and set up a maize trial at one site in December 1984 to test maize performance and soil constraints. The data is being analyzed in Zambia and will be sent to IBSNAT when the forms are complete. Zambia will require training, computers, and increased local support before it has the capability to run the models.

- Panama. In May 1984, the IDIAP installed two cassava experiments with 10 varieties to investigate the influence of soil acidity. Since then they have conducted rice and maize MDS trials at three of the 17 sites characterized by SMSS. Without more training, staff, computer software, and soil-climate inventories, Panama will not be able to develop a prediction model by End-Of-Project (EOP).

- Burundi. SMSS has described the soils and USAID has purchased the weather station for the Kajondi seed farm. Maize trials will be planted in October 1985, and plans for a wheat trial in 1986 are being developed.

- Thailand has installed trials to generate MDS for maize, rice, cassava, peanuts, and sorghum at 14 stations. Recently, researchers at the DOA have also expressed interest in participating in the development of crop models for rice and cassava.

- The Philippines has conducted wheat MDS trials at two sites. PCARRD will attempt to predict suitable areas for wheat production in the country. PCARRD will need the model

software and soil-climate-cultivar inventories in order to predict wheat response.

- Malaysia has recently become a collaborator. MARDI plans to use the rice model when developed to predict areas in which to grow rice at lower input cost. They have also shown interest in using models for plantation crops.

- Syria. ACSAD has conducted wheat trials to produce MDS at two sites which were harvested in June 1985. A third site will be added.

- ICRISAT planted dryland wheat trials in four locations. These trials were harvested in June 1985.

Case Studies

There are no "case studies" under way at this time. Developing country collaborators have expressed a wish to apply systems analysis to country-specific research goals. PCARRD of the Philippines wants to find suitable sites for wheat production; if they can simulate suitable areas for policy decisions.

Venezuela will attempt to simulate management practices such as cultivar selection, planting dates, and fertilizer rates. Thailand, as a first step will attempt to predict optimum fertilizer rates for recommendations to farmers.

b) Adequacy of Current Plans

Team members had an opportunity to discuss with developing country (DC) collaborators the constraints that they would need to overcome in order to develop the capability to use the models in a predictive mode. The actions necessary to overcome these constraints include:

- training in field plot design and data collection for MDS trials;

- training on theory and practices of MDS, DBMS, and operation of the model;

- provision to DC collaborators of the hardware and software needed for modeling, when necessary;

- more site- and policy-level visits by IBSNAT staff;

- information and training on technology transfer; and

- o assistance in planning and collection of data for soil-weather-genetic inventories. Much of this data can be accessed from historic data and some can be simulated.

There is a concern that some of the collaborators, although enthusiastic, are inadequately trained and supported, and as a consequence, may abandon the model/simulation approach of research. It appears that as a group, they underestimated the amount of data necessary and the resources and time needed to prepare the data in files. They also appear to hold the belief that the simulation model approach of technology transfer is very similar to the analog approach such as that used in the Benchmark Soils Project which, of course, is not correct as the team views the two concepts.

To date, the selection of case studies has been mostly opportunistic, such as in the Philippines, and without much thought as to their purpose, scope, methodology, intended audiences, etc. The use of the title "case study" is misleading and academic as they are actually on-site applications intended to demonstrate the validity of crop models and accelerate their use at policy levels and on the farm. As such, the Evaluation Team considers case studies crucial for model validation and utilization. IBSNAT should begin at once to develop criteria for the selection and design of the studies in relation to the project objective (purpose) and prepare the standard methodology needed, including IBSNAT's role in their development. IBSNAT should extend whatever assistance is necessary to accelerate the production of this sub-output, including the means to involve the targeted audiences in a review of the results and as a feedback to the modelers for model improvement.

4. <u>Create a prototype, functional network of international, regional, and national research centers and development agencies for agrotechnology transfer.</u>

a) <u>Performance to Date</u>

IBSNAT Project

IBSNAT has been very successful in attracting the interest and active collaboration of national, regional, and international agencies as participants in the IBSNAT Project. Of the 29 collaborators in those categories, 20 represent developing countries or regions. That achievement is remarkable because IBSNAT did not provide material inducements to attract collaborators, instead the participating agencies in developing countries were committing their own resources in order to engage in what they perceived as an exciting opportunity (for them) to

reduce the technological gap between their countries and the industrialized group of countries.

There are other confirmations of interest in IBSNAT. The two IBSNAT symposia had representatives from over 35 countries and agencies in addition to some 15 U.S. participating agencies. Memoranda of Agreement, or informal agreements for collaboration, have been obtained from 20 developing countries. The agreements provide for collection of minimum data sets by the collaborators and submission of the data to IBSNAT which returns the processed analyses. The distribution of products of the data base management system to participants has begun.

Regional

Several regional IBSNAT networks are in the process of evolution.

- With the approval of the South Pacific Commission (SPC) a proposal for the establishment of the OBSNAT ("Oceanic IBSNAT") network is under active development. When that proposal has been carefully refined, donor funding for implementation will be sought. The optimism regarding funding support appears to be justified, particularly from Australia and New Zealand.

- Interest in an ABSNAT ("ASEAN IBSNAT") network was sparked by a SMSS workshop and was subsequently supported by an IBSNAT-funded meeting of six ASEAN representatives who prepared a draft proposal for formation of ABSNAT. That proposal will go before the ASEAN Food, Forestry and Agriculture Committee for consideration. When the draft of the ABSNAT network proposal is endorsed, donor funding will be sought. The USAID ASEAN regional mission may become a supporter of ABSNAT.

- The ACSAD network is developing and one minimum data set has been submitted to IBSNAT. A SMSS workshop in the region led to the IBSNAT workshop held in Jordan.

- Interest in the possibility of establishing two other IBSNAT regional networks occurred following SMSS workshops. One was held in Central Africa. Burundi, Rwanda, and Zaire through IRAZ have indicated interest in forming a network. The second workshop was in Zambia and as a result, the Southern Africa Development Coordination Conference (SADCC) is potentially interested in forming an IBSNAT network.

- Additionally, there have been 10 SMSS Forums on Soil Taxonomy and Agrotechnology Transfer. They have contributed importantly to interest in IBSNAT.

CAP

The recent establishment of the Collaborators' Advisory Panel (CAP) is a desirable development. It will provide a mechanism for continuing communication between IBSNAT, the networks, and country collaborators. In general terms, it is planned that the CAP will assist the Principal Investigator in any of the following ways by:

- identifying the constraints faced by collaborators--singly or collectively, which may impede the project from producing its principal outputs--and recommending ways to overcome them;

- providing an awareness of current and changing needs for training as perceived by the collaborators as the project progresses;

- identifying needs for communication of information between project staff and collaborators, and among collaborators, that will foster the aims of the project;

- alerting the IBSNAT management to opportunities to involve national or regional organizations that can contribute to the formation of regional networks; and

- helping to inform other regional and international sponsoring agencies about IBSNAT and identify those which may provide additional, complementary sources of support to national institutes or scientists.

The functions and responsibilities of CAP will evolve and become more specific over time. Considerations to be addressed will be the duration of individual memberships on CAP, a mechanism for rotation of memberships and the qualifications to be sought when seeking new members for CAP in order to balance its political and intellectual composition.

The Evaluation Team assesses IBSNAT's performance to date with respect to project output number 4 as being very successful and finds that the establishment of the CAP is a very desirable development.

b) Adequacy of Current Plans

Network and Collaborator Related Plans

The provision of DBMS products to network collaborators and other users will increase as refinements develop. IBSNAT is

planning to update information regarding new developments in microcomputer capabilities, software, and related tools so that collaborators are informed of new developments and how they can be employed in their network activities.

The decisions regarding the range and number of sites to be used for validation of models is under active study by the TAC and project management. Execution will entail participation by selected collaborators as already pointed out.

IBSNAT is anticipating the production of distinctly new and different crop cultivars using biotechnology. When that occurs there will be great interest in the performance and agroecological suitabilities of such materials. IBSNAT technology needs to be prepared to make such determinations quickly so as to obviate the use of the slow and costly trial and error method of making such decisions.

Training: A Special Need

IBSNAT has provided the following detailed information regarding training activities.

Training Workshops/Clinics

IBSNAT conducts training workshops in all parts of the world for the purpose of instructing participants in collecting the minimum data sets, operating the project's data base management system, and executing crop simulation models on microcomputers. A second function of the workshops is to develop resource persons to serve on the teaching faculty of subsequent workshops. In order to meet the increasing demands for training and strengthen the project's response capability, six persons have been identified for training in teaching systems-based research.

The following workshops are planned.

November 1985: Jordan

This workshop is cosponsored by the University of Jordan and ACSAD. It will focus on the wheat model and is conducted primarily for participants from the Arab countries.

June 1986: Malaysia

Hosted and cosponsored by the Malaysian Agricultural Research and Development Institute, the workshop will emphasize the rice model. Participants will be predominantly from southeast Asia.

June 1986: Taiwan

This workshop will be conducted in cooperation with FFTC and will concentrate on data base management.

November 1986: (location not decided)

ICRISAT will collaborate with IBSNAT in conducting a workshop for grain legumes.

February 1987: Zambia

The University of Zambia will organize this workshop to serve the southern African nations. The models for cereals and grain legumes will be taught.

Collaborators requesting assistance in field operations will be invited to spend some time with IBSNAT agronomists at the research site in Maui. Informal training in data base management will be provided upon request at the IBSNAT headquarters at the University of Hawaii in Honolulu. The project will also sponsor the participation of collaborators at the short course in crop modeling held annually at the University of Florida in Gainesville.

Consultancies

In special cases, the project is prepared to provide consultants to visit project collaborating institutions on a short-term basis. The pool of expertise available for such services comprises scientists from IBSNAT/Hawaii, Michigan State University, University of Florida, USDA-ARS, and IFDC.

Conclusions

Although IBSNAT activities which are planned to meet the needs of networks and collaborators are good, they may not be adequate to meet the need to maintain the interest of collaborators and to enable effective execution of field experiments by them. The IBSNAT collaborators have stated very clearly their great need for and interest in training. As reported in the foregoing, IBSNAT response to that need has been a program of relevant, high quality, and diverse training activities. However, on the basis of the requests and comments from collaborators, the perceived needs for training are not being fully met to their satisfaction and these requests are likely to increase as the project matures. To meet those requests three responses by IBSNAT appear appropriate.

- A further increase in "hands-on" workshops by and with collaborating regional networks should be considered. Such workshops should be conducted at sites of validation experiments so that the participants encounter and work with the realities of experiment execution; and data compilation, processing, and interpretation. Participants should be involved to the maximum extent possible in those and related activities. Such workshops provide IBSNAT with opportunities to demonstrate to collaborators the potentials for practical applications of agrotechnology transfer which are the basis of their interest in IBSNAT. Practical demonstrations of how the models can be employed and their write-up as case studies will generate great enthusiasm and support for IBSNAT.

- IBSNAT has a limited duration under the AID contract. Therefore, to ensure their viability, networks should be assisted and encouraged to assume an increasing role in the planning and execution of their training needs. Networks should also develop and coordinate a regional capability to do modeling and to encourage their members to validate and use them.

- Establishment of a "collaborators' support team" (or teams) would also be very useful and an effective use of project funds. Such a team would consist of not less than two persons who need not be at the forefront of IBSNAT developments, but who would be fully conversant with experiment layouts, minimum data set collection and reasons for same, as well as the compilation of data including their entry and processing in microcomputers. Such a team would visit project collaborators on a planned and continual basis. Team visits would demonstrate IBSNAT's sustained interest and support for developing country collaborators. Team members would provide technical advice, respond to questions, explain the rationale of and use of minimum data sets, and be supportive of collaborators in a variety of ways as well as providing an additional channel of communication and feedback to IBSNAT management. In the Evaluation Team's opinion, these visits would not reduce the self-dependency of collaborators but would assist the development of real capability and self-confidence.

The proposed system of team visits would be very important for maintenance of collaborator enthusiasm and to minimization of discrediting failures or dropouts by some disillusioned collaborators.

5. Communicate project rationale and results to the scientific community, development agencies, and developing country governments through publications and other media.

a) Performance to Date

Since the inception of IBSNAT there has been emphasis on development of networks, recruitment of collaborators, workshops, and training. Those are excellent communication devices which must be maintained and indeed increased as already discussed. IBSNAT has had an active program for publication which can be grouped into the following two categories.

Widely Distributed General Publications

Publications in this category are:

- An explanatory brochure entitled International Benchmark Sites Network for Agrotechnology Transfer;
- A leaflet also having the foregoing title;
- IBSNAT's Benchmark Sites News (a quarterly newsletter); and
- Agrotechnology Transfer (the successor to Benchmark Sites News). Publication commenced on September 1985. The size of the mailing list for the newsletters is over 3000.

Technical Publications

This category of publications has more entries with several additions during 1985. The titles follow:

- Minimum Data Sets for Agrotechnology Transfer;
- Technical Report No. 1. Experimental Design and Data Collection Procedures for IBSNAT;
- Users Guide to Integrated Data Base Management and Modeling System;
- Design Elements for the IBSNAT Project, January 1985;
- IBSNAT Progress Report 1982-1985 (not yet published);
- Handbook of Field and Laboratory Methods (for collaborators);
- Benchmark Soils Program Data Base;

- Minimum Data Base Forms (two sets); and
- miscellaneous explanatory and instructional items for collaborators.

Several handbooks, guidelines, instruction sets and so forth are in the course of preparation or distribution to collaborators.

It is concluded that the IBSNAT communication program so far has been adequate but there is now need for some additional and timely activity, including use of other media, some of which is in preparation as described hereafter.

b) Adequacy of Current Plans

Additional handbooks, guidelines, and explanatory materials to meet requirements and requests of collaborators are under preparation or are planned. Two commendable information activities are in preparation for two quite different audiences:

- An IBSNAT symposium entitled "The role of soils in systems analysis for agrotechnology transfer" is scheduled for the Thirteenth Congress of the International Soil Science Society at Hamburg, Germany in August 1986.
- A draft proposal for the program of an IBSNAT-sponsored symposium entitled "Utilizing a systems-based approach to agricultural development" is in preparation for an AID Agricultural Development Officers conference scheduled for Washington, D.C. in June 1986.

Conclusions

Because of the importance of IBSNAT and its impressive achievements to date, the Evaluation Team believes there is a need for an attractive and substantial publication describing the nature, activities, and *modus operandi* of IBSNAT to a general and worldwide audience. Such a publication should include simple, clear explanations, and illustrations or examples of the technical terms and phrases used when discussing systems analysis, models, simulation modeling, computer use, and other aspects of IBSNAT activities.

A "user friendly" style of writing as described above is needed for IBSNAT materials generally insofar as such a style is reasonably practical. IBSNAT personnel, members of TAC, and others at that high level of innovation in the IBSNAT sphere of activity are at the leading edge of an important new development in science. It is important to achievement of their objectives

that they have the understanding and support not only of the collaborators attracted to IBSNAT activities but also much less-technical as well as nontechnical persons. Many such people in positions of power and influence will make decisions that will affect support for IBSNAT activities. Their understanding can be very important! Additionally such a style of writing will be helpful to collaborators especially at the outset of their interactions with IBSNAT. An alternative to, or a supplement of, the "user friendly" style of writing suggested above might be the preparation of a publication with a title such as "An Introduction to IBSNAT Terminologies."

In addition to the foregoing, IBSNAT should seek wider opportunities and media to publicize its purpose, activities, and achievements and the expected impact on agriculture development, particularly in the third world. Personnel should endeavor to make presentations to professional and other groups with a view to creating an understanding of and support for agrotechnology transfer. Such efforts should be consciously directed to possible sources of funding support. The regional development banks and USAID Missions are examples of potential sources of support for IBSNAT networks and country collaborators.

To conclude, another promotional suggestion is made. The articles in Benchmark Soils News and the first issue of Agrotechnology Transfer have been interesting and informative for IBSNAT collaborators, interested scientists, and other agencies. However, few articles have been of a type likely to be used for reproduction or use by other media. Perhaps occasional brief, popular-type articles might be included in some future issues. Recipients of Agrotechnology Transfer might be invited to draw the attention of local or national media to such items in the hope that a broader audience would become aware of IBSNAT, its collaborators, and their activities.

Anything that contributes to greater awareness of the nature and tremendous potential of IBSNAT's activities will benefit society as a whole--as well as IBSNAT!

6. Design an operational system of project management.

Establish and sustain for the life of the project a functional and adequately staffed project headquarters at the University of Hawaii.

In the sense that an output represents an end result of project activity, management per se is not an output but a means or activity. Nevertheless, as a way to focus attention on its importance and for budgeting and reporting purposes, it has been included in the project design as an output which is of major

concern both to AID as the sponsor, and the University of Hawaii as the contractor.

a) Performance to Date

The Players

AID has contracted directly with the University of Hawaii to provide organization, leadership, and support of IBSNAT activities including subcontracts with: the University of Puerto Rico at Mayaguez; the Grassland, Soil and Water Research Laboratory at Temple, Texas (ARS); L'Institute National de le Research Agronomic (INRA); and the University of Florida. Through AID funding, formal cooperative activities have also involved SMSS, the SCS, National Soil Survey Laboratories, the International Fertilizer Development Corporation (IFDC), and Michigan State University. The IBSNAT project has initiated informal agreements with the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia, the Department of Scientific and Industrial Research (DSIR) scientists in New Zealand, and also with nine developing countries. Approximately 30 more countries are expected to participate with IBSNAT in the near future. The draft or pre-publication of IBSNAT Progress Report for 1982-1985 does not contain much information on the purpose, plans, or accomplishments of individual subcontracts, or the SMSS activities, although brief oral presentations were made to the team.

Management Control

The contractor has little direct control over most of the network collaborators and its P.I. must rely on leadership, persuasion, and support activities to exercise the level of management and quality control necessary to assure both the essential cooperation and coordination of collaborators and for maintaining the prospective schedule to achieve successfully the project purpose. Therefore, IBSNAT management or core staff must rely on the leadership of dedicated scientists and on the prospect of mutual benefits for all participants. The IBSNAT Project's incentive for motivation that encourages effective participation includes activities such as special purpose working groups, field visitations, collaborator progress reviews, instructional workshops, and informative symposia. As explained below, a number of committees have also been established to advise and assist the Principal Investigator in carrying out his responsibilities. In the view of the P.I., his principal levers for quality control are: (1) the establishment of the MDS, which places a management constraint on the field experiments; (2) the control of experiments through the data base management input-output requirements; and (3) the training workshops.

Project Logic

After the second IBSNAT symposium held in Maui in August 1984, at the critical time when the minimum data sets were finalized, the stage was set to begin model development and validation in earnest. The P.I. with assistance of the Project Manager, other IBSNAT staff and a consultant, and in reference to the events which had occurred since contract initiation, conducted a 3-day exercise which resulted in clarification, updating, and redefinition of the major project design elements, i.e., the development goal and hypothesis, project purpose and approach, expected results, critical assumptions, and end-of-project-status (EOPS) indicators. A first crack at the life-of-the-project work plan was also taken, including establishing milestone events for monitoring progress. It was also decided at this time to create an Executive Management Committee (EMC) and a Collaborators' Advisory Panel (CAP). After discussions by the TAC and approval by AID/S&T, the results of this important and very useful exercise were published in January 1985, with the title Design Elements for the IBSNAT Project.

Technical Advisory Committee

Creation of the TAC was a result of the first symposium held in Hyderabad in 1983, when it was realized that agreement on MDS for each crop could not be achieved in plenary sessions. It gradually evolved into its present role of providing advice on technical matters and in helping the P.I. to strategize. According to the UH reply on the "issues," the TAC also reviews progress and recommends project activities for the upcoming months. Current members include: J. A. Comerma of FONAIAP, Venzuela; J. B. Dent of Lincoln College, New Zealand; L. A. Hunt of the University of Guelph, Canada; H. A. Nix of CSIRO, Australia; and its Chairman, J. T. Ritchie of Michigan State University. In 1984, TAC met at the second IBSNAT Symposium at Maui, and again at the Venzuela workshop in December. In 1985, it met in conjunction with this external evaluation exercise, also held in Maui. While the draft Progress Report fails to describe in detail the recent activities and results of TAC meetings, it is obvious that TAC is playing a very important role in helping the P.I. guide the modelers and, as individuals, assisting IBSNAT in training, networking, and publications. The P.I. modestly attributes the success of the project to date to the TAC.

Executive Management Committee

The EMC is composed of the P.I., Goro Uehara; the Associate P.I., F. H. Beinroth, University of Puerto Rico; H. Eswaran of SMSS; and G. Y. Tsuji, the Project Manager. T. S. Gill, the AID Program Manager and Project Monitor, also attends in an ex officio capacity. According to the IBSNAT draft Progress Report, the EMC is responsible to the P.I. regarding all matters related to the operational management and implementation of activities to achieve IBSNAT objectives.

The EMC meets irregularly (twice so far) at the call of the P.I. and, at least insofar as the AID Project Monitor is concerned, has not yet adequately defined its role or modus operandi. The draft Progress Report contains no information of the results of its meetings. It is also noted that, except for an Annual Report required by the AID Contracts' Office, progress reporting has been delinquent. While the draft Progress Report for 1982-85 is above average in technical content, it is deficient in other areas, e.g., coordination of field activities with other AID soils and water projects. As yet there has been no significant further deliniations of output and sub-output schedules, or development of short-term work plans as anticipated in output 6a of the Design Elements and which are indispensable for monitoring and review. It is also noted that the activities detailed in the Design Elements include no target completion or milestone dates making objective monitoring almost impossible. Omitting such dates may be desirable in a general publication, as the team understands was suggested by the AID Project Monitor, but an "approved and operational" work plan must include such dates.

Collaborator's Advisory Panel

This panel, which met for the first time during the evaluation exercise, is discussed elsewhere in this report. Suffice to say that it is viewed as a representative of the targeted "user group" and its role will increase in importance as model validations and applications and regional networks come on-line. The P.I. also views it as a link between the TAC and the EMC.

University Support

The IBSNAT project is administered by the University of Hawaii, as prime contractor, through the Research Corporation of the University of Hawaii. Personnel and operational management of the project are handled by the latter.

The University supports the project by providing the following.

o Direct Support

- salary and fringe benefits of the P.I. and two faculty researchers
- office space of approximately 1800 square feet and laboratory space of approximately 800 square feet
- availability of faculty and research staff as technical and operational resources

o Indirect Support

- utilities, including basic telephone costs
- administrative and fiscal support for personnel benefits, purchasing guidelines, liability protection, etc.

Space for the microcomputer, production and graphics, and storage is inadequate. The physical facilities are old and over-crowded. It does not present a very impressive sight for international visitors and cannot help but adversely affect work efficiency.

Staffing

Appendix No. 5 is a summary of IBSNAT's staffing pattern and provides information on the function(s) of individual IBSNAT professional and technical staff members, the percentage of their salary paid from AID and/or UH funds, and a gross estimate of the distribution of their time between IBSNAT, TropSoils, and SMSS activities. As implied elsewhere, the quality and dedication of the staff is outstanding, but they appear hard pressed to handle the growing work load.

Performance Assessment

Overall, management of this very complicated and difficult project, which is pushing out the state-of-the-art in crop simulation, must be judged as above average, given the progress that has been made in developing the project strategy and approach, establishing a network including some of the most outstanding scientists and modelers in the world, designing the MDS, and getting collaborators to start field experiments using their own resources. Credit is due to AID, the contractor, and the IBSNAT collaborators for this outstanding performance.

2. Adequacy of Current Plans

Conceptualization

Although AID chose a contract as the mechanism for implementing the IBSNAT Project with the University of Hawaii, de facto, it resembles a cooperative agreement in that (i) the P.I. has been granted a great deal of flexibility to adjust the design and work program as work progresses, and (ii) there is a need for close collaboration between AID and the University at all stages and levels of the project. The Evaluation Team believes the flexibility granted to the P.I. has been both necessary and is accomplishing its purpose, i.e., the project approach and expected results are continually being improved and adapted to changing circumstances and opportunities. The team does not wish to suggest anything which would change this situation.

On the other hand, the conceptualization phase of the project is about over and the operational phase has begun in earnest. For the cereals models, validation will soon start. For the legumes and root crops, field experiments are beginning. The DBMS has been established and is functioning. It is now time to give closer attention to the remaining outputs, i.e., assisting in developing capability in collaborating countries, demonstrating crop model applications, and networking. These types of activities are required and are more easily adaptable to work planning, scheduling, and resource specification. Some of the more traditional AID management tools and mechanisms can and should come usefully into play now.

The AID Role

There is a long history of friendly and close cooperation and mutual respect between the P.I. and AID Monitor going back to the original 211(d) soils grant and the Benchmark Soils Project. Nevertheless, there appear at times to be some misunderstandings or misconceptions by the principals as to their respective roles. This is exacerbated by the distance involved and the "fuzziness" to date of the EMC meetings. While it is clear that the P.I. has the overall and prime responsibility for contract implementation. AID certainly has a strong and legitimate interest in monitoring progress and putting forth its own suggestions for consideration by the P.I. The Evaluation Team concludes that part of the problem lies in the sole reliance, up to this point, on AID's ex officio participation in the EMC which is an "advisory" group to the P.I. and consists of IBSNAT staff members and SMSS representation. We believe the usefulness of this advisory committee is for the P.I. to judge and he may use it as much or as little as he wishes. However, AID's role needs to be clarified and formalized through creation of a Management Review

Group (MRG) consisting of the P.I. and AID Project Monitor as equal members, with ad hoc membership or additional participation as the agenda requires. This device is being successfully used by AID/S&T in a number of similar projects. For at least the next year, it should meet quarterly or upon the request of either member. The MRG should be concerned with: (i) approval of strategic decisions, i.e., any changes in the project design at the purpose and output levels, including EOPS indicators; (ii) life-of-the-project work plan and progress indicators; (iii) short-term or annual changes in program priorities and major resource allocations or reallocations; (iv) coordination with other AID projects, particularly TropSoils and FSR/E, and monitoring of progress; (v) reporting; and (vi) AID and university support.

TAC and CAP

Up to this point, the TAC has had a common and cohesive goal of establishing MDS for selected crops and adapting existing models as appropriate. As the project moves on to creation of new models, validation, addition of management systems components, and applications the team believes the project would be well served if the process was more systematized, i.e., the purpose and agenda of called meetings was discussed and distributed beforehand, and that results were summarized, recorded, and eventually included in annual progress reports. The TAC's future role, if any, in model validation, networking, training, etc., also could be usefully outlined. It may well be that as the project progresses, the role of the TAC will change, both in concept and mode, while that of the CAP increases. IBSNAT management would be well advised to assure adequate overlap and liaison between the two advisory groups, with AID's ex officio participation. In particular, the CAP may be very useful in organization of regional efforts to obtain genetic coefficients, provide training, etc.

Staffing and Project Resources

Appendix No. 5 indicates that the P.I., given his university and TropSoils responsibilities, is only able to devote about 40 percent of his time to IBSNAT activities. With the exception of the Associate P.I., hired under a subcontracting arrangement with the University of Puerto Rico, most other IBSNAT staff members time varies from 10 to 75 percent. Given delays in reporting and other difficulties, and the increase in staff time recommended elsewhere in this report to hands-on training, help in establishing and conducting experiments, and fostering the collaboration of developing countries, the team believes resources need to be allocated for at least two full-time additional staff members, including travel and support costs. In addition, for those critical collaborators in developing counties who are experiencing difficulties or need some

additional motivation to sustain their interest until results are achievable, basic equipment such as personal computers, weather instruments, etc., should be supplied from project funds. This was discussed last year and ample funds have been included in the IBSNAT Project budget.

University Commitment and Support

A new president of the UH system was recently appointed, and he is also now the chancellor of the Manoa campus. A major reorganization is in process which will delegate more responsibility to the college levels. While their duties and functions have not yet been defined, new vice-president positions for research and international programs have been established. The latter, in particular, reflects UH's commitment to the international dimension throughout its academic programs. The UH has a natural and obvious commitment to tropical science with an emphasis on Asia but extending throughout the developing world and a long history of association with AID activities.

More recently, but equally important and particularly in the College of Tropical Agriculture and Human Resources (CTAHR), there is a commitment to the systems approach in both education and science. In the opinion of Dean Ned P. Kefford, IBSNAT is in the front line of a "daring" activity which "gives a lift" to the whole University and is highly stimulating. It is also having its impact on UH collaboration with USDA activities. The amalgamation of agricultural research and extension is now being followed by infusion of the international dimension into the total program. As its scientific neighbors (other countries rather than contiguous states) increase in capability, the tide is starting to turn, i.e. benefits are flowing back to UH, requiring a change in mind-sets.

One change required, which shows some evolutionary progress but still needs improvement, is an increase in the amount of contract overhead which is returned to the college and departments working on AID-funded projects. This is very important in terms of providing motivation, particularly when project staff members are fully funded (hard money) by the university, and for providing flexibility and supportive efforts which are not always forseeable or directly fundable in contracts. The current return is approximately 15 percent which amounted to $14,205 in FY 1985. Further increases would be in line both with the need and with the practices of other Title XII universities.

A second change, which is urgently needed, regards the quality and quantity of space made available to IBSNAT staff by UH. While office space for faculty is adequate, the facilities for technical, support, and administrative staff, as well as visitors, is very

poor. It also must be shared with other projects. In addition to IBSNAT, the UH is actively engaged in the AID-funded NifTAL project and TropSoils CRSP and will soon take on a new AID project in agroforestry. As already noted, the team believes the efficiency of project staff is adversely affected by the inadequate and run-down facilities long in use. As the UH increases its commitment and image in international development activities, and as foreign visitors increase in number and importance, surely the University and the State of Hawaii needs to present a better face to its public. Therefore, the Evaluation Team urges that the newly appointed management team of UH make every effort to solve this problem on an urgent basis.

Finally, given the number and importance of AID projects in its current portfolio, CTAHR may wish to consider a more active role in supporting projects through constructive involvement, encouragement, coordination and accountability. This is particularly important in assuring that existing projects maintain mutually advantageous interfaces, on-campus and off, with other AID-sponsored agricultural research projects. Maintaining the DBMS after project completion would also strengthen the university's position in international agriculture.

Reporting and Work Planning

There is some ambiguity in contract reporting requirements and purpose, particular in reference to Annual Reports and Project and Progress Reports. The substantive material included in the annual reports has been skimpy and the progress report, not yet published, covers a two year period which ended 31 July 1985, and seems aimed at a larger audience than AID. For both monitoring and work planning purposes, an annual report focused on the progress in producing the outputs during the reporting period, (using the scheduled milestones included in the draft Design Elements, and including adjustments required for the next year), changes in critical assumptions, coordination with other soil and water projects, etc., should be prepared and transmitted to AID within 30 days after completion of a contract year. In turn, through the mechanism of the proposed MRG, AID's inputs and approval should be provided within the next 30 days. This should not be combined with or substituted for the fiscal and administrative data required by the AID Contracts Office or for IBSNAT technical or information publications.

III. CURRENT VALIDITY OF DEVELOPMENT AND PROJECT HYPOTHESIS

A. Probability of Producing Outputs

Schedule

In its reply to the issues, UH states that "It is highly probable that all projects outputs will be produced on schedule and that in certain areas, new advances in technology will enable the Project to do more than it now promises." It notes the time saved in adoption of a commercially available data base management system and the potential impact of "expert systems," a product of artificial intelligence research.

Unfortunately, no target dates appear in the work plan included in the published version of the Design Elements provided the team although they were included in the draft prepared in September 1984. They may be partially inferred from Table 1 which appears on page 14 of the published version, but are only projected to 1987, the end of the current contract term. Using this data, plus worksheets provided to the team during its on-site review, the estimated completion date for each major output now appears as follows:

1 DBMS - December 1987+
2 (a) Crop models validated - 1989+
  (b) General agricultural management model - 1991-
3 (a) Capability in five LDCs - 1987
  (b) Case studies/demonstrations - 1989+
4 Functional network - 1989+
5 Communication (publications) - 1991

Critical Path

In general, the project appears on schedule, but is obvious that all outputs, in their entirety, cannot be producted within the term of the current contract and an extension will be required for another 4 to 5 years. Some outputs appear highly likely to involve schedule slippage, e.g., model development and validation for root crops, and such delays will impact on other outputs, e.g., case studies. On the other hand, advances in technology may facilitate and shorten the time required to develop the general agricultural model. Nevertheless, there is some merit for AID's concern with schedule slippage as expressed in issue statement 2b. (see Appendix No. 1), which explains the Evaluation Team's suggestion that the "critical experiments," i.e., those necessary to develop, test and validate crop simulation models, should be scheduled and monitored separately from other experiments, reported upon quarterly, and that the colla- borators should be provided with whatever support and assistance is necessary to stay on schedule (i.e., the critical path) and complete the experiments with the required accuracy and completeness.

B. Validity of Project Approach

Flexible

The Evaluation Team believes the basic approach of the IBSNAT Project as described in the publication Design Elements, including the explicit critical assumptions contained therein, and as explained to the team in written and oral presentations; plus witnessing the field experiments being carried out in the MauiNet--which is sound. The approach is also flexible enough to respond to operational experience and adopt new technology as it appears. Team comments on individual outputs, all of which are necessary for successful project completion, have been supplied. The team also wishes to note the fascinating prospects of "expert systems," i.e., computer programs which can make the knowledge of experts available to nonexperts, and for its use in decision-making and its potential interfaces with simulation models.

New Phase

As already noted, the IBSNAT Project has moved from a "conceptual" to an "operational" phase. It will soon move into what might be described as its "validation and extension" phase where the activities concerned with outputs other than the DBMS and model development will increase in intensity and importance. Detailed planning to produce these "software" outputs needs to begin now. The existing EOPS indicators seem reasonable to the team.

C. Development Hypothesis

As recently reformulated, the development goal or higher level program of the IBSNAT Project is:

- To accelerate the rate of agrotechnology transfer to and among developing countries on a cost-effective and scientific basis to improve the understanding of cropping systems, provide decision makers with the means to predict crop yields using alternative management practices, and use crop simulation models to develop management strategies at all levels.

The Soils Benchmark Project demonstrated the feasibility of transfer by analogy. The team sees no reason to doubt the hypothesis of this project, and in fact, is impressed with the progress to date, viz, transfer by simulation. As when the project was approved, the potential impact on the agricultural production of developing countries is breath-taking in its sweep. Models, coupled with management practices and "expert systems," can enable many developing countries to leap across the existing wide technological gaps and obviate the time and cost for extensive on-site trial and error experiments. This will be particularly significant in areas where infrastructure is limited, diversity extreme, and

basic data is sparse, e.g., Africa. It is worth noting that developed countries share an almost equal interest in these benefits.

Farming Systems

For example, in the view of some TAC members, crop models of the type associated with IBSNAT, which have been calibrated for local conditions and appropriately validated with local data, will have the immediate application of supplementing and partially replacing local applied agricultural research programs. In this role, the models can be used to explore agronomic questions within a few hours of keyboard time. Examples of the models' roles follow.

- The impact of agro-inputs or technology packages on individual crop yields in a local climatic environment can be simulated over many years.

- The effect of varying timing of crop production within the year and/or in a rotational cropping sequence can also be examined through simulation runs over a number of years.

Providing agroclimatic and soils data are available--which is a critical constraint--this process can be repeated with equal speed for as many local or distinct situations as are relevant.

Given access to these kind of data, and assuming survey and analyses of existing systems has been carried out, the farming systems procedure 2/ could do the following.

EITHER

- Use stochastic dominance techniques to determine "best" technology options in the context of yield and yield variability.

- Set out selected technology(ies) on reference farms at large-scale plot and monitor results (NB if technology is a cropping sequence this may take several years).

- Set up demonstration farms, and monitor and begin development of extension program.

2/ One failing of FSR/E, as now practiced, is the inability to predict response of site-specific results in other specific sites.

OR BETTER (BEST) (using expert systems approach)

- Use input-output data generated from crop models for alternative technology options (many years of simulated data) as the 'technology' component (black box) of a whole farm simulator. Other components of the simulator will include the farm family for a reference: consumption behavior; expenditure, investment for development, debt attitudes; financial and social limitations; objectives for self-sufficiency, employment on and off farm, and risk.

- Use a whole farm simulator to develop farm programs to meet farm family objectives.

- Set up the best farm programs on demonstration farms and monitor them. Review farm program through whole farm simulator as required in the light of reaction from local farmers.

- Establish extension programs.

The team includes the above proposition because (i) it further justifies and expands the development hypothesis, and (ii) it illustrates the importance of monitoring IBSNAT results closely for their actual and potential impact on other agricultural research and development activities supported by AID, e.g., farming systems research, TropSoils and crop CRSPs, plant tissue culture, water management systems, pest control, dryland agriculture, animal disease control, and even aquaculture. It is truly a dramatic and pervasive force.

D. Overall Assessment

Succinctly, and in response to the purpose of the evaluation as included in its Terms-of-reference, the Evaluation Team concludes the following.

- The scientists collaborating on model development are highly talented.

- Performance to date has ranged from satisfactory to outstanding.

- The probability of successfully achieving the project objectives (purpose) remains high. The team is not sanguine, however, that this can be adequately accomplished by 1987.

- If anything, with the accelerating changes in systems and information technology, the expected impact (development hypothesis) of IBSNAT's results has increased and remains valid.

IV. RECOMMENDATIONS

The narrative of this report has included many explicit and implied suggestions designed to assist AID and the Principal Investigator in planning and carrying out improvements and actions which, if accepted, will increase the probability of project success. Those suggestions which are "actionable"--that is, if approved actions can be initiated to implement them--have been compiled and are consolidated below to facilitate their review by management and to minimize duplication and overlap.

Data Base and Models

1. Work plans should separate data acquisition activities which are: (a) needed to validate models; (b) needed to verify or calibrate models in specific countries or locations; or (c) are related to model applications to on-site problems. Those collaborators selected from above category (a) should be treated as "critical path" activities requiring quarterly reporting and extraordinary support measures to assure production of timely and quality minimum data sets.

2. IBSNAT should provide more training for collaborators regarding how to access and use the data base and the verified models.

3. Specific plans should be made to strengthen data acquisition efforts on genetic coefficients for crop cultivars. This should include a users manual explaining why genetic coefficients are important and specific experimental instructions on how to obtain them.

4. The "Users Guide to Integrated Data Base Management and Modeling Systems" should be finalized, translated, and distributed as soon as possible.

5. The end-of-the-project fate of the DBMS needs to be addressed soon. It is suggested that the University of Hawaii might consider this an appropriate university function fitting in with its commitment to the international dimension of its programs and, if so, that it initiate action to take over the DBMS at or near project completion.

6. Millet, an essential crop in much of Africa and parts of Asia, should be added to the selected crops. If necessary to accommodate this addition, or for other reasons, a lower priority can be allocated to the aroids.

7. A new sub-output should be added to crop models covering work on submodels to describe the impact of diseases and insects on crop production. Work plans, schedules, and the identification of major events and progress indicators should be developed accordingly.

Developing Country Capabilities and Use

8. IBSNAT should assist each project collaborator to prepare a list of deficiencies and constraints in the areas of human resources, equipment, and soil-weather-cultivar inventories.

9. On the basis of such a resource inventory, IBSNAT staff should assist each collaborator to prepare a plan for establishing institutional capability to conduct experiments and use crops models (in addition to the instructional materials and workshops already provided).

10. In short, training activities must be increased to meet the felt needs of collaborators who have signed MOAs. An appropriate IBSNAT response might be to increase "hands-on" workshops, including help in conducting field experiments; data compilation, processing and interpretation; and demonstrations of potential applications.

11. IBSNAT should, as part of this total process, quickly establish "collaborators' support team(s)," each consisting of at least two staff members fully knowledgeable regarding experiment layouts, MDS collection and their rationale, data input, etc., who would visit field sites on a mutually planned and frequent basis (a la SMSS site characterization) to provide technical advice, respond to questions, assist in "hands-on" training, provide encouragement and support, and add a new channel of communication and rapid feedback to IBSNAT headquarters.

12. IBSNAT funds should also be utilized to ensure that each new developing country collaborator has at least an IBM-compatible microcomputer and one weather station so the process of developing capability can begin at the outset of the collaboration.

Demonstrations

13. Activity should commence as soon as possible to develop criteria for the selection and design of "representative" case studies in relation to the project purpose (objective). This should include the methodology to be used, and the clarification that the preparation and distribution of the case study is the means for demonstrating crop- and site-specific applications and not an end in itself.

14. IBSNAT should be extended whatever assistance is necessary by AID to ensure and accelerate the country application of validated models, including the means to involve the targeted audience(s) in the process and to provide feedback for model improvement.

Regional Networks

15. IBSNAT should continue to encourage and assist in the creation of regional networks that would (a) assume an increasing role in the planning and execution of training programs to meet their needs; (b) develop and coordinate a regional capability to do modeling; and (c) encourage their members to validate and use crop models.

Publications

16. There is a need for an attractive, substantial and "user friendly" publication describing the nature of IBSNAT activities and its *modus operandi* to a worldwide lay audience.

17. Such a publication should be part of an IBSNAT effort to seek wider opportunities and different media to publicize its purpose, activities, and achievements (e.g., presentations to professional and other groups, particularly among the bioscientists) with a view to create an understanding of agrotechnology transfer.

18. Future issues of the *Agrotechnology Transfer* news should include some brief, popular-type articles which could be drawn to the attention of local or national media by recipients.

Management

19. Increasing attention, in planning and implementation, should now be given to those outputs concerned with building capability in the DCs, demonstrating applications, regional networking, and communication or outreach.

20. In order to facilitate AID's legitimate interest in the planning and the monitoring of project progress, a Management Review Group (MRG) should be immediately established and consist of the AID Project Monitor and the Principal Investigator as equal members, with the *ad hoc* participation of others as required, including representation from the CTAHR.

21. The MRG should be primarily concerned with (a) approval of strategic decisions, (b) life-of-the-project work planning and progress indicators, (c) annual changes in program priorities and resource allocations by outputs, (d) coordination with other AID projects, (e) progress monitoring and reporting, and (f) university and AID support.

22. On the agenda of the first meeting of the MRG should be a proposal to increase the timeliness and usefulness of progress reporting and work planning, including progress, and slippage; and problems concerning *all* outputs, subcontractors, and advisory committees.

23. The purpose and role of the TAC should be updated and its deliberations and advice should be recorded. Adequate liaison with the recently established CAP should be maintained. Among other things, the CAP should encourage and facilitate national and regional efforts.

24. At least two full person-years of additional staff time, including travel and support, should be added to IBSNAT headquarters to increase hands-on training and site visitations, to expedite the preparation and distribution of manuals and publications, etc.

University Support

25. The University of Hawaii and particularly CTAHR, should seek out additional opportunities to support IBSNAT (and other AID-funded projects), e.g., increase the amount of contract-generated overhead which is returned to the department(s) involved, take a more active and supportive role in the coordination and monitoring of desirable project interfaces, and eventually to assume responsibility for the DBMS when the IBSNAT contract is phased out.

26. Most urgently, the University and the State of Hawaii need to provide IBSNAT (and TropSoils) with additional and adequate on-campus space. The University is requested to undertake a review, as soon as possible, of the affect of the present run-down facilities on work efficiency and its international image as a leader in agricultural development in the tropics and subtropics and to take appropriate action.

Contract Status

27. AID/S&T and IBSNAT Project management should seize every opportunity to tie in the IBSNAT systems analysis approach to ongoing and proposed projects, e.g. FSR/E, TropSoils, plant tissue culture, dryland agriculture, animal disease and pest control, aquaculture and mariculture, biotechnology, etc.; and with parallel projects being carried out by the USDA, particularly ARS and SCS.

28. Finally, and without hesitation, the Evaluation Team recommends that the project/contract be extended to 1991.

Appendix No. 1

Terms-of-Reference for
IBSNAT External Evaluation Team

1. The overall purpose of this midterm evaluation is to: (a) assess performance to date; (b) on the basis of this assessment, project the probability of successfully achieving the project objective (effectiveness); and (c) revalidate, in the light of changes since project approval, the development hypothesis (expected impact).

2. In order to provide the team with some guidance on the issues deemed important for this review, the following statements have been developed. They are not intended, however, to limit the team's investigation of any other issues which develop during the course of this exercise and which are within the scope of the evaluation purpose.

The Evaluation Team, in its discussions with IBSNAT staff and collaborators during the External Comprehensive Evaluation scheduled for 30 September to 4 October 1985, and in preparation of its final report, is requested to focus on the following issues. The contractor will also be given the opportunity to prepare a written response to each issue which will be included as Appendix No. 2 of the team report.

A. In view of advances in science and technology since the start of the IBSNAT Project, and considering the original project assumptions, is the project rationale (i.e., development hypothesis) and objective, including the project approach*, still relevant and significant to developing country needs?

B. The key (critical path) activities involved in producing Output No. 2a*--i.e., develop, test and validate crop simulation models for selected crops by 1987--involve the collection of minimum data sets by collaborating institutions. Since this is the core output, it is of principal concern to AID management at this time in particular, whether any schedule slippages are ocurring and, if so, how they can be prevented or overcome?

C. Is progress to date satisfactory regarding the plans, activities, and accomplishments for achieving the remaining project outputs*?

---

* Use the "Design Elements for the IBSNAT Project," January 1985.

D. Given the redefinition of major design elements approved last year*, particularly the sections dealing with project management and the problems inherent in managing a collaborative network, review the existing IBSNAT management structure and plans of the Principal Investigator, including effective use of the Technical Advisory Committee and the Collaborators' Advisory Panel.

E. Given the progress to date and your evaluation of performance (i.e., effectiveness), is it probable that all project outputs can be produced on schedule and within the contemplated 9-year span of the project, i.e., to 1991? Are the EOPS indicators* reasonable?

3. The Team will arrive at its principal observations, conclusions, and recommendations on the basis of consensus. The chairperson will be responsible for: (a) conducting the review sessions; (b) presenting a suggested division of work load for both the on-site review and report preparation; (c) leading the team into an agreement on report structure and content; (d) based on individual team member inputs, prepare the final version; and (e) give an oral presentation of the results to AID management.

---

* Use the "Design Elements for the IBSNAT Project," January 1985.

Appendix No. 2

Replies by the University of Hawaii to Issues Included in Terms-of-reference

A. In view of advances in science and technology since the start of the IBSNAT Project, and considering the original project assumptions, is the project rationale (i.e., development hypothesis) and objective, including the project approach*, still relevant and significant to developing country needs?

Systems analysis and simulation as a way to accelerate agricultural development in tropical countries is more relevant today than it was in 1982. In 1982, the project set out to prove that it is possible to predict the growth, development, and yield of a cultivar of a food crop anywhere in the world. Progress to date clearly indicates that it is possible to do so in locations where a minimum data set for soil and climate is available. The minimum data set needed to make such predictions along with suggested field experiments to compare predicted with measured results is contained in a manual entitled "Experimental Design and Data Collection Procedures for IBSNAT" published by the project in 1984.

Two crops, wheat and maize, can now be tested for performance and suitability in any location by rapid computer simulation. Simulation models for eight more crops are in various stages of development, and there is reason to believe the growth development and yield of any food, fiber, or fuelwood crop can be similarly modeled.

A simulation model's purpose is to integrate sets of disconnected relationships into a coherent whole which will show the effects of the interplay of those relationships. The solution to most development problems requires the synthesis and integration of these knowledge relationships. Many development projects deal with crops, climate, and soils as separate entities, but complex genotype-environment interactions demand that we view the agroproduction system as a soil-plant-atmosphere continuum. The capacity to predict crop performance in a wide range of agroenvironments suggests that systems simulations can help accelerate development in developing countries.

The development of crop models also enables AID and other development agencies to link existing projects that now operate independently and in isolation of related projects into more efficient and cost-effective programs. Integrated pest management, for example, can and should be tied to soil-plant-climate-management systems. Biological nitrogen fixation and biotechnology are all part of the system. Projects on rainfed agriculture,

---

* Use "Design Elements for the IBSNAT Project," January 1985.

fast-growing fuelwood species, agroforestry, sociology of farming systems, aquaculture, small ruminants, and farm income and economics can and should be studied as interdependent components of a dynamic agricultural system.

It is becoming increasingly clear that while the project rationale and objectives have become more relevant, timely, and achievable, the approach to achieve them will need to be modified to take advantage of the rapidly advancing field of artificial intelligence. IBSNAT is currently reviewing the potential role of Expert Systems--a product of artificial intelligence research--for knowledge representation and as decision support systems.

B. The key (critical path) activities involved in producing Output No. 2a*--i.e., develop, test and validate crop simulation models for selected crops by 1987--involve the collection of minimum data sets by collaborating institutions. Since this is the core output, it is of principal concern to AID management at this time in particular, whether any schedule slippages are ocurring and, if so, how they can be prevented or overcome?

When the project was first created, the participation of a large number of data generating collaborators was considered essential and critical to project success. Evidence to date suggests that each crop needs to be tested in no more than three benchmark sites.

A rigorous test of a crop model is to test how well it mimics the performance of a cultivar in a submarginal, stressful environment for which the crop was never intended. The aim is to test a crop model in a minimum of three environmentally diverse benchmark research sites. In practice, one of the sites should be the research center which developed the crop. The other two environments should be stressful to the crop and different from each other and from the research center. Any model that can simulate crop performance in three very different environments is also likely to do so for all environments.

The IBSNAT Project also assumed that each collaborator would establish only one benchmark research site. What has actually happened is that most collaborators have established or intend to establish several sites. For example, Thailand has established 14 benchmark sites to validate five crop models. It now appears more efficient to collect the minimum data set for model validation in a few selected "advanced" developing countries with experienced researchers and well-equipped research stations. These countries include Malaysia near the equator, Venezuela at about 10°N, Hawaii at 20°N, and Syria (ACSAD) at 35°N. Australia has indicated its intent to install install experiments to validate the cassava and taro (aroid) models in Queensland. IBSNAT also has a Memorandum of Agreement to work with an Australian team in Kenya and Nigeria to collect minimum data sets for several crop models. Another potential source of minimum data set is a 7-station, IBSNAT-type project recently established in Fiji and funded and supported by Australia.

---

*Use "Design Elements for the IBSNAT Project," January 1985.

IBSNAT has a larger group that desires to take advantage of the principles and concepts offered by the project. This group forms the "user network". It includes countries like Burundi and Zambia in Africa; Panama in Central America; and Guam, the Cook Islands, and Western Samoa in Oceania. The Philippines, Indonesia, Thailand, and Pakistan are intermediate countries that can make major contributions to their national efforts by committing greater resources to their IBSNAT effort.

Whereas the "advanced" group is prepared to validate crop models, the user group is in a position to prove whether IBSNAT's principles and concepts can be exploited by countries with limited resources and few trained people. The Cook Islands, Burundi, Panama and Zambia are countries that merit watching to assess the capability of small or resource-poor nations to adopt IBSNAT principles and concepts.

In short, the critical path to collecting the minimum data set is not linear, but exponential with time. The upswing in data generation is just beginning. To date the project has obtained ten data sets for three crops from ten experiments in four countries. We expect this to increase by an order of magnitude next year.

C. Is progress to date satisfactory regarding the the plans, activities, and accomplishments for achieving the remaining project outputs*?

Progress of a project based on systems analysis and simulation is predictable. Systems simulation is very discriminating in its data requirements. This enabled the project to identify the minimum data set needed to predict crop performance in any environment. The manual on "Experimental Design and Data Collection Procedures for IBSNAT" was the first major project product. This output enabled the project to produce a second major product, namely the data base management system.

It is important to note that the crop models enabled the minimum data set to be identified; and the minimum data set, in turn, enabled the data base management system to be designed specifically to accommodate the minimum data set needed to validate the crop models. The clear direction given to the identification of the minimum data set and the data base management system by the crop models has been the single most important factor in keeping the project on schedule.

IBSNAT's major achievement to date has been to demonstrate the utility and superiority of systems research over traditional methods. It has done so in the following ways.

1. Captured the imagination and excitement of DC scientists and administrators to collaborate in systems research for technology sharing on a global scale.

---

*Use "Design Elements for the IBSNAT Project," January 1985.

2. Involved the DCs in identifying the minimum data set to conduct systems research and crop modeling.

3. Succeeded in persuading the DCs to establish benchmark research sites at their own expense.

4. Mobilized an international group of systems analysts and modelers to assist project efforts.

5. Established a growing prototype benchmark sites network for collecting the minimum data set to develop and validate models for ten crops.

6. Has operational models for wheat, maize, and soybean.

7. Is developing models for sorghum, rice, groundnut, Phaseolus beans, cassava, potatoes, and cocoyams.

8. Has developed the capability to train DC scientists in systems research and modeling.

9. Has designed and developed a data base management system for use in DCs.

10. Has a program to publicize project results through technical reports, manuals, newsletters, and brochures.

D. Given the redefinition of major design elements approved last year*, particularly the sections dealing with project management and the problems inherent in managing a collaborative network, review the existing IBSNAT management structure and plans of the Principal Investigator, including effective use of the Technical Advisory Committee and the Collaborators' Advisory Panel.

Project management occurs at two levels. It occurs at the decision making and implementation levels. Project decisions affect collaborators from more than 20 highly variable and dispersed countries, and any action they take depend more on their commitment to the principles and concepts of the project than on their expectation of technical aid. "IBSNAT is trade, not aid" has become the project trademark.

The management objectives are to capture and sustain the excitement and imagination of the collaborators, and to create the environment that makes it possible for collaborators to do what is right. Collecting a minimum data set to test whether a crop model predicts the performance of a cultivar of a food crop anywhere in the world is what excites the collaborators into doing the right thing.

---

*Use "Design Elements for the IBSNAT Project," January 1985.

The IBSNAT Project proves that developing country collaborators like to be challenged with good ideas and that they are prepared to invest their own resources to test these ideas.

The Technical Advisory Committee is the main source of ideas. It consists of five members from five nations. It meets twice a year to review progress and to recommend project activities for the coming months. The success of the project can largely be attributed to this committee.

Last year, a Collaborators' Advisory Panel was created. The purpose of this panel is to solicit ideas from representatives of the developing countries. This panel meets for the first time during the week of the project evaluation.

Lastly, the IBSNAT Project Monitor (T. S. Gill) from AID in Washington, Project Manager (G. Y. Tsuji), Associate Principal Investigator (F. H. Beinroth), Project Coordinator (H. Eswaran), and Principal Investigator (G. Uehara) meet biannually to review project management. This "Executive Management Committee" was established in 1984 and has met twice.

E. Given the progress to date and your evaluation of performance (i.e., effectiveness), is it probable that all project outputs can be produced on schedule and within the contemplated 9-year span of the project, i.e., to 1991? Are the EOPS indicators* reasonable?

When the project was established in 1982, microcomputers with 640 kilobyte capacities were becoming readily available. Today units 130 megabyte capabilities are advertised.

In 1982, the Technical Advisory Committee recommended that the project seek the services of a data base management specialist from France to develop IBSNAT's data base management system. Just before this recommendation was implemented, the project's computer specialists recommended the adoption of a commercially available data base management system. This recommendation enabled the effort--that would have taken two years to achieve--to be completed in less than a year.

During the first IBSNAT collaborators' meeting in Hyderabad, India in 1982, a participant mentioned artificial intelligence as a potential tool for IBSNAT. Now artificial intelligence tools and development systems are becoming commercially available, and techniques are sufficiently perfected for early application. Substantial sums of money in the United States and abroad are being committed to research and development of artificial intelligence application. There are indications that expert systems, a product of artificial intelligence research, will gradually do what simulation models are currently doing.

It is highly probable that all project outputs will be produced on schedule and that in certain areas, new advances in information technology will enable the project to do more than it now promises.

Appendix No. 3

IBSNAT Project Review Participants List
September 30 - October 5, 1985
Kaanapali, Maui, Hawaii

Mr. Valentine Ah Loy*

Dr. Sharif Ahmad
Malaysian Agricultural Research
& Development Institute (MARDI)
Peti Surat 12301
Pejabat Besar Pos
Kuala Lumpur 01-02
MALAYSIA

Ms. Vivian Anderson
AID/S&T/PO
Room 306 F, SA-18
Washington, D.C. 20523

Dr. Friedrich H. Beinroth
Department of Agronomy and Soils
College of Agricultural Sciences
University of Puerto Rico
Mayaguez, Puerto Rico 00708

Dr. C. Fred Bentley
External Evaluation Team Member
Chairman, IBSRAM
13103-66 Avenue
Edmonton, CANADA T6H 1Y6

Dr. Ben B. Bohlool
NifTAL Project
P.O. Box 'O'
Paia, Maui, HI 96779

Ms. Yuk Chin Chan*

Mrs. Annette E. Chang*

Dr. Vernon R.N. Chinene
The University of Zambia
School of Agriculture
Soil Science Department
P.O. Box 32379
Lusaka, ZAMBIA

Mr. Patrick C. Ching*

Mrs. Ada E. Chu*

Dr. Juan A. Comerma
Director
FONAIAP - CENIAP
Apartado Postal 4653
Maracay 2101
VENEZUELA

Dr. J. Barry Dent
Professor and Head
Farm Management Department
Lincoln College
Canterbury, NEW ZEALAND

Dr. Samir El-Swaify
Chairman, Department of Agronomy
and Soil Science
1910 East West Road
Sherman Laboratory #101
University of Hawaii
Honolulu, Hawaii 96822

*Note--Those with asterisks have the following address:

IBSNAT Project, University of Hawaii
Department of Agronomy
2500 Dole Street #22
Honolulu, Hawaii 96822

Dr. Foster B. Cady*

Dr. Bernardino G. Cagauan, Jr.*

Mr. Clement Chan*

Dr. Christano R. Escaño
Assistant Director
Crops Research Division
Philippine Council for Agriculture
& Resources Research & Development
c/o Miramar House
2nd Floor, Room #24
Manila Domestic Airport
Metro Manila, PHILIPPINES

Dr. Hariharan Eswaran
Soil Management Support Services
P.O. Box 2890
Washington, D.C. 20013

Dr. Elmer E. Ewing
Department of Vegetable Crops
Cornell University
Ithaca, New York 14853

Dr. Tejpal S. Gill
Chief, Renewable Natural Resources
Office of Agriculture
Bureau for Science & Technology
Agency for International Development
Washington, D.C. 20523

Mr. Douglas C. Godwin
International Fertilizer Development
Center
P.O. Box 2040
Muscle Shoals, Alabama 35660

Dr. Peter Goldsworthy
Deputy Director General - Research
International Center for Agricultural
Research in the Dry Areas (ICARDA)
P.O. Box 5466
Aleppo, SYRIA

Dr. Jorge L. Jonas
IDIAP
Apartado 6-4391
El Dorado
Panama 6A, PANAMA

Dr. C. Allan Jones
Plant Physiologist
Crop Systems Evaluation Unit
Grassland, Soil & Water Research
Laboratory
P.O. Box 748
Temple, Texas 76503

Dr. James W. Jones
Agricultural Engineering Department
Frazier Rogers Hall
University of Florida
Gainesville, Florida 32611

Dr. Noel P. Kefford
Dean, College of Tropical Agriculture
& Human Resources (CTAHR)
3050 Maile Way, Gilmore 202
University of Hawaii
Honolulu, Hawaii 96822

Mr. Raymond E. Kitchell
Chairman, External Evaluation Team
Development Management, Inc.
7414 Rebecca Drive
Alexandria, Virginia 22307

Mr. David M. Leslie
Soil Bureau
Department of Scientific &
Industrial Research (DSIR)
Private Bag
Lower Hutt, NEW ZEALAND

Dr. J. R. McWilliam
External Evaluation Team Member
Director
Australian Centre for International
Agricultural Research (ACIAR)
P.O. Box 1571
Canberra City 2601
AUSTRALIA

Dr. L. A. Hunt
Department of Crop Science
University of Guelph
Guelph, Ontario
CANADA NIG 2WI

Dr. William F. Johnson
BIFAD Room 947
Department of State
Washington, D.C. 20523

Dr. Dale N. Moss
External Evaluation Team Member
Department of Agronomy
Oregon State University
Corvallis, Oregon 97331

Dr. R. Muniappan
Associate Director
Agricultural Experiment Station
College of Agriculture & Life Science
University of Guam
Mangilao, Guam 96913

Ms. Naomi M. Murabayashi*

Dr. Henry A. Nix
Leader, Resource Management Program
CSIRO, Land Use Research
P.O. Box 1666
Canberra City, ACT 2601
AUSTRALIA

Dr. Ahmed Osman
Director, Soils Division
ACSAD
P.O. Box 2440
Damascus, SYRIA

Ms. Jeri-Lynn Palacio*

Mrs. Victoria L. Pecsok*

Dr. Edward Rice
External Evaluation Team Member
ASIA/TR/ARD
Room 3327
New State Building
Agency for International Development
Washington, D.C. 20523

Dr. John Morrison, Director
Institute of Natural Resources
University of the South Pacific
P.O. Box 1168
Suva, FIJI

Dr. Upendra Singh*

Dr. M. Sudajdi
Director
Center for Soil Research
Jalan Ir. H. Juanda No. 98
Bogor, INDONESIA

Dr. Rodrigo Tarte
Director
Centro Agronomico Tropical de
Investigacion y Enseñanza (CATIE)
Turrialba, COSTA RICA

Dr. Gordon Y. Tsuji*

Dr. Goro Uehara*

Dr. Ramon Valmayor
Executive Director
Philippine Council for Agriculture
& Resources Research & Development
c/o Miramar House
2nd Floor, Room #24
Manila Domestic Airport
Metro Manila, PHILIPPINES

Dr. Joe T. Ritchie
Homer Nowlin Chair
Michigan State University
Institute of Water Research
Natural Resources Building
East Lansing, Michigan 48824-1222

Ms. Suemi Sakumoto*

Mr. Daniel Shigeta
County Administrator
University of Hawaii
310 Kaahumanu Avenue, Building 214
Kahului, Hawaii 96732

Appendix No. 4

IBSNAT Project Evaluation Program
September 30 - October 5, 1985
Kaanapali, Maui, Hawaii

PROGRAM

Date:	Time	Event
Sunday 29 September 1985		Evaluation Panel meets with Dr. T. S. Gill of USAID. (Chief, Renewable Natural Resources, Office of Agriculture, Bureau for Science and Technology, AID, Washington, D.C.)
	1700-1900	Registration
	1700-1800	Informal get-together
Day 1, Monday 30 September 1985	0830	Opening Session
		Introduction of participants: G.Y. Tsuji, Department of Agronomy and Soil Science, University of Hawaii, Honolulu, Hawaii.
		CTAHR and IBSNAT: N. P. Kefford, Dean, College of Tropical Agriculture and Human Resources, University of Hawaii, Honolulu, Hawaii.
		Purpose of the review: R. E. Kitchell, Chairman, IBSNAT Evaluation Panel.
	0915	Project Concepts and Rationale
		Role of models in agricultural research and development: H. A. Nix, CSIRO, Canberra, Australia.
		Discussions
	1015	Refreshments

1045 Project Overview and Progress

Overview of IBSNAT:
G. Uehara, Department of Agronomy and Soil Science, University of Hawaii, Honolulu, Hawaii.

IBSNAT Progress Report: F. H. Beinroth, Department of Agronomy and Soils, University of Puerto Rico, Mayaguez, Puerto Rico.

1200 Lunch

1330 MODEL DEVELOPMENT, VERIFICATION, AND CALIBRATION

Chairman: J. T. Ritchie, Institute of Water Research, Michigan State University

Cereals - J. T. Ritchie
D. Godwin, IFDC, Muscle Shoals, Alabama;

C. A. Jones, Crop Systems Evaluation Unit, Grassland, Soil & Water Research Laboratory, Temple, Texas; U. Singh, Department of Agronomy and Soil Science, University of Hawaii, Honolulu, Hawaii.

Grain Legumes - J. W. Jones, Agricultural Engineering Depart- ment, University of Florida

Root crops - H. A. Nix

Genetic coefficients for IBSNAT models - L. A. Hunt, Department of Crop Science, University of Guelph, Guelph, Ontario

Model verification and calibration - J. B. Dent, Farm Management Department, Lincoln College Canterbury, New Zealand.

1500 Refreshments

	1530	DATA BASE MANAGEMENT SYSTEM Chairman: J. W. Jones Overview of IBSNAT DBMS: C.P.Y. Chan and F.B. Cady, Department of Agronomy and Soil Science, University of Hawaii, Honolulu, Hawaii Demonstration of DBMS Applications: C. P. Y. Chan/F. B. Cady
Day 2, Tuesday 1 October 1985		FIELD TRIP Chairmen: P. C. Ching and B. G. Cagauan, Jr., Department of Agronomy and Soil Science, University of Hawaii, Honolulu, Hawaii
	0700	Depart hotel for site visit Visit three experimental sites situated along an elevation transact on the slopes of Mt. Haleakala at Kuiaha, Haleakala, and Olinda.
	1200	Lunch and return to hotel
	1330	COLLABORATORS' REPORTS Chairman: F. H. Beinroth Venezuela: J. A. Comerma, FONAIAP, Maracay, Venezuela Zambia: V. R. N. Chinene, Soil Science Department, University of Zambia, Lusaka, Zambia Philippines: C.R. Escaño, PCARRD, Los Baños, Philippines Panama: J. Jonas, IDIAP, Panama City, Panama Malaysia: Sharif Ahmad, MARDI, Kuala Lumpur, Malaysia Guam: R. Muniappan, College of Agriculture and Life Sciences, University of Guam, Mangilao, Guam

	1530	Refreshments
	1600	REGIONAL NETWORKS:
		OBSNAT - D. M. Leslie, Soil Bureau, DSIR, Lower Hutt, New Zealand
		ACSAD - A. Osman, ACSAD, Damascus, Syria
	1640	SMSS and IBSNAT H. Eswaran, SMSS, Washington, D.C.
	1815	Meet in hotel lobby for dinner transportation
	1845	No-host cocktail/dinner at Golden Palace Chinese Restaurant.
Day 3, Wednesday 2 October 1985	0830	TEAM SESSIONS Meetings with TAC, CAP and EMC on evaluation issues. (all day)
	0830	Development of Team Consensus - Evaluation Panel (all day)
Day 4, Thursday 3 October 1985	0830	Development of Team Consensus - Evaluation Panel
	0830	Meeting of Technical Advisory Committee (TAC) and Collaborators' Advisory Committee (CAP).
	0830	Computer Demonstration
Day 5, Friday 4 October, 1985		Initial drafting of Team Report (all day)

Appendix No. 5

IBSNAT Staffing Pattern

A brief description of the duties and responsibilities of IBSNAT core staff members are as follows:

Beinroth, F. H.
Associate Principal Investigator

- Assists the P.I. in planning and organizing training workshops.
- Works with project collaborators in conceptualizing regional networks and developing proposals.
- Maintains liaison with IBSNAT collaborators in Latin America and the Near East.
- Serves as a member of the Executive Management Committee.

Cagauan, B. G., Jr.
Research Associate/Soil Scientist

- Responsible for organizing and participating in the development of training materials for use in workshops.
- Assists Project Manager and Principal Investigator in implementing planning activities.

Chan, C. P. Y.
Data Manager

- Responsible for developing the Data Base Management System (DBMS) with IBSNAT model developers.
- Participates in training activities, lectures, and laboratory sessions on microcomputers and the DBMS.

Chan Y. C.
Assistant Data Manager

- Assists Data Manager in developing computer programs for MDS inputs, and with development and testing of the data base management system.

Chang, A. E.
Assistant Project Manager

- Administratively responsible for personnel matters, travel, and coordination of clerical support.
- Assists Project Manager in reviewing existing and new agreements and subcontracts with collaborators.

Ching, P. C.
Research Associate/Agronomist

- Responsible for designing and implementing agronomic experiments to collect MDS for model development of maize, soybeans, taro, and rice.
- Assists in development of training guidelines for field experiments.

Chu, A. E.
Research Associate/Soil Chemist

- Provides laboratory and analytical backstopping for soil chemical and physical analyses.
- Provides crop analysis for UH/MDS.

El-Swaify, S. A.
Soil Scientist/Department Chairman

- Serves as administrative head of Department of Agronomy and Soil Science, and provides necessary support from the departmental base of operations.

Ikawa, H.
Soil Scientist/Soil Classification

- Assists IBSNAT in activities of site characterization.
- Serves as principal linkage for MauiNet.

Manrique, L. A.
Research Associate/Soil Scientist

- Responsible for designing and implementing experiments with potatoes.
- Coordinates modeling experiments with model developer Elmer Ewing and researchers in Hawaii.

Murabayashi, N. M.
Word Processor Operator

- Operates word processor for all project staff.
- Assists the Administrative Assistant.

Palacio, J-L.
Writer/Editor

- Provides support as writer/editor to project staff and collaborators.
- Writes and edits materials for publication.
- Coordinates editorial services.

Pecsok, V. L.
Publications Specialist

- Responsible for the production and scheduling of project publications.
- Coordinates production schedules with Editor, Project Manager, P.I., and Associate P.I.

Sakumoto, S.
Accounting/Fiscal

- Handles preparation of all purchase orders, accounts receivable, and monitoring of expenditures/balances.

Silva, J. A.
Soil Scientist/Soil Fertility

- Assists IBSNAT in matters relating to experimental design for field plots to obtain MDS.

Singh, U.
Assistant Soil Scientist

- Involved in development of rice model and modification of CERES maize model.
- Assists Data Manager in development of DBMS.

Tsuji, G. Y.
Project Manager

- Assist P.I. in implementing planned activities to achieve project outputs.
- Serves as member of EMC.
- Participates in project planning.

At the request of the team leader, the IBSNAT Project Manager made a rough approximation of the distribution of staff time on IBSNAT activities as follows:

Name	Function	Percent Paid by Univ./AID	Time Distribution		
			IBSNAT	TROP	SMSS
Beinroth	Assoc. P.I.	60/40	100	-	-
Cagauan	Res. Assoc.	0/100	100	-	-
Chan, C. P. Y.	Data Mgr.	0/100	75	25	-
Chan, A. C.	Asst. Data	0/100	75	25	-
Chang	Asst. Proj. Mgr.	0/90	75	25	-
Ching	Res. Assoc.	0/100	45	45	-
Che	Res. Assoc.	0/100	50	50	-
Manrique	Res. Assoc.	0/100	100	-	-
El-Swaify	Soil Sci.	100/0	10	10	-
Ikawa	Soil Sci.	100/0	10	-	-
Eswaran	Proj. Coord.	0/100	-	-	100
Murabayashi	Word Proc.	0/100	35	35	30
Palacio	Writ./Edit.	0/100	50	25	-
Pecsok	Publ. Spec.	0/100	50	25	25
Sakumoto	Acct/Fis.	0/100	40	40	20
Silva	Soil Sci.	100/0	10	-	-
Singh	Asst. Soil Sci.	0/100	75	25	-
Tsuji	Proj. Mgr.	0/100	60	30	10
Uehara	P.I.	100/0	40	25	-

Appendix No. 6

Acronyms

Code	Name
AARD	Agency for Agricultural Research and Development (Jakarta, Indonesia)
ABSNAT	ASEAN Benchmark Sites Network for Agrotechnology Transfer
ACSAD	Arab Center for Studies of Arid Zones and Dry Lands (Damascus, Syria)
AID/S&T/ AGR/RNR	Agency for International Development, Bureau for Science and Technology, Office of Agriculture, Renewable Natural Resources (Washington, D.C., USA)
ARS	Agricultural Research Service (Temple, Texas, USA)
ASEAN	Association of Southeast Asian Nations
AVRDC	Asian Vegetable Research and Development Center (Taiwan, Republic of China)
CARIBSNAT	Caribbean Benchmark Sites Network for Agrotechnology Transfer
CATIE	Centro Agronomico Tropical de Investigacion y Ensenanza (Turrialba, Costa Rica)
CENIAP	Centro Nacional de Investigaciones Agropecuarias (Maracay, Venezuela)
CEPGL	Commission Economique des Pays du Grande Lac
CIAT	Centro Internacional de Agricultura Tropical (Cali, Colombia)
CIP	Centro Interancional de la Papa [=International Potato Center] (Lima, Peru)
COFAF	Committee on Food, Agriculture and Forestry (ASEAN)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Brisbane, Australia)
CSR	Center for Soil Research (Bogor, Indonesia)
DSIR	Department of Scientific and Industrial Research (Lower Hutt, New Zealand)
FAO	Food and Agriculture Organization (United Nations, Rome, Italy)

Code	Name
FFTC/ASPAC	Food and Fertilizer Technology Center for the Asian and Pacific Region (Taipei, Taiwan, Republic of China)
FONAIAP	Fondo Nacional de Investigaciones Agropecuarias (Caracas, Venezuela)
ICARDA	International Center for Agricultural Research in the Dry Areas (Aleppo, Syria)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics (Hyderabad, India)
IDIAP	Instituto de Investigacion Agropecuaria de Panama [=National Research Institute of Panama] (Panama)
IFDC	International Fertilizer Development Center (Muscle Shoals, Alabama, USA)
INRA	Institut National de la Recherche Agronomique (Paris, France)
IRA	Institut de la Recherche Agronomique (Yaounde, Cameroon)
IRAZ	Institut de Recherche Agronomique et Zootechnique (Burundi)
MARDI	Malaysian Agricultural Research and Development Institute (Malaysia)
MPI	Ministry of Primary Industries (Suva, Fiji)
OBSNAT	Oceania Benchmark Sites Network for Agrotechnology Transfer
PARC	Pakistan Agricultural Research Council (Islamabad, Pakistan)
PCARRD	Philippine Council for Agriculture and Resources Research and Development (Manila, Philippines)
RCUH	Research Corporation of the University of Hawaii (Honolulu, Hawaii, USA)
SCS	Soil Conservation Service
SMSS	Soil Management Support Services (Washington, D.C., USA)
USAID	United States Agency for International Development
USDA/ARS	United States Department of Agriculture, Agricultural Research Service
USDA/SCS	United States Department of Agriculture, Soil Conservation Service (Washington, D.C., USA)