



REPORT OF AN INTERIM EVALUATION
INDO/U.S. AGRICULTURAL RESEARCH PROJECT

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LIST OF ACRONYMS

ADG	Assistant Director General
AICRP	All India Coordinated Research Project
APAU	Andhra Pradesh Agricultural University
ARP	Agricultural Research Project
AS	Animal Sciences
ASAP	As Soon As Possible
AgFOR	Agro-Forestry
AgMET	Strengthening Agro-Meteorological Research to Enhance Crop Production
BP	Blood Protista
BW	Bio-Degradation of Waste
CFTRI	Central Food Technology Research Institute
CIAE	Central Institute of Agricultural Engineering
CIRB	Central Institute of Research on Buffaloes
CIRG	Central Institute of Research on Goats
CIHNP	Central Institute for Horticulture for Northern Plains
DARE	Department of Agricultural Research and Education
DDG	Deputy Director General
DEA	Department of Economic Affairs
DG	Director General
ETT	Embryo Transfer Technology
FAO	Food and Agricultural Organization of the United Nations
FAS	Foreign Aid Section
FEMTC	Farm Equipment Manufacturing Technology Centers
FERRO	Far Eastern Regional Research Office, USDA
FTR	Forestry Training
GBPUAT	G.P. Pant University of Agriculture & Technology
GOI	Government of India
HAU	Haryana Agricultural University
IARI	Indian Agricultural Research Institute
IBRD	International Bank For Reconstruction and Development (World Bank)
IC	International Cooperation
ICAR	Indian Council of Agricultural Research
IIHR	Indian Institute of Horticulture Research
IVRI	Indian Veterinary Research Institute
JCC	Joint Career Corps
JNKVV	Jawaharlal Nehru Krishi Vishwa Vidyalaya (Madhya Pradesh Agricultural University)
LOP	Life of Project
MSS	Management Support Services
NAARM	National Academy for Agricultural Research Management
NARP	National Agricultural Research Project
NDDB	National Dairy Development Board
NDRI	National Dairy Research Institute
NRCC	National Research Center for Citrus
OFWM	On-Farm Water Management
PAMC	Project Administration and Monitoring Committee
PAU	Punjab Agricultural University
PCMD	Project Coordination and Monitoring Division

PCMU	Project Coordination and Monitoring Unit
PCU	Project Coordinating Unit
PGR	Plant Genetic Resources
PHT	Post Harvest Technology
PHT-FV	Post Harvest Technology - Fruits and Vegetables
PIL	Project Implementation Letter
PIMU	Project Implementation Monitoring Unit
PIU	Project Implementation Unit
PU	Project Unit
RAU	Rajendra Agricultural University
SAU	State Agricultural University
SMD	Subject Matter Division
SPU	Soybean Processing and Utilization
STI	Science and Technology Initiative
TAG	Technical Advisory Groups
TNAU	Tamil Nadu Agricultural University
UNDP	United Nations Development Program
U.S.	United States
USAID	United States Agency for International Development
USDA	United States Department of Agriculture

PROJECT IDENTIFICATION DATA

1. Country: India
2. Project Title: Indo-U.S. Agriculture Research Project
3. Project Number: 386-0470
4. Project Dates: June 30, 1983 to June 30, 1992
 - a. First Project Agreement: June 30, 1983
 - b. Final Obligation Date: Planned/June 30, 1990
 - c. Most recent Project Assistance Completion Date (PACD):
June 30, 1992
5. Project Funding (amounts obligated to date in dollars or dollar equivalents from the following sources):
 - a. AID Bilateral Funding (grant) US\$20 Million
 - b. Other Major Donors US\$ none
 - c. Host-Country Counterpart Funds US\$ 8 Million
 - Total US\$28 Million
6. Mode of Implementation: host country with management support services provided by AID contractor Winrock International.
7. Project Designers: the Government of India (the Indian Council for Agricultural Research) and USAID/INDIA.
8. Responsible Mission Officials:
 - a. Mission Director(s): Robert Bakley/Owen Cylke
 - b. Project Officer(s): John A. Becker/Mark Smith/Ron Pollock
9. Previous Evaluation(s): none

EXECUTIVE SUMMARY

This interim evaluation of the Indian Agricultural Research Project (ARP) was carried out in March/April 1988 at the request of USAID/India.

The ARP was initially approved for seven years starting in 1983 but subsequently extended to nine years (until 1992). Its goal is to increase agricultural productivity, production, employment and income. Its purpose is to build institutional research capacity and assist in technology development and transfer through collaborative research between Indian and U.S. research scientists with cooperation and support from their respective institutions. The total support for the life of the project (LOP) is \$28 million of which USAID/India has committed \$20 million and the Government of India (GOI) has committed the local currency equivalent of \$8 million.

The ARP was designed to permit a response to the need for collaborative research in selected areas as expressed by the GOI through the Indo-U.S. Sub-Commission on Agriculture. This commission, which meets annually, serves as a forum to determine issues of mutual interest concerning agricultural research, education and development. It identifies these areas from among the priority areas presented by the Indian Council for Agricultural Research (ICAR) and noted in its five-year plan. Individual sub-projects within the overall umbrella project are developed from selected areas on the basis of GOI priorities and the agreement of USAID/India and ICAR (the Indian implementing organization for this project). From the areas identified by the joint sub-commission, 14 sub-projects have been agreed upon to date. Seven (soy bean processing, post harvest technology, project implementation unit, embryo transfer, biodegradable waste blood protista, and forestry training) are operational, project action has been initiated on one (plant genetic resources), five are designed but not approved, and one is yet to be designed. A status report and analysis of each of the sub-projects is presented in annex C.

The components of the sub-project are: 1) non-degree staff training (usually in the U.S.); 2) scientific consultation from the U.S.; 3) existing and additional staff working in the sub-project areas; 4) laboratory and field equipment and supplies; 5) physical facilities; and 6) recurring project costs. The first two of these are financed by USAID, usually for a five-year period; there is shared funding of items 3) and 4); and the GOI provides items 5) and 6). With regard to the financing by USAID of additional staff for a sub-project, a formula has been agreed upon for initial full support by USAID but with the Indian executing agency, ICAR, responsible for gradual assumption of full payment after a five-year period. Following the five-year

term of any of the sub-projects, ICAR has the responsibility to continue the sub-project with its own budget.

The review team was requested to: a) assess the project impact to date; b) determine what, if any, changes need to be made in the time remaining to improve the performance of the ARP, and to improve the project impact; and c) identify important principles and procedures for ARP operation that could lead to a long-range program for Indo-U.S. collaboration in agricultural research. (See annex A for the complete scope of work.) The evaluation was carried out by a joint U.S./India team of scientists (annex E) with considerable experience in Indian agricultural research and project evaluation. The evaluation methodology, presented in annex B, included a comprehensive review of background information and project documentation and site visits and interviews in the U.S. and India.

The ARP was developed at a time when Indo-U.S. cooperation in agriculture was being reestablished after a number of years of limited contact. The concept of an umbrella-type project--with support for specific sub-projects to strengthen Indian institutional research capacity and assist in technology development and transfer through collaborative research between Indian and U.S. research scientists--appears to be sound. It was particularly appropriate at the time of initiation and has served to increase opportunities for cooperation. There is a question as to whether this model should be the sole approach for future collaborative Indo/U.S. projects or whether other models should be examined as well.

The project has suffered and continues to suffer from delays in implementation with a subsequent negative impact on progress. To a certain extent, particularly in the first years of the project, delays were due to timing problems. There was a desire on the part of the Indian scientists involved to time their staff training in the U.S. so that new equipment purchased under the project would be available for use on their return. Also, they wanted the U.S. consultancies to take place after the staff training and after the installation of the new equipment and in some cases after the construction of new facilities. With an exceedingly long time required to complete procurement of equipment from the U.S., there has been a major bottleneck in the project. Another major bottleneck, for which ICAR is responsible, is the lack of adequate staffing and support for its Project Implementation Unit (PIU) which serves as the GOI counterpart to USAID for this project.

Some delays were alleviated starting in 1986 with the appointment by USAID, with funding outside the ARP, of a Management Support Services unit (MSS) operated by Winrock International. The addition of the MSS has been very helpful in arranging for training for Indian scientists in the U.S., in

identifying U.S. consultants for the sub-projects, and in purchasing equipment outside India.

In 1986 at the request of ICAR, a review of operational problems was conducted by the Indian National Academy for Agricultural Research Management (NAARM). This review, followed by a workshop on its findings, identified a great many of the operational problems and recommended corrective measures. These recommendations are still valid but to date there has been little action taken.

In chapter 5, the review team has noted a number of conclusions, lessons learned and recommendations. Among the most important are:

- o The rate of expenditure for several of the projects is well behind projections. There are additional sub-projects that have been agreed upon but for which there may not be funds or for which a decision has not been made by USAID as to whether they will be included. A mid-term correction should be made in the project to reallocate funds within the sub-projects and to reach a decision on what if any additional sub-projects are to be included.
- o The original project design and concept are sound.
- o The project's purposes are appropriate and it should be possible to a large extent to achieve them.
- o There is no evidence of the project's impact on Indian agriculture to date, nor should there be any expectation of such impact. It is much too early.
- o The sub-project designs should be carried out by joint U.S./India working teams.
- o Sub-project designs should include status reports on work that has been carried out and provide a base line from which accomplishment may be measured. They should also include an operational chart as a guide for project implementation, monitoring and evaluation.
- o There should be early action by USAID and ICAR to bring the PIU into full operation. This probably will require discussions between senior staff of USAID/India and the director general of ICAR to assure that ICAR meets its commitment according to the project agreement.
- o Funding should be assured to continue MSS for the LOP.

- o Some funding to FERRO for dollar costs for more staff training for Indian scientists and for more consultations by U.S. scientists would be very beneficial to the FERRO projects and should help link ARP and FERRO projects.
- o A follow-up of the ARP, or a similar umbrella-type project, could well be a significant component of future strategy for Indo-U.S. collaboration in agricultural research, but not the exclusive approach. In certain fields, larger stand-alone projects are already evolving, which provide the basis for longer-term benefits and more truly collaborative research than was possible at the early stages of the ARP sub-projects. Without losing the advantages of flexibility and opportunities for prompt and timely response to newly identified opportunities inherent in the ARP, such approaches could add to the depth and maturity of collaborative efforts. The experience of ARP should help USAID and ARP to identify a limited list of topics with a sharper focus, to which they can provide sufficient resources to make a more lasting contribution and build scientist-to-scientist and institution-to-institution collaborative research.
- o It is realistic to plan for long-range Indo-U.S. cooperative research programs in a few selected areas. However, this plan will require a financial commitment on both sides for a minimum of 10 to 15 years. From the U.S. side, in order of priority, support for collaborative research will require staff training for Indian scientists, consultant visits to India and visits to U.S. institutions by Indian scientists, support for research in U.S. institutions, and some limited support for specialized equipment for India.

The Indian state agricultural universities offer many opportunities to build Indian and U.S. university collaboration. The present project could have benefitted from greater collaboration with Indian universities and this should be a part of the correction made in the process of adding more sub-projects.

The project has a number of problems at this mid-point in the LOP. However, the review team believes that these problems can be overcome if early corrective action is taken, and reasonable success can be achieved within the project's life. Problems and issues are discussed in chapters 2, 3 and 4.

CHAPTER I

BACKGROUND AND DESCRIPTION OF PROJECT

A. Background

Given its importance in India's economy, the agricultural sector must provide not only for an improvement in per capita food supplies, but also a major impetus to overall employment generation and income growth. Thus far, the Government of India has been able to set ambitious but feasible production growth rates. The GOI strategy for food production and rural employment combines efforts to consolidate and spread the agricultural production gains of the Green Revolution with targeted rural development programs aimed at raising household incomes above the poverty line. However, to sustain its agricultural growth, the GOI must continue to strengthen its agricultural research for technology generation and transfer. It is in this area that this project has its focus in collaboration with U.S. institutions and scientists.

There is an Indo-U.S. Sub-Commission on Agriculture that serves as an official forum for the development and enhancement of bilateral programs between the two countries concerning agricultural research, education and development. It has met five times since its first meeting in 1980. It meets alternately in Washington, D.C. and New Delhi. The sub-commission identifies priority areas of mutual interest from among those presented by the Indian Council of Agricultural Research (ICAR) from its priority areas, which are normally noted in its five year plan.

B. Description of Project

An "umbrella-type" Agricultural Research Project (386-0470) was initiated in June, 1983, through an agreement between the Government of India and the Government of the United States acting through the United States Agency for International Development (USAID). The original project was for seven years but was subsequently extended to nine years (until June, 1992). Any further extension would require approval by the AID administration in Washington. The project provides for a series of sub-projects to be developed over time, by mutual agreement between the GOI and USAID, and selected from areas identified by the Indo-U.S. Sub-Commission on Agriculture. Following identification of these areas, ICAR and USAID, through established procedures, would: a) determine what sub-projects should be considered for inclusion in the umbrella project; b) design the sub-projects; and c) prepare budgets and time frames for them. Each sub-project was expected to have a life of up to five years.

Two sub-projects were identified in the initial project document. Five additional sub-projects have since been developed, approved and are under implementation. Project activity has been initiated on one other sub-project. Five other sub-projects have been designed but not approved and one has yet to be designed. Additional sub-projects may be under consideration.

C. Project Goal and Purpose

The overall goal of the project is to contribute to an increase in agricultural productivity, production, employment and income by enhancing the capability of the Indian agricultural research system to deal with specific scientific problems related to the production and processing of commodities in selected functional areas. It would make its contribution by assisting in the development of institutional research capability and in technology development and transfer through collaborative arrangements between Indian and U.S. institutions and scientists. In support of the project under the agreement between the GOI and USAID, the contribution by USAID is to be \$20 million out of a total project cost of \$28 million. The GOI is to provide the equivalent of \$8 million in local currency.

D. Sub-Projects and their Status

The table on the following page lists the sub-projects and their status. 1/

E. The MSS

Winrock International received a contract in 1986, with funding support outside the project, to provide Management Support Services (MSS). The contract provides goods and services such as consultants, training, visits of scientists, and scientific/research equipment in relation to the project.

1/ See Annex C, for descriptive status of the sub-projects.

Table 1

Sub-Project	Approved PIL Issued	Implemented (Nominal Starting Date)	Projected Completion Date
1. Soybean processing and utilization	Nov. 20, 84	April 1, 85	March 31, 90
2. Post-harvest Technology - Fruit and Vegetables	Jan. 5, 85	April 1, 85	March 31, 90
3. Project Implementation Unit		April 1, 85	March 31, 92
4. Blood Protista	Nov.24, 86	April 1, 87	March 31, 92
5. Embryo Transplant Technology	Jan. 9, 87	April 1, 87	March 31, 92
6. Biological Waste Utilization for Animal Feed	Jan. 21, 87	April 1, 87	March 31, 92
7. Forestry Education/Faculty Training	April 20, 86	Initially for two years, and will probably be extended for at least one additional year.	
8. Plant Genetic Resources	Limited funds provided for project preparation but full implementation will require more funds than can be provided through the ARP. This may require a stand-alone project.		
9. Agro-Forestry	PIL not yet issued		
10. Agro-Meteorology	PIL not yet issued		
11. Integrated Nutrient Management	Not yet approved		
12. On Farm Water Management	Not yet approved		
13. Farm Equipment	Not yet approved		
14. Tissue Culture	Not yet approved		

F. Interim Evaluation

In early 1988, the USAID Mission in India, through Chemonics International of Washington, D.C., authorized the current team 1/ to carry out an interim evaluation of the project 2/ in accordance with the scope of work it provided; 3/ and to review conceptual, organizational, design, implementation, financial and impact issues. For the evaluation the review team was to suggest ways to carry out the project operation more effectively for the remainder of the LOP and to make suggestions from lessons learned on the project that might have a bearing on future activities of Indo-U.S. collaboration in agricultural research.

The review team carried out the review during the period March 14, 1988 to April 30, 1988 4/.

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- 1/ See annex E for a list of team members.
 - 2/ See annex B for the methodology used by the review team.
 - 3/ See annex A for the detailed scope of work.
 - 4/ See annex F for a list of places and institutions visited and individuals contacted.

CHAPTER II

ISSUES

In the scope of work (see annex A) a series of issues were raised for the review team to examine and address. These were listed under five headings--conceptual, organizational, operational (with five sub-headings), impact, and implementation for the future. In this chapter, each of these will be examined.

A. Conceptual Issues

The project concept is that through concentrated support, both external and national, over a limited period of time, selected elements in the Indian agricultural research system can be strengthened to enhance its capability to increase agricultural productivity, production, employment and income. There are at least three additional concepts: 1) that an umbrella-type project that identifies a sector or sub-sector and allocates funding, with the actual work to be identified later, is an appropriate model for assistance; 2) that once the umbrella project is established, the best means, or at least an appropriate method in the Indian situation, is to select areas of priority through a joint India/U.S. Sub-Commission on Agriculture; and 3) that using management teams made up of selected national scientists and administrators concerned with the sub-project, initiative and leadership can be stimulated for productive sub-project operation.

The review team finds the project concepts to be sound for the period in which the project was initiated, a time when India/U.S. cooperation was being re-established after some years of interruption. However, these concepts must be reviewed in light of experience, changing times and a reduction in the level of funding for USAID support in India. The review team will come back to this issue in chapter 4, "Implications for the Future."

The Indo-U.S. Sub-Commission on Agriculture, which meets annually, serves as a forum to determine issues of mutual interest concerning agricultural research, education and development. The sub-commission identifies these areas from among those presented by ICAR from its priority areas, normally noted in its five year plan. Following identification of these areas, ICAR and USAID go through established procedures: a) they determine what sub-projects should be considered for implementation; b) design the sub-projects; and c) prepare their budgets and time frames.

The review team was asked to comment on the role of the Indo-U.S. Sub-Commission on Agriculture in the selection process. The team considers that it has provided an appropriate forum, particularly during the period when close India/U.S.

relationships were being reestablished. The future role of the Indo-U.S. Sub-Commission needs to be questioned, however. Should it continue to identify areas of mutual concern, given that some 31 have already been identified, and 15-16 accepted by ICAR, only a few have been initiated and most of these are barely started and appear to be encountering many difficulties in implementation? It appears to the review team that while the Indo-U.S. Sub-Commission on Agriculture can continue to plan an important role, perhaps it is time to consider extending its function to give more attention to existing cooperative efforts and to plan how to develop truly collaborative projects.

It is the view of the review team that the representation on the sub-commission is not sufficiently broad to give agricultural research the attention that is required. From the U.S. side the sub-commission is heavily weighted toward the USDA, while the universities are under-represented. To a certain extent, the same is true for the Indian side, where the state agricultural universities (SAU) are also noticeably under-represented.

A second conceptual issue concerns the relative balance of support for the project purposes (institutional strengthening, technology development and transfer, and collaborative research) and the balance of support for the various project components: 1) staff training (usually in the United States); 2) scientific consultation from the U.S.; 3) laboratory and field equipment and supplies; 4) additional and existing staff working in the project; 5) physical facilities; and, 6) recurring project costs. The first two are financed by USAID, usually for a five-year period; 3) and 4) may be financed jointly by USAID and ICAR; and the last two are financed by ICAR. With regard to financing of additional national staff for a sub-project, a formula has been agreed upon providing full support from USAID initially, but with ICAR gradually assuming payment over the life of the project. Following the five-year project period, ICAR is responsible for continuing the sub-project from its own budget.

As to the project's purposes of institutional strengthening, technology development and transfer, and collaborative research, the team suggests that "balance" should not be the issue. Rather, in the design process, the importance of each of the purposes should be examined and the need and opportunity to achieve significant progress determined. Each sub-project may benefit from different levels of support within each of the project components depending upon the point from which it is starting, and whether other national institutions are addressing the same topic, either with national support alone, or with external support from sources other than USAID. In some cases no external funding may be required to achieve a given purpose.

With regard to the use of the management team concept to stimulate initiative and leadership, there does not appear to be

a significant role for such a team after the sub-project design is completed. The responsibility for decision making after the completion of the design now lies with the Coordination Committee. If this arrangement continues, the review team recommends that the principal investigator from each of the sub-project centers be included on the Coordination Committee. However, the review team would like to see a management team formed for the design of each new sub-project, composed of not more than four persons, three from the institutions involved in the sub-project and one from the Coordinating Committee. Further, once a management team is formed the review team believes it should be given responsibility for much of the sub-project implementation while still maintaining close contact with the Coordinating Committee. In short, the review team feels that the very centralized nature of the project within ICAR does not promote initiative or leadership sufficiently at the sub-project level.

A further question, not really conceptual yet related to the project, concerns the interrelationship of the ARP with other U.S. initiatives such as the Science and Technology Initiative (STI) and the projects supported by the U.S./India Fund, commonly referred to as FERRO. (See appendix D for a comparison of the major features of each.) The review team notes that it should be beneficial to all parties concerned if the sub-commission and STI could develop greater cooperation. With cooperation and planning, some of the basic or fundamental research carried out by STI could be linked to ARP to serve as a basis for the more applied, problem-oriented research of the ARP. The team is not able to recommend how such cooperation might be achieved except through discussion among the parties concerned. USAID and USDA (FERRO) in particular might be able to identify certain themes--by joint discussions at an early stage--in which each party could provide special emphasis in the selection of topics for support.

Closer linkage between FERRO and the ARP should also be beneficial to both and easier to bring about than cooperation with STI. Some FERRO projects, for example, could benefit from an input of foreign currency from the ARP for their project leaders and key staff to undertake short-term training and observation and for visits from U.S. scientists. By the same token, several sub-projects could benefit from scientific linkage with FERRO-supported projects. At the present time there does not appear to be any clear relationship between the objectives of the ARP, STI and FERRO programs, and the selection process for each is separate. For FERRO and ARP, given the separate sources of funding, and separate lines of authority and responsibility, formal linkage will be difficult and informal means will need to be sought. There is an opportunity to link them, however, through some foreign exchange grant funding to FERRO and through areas of mutual concern as identified by the Indo-U.S. Sub-Commission.

Finally, there is some concern over the degree to which "collaborative Indo/U.S. research" is being carried out and whether this is a sound approach to Indo/U.S. scientific interchange in agriculture. Under the present project little, if any, collaborative research has developed up to the present time, although the project is in an early stage and it may be too early to expect it. The review team is of the opinion that there should be an increased emphasis on collaborative research as an ultimate objective but that it may be difficult to achieve in the LOP of most sub-projects.

B. Organizational Issues

The review team was asked to comment on: a) the project organization; b) the means to more efficaciously accommodate USAID's project responsibilities given limited staff; c) the effectiveness of the arrangement with Winrock International for management support services; d) the delivery order process; and, e) the organizational relationship of ARP to STI and FERRO.

The project organization--an umbrella-type with sub-projects--is able to address the broad project objectives, and provide flexibility, funding, and a basis for action for the development and implementation of sub-projects. A word of caution is needed, however. Flexibility may not lead to a sufficiently rigorous analysis of proposed sub-projects to determine if a) they are of highest priority; b) they can be carried out within the project time frame; c) they are already receiving support from other sources, i.e., UNDP, STI, World Bank; and d) they give the greatest leverage to the marginal funds that USAID has for work in India. Each sub-project needs to be put to the same examination as if it were a "stand alone" project. The review team is not able to find in most project papers the extent to which such an analysis has been carried out.

A second organizational issue is that the organizational units and procedures established for implementation of the ARP are too complex and time consuming. The number of GOI organizational units involved appears to the team to be excessive. The one unit in ICAR that should be operational, the Projects Implementation Unit (PIU), does not have essential staff to carry out its responsibilities nor is there optimism at present that it will acquire such staff. In particular, staff in systems analysis and computer operations are essential to operation of the PIU but the team was advised that these positions have not been agreed to by the representative of the Ministry of Finance assigned to ICAR, even though they are in the budget.

In response to the question as to how to accommodate USAID's responsibilities with limited staff, the team suggests two

immediate actions. First, there should be a clear delineation of responsibilities among USAID staff assigned to the project. Second, high priority should be given to bring the PIU into effective operation. It also appears to the team that the preparation of an operational or flow chart for each of the sub-projects may be desirable to help guide resource allocation by ICAR-PIU, sub-project leaders, management teams and USAID staff.

With respect to the management support services provided by Winrock International, in the view of the team, they are essential and should, without question, be continued either with Winrock International or a similar organization. It appears to the team that project implementation would have experienced even more problems if Winrock International were not performing the services it now carries out. It is the one place where project information from both USAID and ICAR appears to be coming together and documented on a regular basis. It is the recommendation of the team that even with a well functioning PIU, a management support services unit is important to service project needs outside India.

A question was also raised about the delivery order process. The team concurs with others that this process seems to be an efficient means of arranging for management support services, but delivery orders could be carried out much more efficiently if annual delivery orders were issued based on an agreed-upon annual work plan.

At the request of ICAR, a study of the project was carried out by the National Academy of Agricultural Research Management (NAARM), Rajendranga, Hyderabad, in 1986. This study gave major attention to organizational issues and was followed by a workshop to discuss the findings.

The review team has studied the NAARM Report and discussed it with several persons who are involved in the project and participated in the workshop. There is consensus that it is a good study and that NAARM performed a real service to ARP by identifying and sequencing procedural steps. NAARM appears to have correctly identified problems not only related to organizational issues but also to implementation. These recommendations are still valid. The team noted that implementation of many of the NAARM recommendations is still pending, although there is no evidence that the recommendations were rejected by ICAR. ICAR should take steps to implement the recommendations as soon as possible. (The recommendations of the NAARM report and the ADG-PIU response thereto are summarized in annex C-3.)

The review team believes it is essential that USAID and ICAR give high priority to resolve the very serious organizational and implementation issues raised in the NAARM report. Resolution of

these issues will probably require direct discussions with the DG-ICAR by very senior USAID officials. All the blame cannot be placed on ICAR. There are serious bottlenecks in both agencies, and they will not go away by so wishing. If the project is to succeed, now is the time to seek ways to overcome the problems. Both agencies must be committed to this objective.

The team suggests that in discussions between USAID and ICAR, an alternative arrangement be considered within ICAR whereby all the various international assistance projects are coordinated through a coordination and monitoring division responsible to the Director General of ICAR. As an interim measure, the USAID mission may wish to expand its contract with Winrock to supplement USAID as well as ICAR/PIU functions. Such an expansion might include one or more JCC-type positions to assist with technical monitoring of progress in implementing sub-projects. Winrock has developed a management information system (MIS) which is based on annual sub-project work plans that it helps to prepare. This MIS could be expanded and geared to ICAR use. Winrock might also draft standard operating procedures along the lines suggested in the NAARM report. And Winrock might be given responsibility for arranging and preparing an agenda for periodic joint ICAR-USAID meetings on individual sub-projects.

C. Operational Issues

1. The Selection Process

Within the framework of the Indo-U.S. Subcommittee of Agriculture, how are sub-projects selected? How can selection be improved?

The Indo-U.S. Sub-Commission determines broad areas of mutual interest on the basis of documentation presented and discussions that take place in its meetings. The issues that ICAR presents for consideration rely heavily on the GOI five-year plan. Based on the conclusions of the sub-commission meetings, ICAR develops a concept paper(s) and presents it to USAID. This proposal is considered by USAID, which may approve it, reject it or suggest modifications. If USAID response is positive, ICAR proceeds with a specific request to USAID. Following ICAR'S request to USAID, a process is initiated through the management support services unit to search for appropriate consultants from the U.S. to come to India to work with Indian scientists to design a sub-project.

The most pressing needs in the selection of sub-projects, in the view of the review team, are to improve the preparation of the Indo-U.S. Sub-Commission and to improve the design process through joint working teams. The team also wishes to emphasize the points made above concerning the need for full analysis of each sub-project as if it were a completely separate project to

assure that it provides a real comparative advantage for the use of USAID funds.

2. Design Activities

The review team was asked to consider the following questions concerning design:

- o How to reduce the total time for project identification, project design, project approval and financial sanction to a more reasonable period, say one year from the date of acceptance of the concept paper.
- o How to enhance participation by all concerned, both U.S. and Indian, particularly scientific personnel, in all stages of the project to improve quality, enhance commitment, and reduce delays and costs. Should the system of joint working teams be adopted.
- o At what stage should the location of implementation centers be decided? Should the decision not form part of the detailed project report before appraisal? Should not an operational chart be an essential ingredient of each project approved for implementation?

These three questions are interrelated and will be addressed in a single response.

The review team strongly supports the recommendations that have been made by NAARM and others to: a) reduce the number of steps in the approval process; and b) to make the design process more of a joint effort. For the first sub-projects, for the most part, the design was prepared by a consultant from the U.S. with "participation" by Indian scientists, but the latter did not have equal status in the preparation process and were not considered joint authors of the design.

The review team considers that a joint design team with equal responsibility and commitment should be an essential requirement for future design work. The team noted that such a process has been evolving, and there is some evidence to that effect in subsequent sub-projects.

Finally, the location of implementation centers should be proposed in the design and only changed subsequently on the basis of thorough study during the project appraisal or on the return of the management team from its first visit to the U.S. prior to appraisal. It appears to the team that for some of the sub-projects too many centers have been identified and in some cases, they are not well located. For example, in the case of the embryo transfer sub-project, seven centers were selected, with three of them in the same state, whereas PAU is at a stage in its

work where it could have both benefitted from and contributed to the project, yet it was not included. In other cases, for example, the soybean processing and utilization sub-project, centers such as GBPUAT and JNKVV could have had a more prominent role.

The team strongly recommends that an operational chart be an essential ingredient of every sub-project approved for implementation. However, since it is prepared at the time of sub-project approval the chart must have some flexibility and be modified as necessary by the management team and USAID, as part of the monitoring process over the LOP.

3. Appraisal

The review team was asked to comment on whether each sub-project should be appraised by an independent team before it is finally approved. Such an appraisal is highly desirable and should be conducted where feasible. However, it should not be a costly or time-consuming exercise. It should take place after the original design has been completed and may be limited to a desk study by knowledgeable individuals (two or three) representing ICAR and USAID. It should not be allowed to take more than one month. If the appraisal will cause considerable delay, then it should not be carried out; rather, modifications to the sub-project should be introduced through the normal monitoring and evaluation process.

4. Implementation, Monitoring and the NAARM Management Review

In the scope of work for this review, there were four questions put before the review team. These referred to the recommendations of the NAARM review, implementation procedures that have proved to be sound, major unresolved implementation problems, and how to address them.

In the section above on organizational issues, the team addressed the question of the NAARM report recommendations, both the soundness of the recommendations and the need to give very high priority to their implementation.

As to the major unresolved implementation problems, this is a constant theme of the status of the various sub-projects in annex C. However, the major unresolved problem is the ineffectiveness of the PID, which is compounded by delays in communication and decision making between ICAR and USAID and insufficient communication with sub project staff at the implementation centers. The team talked with project staff who assumed that once they had discussed equipment lists with MSS staff or had indicated problems to USAID or ICAR staff who were monitoring the sub-projects, solutions would follow. This has

not been the case, however, and monitoring by the PIU has been negligible.

The PIU must be made effective and some means of monitoring must be established if implementation problems are to be overcome. Also, procedures for ordering equipment through the U.S. dollar fund were noted at every center to be excessively time consuming and were reported to be responsible for much of the delay in sub-project implementation.

5. Financial Issues

Dollar disbursements under the project are, to date, considerably below projections. The team was asked to determine what might be a reasonable expectation as to resource needs through the PACD.

The original prediction of USAID disbursements over the LOP were overly optimistic. It anticipated a rapid peaking of expenditures in the second and third years, with a falling off in the sixth and seventh years (table 3). Actually, expenditures have built up gradually over the three years of the project with a peak expected in the fourth or fifth year.

The nature of the umbrella project itself dictates a relatively slow start-up of expenditure. Only two sub-projects were included in the original ARP. On both SPU and PHT, major initial expenditures were for salaries, which extend at a diminishing level over LOP. The other major costs were to be the construction of facilities, training of Indian scientists in the U.S. and purchase of equipment. The process of nominating and approving scientists for training takes time. The determination of where they will go and for how long is based on the recommendations of the management coordination committee.

In this project, another major element in the rate of financial expenditure is the functioning of the PIU and the MSS. While the PIU was implemented in early 1985, the MSS did not start until 1986. Therefore, it was not until 1986 that the management teams started their study tours, and the MSS could then identify locations and negotiate for training. In the SPU, in particular, implementation required the recruitment of a large number of project staff, in disciplinary areas not previously well-developed in the principal implementing institution.

The lag in expenditures for U.S. equipment also contributed to slowness in project expenditures in the early years. USAID restraints on the process of specifications and preparation of bid documents requires a large amount of work by the MSS during each delivery order.

TABLE 2

AGRICULTURAL RESEARCH PROJECT

Financial Achievements
USAID Input (Thousands of Dollars)

Subproject 1/	Implementation Date	Approved Budget	Expenditure 2/ through 12/31/87		Estimated Expenditure through 3/31/89	
			\$	%	\$	%
SPU	1984	2,800	526.9	19	834.0	30
PHT	1985	5,003	806.5	16	1837.0	37
PIU	1985	551	385.9	70	462.0	84
BP	1986	1,572	68.5	4	855.0	64
FTR	1986	2,700	2,220.0	81	2800.0	127
PGR	1986	200	66.6	33	76.3	38
ETT	1987	2,186	103.0	5	1012.0	46
BW	1987	<u>1,339</u>	<u>50.0</u>	<u>4</u>	<u>855.0</u>	<u>64</u>
TOTAL		16,351	4,227.4	26	8731.3	53
Not implemented		3,649				
Project Total		20,000	4227.4	15%	8731.3	44

PENDING SUBPROJECTS

	(PROPOSED)	(ESTIMATED)
Ag Met	- 1,610	- 200.0 12
Ag For	- 1,869	- 343.0 18
Farm Mach	- <u>513</u>	- <u>543.0</u> <u>14.0</u>
	3,982	

1/ from MSS projection.

2/ Actual expenditure - estimated full cost of approved delivery orders plus reimbursement of approved rupee expenditures.

TABLE 3

COMPARISON OF ARP BUDGET TARGET
With Estimated Project Expenditures by Year
(Thousands of Dollars)

Preliminary ARP Budget Target <u>1/</u>			Estimated Expenditures <u>2/</u>		
YEAR	ANNUAL	CUMULATIVE	YEAR	ANNUAL	CUMULATIVE
1983	1	2,000			
	2	4,000		0	0
	3	4,000		0	0
	4	3,500	1985	1	170.0
	5	3,000		2	1,783.0
	6	2,000		3	2,444.4
1990	7	1,500		4	5,230.6 <u>3/</u>
		20,000		5	
				6	
			1992	7	

1/ From ARP Project

2/ First-year USAID disbursements; subsequent years, MSS system of actual expenditures from ongoing delivery orders, estimated full costs of recently approved delivery orders, plus reimbursement for approved rupee expenditures.

3/ Estimated by MSS to March 31, 1989 from 12/31/88 (15 months)

TABLE 4

AGRICULTURAL RESEARCH PROJECT
Financial Achievements
GOI Inputs (000s of Rupees)

Expenditures
Through 12/31/87

<u>SUB-PROJECT</u>	<u>TARGET</u>	<u>RS.</u>	<u>%</u>
PIU	3,127	12.6	1
SPU	5,310	3,282	62
PHT	19,297	3,047.8	16
ETT	10,189	1,866.6	18
BW	13,708	1,843.4	13
BP	9,993	92.1	1
FTR	-----	not applicable	-----
PGR	-----	not applicable	-----
Total	<u>61,624</u>	<u>10,144.5</u>	<u>16%</u>

The tables above reflect a great deal of uncertainty in projections; it does appear, however, that it would be timely to initiate a reallocation process for sub-projects within the total budget.

The combination of these elements dictated a relatively slow start-up. By mid 1986, there was much preliminary activity under way on the design of additional sub-projects. Forestry training, initiated in 1986, increased the financial outlay. In 1987, with seven sub-projects implemented, the foundation was being laid for a larger surge of both training and equipment purchase.

The impact of reaching the peak training and equipment purchase period of 1988-89 is shown in the MSS projections (see table 2). The overall budget expenditure (and mortgage) will increase from 15% to 44% of total project cost in a period of fifteen months. With the targeted training and the equipment bids under way, this projection seems realistic.

The budgets for several of the sub-projects may need adjustment at this time to avoid reaching the expenditure limit, most notably forestry training. At least for the present, this activity should be funded by ARP to assure its continuity until the time a firm decision is made as to whether or not a stand-alone UFKED project will be funded. The same kind of decision, though less urgent, will be needed for the plant genetic resources sub-project. Will the PGR sub-project be used for further design work on a PGR project? Should it be expanded to include PGR training while the decision on a separate project is pending?

These decisions, and others related to financial expenditures for other sub-projects, indicate that now is the time for USAID and GOI to review carefully the sub-project budgets for mid-term correction. The objective of this review should be to assess the LOP financial needs of each existing sub-project, as well as determine the amount of resources to put into sub-projects designed but not yet implemented.

GOI expenditures for the sub-projects that have been approved have approximately paralleled USAID expenditures thus far, in comparison with the sub-project budget targets (table 4). Overall, 16% of the GOI target budget has been expended compared with 15% of the USAID budget up to 12/31/87. It is expected that amounts will vary appreciably from year to year for each sub-project, since capital costs can greatly increase the budget outlay. This is shown in the case of SPU, where capital construction has occurred.

Projections for future expenditures by the GOI have not been studied. These would be useful components of the joint mid-term budget analysis suggested above.

It is reasonable to expect that the ARP project budget could be expended by the current terminal date of March 1992. This will require mid-term corrections in budget, as well as subsequent corrections in the final two years. In the final

years, the emphasis should be on building collaborative research relationships in sub-projects that have accomplished substantial training and equipment objectives.

CHAPTER III

IMPACT

The review team was asked to quantify, if possible, the degree of progress towards the project purposes and goals and to comment on whether or not the original project purposes and objectives were realistic.

There is no evidence of impact by the project on Indian agriculture to date, nor should there be an expectation of such impact. It is much too early. In the total scheme of Indian agriculture, impact cannot be expected to be felt until some years after completion of the present project. As the project is designed, the major impact may be expected to be the lasting contribution of scientists trained and equipment provided and the development of collaboration between U.S. and Indian institutions and scientists. As this is a mid-term review and some of the sub-projects have been delayed in implementation, the team found itself considering inputs and implementation of research more than impact.

To the extent they have occurred, professional enhancement and training programs appear to be very appropriate and successful. To date, these programs are the best evidence of success, and all individuals and institutions contacted on this subject have given highly favorable comments. With regard to strengthening the capability of Indian scientists and institutions to carry out their research, training programs have indeed made a major contribution. This issue is addressed in annex C with specific comments on each sub-project.

Concerning the degree to which technology has been transferred from the United States to India, this process appears to be just starting. It evolves out of the professional enhancement/training and the working visits by U.S. consultants. The team strongly recommends that there be increased use of consultants in the future in accordance with the original project plan. To date, project staff indicate they have been waiting for completion of training and for the arrival of equipment before calling on consultants. To a certain extent, this is sound reasoning, but it is the conclusion of the review team that given the long delay in the arrival of equipment, in several cases consultants should be utilized even before equipment arrives. From the comments of project staff and contacts made by team members with consultants in the United States, there is a strong commitment on the part of consultants or potential consultants to cooperate in the program.

The team was asked to identify technologies that have been transferred and the mechanisms that exist for dissemination. It

is too early to expect any technologies to be generated and transferred. As to dissemination mechanisms, this question goes far beyond the project and involves the whole issue of technology transfer within the Indian agricultural system.

CHAPTER IV

IMPLICATIONS FOR THE FUTURE

The most obvious implication from the present review is the need for a mid-project correction in several different areas.

- o For existing sub-projects, they may be substantially improved through increased utilization of consultants, clarification of collaborative institutions and scientists in the U.S. and their commitment to the project.
- o For implementation, there is an urgent need to implement the PIU in accordance with the project agreement, or in accordance with an agreed-upon alternative.
- o For funding, there should be a reallocation of funds within the project within the realistic expectations for each of the present sub-projects, to permit a start-up of already approved additional sub-projects.
- o For the MSS, the need exists to assure funding for the LOP.
- o For consultants, their services should be utilized for centers that may not now be included in the sub-projects but that are doing important work along the same lines as the sub-project centers. Similarly staff training should be extended under the same principle.
- o For management, decision making for the sub-projects should be decentralized to the extent possible to give the implementing centers more authority and responsibility for sub-projects, and to get scientists more involved with the Coordination Committee.
- o For dollar purchases, purchase procedures need to be improved to decrease the incidence of long delays.
- o For additional sub-projects, there need to be decisions on which if any are to be included. Peer review should be utilized as a mechanism for accelerating the process of project selection and implementation.

Additional implications may include the following:

- o For institutional strengthening, project assistance has the potential to build a long-term program of Indo-U.S. collaboration in agricultural research if true collaboration is developed and sustained.

- o For future Indo-U.S. collaboration, the ARP could well be a significant component of strategy but not the sole one. Collaboration must be built on the basis of mutual interest, taking into account available resources and national priorities. An umbrella-type project such as the ARP provides a considerable amount of flexibility, permitting a reasonably prompt and timely response to opportunities for collaboration. As indicated elsewhere in this report, each sub-project, even though it may be relatively small in financial requirement, should be subject to the same rigorous examination and analysis as much larger stand-alone projects. As has been the case with some of the ARP sub-projects, the initial LOP may involve a heavy component of technology transfer and may set the stage for longer-term relationships, which may result in true collaboration in research and technology generation, with or without the requirement for a larger transfer of resources. Thus, in addition to a further umbrella-type project for implementation of fields of mutual interest as identified by the Indo-U.S. Sub-Commission on Agriculture, the team feels there is a place for larger, stand-alone projects that involve collaborative research, technology development, and technology transfer, and institutional strengthening in areas of mutual interest. Experience with the ARP has already helped the USAID and ICAR focus attention on a few topics where more resources are required for longer-term collaboration.
- o For continuation of the project after the termination of USAID support, the prospects are good that ICAR will assume this responsibility since there is a formal agreement to this effect. Also based on what the team has seen, the sub-projects are ones that ICAR had already included in its plans but for which it needed additional support to speed up implementation.
- o For ARP, STI and FERRO relationships, there are no clear implications from the project to date except that some dollar support to FERRO could be very useful to train Indian scientists in the U.S. and to provide opportunities for more international exchange for U.S and Indian scientists. Greater collaboration and interaction among these programs would be beneficial.
- o For closer relations with the private sector, the review team did not find any opportunities in the short run and probably not during the LOP. Of the existing sub-projects, there should be some possibility of linkage for soy bean processing and post harvest technology.

- o As to whether it is timely and realistic to think about long-range Indo-U.S. cooperative research programs, this depends upon the length of commitment of such programs. The team believes it is a very worthy objective but should only be undertaken if there is a commitment of intent for a minimum of 10 years. Such a commitment should emphasize support for a limited number of centers or institutions for training, consultants, transfer of technology, collaborative research, and essential equipment not available in India, in that order of priority.

CHAPTER V

CONCLUSIONS, LESSONS LEARNED AND RECOMMENDATIONS

A. Conclusions

It appears to the review team that the conceptual framework of the Agricultural Research Project (ARP) is sound and that the project has made progress toward the achievement of its purpose to strengthen the capability of the Indian agricultural research system to conduct research in certain key areas. Progress has been most notable in staff training.

With respect to the other project components, however, there is great variation from center to center in the utilization of scientific consultation, transfer of technology, addition of staff, improvement of physical facilities, and the acquisition of laboratory and field equipment and supplies. Collaborative research has not been initiated although several centers indicated a strong interest to do so.

There is no indication that the project is making progress toward its stated goal "to increase agricultural productivity, production, employment and income." This is probably an unrealistic goal for the project.

At the mid-point of the project it does appear that the end-of-project outputs as stated in the project document should be achievable in some of the centers. For others, due to the lack of implementation and questionable center selection, project outputs will be very few.

Project implementation has fallen far short of the projected timetable. The review team has concluded that the implementation schedule was overly optimistic in light of the time required for normal project start-up, but even taking this into account, the rate of implementation is very disappointing.

The Indo-U.S. Sub-Commission on Agriculture has served an important function in raising the level of discussion to a sufficiently high level to gain the attention of both governments. The meetings of the sub-commission should continue, but they should give more attention to securing increased and continuing collaboration.

The project has served to re-establish agricultural cooperation between the two countries, and the credibility of USAID support is evident. These are important accomplishments.

Stronger support for project implementation on the part of the Government of India through ICAR is needed for the success of the whole venture.

The work of the Management Support Services (MSS) managed by Winrock International has served the project very well, and implementation would have been much less advanced had it not been in existence. The MSS should, without question, be continued.

B. Lessons Learned

A number of lessons are apparent as a result of the mid-term review. Most of these are well known and are recurrent themes in project evaluations. They include:

- o The design of the sub-projects, with subsequent ease of implementation, can be most effectively accomplished through joint working teams composed of Indian and U.S. scientists.
- o Project preparation should include a description of the work that has been carried out previously, a flow chart of the schedule the project is to follow, the expected outputs so that monitoring and evaluation can be accomplished, and the locations of the centers identified.
- c An umbrella-type project offers flexibility and assured funding for sub-projects, but it still requires the same scrutiny of sub-projects as if they were "stand alone" projects.
- o The procurement process for purchase of U.S. equipment is unduly time-consuming, and a project that is phased so that training schedules are matched to the arrival and installation of equipment will require a long start-up period.
- o Staff training in the U.S. is the most important component of the project, and this may be expected to be the case in other projects. The second most important component-- which may also be expected to be the case in other projects--is scientist-to-scientist contact.
- o Projects often require a mid-point correction, and allowance for change should be made at the time the project is negotiated with the host country.
- o There is a real potential for closer collaboration between Indian and U.S. scientists on research topics of mutual interest. This should be directed toward true collaboration, which will require additional resources.

- o Agricultural research is recognized by both Indian and U.S. scientists as an area of high priority. It is essential to sustain the knowledge base for continued growth in agriculture to feed India's growing population.
- o The Indian state agricultural universities offer many opportunities to build Indian and U.S. university collaboration. The present project could have benefited from greater collaboration with Indian universities, and this contact should be a part of the correction made when adding more sub-projects.

C. Recommendations

Throughout this report the review team has used such terms as "the team suggests," "it is the view of the team," "it is the opinion of the team," or, "the team recommends." A number of recommendations are implied in the conclusions and lessons learned. In this final section, only major recommendations are noted. These recommendations are:

- o that there be discussions at a very early date between senior staff of USAID/India and the Director General of ICAR to assure that ICAR takes the necessary action to bring the Project Implementation Unit (PIU) into more effective operation, as had been agreed at the time of project negotiation, or in accordance with an agreed upon alternative.
- o that a joint review of existing sub-projects be made (most of which has been done and is reported in annex C of this report along with the most recent MSS quarterly report) and a reallocation of funds be negotiated with ICAR for the existing projects.
- o that an operational chart be a requirement for each existing and new sub-project.
- o that following the review of existing sub-projects and a reallocation to appropriately fund them for the life of each, a decision be made in the very near future by USAID and ICAR as to what additional sub-projects are to be included in the LOP.
- o that within the ARP there is a need to give increased attention during the remainder of the LOP to the use of consultants who have been identified within the sub-projects.
- o that funding be assured for a continuation of the MSS for the LOP.

- o that annual work plans be developed for each sub-project and a blanket delivery order be issued to the MSS on an annual basis.
- o that, if possible, a U.S. dollar grant be made to FERRO to support U.S. training for Indian scientists and to provide opportunities for more international exchange by U.S. and Indian scientists. At the same time an attempt should be made to obtain closer collaboration between USAID and FERRO projects to attract additional Lupce support for the ARP and other projects.
- o that the Indo-U.S. Sub-Commission on Agriculture be encouraged to continue, but with an emphasis on seeking ways to develop truly collaborative research with long-term support.
- o that in the monitoring process, both USAID and ICAR provide better and more timely feedback to project staff in the field as to the status of purchases, the status of requests for new sub-projects or support for specific activities such as collaborative research, and action that may be required by them. The review team found that many field project staff are baffled by long delays in procurement without explanation, and long delays or lack of replies to requests they have submitted. Project staff in the centers are enthusiastic about the project but often feel isolated.

The project has a number of problems at the mid-point in the LOP. However, the review team believes these problems can be overcome if early corrective action is taken, and reasonable success can be achieved within the LOP. As noted earlier in the report, the problems will not simply go away. Positive steps are required by both USAID and ICAR.

ANNEX A

SCOPE OF WORK

The review team is to conduct an evaluation which addresses the following areas:

1. Conceptual

- a) - Are the project's purposes of institutional strengthening, technology development and transfer, and collaborative research appropriately balanced under the current project structure?
- b) - The project has relied heavily on the Indo-U.S. Subcommission of Agriculture for the identification of subproject themes. Is this mechanism, based on criteria of mutual interest, appropriate to identify USAID activities in collaborative agricultural research?
- c) - The phrase "collaborative Indo/U.S. research" is mentioned in the project. To what extent is it being realized? Is it a sound approach to Indo/U.S. scientific interchange in agriculture?
- d) - Is design subproject initiative and leadership properly recognized and stimulated through the management team concept?
- e) - How do the objectives of ARP relate to those of the Science Office/Science & Technology Initiative (STI) and United States Department of Agriculture/Far Eastern Regional Research Office (USDA/FERRO)? What are the key similarities and differences in the purposes of the three programs?

2. Organizational

- a) - Is the umbrella ARP with subprojects an effective arrangement for expediting approval, funding, and implementation of research?
- b) - Are the USAID and ICAR organizational units established for the implementation of ARP suitable and effective? Are management and leadership roles adequately defined among all the organizations involved?
- c) - Is the Project Implementation Unit (PIU) appropriately staffed to carry out ARP programs and operations effectively?

d) - Does the umbrella design result in agreeable effects which address the broad project objectives?

e) - Are there synergistic effects from this design?

f) - How can the USAID organizational responsibilities be more efficaciously accommodated in the context of minimizing demands on USAID DH and FSN staff.

g) - A contractor, Winrock International, provides USAID and ICAR with ARP-related management support services. Is the arrangement effective? Is the delivery order process an efficient means of arranging for the management support services?

h) - What is the organizational relationship of ARP to STI and FERRO? Is the relationship complementary?

3. Operational

A. Selection

a) - Within the framework of the Indo-U.S. Subcommittee of Agriculture, how are subprojects selected?

b) - How can selection procedures be improved?

B. Design Activities

a) - How to reduce the total time taken in project identification, project designing, project approval and financial sanction to a more reasonable period, say one year from the date of acceptance of the concept paper?

b) - How to enhance participation by all concerned, both U.S. and Indian, particularly the scientific personnel, in all stages of the project to improve quality, enhance commitment, reduce delays and costs? Should the system of Joint Working Teams be adopted?

c) - At what stage should the location of implementation centers be decided? Should it not form part of the detailed project report before appraisal? Should not an operational chart be an essential ingredient of each project approved for implementation?

C. Appraisal

- Should each project be appraised by an independent appraisal team before it is finally approved?

D. Implementation

a) - Can the recommendations made by the National Academy for Agricultural Research Management (NAARM) be supplemented or improved upon?

b) - What is the status of implementation of the NAARM recommendations?

c) - What implementation procedures have proved to be sound?

d) - What are the major unresolved implementation problems, and what is recommended to address them?

E. Financial

- What were USAID expected dollar disbursements over the LOP by year? What have actual disbursements been? What are reasonable expectations as to resource needs through PACD?

F. Project Completion Report

a) - Should there be a project completion report based on evaluation of the project at the end of the project period?

4. Impact

In as quantified terms as possible,

a) - What is the progress of the project towards the purposes and goals as stated in the logical framework? Are the original project purposes and objectives realistic?

b) - What has been the effect of the project on strengthening the capability of Indian scientists/institutions to carry out research in specialized areas? Have the professional enhancement/training programs proved to be appropriate and successful?

c) - Has the project facilitated/strengthened the development and transfer of technology from the United States to India and helped to establish ties between participating scientists and institutions?

d) - What impact has the project had on the development of Indian agriculture?

e) - How effective are the mechanisms for the dissemination of research results, and to what extent are the new technologies being adopted by potential users? Are small and marginal farmers benefiting from the new technologies promoted by the project?

5. Implications for the Future

- What changes, if any, are needed to improve the effectiveness of the project.
- How important is the kind of institutional strengthening provided by ARP to a long term program of Indo-U.S. collaborative research?
- How can the private sector be more fully organized in this project?
- Should ARP serve as a model for subsequent Indo-U.S. collaboration in agricultural research?
- What are the relative strengths and weaknesses of the ARP model as compared to STI and FERRO? Are there areas in which ARP can make a unique contribution to future initiatives in agricultural research?
- What is the potential for increasing the collaboration among ARP, FERRO, and STI in support of future agricultural research activities? How can this best be done?
- What is the potential for sustainability of the institutional structure and/or benefit flows of this project following AID termination of external funding?
- What are specific adjustments now that could enhance the probability of sustainability.
- Is it timely and realistic to think about long-range Indo-U.S. cooperative research programs in agriculture? If so, what should be the basic guidelines for such programs?

ANNEX B

METHODOLOGY

The team carried out an extensive review of project documentation, site visits to three U.S. institutions cooperating in staff training and providing consultants for the project, interviews with trainees and consultants at these institutions, discussions in Washington with officials of USAID, USDA, the State Department and Winrock International.

In India, the team continued its review of documentation, held discussions with USAID staff concerned with the project, Winrock International staff in the ESS, staff of FERRO, senior officers in ICAR, project staff, DEA staff concerned with the project, and staff of the World Bank and UNDP/FAO who are working on projects related to the APP.

In its interviews with trainees and sub-project staff in India, the team, to a large extent, used the Rapid Rural Appraisal Methodology.

ANNEX C-1

SOYBEAN PROCESSING AND UTILIZATION

FULL TITLE	Soybean Processing and Utilization
BUDGET (USAID)	\$2.8 Million (Rs. 20.7 Million)
IMPLEMENTATION DATE	1-4-1985
PARTICIPATING INSTITUTIONS	1. CIAE, Bhopal 2. GBPUAT, Pantnagar
LEAD CONSULTANTS	Nil

I. Background

Introduction of soybean cultivation on a large scale in the plains of India, initiated in the late sixties, owes its origin to the University of Illinois collaboration with the G.B. Pant University of Agriculture and Technology, Pantnagar, and Jawaharal Krishi Nehru Vishwa Vidyalay, Jabalpur, under the auspices of USAID.

USAID made a substantial contribution to soybean cultivation as well as processing and utilization research at Pantnagar through consultants such as Edwin Bay, R.M. Matsura, Forster Davidson and Al Nelson, staff training, as well as the supply of equipment for research and a commercial pilot plant located at Bareilly. Similar support was provided at Jabalpur through Carl Hittle, J.A. Jackobs and R.T. Milner.

Soybean cultivation spread very fast in Madhya Pradesh because it provided an additional crop for rainfed farming. Madhya Pradesh accounts for 80 % followed by U.P. (8%) of over one million hectares under soybeans. The area is growing fast.

Soybeans are, for the most part, used as an oilseed and soybean cake is exported as cattle feed. Sipso, a soybean drink, Nutri nuggets and N-cela, etc., are in the market as a result of soybean utilization research but they account for only a microscopic fraction.

II. Project Design

The Project was designed by Dr. A. Siegel from the University of Illinois, assisted by Dr. A. Alam and Dr. T.P. Ojha of the Central Institute of Agricultural Engineering, Bhopal. The scientific talent from India represented only one discipline-

Agricultural Engineering- drawn from only one institution, CIAE, which resulted in an imbalance in project design and the selection of the wrong locations. Had the scientists from GBPUAT, Pantnagar, J.N.K.V., Jabalpur, and Central Food Technology Research Institute, Mysore, been included in the design team, these deficiencies could have been, to a large extent, eliminated.

III. Location

The main center is located at CIAE, Bhopal, while the sub-center is located at G.B. Pant University of Agriculture and Technology, Pantnagar. The former accounts for about 90% of the resource allocation.

CIAE is quite strong in agricultural engineering, but it does not have the complementary disciplines of basic sciences, home science, food science, economics, etc. The posts provided for these disciplines in the project had to be recruited anew and to a large extent, have been lying vacant. It is most unlikely that any first-rate scientist from these complementary disciplines would ever join CIAE, because the posts are temporary and there are no departments in the disciplines that might provide career prospects for such scientists.

The logical choice for the location of the main center of the project was Pantnagar or Jabalpur where all the collaborative disciplines were already. The Central Food Technology Research Institute, Mysore, should also have been included as a sub-center.

IV Appraisal

There was no peer review of the project before implementation by any independent individual or team, with the result that these basic deficiencies remained undetected.

V Objectives

The basic objectives of the sub-project are to maximize the use of soybeans as a food source and to improve soybean processing and utilization with particular reference to the low income segment of the society. Research activities, therefore, are geared to the development of simple and adaptable soybean processes and equipment, and subsequent technology transfer to the rural population at the home, village and small industry level. The sub-project also aims at dissemination of proven technologies to consumers and processors at various levels of operation.

The problems associated with processing and utilization of soybeans adaptable to the home and village levels are

attributable to: (a) an unpalatable off-flavor (beany flavor); (b) presence of trypsin inhibitors in unprocessed soybeans; (c) flatulence factors (formation of gastrointestinal gas) in soybeans; (d) poor cooking quality of soybeans associated with hardness and consequent increased cooking time; (e) lack of simple processing methods for soybeans at the home and village level; (f) unavailability of low-cost equipment for processing soybeans at the home and village level; (g) lack of pilot plant facilities for promoting soybean processing at the small industry level, and, last but not least, (h) lack of information on proper packaging and storage methods for soybean products.

VI. Strategy: Components of the Sub-project

The sub-project aims at solving these problems by means of the following components:

- i. Development of processes and equipment for full-fat soybean flour applicable to home, village and small industry levels.
- ii. Development of processes and equipment to obtain Dal from soybeans applicable to home, village and small industry levels.
- iii. Development of low-cost extrusion cooking processes and equipment for soybean flour and other soyproducts applicable to small industry levels.
- iv. Development of processes and equipment for preparing low-fat soybean flour applicable to village and small industry levels.
- v. Development of processes and equipment for soyflour-supplemented baked foods applicable to the small industry level.
- vi. Development of processes and equipment for a fermented and coagulated soy-based product applicable to home village and small industry levels.
- vii. Establishment of appropriate systems/technologies for handling, storage and packaging of whole soybeans and soy products.
- viii. Supportive training programs in oilseeds processing and utilization.
- ix. Establishment of pilot plants and demonstration units.

- x. Establishment of soybean processing plants by entrepreneurs.

VII. Collaborating Foreign Institutions

The following institutions are listed in the report of the Management Team for the purpose:

- i. University of Illinois, Champaign/Urbana: Dept. of Food Science, Dept. of Agricultural Engineering, Dept. of Food and Nutrition and INTSOY - International Soybean Program.
- ii. Colorado State University, Fort Collins, Colorado: Dept. of Agricultural Engineering and Dept. of Nutrition.
- iii. USDA Laboratory, Peoria, Illinois (Northern Regional Lab.)
- iv. Kansas State University, Manhattan, Kansas: Food and Feed Grain Institute and Dept. of Grain Science and Industry.
- v. University of Minnesota, St. Paul, Minnesota: Dept. of Food Science and Dept. of Biochemistry.
- vi. School of Packaging, Michigan State University, St. Joseph.
- vii. All India Postharvest Technology Scheme, (ICAR).
- viii. All India Coordinated Scheme on Soybean Production (ICAR).

Though the list of collaborative institutions is quite impressive, the degree of collaboration is far from adequate. What is needed is institution-to-institution collaboration on a close and continuing basis with a lead institution like the University of Illinois.

VIII. Collaborative Indian Institutions

CIAE Bhopal and GBPUAT Pantnagar are collaborating in the project but 90% of the burden is shouldered by the former and the latter is concerned with only one of the ten components of the sub-project listed under VI above, namely, "supportive training program in oil seeds processing and utilization" and related student research. The main responsibility for the development of products, processes and equipment (components 1 to 7 of the sub-project), lies with CIAE Bhopal. In consequence of this overwhelming reliance on a single institution, the constraints of

CIAE have become the stumbling blocks for the sub-project. As a matter of fact, the sub-project has been more a means of institutional strengthening to CIAE than that of technology development and transfer. Collaborative research is simply conspicuous by its absence. Technology development and transfer through collaborative research, as between Indian institutions, can be realized only if the relevant institutions, such as, GBPUAT Pantnager, JNKVV Jahalpur, and CFTRI Mysore, participate in the sub-project. Likewise, collaborative research or even collaboration in research with the foreign institutes and universities can become a reality only if some of those listed under VII above are involved effectively in the sub-project.

IX Operational Chart (PERT)

As no operational chart was drawn up, it is not possible to determine the degree of slippage under various items precisely and in quantitative terms. An annual break-up was provided for each component of the sub-project and it was envisaged that the "sub-project will be evaluated annually," but it has not been done in practice.

X. Sub-project Sanction and Budget Provision

The sub-project was sanctioned by the ICAR vide letter No. 9-11/80 A.E. dated 1/5/1984. The budget provision and sanction for staff and contingencies was, however, made with effect from 1/4/1985. In view of the delay in the sanction, the original outlay of Rs. 3,33 lakhs was scaled down to Rs. 275 lakhs, shared by USAID and ICAR by Rs. 207 lakhs (75.24%) and Rs. 68 lakhs (24.76%) respectively. (For details, please see exhibit C-1-I)

XI Management Team

The Project Management Team visited the U.S. between the 16th of August and 20th of September, 1986, and made very substantial contributions in locating potential collaborating institutions and scientists, and finalizing the list of equipment and details of the products and processes included in the project. The Project Management Team should have visited the U.S. immediately after the sub-project paper was ready and approved by USAID and the ICAR, that is, the second quarter of 1984, thereby eliminating the delay of over 2 years.

The Management Team should also have been more broad-based and should not have included any person not concerned with the implementation of the sub-project. As it happened, one person who was not concerned with the implementation of the project had been included on the team in place of a person closely concerned with the design and implementation of the sub-project.

EXHIBIT C-1-1

Progress Report (October-December 1987)
Implementation Plan (January-March 1988)

Subproject: SOYBEAN PROCESSING & UTILIZATION

I. Financial Summary (as \$'000 and Rs. '000)

A. USAID Input (\$ and Rs.)

Component	LOP Target		Cum Total ^{1/} thru Dec 87		Progress ^{1/} Oct-Dec 87		Plans Jan-Mar 88	
	\$.	Rs.	\$.	Rs.	\$.	Rs.	\$	Rs.
(Exchange rate used \$1 = Rs.9.50)								
1. U.S. Scientists to India	375	-	27.5	-	0	-	0	18
2. Indian Scientists to U.S.	413	-	115.3	-	0	-	100	-
3. Workshop, etc. in India	-	228	-	9.8	-	0	-	75
4. Workshops, Conferences outside India	14	-	-	-	0	-	0	-
5. Equipment imported	544	-	137.1	-	0	-	139	-
local	-	3,506	-	722 ^{1/}	-	17 ^{2/}	-	300
6. Operational Res.	-	1,349	-	97	-	1	-	20
7. Staff salaries	-	2,888	-	1,129	-	150	-	400
8. Maintenance of Research	-	5,842	-	192	-	20	-	50
Equipment	1,346	13,813	279.9	2,346	-	235	239	863
TOTAL (\$)	1,346	1,454	279.9	247	0	24.7	239	90.9
Combined (\$)	-	2,800	-	526.9	-	24.7	-	329.8

^{1/} Consists of actual expenditures under ongoing D.O.s, full estimated costs of recently approved D.O.s (where no expenditures have been reported), plus reimbursement to ICAR for approved rupee expenditures.

^{2/} Expenditures reported by ICAR cumulative through December 1987 and for quarter July-September 1987. Expenditures reported as of September 1987 and for quarter July-September were Rs. 725,859 and Rs. 36,515 respectively.

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EXHIBIT C-1-1 - Page two

Progress Report (October-December 1987)
Implementation Plan (January-March 1988)

B. ICAR input (Rs. '000)

<u>Component</u>	LOP	Cum Total	Progress	Plans
	<u>Target</u>	<u>thru Dec 87</u>	<u>Oct-Dec 87</u>	<u>Jan-Mar 1988</u>
	Rs.	Rs.	Rs.	Rs.
1. Building & Facilities	1,666	1,893	0	800
2. Office Equipment/Supplies	760	463	6.5	100
3. Vehicles	265	0	0	125
4. Maintenance:				
- Office Equipment	285	0	0	10
- Vehicle	265	0	0	10
5. Staff Salaries	1,786	785	196.8	200
6. In-country travel	283	71	6.6	10
7. Contingencies	-	70	1.7	10
TOTAL	5,310	3,282	211.6	1,265
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The Management Team should also have been included in the Coordination Committee in the interests of continuity of operation and follow-up. This was, however, not done. The representative of GBPUAT, Pantnagar, was left out of the committee but was subsequently included as invitee.

XII. Implementation

A. Product, Process and Equipment Development.

Considerable work has been done on the development of soybean products, such as, full-fat flour, dal, paneer (tofu), flakes snacks, partially defatted flour etc. at CIAE, Bhopal and oil extraction and utilization of defatted flour at GBPUAT, Pantnagar. Some good equipment for operation at the home and cottage industry levels, such as, dehuller, blancher, flaking machine, screw extruder and wet grinder, have been developed at CIAE, Bhopal. Similar work had been done at Pantnagar up to 1979 under a PL 480 project with an outlay of Rs. 4 million.

B. Training at Post-Graduate Level. The supportive training program in process engineering, food science and technology and post-harvest technology of master's and doctoral levels has been proceeding according to plan at GBPUAT, Pantnagar. Sixteen students have enlisted as post-graduate students.

C. Delays, Deficiencies and Defaults. Barring these accomplishments, the general picture of implementation of the sub-project is quite dark, as will be evident from the following facts:

- i. There have been enormous delays all round and the over-all achievement of the objectives of the sub-project is a small fraction of the total.
- ii. The research work is confined to the laboratory stage. The pilot plant unit has not even started functioning at Bhopal while the one at Pantnagar is "grossly underutilised." Out of the two wings of the building at Bhopal only one has been built due to escalation of the cost and the other has not even been started. The obvious remedy was to revise the cost of the building per revised C.P.W.D. schedule from time to time and to issue a revised sanction. Unless the operations are stepped up very substantially, the most crucial components of the sub-project, namely, pilot plant trials and operational research, may not be completed.

- iii. The product development programme in the laboratory is without adequate consumer acceptance trials. The soyflour and paneer produced in the laboratories are supplied to the local staff at half the cost and it is not known if the product will be at all accepted if the full price is charged.
- iv. There should have been a provision for multi-location trials and the research work should have been taken up at Pantnagar, Jabalpur and Mysore, besides CIAE, Bhopal. Not much reliance can be placed on trials confined to one location and one institution.
- v. Even the single location trials at CIAE are seriously handicapped by the fact that they are conducted by process engineers and a biochemist. Six posts in food technology, nutrition, food science, economics, etc., are lying vacant and are not likely to be filled in the future.
- vi. The baseline for the research program should have been clearly determined by taking into account the work already done at Pantnagar under the University Development Project up to 1972 and the PL 480 project thereafter. The laboratory work at CIAE, Bhopal is similar to, if not repetitive of, that done at GBPUAT, Pantnagar, where it had crossed the pilot plant and operational research stages in some items. "Some of the processes were released for commercial exploitation. Soybean Production and Research Association, Bareilly, a subsidiary of M/s Nave Technical Institute, Shahjahanpur, undertook commercial production of extruded soy products. This started a chain reaction in the country. It led to the establishment of many small and large commercial ventures in the country manufacturing soy extruded food. The technical know how of soy-milk manufacture was given to M/s Pantnagar Soy Products, New Delhi. This private company markets soy milk under the brand name of SIPSO."

While determining the baseline, both the strengths as well as the weaknesses of the work undertaken earlier should have been identified and highlighted. Thus, for example, commercial production by the Soybean and Research Association, Bareilly, came to grief in spite of heavy investment by DSAB and GBPUAT, Pantnagar. It is reported to be due to mismanagement and personality factors. The elements responsible for the failure should have been studied and the safeguard against the same should have been provided in the design of the research programme.

D. Resource Utilization. Resource utilization has also been extremely low as would be evident from Exhibit C-1-I, an extract from the quarterly progress report prepared by Winrock.

(i) Out of 15 posts of scientists and technologists, only 9 have been filled and the other six are not only vacant but are likely to remain vacant at Bhopal.

(ii) Only 4 pieces of equipment out of 18 have been received. Revised performance specifications of the remaining 14 pieces worth \$82,480 have been submitted to the ICAR.

(iii) Four scientists have been trained in USA accounting for 15 man months. Five are likely to go in 1988, accounting for a total of 18 man months out of 97.

(iv) In spite of a provision of 27 man months for consultancy and the location of good collaborative institutions and scientists by the management team, the utilization has been extremely low. One consultant, Dr. Gene C. Shove, Professor of Agricultural Engineering, UI, Urbana Champaign was here for 6 weeks (4.11.86 to 14.12.86). His activities related to storage of soybeans. The plea that the delay in the supply of equipment delayed the utilization of consultancy services is not applicable to this subproject because enough equipment already existed at Pantnagar and some at Bhopal.

4.1. Implications for the Future

i) Expeditions Implementation: Implementation of the sub-project should be expedited in respect of all its components, such as, technical assistance, foreign training, procurement of equipment and, last but not least, appointment of scientific staff. The arrangements for coordination and monitoring should also be strengthened by appointing the representatives of GBPUAT as well as PIU to the Coordination Committee. The Head of the PIU should become the Member-Secretary of the Coordination Committee.

ii) Mid-Course Corrections: As two important centers, namely, JBEVV, Jabalpur, and CFTRI, Mysore, were completely left out of the sub-project and GBPUAT, Pantnagar, was only partly involved, it is desirable that all three institutions as well as private enterprises, such as, M/s Pantnagar Soya Product, Rewa, Delhi, and others should be made partners in the project in order to get the maximum benefit out of technical assistance and training abroad. All these institutions are fairly well equipped and may not need any additional support for staff or equipment or in any case they may obtain the same from their own resources.

They should, however, be made partners in the objectives and the programme of the sub-project relevant to them as well as technical assistance and training abroad for which ample provision already exists in the sub-project and which has been utilized only to a very small extent. Consultants may be invited as a team and they may make their services available to all these institutions. If this is done, the provision for technical assistance can be fully utilized during the remaining two years of the project life.

iii) Procedure For Design and Implementation: Under the existing arrangements, the work of designing and examination of sub-projects is carried out piecemeal by fragmentary teams involving enormous loss of time, sometimes running into several years. It will be desirable to set up joint working teams consisting of all concerned, namely, consultants from USA, PIU and subject matter divisions of ICAR, key representatives of agricultural universities or central institutions proposed as participants in the sub-projects, the Department of Economic Affairs and Planning Commission, and also, in appropriate cases, representatives of the UNDP, FAO and others interested in specific sub-projects. This will not only cut down the delay very substantially but will also improve the quality of sub-projects by ensuring the participation of all concerned in the design and implementation of the project. It would also facilitate coordination of various agencies and demarcation of their roles in the same field. (This procedure was adopted in the case of the National Seeds Project, involving an outlay of \$52 million which was formulated in 7 months by the joint working team and appraised by the World Bank during the next two months.)

iv) Project Monitoring: The Project Implementation Unit has not been involved at all in monitoring the project. The quarterly progress reports have been handled by the subject matter division. It will be desirable if progress reports from the participating institutions were received by the subject-matter division as well as the Project Implementation Unit simultaneously and the latter would consolidate and analyse them with the help of the computer center and circulate the results to all concerned. This subject has been dealt with at greater length in the sub-project on the Project Implementation Unit.

v) Local Project Advisory Committee: Research projects should form an integral part of the research program of the participating institutions and, to that end, it should be reviewed by the Research Advisory Committee of the institution and other bodies. In fact, it would be an advantage if the Research Advisory Committee of the

participating institution held meetings prior to the meeting of the Coordination Committee and if the recommendations made by the Research Advisory Committees were also considered by the Coordination Committee.

vi) How can the private sector be more fully organized in this project? The soy utilization research programme of G.B. Pant University of Agriculture and Technology, Pantnagar, carried out in the seventies led to the establishment of two commercial units, one at Bareilly and the other at Delhi. The former was known as Soyabean Production Association, in which the university purchased shares worth Rs.2 lakhs or 20% of the total capital. The USAID also contributed a substantial amount, about Rs.7 lakhs, in the form of extrusion equipment. One of its products, Nutri Nuggets, became quite popular, but it came to grief on account of poor management and some personality factors. The unit is now closed. It would be desirable that the University or the USAID undertake a critical study of the reasons why this venture failed in spite of so much outside support and what the lessons are for extending requisite support to commercial units in the private sector. In case there is any possibility of reviving this unit, the pre-requisites for the same may also be worked out.

The second unit was named Pant Nagar Soya Milk (Pvt) Ltd. It was started by two Parai farmers, S. Bhagat Singh and S. Harbhajan Singh, but the former died soon after the commencement of production and the latter did not have the resources to carry on the project on his own. The unit was sold to Shri Amrish Mehra, an industrialist with an M.B.A. degree, with whom the team had a detailed discussion. According to the information given by Shri Mehra, the turn-over of the unit has been as follows:

1981	Rs.	0.40 lakhs	1985	Rs.	25.0 lakhs
1982	Rs.	1.20 lakhs	1986	Rs.	70.0 lakhs
1983	Rs.	0.20 lakhs	1987	Rs.	100.0 lakhs
1984	Rs.	3-4 lakhs			

Shri Mehra has been making substantial profits for the last three years. The turn-over fell quite substantially in 1983 as the retailers found much more profit in selling the empty bottles in the open market. The unit was forced to switch over to sachet packing after this bitter experience in which the company lost over Rs.5.0 lacs. The growth of turn-over has been quite steep during the last three years and Shri Mehra is confident of

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maintaining the same in the foreseeable future. This private sector enterprise can, and should, be assisted by the following measures:

(i) Technical assistance: The consultants coming to India should work not only with Bhopal and Pantnagar (as also Jabalpur and Mysore, as suggested in this report elsewhere) but also with M/s Pantnagar Soya Milk Products Private Limited and other commercial units and advise them in their respective fields. The sharing of consultancy services will not mean any extra expenditure on the sub-projects.

(ii) Training: Shri Mehra is prepared to sponsor some members of his technical staff (one of whom is a graduate in food technology from Pantnagar) for foreign training. As the provision for training abroad in this sub-project is still very much underutilised (33 man-months out of a total provision of 97), it should be possible to accommodate one or two of his staff members. If necessary, he should be required to meet part of the cost.

(iii) Advice: Both Pantnagar as well as Bhopal should maintain close and continuous contact with him through regular visits and advise him from time to time. Shri Mehra stated that he had made some references to Dr. Chauhan, Dean, College of Technology, Pantnagar, but did not get any response and, therefore, stopped thereafter.

(iv) Other commercial units: A number of other units are coming up in the private sector, one of them being at Ghaziabad in close proximity to Delhi. They should be given similar assistance irrespective of whether the units are in the small scale sector or not.

(v) Shri Mehra is already in touch with the Soybean Association of U.S.A. It will be desirable to put him, and others like him, in touch with INSOY, University of Illinois.

2. Principal Objective

The sub-project aims at increasing food supply and improving nutritional status of Indian population by developing appropriate technologies to reduce post harvest losses of major horticultural crops of India. Losses in these crops are reported to be high in India although the critical causes and the magnitudes of such losses have not yet been clearly quantified and defined. Research activities in this sub-project focus on identifying and reducing losses of major perishable horticultural crops of India, during harvesting, farm handling, storage, marketing and processing.

3. Participating Institutes

U.S.

1. USDA Laboratory, Orlando
2. Ohio State University, Columbus, Ohio
3. Purdue University, Lafayette
4. University of Georgia, Athens
5. Michigan State University, East Lansing
6. University of Florida, Gainesville
7. University of Idaho, Moscow
8. University of Arkansas, Fayetteville
9. University of California, Riverside

4. Components

For the project seven commercially important horticultural crops which reportedly suffer substantial pre- and post-harvest losses have been identified. These are: mango, citrus, bananas and guava among fruit crops and potato, onion and tomato among vegetable crops. Essential components of the research program are:

1. Identify causes and magnitude of pre- and post-harvest losses.
2. Determine methods to examine quality and minimize post-harvest losses by improving pre-harvest management and harvesting techniques.
3. Establish systems for pre-cooling, handling and transport to reduce post-harvest losses and maintain quality characteristics.
4. Develop techniques of storage to minimize losses and prolong quality characteristics.
5. Develop methods of processing for maintaining quality characteristics during storage and marketing.

6. Develop methods to utilize wastes from commercially unacceptable fruits and vegetables and from processing systems.

7. Establish instructional materials and teaching programs to implement operational research and educate farmers on proven technologies.

5. Implementation

The sub-project on Post Harvest Technology was the second sub-project taken up for execution under the umbrella Agricultural Research Project. A brief history of the Project as given in the First Quarterly Report and Work Plan by Winrock International is given below:

- | | | |
|----|---|---------------------|
| 1. | The Project Grant Agreement between the Presidents of India and the United States | June 30, 1983 |
| 2. | Project Implementation Letter (No.4) for sub-project. | Jan. 24, 1985 |
| 3. | ICAR sanction of the sub-project (for 1 year). | July, 1985 |
| 4. | Date of the start of project | April 1, 1985 |
| 5. | Visit of USAID staff (Singh & Smith) to: | |
| | (i) IARI | Jan., 1985 |
| | (ii) Lucknow | July 11-16, 1985 |
| | (iii) Bangalore | Sept. 25-27, 1985 |
| | (iv) Lucknow | Sept.30-Oct.1, 1985 |
| | (v) Bangalore (along with Baird) | Jan. 21, 1986 |
| 6. | List of equipment sent to W/W for quote. | Jan. 1986 |

6. Progress of the Sub-project

A. Coordination Committee For the overall implementation of the sub-project a coordination committee was constituted by the ICAR. The composition of the committee as given in the sub-project document is as follows:

- | | | |
|----|---|--------------------|
| 1. | Deputy Director General (Crops) ICAR | - Chairman |
| 2. | Director Indian Agricultural Research Institute (IARI) | - Member |
| 3. | Director Indian Institute of Horticulture Research (IIHR) | - Member |
| 4. | Project Coordinator ICAR Coordinated Project (Post-Harvest) | - Member |
| 5. | Asst. Director General Horticulture | - Member/Secretary |

The principal investigator at each of the four centers, ADG (Eng.), ADG (PIU), and head NRCC are special invitees. With the creation of a new Division of Horticulture in the ICAR, the

Deputy Director General (Horticulture) is now the Chairman of the Committee in place of DDG (Crops). It was also decided in the last meeting of the coordination Committee that ADG (PIU), ADG (Eng) and Head (NRCC) should be made regular members.

The committee discusses and takes decisions on the following issues.

- (a) Progress of construction of building and other facilities.
- (b) Employment of staff.
- (c) Procurement of indigenously manufactured equipment.
- (d) Training of Indian scientists in USA
- (e) Visit of consultants from USA to India
- (f) Procurement of imported equipment
- (g) Financial matters
- (h) Constituents
- (i) Review of technical work (annually)

The committee is required to meet twice a year. It has held five meetings so far.

SN Date

1. Feb. 15, 1985
2. March 18, 1986
3. Oct. 7, 1986
4. April 28, 1987
5. Jan. 4, 1988

In the last meeting held on Jan. 4, 1988, it was decided to hold the meetings quarterly.

E. Building and Other Facilities

In the sub-project document the following facilities were envisaged to be created:

Buildings:

IIHR (Bangalore):

- (a) Processing hall with essential facilities for storage and analytical work.
- (b) Accelerated temperature storage chambers with complete automatic temperature and humidity control designs.
- (c) Ripening chambers with complete automatic gas, temperature and humidity control.

A provision of Rs. 1,247,000 was made. Sanctions for construction of buildings have been issued. Some of the

buildings are nearing completion but none of the buildings is ready for use.

IARI

A provision of Rs. 2,726,000 for the construction of the following buildings was made in the sub-project document.

- (a) Laboratory (50x30x15) with fittings & tables (5)
- (b) Fumigation Chamber (1)
- (c) Ripening Chamber with complete automatic gas temperature and humidity controls and recording devices (1). No action has so far been taken for the construction of the building but Rs. 115,833 has been spent on false ceiling in the processing Hall.

CIHNP, Lucknow

The sub-project document envisaged the construction of following buildings at the new site:

- (a) Processing Hall 30'x40'
- (b) Controlled temperature rooms
- (c) Laboratory space to accommodate 12 scientists

A provision of Rs. 1.96 million was made for the purpose. As of March 31, 1988, only Rs. 0.25 million had been spent.

NRCC, Nagpur

This was to be a newly established center. A provision of Rs. 1,500,000 was made for:

- (a) Processing Hall
- (b) Common Storage

So far nothing has been spent.

Vehicles

IIHR, Bangalore Chassis obtained for body building. Trailers are yet to be purchased.

IARI, New Delhi Matador truck purchased.

CIHRNP, Lucknow Jeep was purchased but it is reported to be stolen.

C. Management Team

The management team of G.L. Kaul, S.K. Roy and Ambadan visited the US on study tour from June 15, 1986 to July 18, 1986. The team visited a number of stations in the US. The wrap up meeting was held at Los Angeles on July 11, 1986 when Robert Skiles, Rtd. Director PIP, was present. Dr. Ronald Buescher from Arkansas accompanied the team throughout. While in the US the team asked for changes in specifications of several pieces of equipment. The team was able to specify the nature and location of training for Indian scientists and the consultants that should visit India.

D. Appointment of Staff

The sub-project document listed the staff needed at different stations which was later modified keeping in view the staff already in position. The sanctioned staff and the staff in position at each of the centers is given below:

Station	Scientific Staff		Others	
	Sanctioned	In Position	Sanctioned	In Position
ICAR Headqtrs.	1	1	2	2
IIHR Bangalore	8	6	12	11
CIHNP Lucknow	8	6	12	9
IARI New Delhi	9	9	15	6
NPCC, Nagpur	6	3	8	1

E. Procurement of Indigenously Manufactured Equipment

The position up to the time of the last Coordination Committee Meeting was that except for IIHR no station had reported the purchase of any locally manufactured equipment. The IIHR list included balances, vacuum oven, solar drier, BOD incubator, water softening unit, flash evaporator and inoculation chamber. CIHRNP, Lucknow purchased equipment worth Rs. 0.41 million up to April, 1988.

F. Imported Equipment

The following equipment was received at different centers in August-September, 1987.

Equipment	No.	Centers
1. Aquameta System	3	IIHR, CIHNP, IARI
2. Viscometa	4	IIHR, CIHNP, IARI, NRCC
3. Spectronic 1201	2	IIHR - IARI, -
4. Color Diff. Meter	3	IIHR, CIHNP, IARI, NRCC
5. Spectrophotometer	1	- - IARI -

The total value of imported equipment was \$146,000 against the LOP target of 10,20,000 or 14.3 percent. Documentation was in process for an additional 24 items with an estimated cost of \$770,000. During January-March D.O's were expected to be issued in the total amount of \$819,000. This would amount to a commitment of \$965,000 or about 95% of the dollar funds available for equipment.

G. Training/Visit of Indian Scientists to US

A total of 13 Indian scientists have either visited or received training in different laboratories in the US. The number of scientists from each institute in different disciplines is given below:

Indian Scientists trained in USA up to March, 1988

<u>Institute</u>	<u>Horticulture</u>	<u>Pathology</u>	<u>Microbiology</u>	<u>Eng.</u>	<u>Economics</u>	<u>Total</u>
IHR	Dr. (Mrs) S.E. Murthy - (Physiology) Sh. K.P.G.K. Rao - (Physiology)	Dr. B.A. Ullasa	Sh. E.R. Suresh	-	-	4
CIHNP	Dr. S.K. Kalara (Storage) Dr. B.P. Singh (Storage) Dr. S.K. Tandon (Waste Use)	Dr. Om Prakash	-	-	-	4
IARI	Dr. B.S. Maini (Waste Use) Dr. D.S. Khurdia (Processing) Dr. A.K. Chakravarthi (Storage Physiology)	-	Dr. (Mrs) Vijay Sethi	Dr. H.S. Sharma	-	5

During 1988-89, eight scientists will be going to the U.S. Of the thirteen scientists, two went to Arkansas, three to Michigan State University, four to Ohio State University, two to California and two received their training in Georgia. Eight persons are scheduled to leave in 1988-89.

H. Consultants

Because the visit of the consultants was tied up with the arrival of the equipment, so far only three consultants have been hired. Dr. Buescher of University of Arkansas helped prepare the equipment list and train programmers, and Dr. Marle Menegay and Lou Riesenbag of the Post Harvest Institute of Perishables, University of Idaho, participated in the workshop and training

program from June 3, 1987 to June 27, 1987. So far only 12 person weeks have been utilized out of 140.

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1. Financial Summary

Financial Summary of PHIT sub-project.

A. USAID input

Component	<u>LOP</u> (\$1000)	<u>Target</u> (Rs.1000)	<u>Expenditure</u> <u>up to Dec. 1987</u>		<u>Estimated Exp.</u> <u>April 1, 1988 to</u> <u>March 31, 1989</u>
			(\$'000)	(Rs.'000)	(\$'000)
1. U.S. Scientists to India	528	-	40.6 (7.7)	-	75
2. Indian Scientists to U.S.	1,695	-	360.0 (21.2)	0	197
3. Workshops in India	-	789	-	-	
4. Workshops, seminars outside India	-	-	-	0	
5. Equipment Imported	1020	-	146 (14.3)	-	
Local	-	-	-	453	758
6. Operational Research	-	5,377	-	593.3	
7. Staff salaries	-	6,027	-	1420.8	
8. Maintenance of research equipment	<u>311</u>	<u>1,036</u>	-	<u>2.0</u>	
Total	3,554	13,770	546.6 (15.4)	2469.1 (17.9)	<u>1,030</u>
Total \$	<u>3,554</u>	<u>1,449</u>	<u>546.6</u>	<u>259.9</u>	

Figures in parentheses denote percent.

Source: Quarterly Report No.8 WI, New Delhi

B. ICAR input (Rs. '000)

Component	<u>LOP</u>	<u>Target</u>	<u>Expenditure</u> <u>up to Dec. 1987</u>	
1. Building and facilities	7,441		450.3	(6.1)
2. Office equipment & supplies	1,740		339.0	(19.5)
3. Vehicles	700		455.5	(65.1)
4. Maintenance Of Office Equipment	1,603		3.3	(.02)
5. Staff salaries	7,138		1,420.8	(19.9)
6. In country travel	670		106.8	(15.9)
7. Contingencies	-	<u>272.1</u>		
Total	<u>19,927</u>		3,047.8	(15.3)

7. Significant Findings

1. Preharvest Factors and Harvesting Techniques

(i) Spray of 0.6 percent calcium chloride proved to be better for carotenoid development in Dashehri mango pulp during storage.

(ii) Calcium nitrate and calcium chloride (2.0% each) exhibited positive effect in increasing shelf-life by 2-3 days.

(iii) Captaf (0.2%) and Bavastin (0.1%) were most effective against anthracnose and stem end rot.

(iv) Guava (L-49) fruits harvested with stalk were found to contain more soluble solids and vitamin C than those without stalk.

2. Handling, Marketing and Transportation of Fruits and Vegetables

(i) Post harvest loss in the field was observed to be 14 percent in Totapari and 3.5 percent in Dashehri. Ripening loss was 15.2 percent in Totapari and 5.6 percent in Dashehri.

(ii) Wrapping mango in tissue paper reduced losses of moisture about 10 percent in 2 days.

8. Impact

The research work at most of the centers is at a preliminary stage. It is too early to study the impact. The training in the use of instruments and methodologies has been useful. The training in estimating the losses from the farm to the market proved to be very useful and a model has been used in two important varieties of mangoes, one prominent in North India (Dashehri) and the other in South India (Totapari).

9. Critique

1. All the centers of this sub-project are in ICAR institutes and none in a state agricultural university. This is a serious shortcoming. Low rate of expenditure in some of the components like buildings appears to be due to the fact that the procedures of getting sanction for construction in ICAR are such that it takes considerable time before the construction work starts. Two of the centers have no building of their own. At Lucknow, even the decision to locate the building has not been taken so far.

2. The training program has been so far unorganized. In many cases neither the trainees nor the host institute had enough notice about the commencement of training. In some instances participants had less than 24 hours' notice and they reached the US at a time when there was no crop in the field. The department offered courses that could be useful to the participants but these courses were not offered during the time the participants were there. For 1988 this situation seems to have improved a little. Training should not be confined to the personnel working in the project. Others at the center working on similar projects should also be sponsored. Out of a total of 337 person months only 52 have been utilized so far.

3. It has taken nearly 3 years to import even a fraction of the equipment. Installation is held up for want of either a small spare part or the lack of response from the agent. The entire procedure needs to be streamlined and a lot more preparation is needed at different levels. Much of the delay in importing equipment was due to a delay in the appointment of the MSS contractor, the decision about the sub-contractor, and work specifications.

4. Two of the centers do not have adequate building facilities. In the absence of such facilities the full use of costly equipment cannot be made. It is therefore recommended that highest priority be given to the construction of buildings. At Lucknow (Rehman Khera) center even the decision about the location of the building has not been taken. Some of the buildings already available at the research station are not fully utilized on the plea that electricity and water supply are erratic. The team recommends that the ICAR should approach the State government for an assured supply of electricity. In the mean time a diesel generator should be used for the processing laboratory. The team further recommends a thorough analysis of the facilities available before a piece of equipment is ordered for Lucknow and Nagpur. In the opinion of the team the buildings (laboratories, offices and residences) should be at Rehman Khera with free bus facilities for the children and staff.

5. There should be more involvement of the scientists at the centers in the purchase of equipment and they should be kept informed about the progress of procurement.

6. The principal investigator of each of the centers should be a member of the Coordination Committee.

7. There is a feeling among the scientists that the program of work as decided at the workshop is too rigid. Forcing any program on a research worker is likely to dampen the enthusiasm and initiative of the scientists. Each center should be asked to develop its own program and present it at the workshop for discussion and approval.

8. Because potato is not a mandatee crop of the CIHNP they have difficulty in carrying out the experiments. The emphasis in the CIHNP should be on mango and guava. Similarly at Nagpur only citrus should be the mandated crop for the next 2 years.

9. Requests for consultants were deferred until the equipment arrived. The visit of consultants to the different centers would have helped in improving the program. It would be in the interest of the project to request the consultants as early as possible.

ANNEX C-3

PROJECT IMPLEMENTATION UNIT

FULL TITLE	Project Implementation Unit
BUDGET (USAID)	.551 Million (Rs. 5.51 Million)
BUDGET (ICAR)	(Rs.'000) 2.927 Million
IMPLEMENTATION DATE	1-4-1985

I. Objectives

The Indo-USA collaborative programmes in Agricultural Research and Education consist of planning, financing, technical assistance, training and delivery of scientific equipment for carrying out the sub-projects. Each sub-project requires preparation, appraisal, implementation, monitoring, evaluation and, above all, coordination with different institutions, centres and departments.

USAID has agreed to administer and manage all business and financial aspects involved in approved sub-project elements and activities outside the sovereignty of India. This includes - but is not limited to - arrangements for procurement and delivery of requested expatriate technical services, off-shore commodities and supplies, professional assignments of Indian staff abroad and specialized training of selected sub-project staff outside India.

The Project Implementation Unit has been set up at the I.C.A.R. headquarters for handling allied and incidental technical and administrative work connected with the Agricultural Research Project. In a sense, it is a counterpart unit providing for a single window for liaison work with USAID, on the one hand, and a service unit for monitoring and coordination of projects/sub-projects, on the other.

II. Major Responsibilities

The PIU has, in theory if not in practice, the following main and important functions;

- i) Expeditions implementation of the sub-projects already developed
- ii) Formulation of new sub-projects
- iii) Coordination in respect of sub-projects monitoring

- iv) Preparation of sub-project reports
- v) Coordination with other governmental agencies/departments
- vi) Processing of cases of training of Indian scientists abroad
- vii) Processing of deputation cases connected with exchange of scientists/specialists
- viii) Handling of US delegations visiting India from time to time
- ix) Coordination work relating to all meetings, symposia, and conferences held in connection with implementation, monitoring of sub-projects and initiation of new project areas, etc.
- x) Handling importation of specialized equipment laboratory items/research instruments and materials from time to time including custom-duty exempting, etc.
- xi) Any other relevant technical/administrative work that may be entrusted to this unit by the Competent Authority, i.e. JS (DARE)/Secretary (DARE).

III. Composition of the Unit

The following staff positions were originally provided in the project.

Assistant Director General	1
Under Secretary	1
Accounts Officer	1
Protocol Officer	1
Section Officer	1
Supporting, Ministerial and other staff	10

The post of Protocol Officer was subsequently deleted while that of a System Analyst was added.

IV. Funding

The total cost of the project, as sanctioned by the I.C.A.R. through its letter No. 10(8)/86-PIU dated November 9, 1987 was Rs. 84.37 lakhs, the USAID share being Rs. 55.10 lakhs consisting of Rs. 48.6 lakhs for consultancy for project designing, etc. and Rs. 3.30 lakhs for foreign training, besides Rs. 3.2. lakhs for

equipment. The equipment included \$23,000/- for computers for modernization of operations.

V. Implementation

The Project Implementation Unit has been doing some useful work but it is only a microscopic fraction of the total that it can, and should, do. For the most part, it is functioning like a post office and that too not completely and effectively. As a matter of fact, the term project implementation unit is a complete misnomer. The PIU has neither been implementing the projects nor it is coordinating or monitoring the projects and has not even been set up as a full-fledged unit. The subject matter divisions are responsible for project implementation. The Computer Center has not been set up. In fact, even the proposal for a System Analyst and Computer Center has not been concurred with by the Financial Advisor. Whatever monitoring is being done, is by the subject matter divisions. The Project Implementation Unit does not come into the picture, at all, not even for consolidating the reports. The Head of the Project Implementation Unit - at present the unit is headless - is not the Secretary of the Coordination Committee of the sub-projects. The subject matter divisions and participating scientists have been dealing, for the most part, directly with USAID and Winrock International.

The provision for training abroad has been utilized but the Head has been shifted to another position and the new Head will have to be trained afresh. The provision for consultancy for project designing has been usefully utilized but right now the activity is at a low ebb.

The urgently needed office equipment was expected to be procured by March, 1988 but this has not happened for want of concurrence by the Financial Advisor, in spite of financial aid from USAID.

The progress during the last two quarters is practically zero, as will be evident from Exhibit C-3-1, an extract from the Winrock report.

VI. Multiplicity of Project Implementation Units

There is a large multiplicity of project implementation units, under different names, concerned with co-ordinating and monitoring roles in the ICAR and the Ministry, as listed below:

- i) Project Implementation Monitoring Unit for all projects for which there is no separate monitoring unit. (PIE)

EXHIBIT C-3-1

Progress Report (October-December 1987)
Implementation Plan (January-March 1988)

Subproject: PROJECT IMPLEMENTATION UNIT

1. Financial Summary (as \$'000 and Rs. '000)
A. USAID Input (\$ and Rs.)

<u>Component</u>	<u>LOP Target</u>		<u>Cum Total 1/ thru Dec 87</u>		<u>Progress 1/ Oct-Dec 87</u>		<u>Plans Jan-Mar 88</u>	
	\$.	Rs.	Rs.	Rs.	\$.	Rs.	\$.	Rs.
(Exchange rate used \$1 = Rs.9.50)								
1. U.S. Scientists to India	486		385.9 2/	-	0	-	0	-
2. Indian Scientists to U.S.	33	-	12.4 3/	-	0	-	-	-
3. Equipment Imported	26	-	0	-	-	-	-	-
Local	-	57	0	0	-	-	?	?
	545	57	398.3	-	0	0	?	?
TOTAL (\$4)	545	6	398.3	0	0	0	?	?
Combined (\$)	- 551 -		- 393.3 -		- 0 -		- ? -	

1/ Consists of actual expenditures under ongoing D.O.s, full estimated costs of recently approved D.O.s (where no expenditures have been reported), plus reimbursement to ICAR for approved rupee expenditures.

2/ In addition to D.O.s, includes \$9,000 for agronometeorology design, \$57,000 for animal science design, and \$37,200 for forestry education design.

3/ Includes pre-M55 expenditure of \$5.0

B. ICAR input (Rs. '000)

<u>Component</u>	<u>LOP Target</u>	<u>Cum Total 1/ thru Dec 87</u>	<u>Progress 1/ Oct-Dec 87</u>	<u>Plans Jan-Mar 88</u>
	Rs.	Rs.	Rs.	Rs.
1. Buildings & Facilities	20	-	-	-
2. Office Equipment/Supplies	197	12.6+?	?	?
3. Vehicles	160	-	-	?
4. Maintenance: Office Equip.	430	-	-	?
5. Staff Salaries	2,010	?	?	?
6. In-country travel	310	?	?	?
7. Contingencies	-	-	?	?
TOTAL	3,127	12.6+?	?	?

- ii) Project Unit, National Agricultural Research Project, consisting of a Director (Dr. Ghosh), two ADG's (Dr. Omanwar and Dr. A.P. Saxena), one Deputy Secretary, three scientists and one engineer. (PU, NARP)
- iii) Project Unit for Advance Centers of Education. The Head of the Unit was on the payroll of UNDP (Dr. V. Kumar replaced by Dr. Mathur).
- iv) Foreign Aid Section for FERRO (FAS)
- v) Project Implementation Unit (PIU)
- vi) International Cooperation Unit (IC)

In addition, there are some small cells or units with other individual projects.

The responsibility for co-ordination and monitoring is quite dispersed and diffused without any coordination among these units inter se. Many of the units are headed by such low level staff that they are hardly viable and carry little prestige.

The procedure followed by the different units is also not uniform. Thus, for example, the proposals for clearance of individual names for training abroad and technical assistance in the projects financed by UNDP do not require any reference to the International Cooperation Unit and the Department of Economic Affairs whereas in the other projects, including ARP, this is required and is one of the most time-consuming items. There is an obvious need for extending the procedure followed in UNDP projects to ARP and others also.

VII. Implications for Future

It is necessary that the role, responsibility and relationship of the project implementation unit with the other institutions and organizations concerned is clearly demarcated and followed rigorously. The National Academy of Agricultural Research Management has made an attempt to demarcate the functions of PIU, subject-matter divisions, the International Cooperation Division and the Department of Agricultural Research and Education. (The suggestions for modification of this demarcation of roles and responsibilities is being included in that section.) The NAARM recommendations and their status as reported by ADG-PIU are summarized in exhibit C-3-III.

The unit should be renamed as Project Coordination and Monitoring Unit. As stated above, it is a misnomer to call it an Implementation Unit because implementation is, and should be the responsibility of the universities or institutions in the field and subject matter divisions at the headquarters. The PIU's role

EXHIBIT C-3-II

SUMMARY OF NAARM RECOMMENDATIONS AND STATUS

The following summary is a paraphrase of NAARM review report recommendations modified by the identifying recommendations in the ADG (PIU) status report. It appears that discussions in the November 1985 seminar clarified or otherwise modified NAARM's initial recommendations somewhat. The first column (NAARM No.) is the number of the recommendation in the review report. The second column (ADG-PIU No.) gives the corresponding number (in parentheses) which appears in the ADG (PIU) status report of 27 July 1987. The last column summarizes the status of the recommendation on that date.

<u>NAARM No.</u>	<u>(ADG-PIU) No.</u>	<u>NAARM RECOMMENDATION</u>	<u>ADG (PIU) RESPONSE</u>
1.1	(1)	Speeding subproject identification and design through better preparation of Indo-U.S. subcommission and undertaking design of identified subprojects.	Of 14 identified subprojects 7 have been authorized, 6 designed and one awaiting design.
1.2	(2)	Design teams should be consulting scientists.	See (3). Consulting scientists used in all designs.
1.3	(3)	Concerned working scientists should be involved in subproject design at earliest stage possible.	Noted for guidance
1.4	(3)	Expedite conversion of the Design Team's report into a project paper and securing of TAG and PAMC approvals.	Noted for guidance
1.5	(4)	Reduce delay in sanctioning of subprojects by securing a blanket endorsement from DEA on basis of umbrella project.	Not acceptable since financial implications not clear until subproject has been designed. DEAs concurrence required before subproject can be forwarded to USAID.

C-3-5

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|-----|--------|---|--|
| 1.6 | (5) | Streamline the ICAR approval and implementation procedures by assessing responsibility to PAMC & eliminating the TAG. | May be possible in future. |
| 2.1 | (6-a) | Constitution of Management Team & U.S. visit should take place ASAP after issuance of PIL. | Being implemented. |
| 2.2 | (6-b) | The Management Team should include two scientists responsible for implementation and one from ICAR Hq. who will be responsible for implementation. One of these three should have participated in project design. The US design consultant should join Team in U.S. | Being implemented. |
| 2.3 | (7) | Provide a one-year gestation period prior to the 5-year subproject course to enable the principal Investigator to staff, equip and otherwise ready the project for operations. | Not possible for new projects given the 1992 PACD. |
| 2.4 | (8) | Confusion over starting date. | After approval, USAID accepts expenditures from date when ICAR submits project for approval. Slow start of SPU and PHT-FV may require extension. (USAID now accepts beginning of GOI FY following PIL as initiation of 5-year period.) |
| 2.5 | (9) | Ensure understanding of the program by preparing an operational manual on ARP subprojects and including a special session on ARP activities in the AICRP workshops. | A manual is in preparation. Special sessions on SPU and PHT-FV were in last AICRP workshop. |
| 2.6 | (10-a) | Design Team should identify U.S. training | Accepted. Now being implemented. |

- 2.7 institutions and management teams should make training arrangements with them. Training programs should be specified early and synchronized.
- 2.8 (10-b) Prepare a long term training plan for DEA to clear globally, delegating to DARE approval of individuals. Not acceptable to DEA. Current procedure should continue.
- (10-c) Annual training plans now being prepared.
- 4.8 (10-d) Complete training in 1st 3-years of project. Being implemented.
- 4.8 (10-e) Long term (12 mos) training too long for 5-year project. Send more for shorter periods. Noted for guidance.
- 3.1 Attach PIU to DDG (Education) for operational efficiency. No comment
- 3.2 (13) Clarify roles and functions of PIU, subject matter divisions and DARE, as suggested. Committee appointed at workshop to review. Functions as recommended being followed.
- 3.3 Shift responsibility for processing training cases from SMD-CI to SMD-PIU. No comment
- 3.4 Recommends uniform structural organization and line of command for each subproject. No comment
- 3.5 See to it that U.S. consultants are available in the implementation phase as well as for design. Being implemented
- 4.7 (11-b) Visits of U.S. consultants should be timed to return of U.S. trained scientists, equipment installation, etc. Noted for guidance

- | | | | |
|------------|--------|--|--|
| 4.7 | (11-c) | Plan consultant visits a year ahead and clear. Identify alternates in case primary is not available when needed. | Noted for guidance |
| 3.6 | (12-a) | Both Design Teams and implementing centers should provide complete commodity descriptions using Winrock catalogues. | This is being implemented |
| 3.7 | (12-b) | Seek a waiver from NMIC (not manufactured in country) certification. | Cannot be dispensed with |
| 3.8 | (12-b) | To avoid reflecting the cost of imported equipment in the plan budget by not requiring reflection or by letting in USAID. | Not believed to be feasible |
| 3.9 | (14) | Expedite staffing of PIU to fill vacancies in view of rising workload. | Action initiated to fill some PIU positions. |
| 4.1 | (15) | Avoid using new centers with inadequate infrastructure and facilities in ARP subprojects. | Since Nov. 1986 only those centers with adequate facilities and equipment are being included. |
| 4.2 | (-) | Concerned subproject scientists should prepare a consolidated report for presentation at AICRP workshops in order to get benefit of technical reviews. | No comment. |
| 4.3 | (16) | Full complement of staff should become available within first 2 yrs of project. | Being implemented as far as possible with ADG (PIU) playing key role. |
| 4.4 | (-) | Clarify lines of control for technical and administrative activities. | No comment. |
| 4.5
4.6 | (17) | Provision should be made for monitoring receipt and utilization of budget allocations. Annual release of funds is preferable to quarterly. | Annual release of funds is authorized for some subprojects. Efforts underway to provide PIU with a small computerized monitoring system. |

(18) Recommends a formal staged, multilevel monitoring system.

System now in place has monitoring at monthly intervals by PIs, quarterly intervals by Directors of Institutes and Project Mgrs., and at six months by PACM. USAID participates in annual reviews.

4.7 (11-b) re U.S. consultants.
(11-c)

Treated under 11-b and 11-c.

4.8 (10-d) re U.S. training
(10-e)

Treated under 10-d and 10-c.

4.9 (19) Ensure a proper organizational climate by providing appropriate facilities recognition, incentives, stability and opportunity.

Scientists deployed to subprojects are being deployed for U.S. training. Other points noted for guidance.

is that of liaison and coordination, on the one hand, and monitoring on the other. These functions should be reflected in the name and the PIU should be called Project Coordination and Monitoring Unit to eliminate possible misunderstanding and confusion.

In order to enable the PIU (or PCMU) to discharge its coordinating role, ADG in-charge should be the member-secretary of the Project Coordination Committee headed by the Deputy DG in charge of the subject-matter division.

With the adoption of joint working team approach for design and implementation of sub-projects, it should be possible to approve the training programme, including the names of the individual or at least their disciplines, and there should be comprehensive concurrence in a single instalment by the Department of Economic Affairs. There should be no need for further reference to DEA for individual clearance. This procedure is already in vogue in regard to UNDP projects. There is no reason why the same procedure should not be extended to ACP also. Under the existing arrangement, in a jointly financed project like Embryo Transfer Technology, one and the same scientist going to one and the same institution for training would require clearance by the DEA, if the funds are provided by USAID, while requiring no such clearance, if it is financed by the UNDP. This is obviously an anomaly.

There is a need for bringing all the units referred to above under the same umbrella by creating a full-fledged Coordination and Monitoring Division headed by a person of DDG's rank, because coordination and monitoring are important functions and their volume as well as importance justify a separate division. The proposed position and relationship of the Coordination and Monitoring Division has been shown in the organizational chart (exhibit C-3-11).

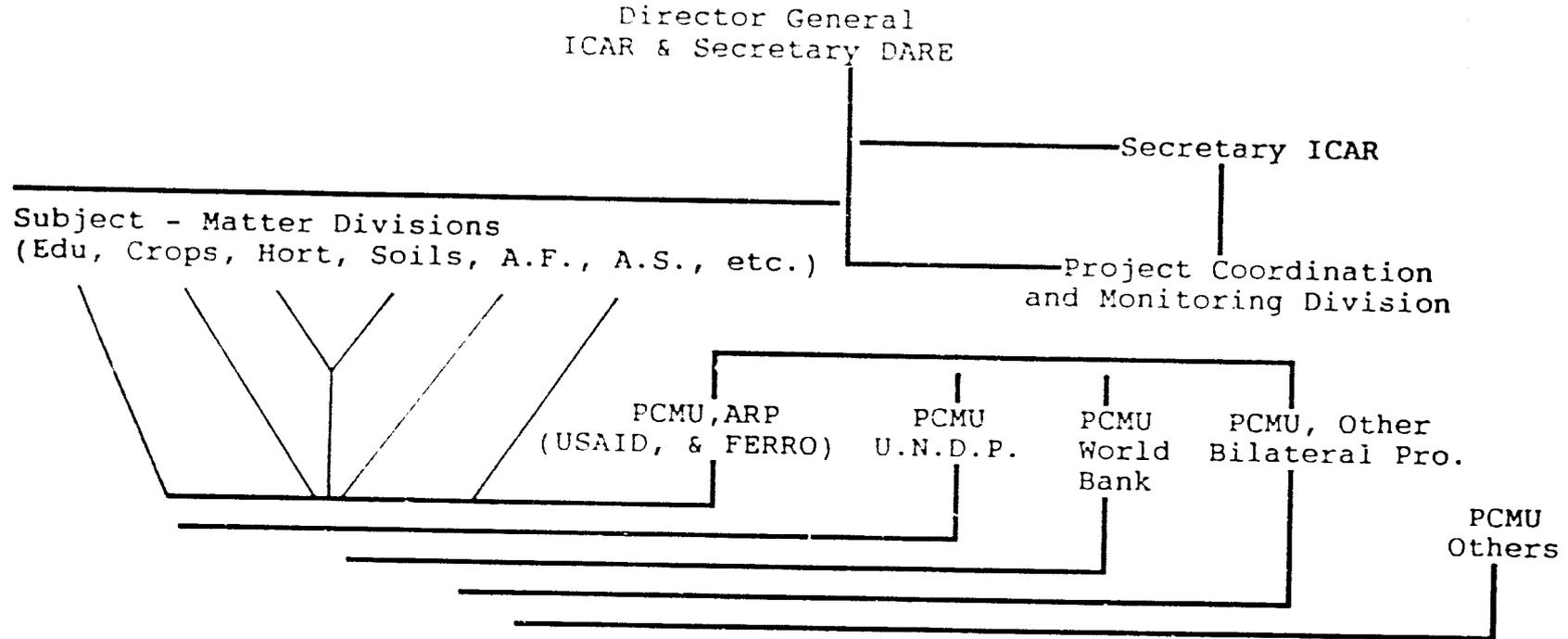
Computerized monitoring by the proposed PCMU (or the PIU pending the establishment of PCMU and PCMD) should be taken up as early as practicable. Quarterly progress reports from the implementing centers should be consolidated and analyzed by PCMU (or PIU) with the help of the computer center and circulated to all concerned. These reports should be considered by the Co-ordination Committees of the sub-projects at regular quarterly meetings held at the implementing centers by rotation. The representatives of the USAID and Winrock may attend these meetings as observers and supporters.

To this end, it is essential that the System Analyst should be appointed and the computer center set up immediately.

Joint Career Corps (JCC)-type advisors will be quite useful in providing scientific and technical guidance on monitoring,

EXHIBIT C-3-III

Organizational Chart of Proposed
Coordination and Monitoring Division



C-3-11

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evaluation and coordination of sub-projects by the Project Co-ordination and Monitoring Units (PCMU) and the projects, as a whole, by the Project Co-ordination and Monitoring Division (PCMD), proposed above.

In order to facilitate liaison and co-ordination, copies of all important communications (letters, reports etc.) should be sent, as a matter of course, to both the subject matter divisions as well as the (PCMU) to keep everybody informed.

The system of yellow file, that is, preparing a spare copy of all important communication issued each day and placing it in a single file circulated to all concerned, may be adopted for this purpose.

ANNEX C-4

BLOOD PROTISTA

FULL TITLE	Intracellular Blood Protista with Particular Reference to Immuno Prophylaxis and Control
BUDGET (UCAID)	(\$'000) 1,572
BUDGET (ICAR)	(Rs.'000) 9,993
IMPLEMENTATION DATE	April 1, 1987
PARTICIPATING INSTITUTIONS	<ol style="list-style-type: none">1. Indian Veterinary Research Institute (IVRI), Izatnagar2. National Dairy Development Board (NDDB), Anand3. Haryana Agricultural University (HAU), Hissar4. Punjab Agricultural University (PAU), Ludhiana5. Tamil Nadu Agricultural University (TNAU), Coimbatore6. Coordinating Centre and Central Laboratory, Hissar*7. Rajendra Agricultural University (RAU), Patna *Recent addition
LEAD CONSULTANT	Dr. M. Ristic, University of Illinois, Urbana

1. Principal Objectives

With a desire to provide sufficient protein to its large vegetarian population GOI introduced the germplasm of high yielding *Bos taurus* into indigenous breeds to increase their milk potential. This type of cattle and their crosses are highly susceptible to tick-transmitted haematropic diseases. The infection causes high morbidity manifested in low milk production, retarded growth and even death of valuable animals in case of acute infection. Besides cattle, these diseases are commonly found in sheep, goats, horses, etc.

Research activities of this project are therefore geared to the development of effective vaccines for prevention and control of three major tick transmissible profusion blood diseases of Indian livestock to improve cattle health and milk production and thus help India achieve WHITE REVOLUTION!!

2. Participating Institutes (U.S.)

1. Kansas State University, Manhattan
2. University of Illinois, Urbana
3. Colorado, State University, Fort Collins

3. Components

In order of their importance to the livestock industry of India, haemotropic diseases are theileriosis (caused by Theileria annulata) babesiosis (caused by Babesia bigemina and B. boyis) and anaplasmosis (caused by Anaplasma marginale). Research activities are directed to discover and develop suitable vaccines for these diseases by utilizing modern methodologies including recent advances in biotechnology.

Essential components of the program are:

(i) to adapt under Indian conditions the use of sheep adapted attenuated Anaplasma marginale vaccine.

(ii) to adopt the use of micro aeroplirlus stationary phase cultivation method for propagation of Babesia equipment for vaccine production.

(iii) to develop immunoprophylactic procedures against theileriosis by utilizing various cell culture immugens of Theileria.

(iv) to find out antigenic relationship and cross protection between different strains of the parasite.

(v) to field test promising candidate drugs for treatment and control of infection.

(vi) to conduct epidemiological studies.

(vii) to carry out training.

4. Implementation

Date issue of PIL Nov. 24, 1986, duration - 5 years

Date of Implementation - April 1, 1987

Sub-project Coordination

The overall implementation of the sub-project is coordinated by the Deputy Director General (Animal Sciences) of ICAR. A coordination committee to continuously monitor and evaluate the project is as follows:

1. Deputy Director General (AS) ICAR - Chairman
2. Director IVRI, Izatnagar - Member
3. Vice Chancellor HAU, Hissar - Member
4. Vice Chancellor PAU, Ludhiana - Member
5. Vice Chancellor TNAU, Coimbtore - Member
6. Scientist NDDB, Anad - Member
7. Project Coordinator ICAR - Member/Secretary

Sub-project Leader Dr. M.N. Malhotra
Senior Scientist, ICAR

Lead Consultant Dr. M. Ristic, Professor
College of Vet. Medicine,
University of Illinois
Urbana, Illinois, U.S.

5. Progress

- (a) Management Team. The management team consisting of Dr. M.N. Malhotra, (ICAR), Dr. N.N. Sharma (IVRI) and Dr. R.D. Sharma (HAU) was constituted to visit different laboratories in the U.S. with the objectives (a) to identify institutions in the U.S. which scientists from India could visit for advanced training (b) identify suitable equipment for import (c) to identify U.S. scientists who could be hired as consultants for a short period.

The team visited the U.S. and Kenya from February 18 to March 12, 1987. The visit of the team to different U.S. institutions included USDA, Beltsville, MD., Ohio State University, University of Illinois, Oklahoma State University and the University of Florida. The team also visited the International Laboratory for Research on Animal Diseases, Nairobi, Kenya. They made recommendations regarding the training, consultants and transfer of technology.

- (b) Coordination Committee Meetings. No record of the meetings of the Coordination Committee of the project is available. The team was informed that these meetings are held every six months under the chairmanship of the D.D.G. (Animal Science), but no records are kept and minutes are not circulated.

- (c) Appointment of Staff. The position with regard to the appointment of scientific staff is given below: -

<u>Center</u>	<u>Filled</u>	
	<u>Sanctioned</u>	<u>Position</u>
1. Coordinating Unit, Hissar	10	1
2. Central Laboratory, Hissar	9	2
3. Haryana Agricultural University	7	5
4. Punjab Agricultural University	3	2*
5. Tamil Nadu Agricultural University	7	0
6. Indian Vet. Research Institute	27	27
7. National Dairy Development Board	8	0

Source: Winrock Quarterly Report No. 5

*The information obtained at Ludhiana.

- (d) Buildings and Other Facilities. Building component of Rs. 1.9 million is provided for the Central Laboratory but it has not been utilized so far.
- (e) Procurement of Indigenously Manufactured Equipment. Up to December 1987, no equipment has been purchased locally.
- (f) Workshops. Two workshops of the project have been held. The first workshop was held in Delhi on January 14 - 15, 1987 and the second at Hissar on January 13-14, 1988. Dr. M. Ristic, the lead consultant from the University of Illinois, attended both workshops. Dr. Burrridge, from the University of Florida, Gainesville, attended the first workshop and Dr. Richard Dierks, Professor and Director, Center for Zoonosis Research, University of Illinois, the second.
- (g) Visit of Indian Scientist to U.S.. Dr. C. Natarajan, ADG (ICAR) visited the U.S. for three weeks in November and December, 1987 to study the research program in the areas of haemoprotozoan diseases. He visited research laboratories at the University of California, Davis; Ohio State University, Columbus; USDA National Animal Diseases Center, Ames, Iowa State University; University of Illinois; and Animal Parasitology Institute, Beltsville, Md. No other person has been sponsored nor does there seem to be any proposal.

- (h) U.S. Consultants. The lead consultant, Dr. M. Ristic, visited India two times to attend the annual review and planning workshops in January 1987 and January 1988, i.e., once before the PJI was issued. He was accompanied by Dr. M.J. Burrige of the University of Florida in 1987 and by Dr. Richard Dierks of the same university, in January 1988.

Dr. Renu B. Lal and Atlaf A. Lal confirm their interest in serving as consultants to assist with an in-country training program on propagation of monoclonal antibodies against parasitic and other antigens at the IVRI. The 14 week training program was expected to begin in January 1988, but it has been deferred to dates suitable to consultants - probably May 1988 or later. But in the implementation plan, provision for only one consultant has been made.

6. Import of Equipment. (Total provision - \$810,000) In quarterly report (6) of Winrock International the following statement is made: "A list of equipment for Haryana Agricultural University was developed by U.S. consultant Dr. M. Ristic following his participation in the workshop of January 1987, and the management team's visit to the U.S. The list provides information on specifications, price and source and photocopies of items from catalogues. The list was sent to ICAR in March 1987. ICAR is in the process of completing the request form." But the list that was received from ICAR for 3 institutes contained 44 different items and several hundred chemicals.

The latest situation is that Winrock received requests from six Indian institutes for a total of 100 pieces of equipment, including a long list of chemicals. Specifications are being prepared and DO(S) are likely to be issued by June 1988 with an estimated cost of \$152,000.

TABLE C-4-1

Financial Summary of Blood Protista Sub-projectA. U.S. AID Input
(\$000)

Component	LOP Target	Expenditure Through Dec. '87	Estimated Exp. 1988- 1989
1. U.S. Scientists to India	242	50.0	15
2. Indian Scientists to U.S.	488	18.5	146
3. Workshop, etc. in India	32	0	-
4. Equipment Import	<u>810</u>	<u>0</u>	<u>810</u>
TOTAL	<u>1572</u>	<u>68.5</u>	<u>971</u>

B. ICAR Input

(Rs.000)

Component	LOP Target	Expendable Through Dec. '87	1988- 1989
1. Buildings	1900	0	NA
2. Vehicles	351	0	
3. Staff salaries	3705	49.7	
4. Incountry travel	162	0.5	
5. Contingencies	1748	41.9	
6. Furniture, Furnishing	104	0	
7. Res. Equip.	<u>1985</u>	<u>0</u>	
TOTAL	<u>9993</u>	<u>92.1</u>	

7. Significant Achievements

The sub-project on blood protista became operative only one year back but work on tick borne diseases has been in progress for a number of years in different laboratories. This work was reviewed in the workshop held at Delhi on 14 and 15 January. Under the ICAR Professor of Eminence Project at Hissar, research on Theileriosis, Babesiosis and Anaplasmosis has been in progress for about 8 years. Tamil Nadu Agricultural University, Haryana Agricultural University, Hissar, NDDB Anand IVRI and Punjab Agricultural University are other centers where research on blood protista was in progress. IVRI, NDDB Anand and HAU have claimed successful development of an effective vaccine. It is therefore difficult to assess the impact of the project.

But the sub-project coordinator has listed the following:

1. Cell culture vaccine has been developed.
2. Promising results have been obtained by application of schizont vaccine under field conditions in different regions of the country.
3. One of the most significant achievements of the project during the last year is the development of Theileria Immunodiagnostic Test, at the PAU center by Dr. A.S. Grewal & his team. They achieved a major breakthrough in the development of an Elisa using Theileria Piroplasm antigen. The team developed an invitro system in which blood phase of Theilrosis (peroplasma) was utilized as a source of diagnostic and vaccinal material. The method is reported to be simple and effective.

Approximately 2000 serum samples from three different organized farms in the Punjab State for seroepidemiology were collected.

4. Dr. Ristic has suggested that polyvalent vaccine technology for use under Indian field conditions can be accomplished by the establishment of a joint research program. (A proposal to this effect has already been prepared by scientists from PAU for financing under FERRO. The total cost will be \$700,000 excluding the cost of liquid N plant at PAU. The liquid N plant has been recommended by the head consultant.)

8. Critiques and Recommendations

- (i) Of the 6 participating centers in the subproject 4 are in central institutes and only two in the state agricultural universities. The coordinating center and central laboratory has no building or facilities.

(ii) There has been an undue delay in the implementation of this project. It was on March 26, 1984 that ICAR submitted the proposal to USAID. It took nearly 9 months for the design team to start the work. The design report was sent to ICAR on January 31, 1985. After the subproject was prepared by ICAR the approval of the project for funding took one year more and was conveyed only in December, 1985. Its final clearance by Government of India (DEA) was in September 1986. The PIL could be issued only on November 24, 1986, i.e., after 2 years and eight months. Its implementation took another 4 months. So a period of more than 3 years elapsed between submission of the proposal and sanction of the project for implementation. Unfortunately this situation is not unique to this project.

(iii) The delay in the issue of the PIL affected the schedule of the visit of the management team to USA and put 40 scientists in 5 different universities and an international centre in serious difficulties to adjust their programme to meet the team.

(iv) The equipment list by the lead consultant was prepared in January 1987 and submitted to ICAR in March, 1987. Up to the time this report was written, there has not been much progress in getting the equipment. The earlier estimate was that the process will be completed by September 1987. The present expectation is that one or more DOs will be issued during April-June 1988 for procurement of equipment with an estimated value of \$152,000. The work plan for 1987-88 as given in the quarterly report for January-March 1987 estimated that the import of all equipment costing \$810,000 will be completed by March, 1988.

The director of one of the institutes informed the team on April 3, 1988 that he intended to modify the list sent earlier as he intended to utilize the funds for the import of an electron microscope needed by the institute. Such last minute changes are likely to affect the programme.

(v) Except for the ADG (A.H.) at the headquarters of ICAR, no scientist of the participating centres of the sub-project could visit the U.S. though it was planned to send 8 scientists, 6 to University of Illinois, 1 to Oklahoma University and 1 to Ohio State University (see quarterly report no. 5).

(vi) In addition to the lead consultant only two short term consultants could visit India during the time of annual workshops.

(vii) Of the total money provided by Government of India less than 1 percent has been utilized up to December 1987. The progress of \$ money is only a shade better, 4 percent.

(viii) Recently a new sub-project center at the Veterinary College Ranchi has been started. Its needs, relationship with other centres, source of funding, etc., were not available to the team.

(ix) Monitoring Full procedures for procurement of equipment were developed and circulated to all concerned. There seems to be very little communication between the participating centers and the Indian Council of Agricultural Research. The procedures for the purchase of imported equipment are not clear. They need to be clearly told about their responsibility regarding NMIC, duty exemption, installation, etc.

(x) The Coordination Committee should be expanded to include principal investigators at each of the centers.

(xi) The buildings of the project headquarters at Hissar are not likely to be ready during the life of project. Ludhiana has good facilities. The possibility of shifting the headquarters to Ludhiana should be explored.

ANNEX C-5

EMBRYO TRANSFER

FULL TITLE Embryo Transfer Technology and Bioengineering in Livestock Species and their Pathobiological Implications

BUDGET (USAID) (\$'000) 2,186

BUDGET (ICAR) (Rs.'000) 10,184

IMPLEMENTATION DATE January 9, 1987

PARTICIPATING INSTITUTIONS

1. Indian Veterinary Research Institute (IVRI), Izatnagar
2. National Dairy Research Institute (NDRI), Karnal
3. Central Institute for Research on Buffaloes (CIRB), Hissar
4. Haryana Agricultural University (HAU), Hissar
5. Central Institute for Research on Goats (CIRG), Makhdoom
6. G.B. Pant University of Agriculture and Technology (GBPUAT), Pantnagar
7. Andhra Pradesh Agricultural University (APAU), Tirupati

LEAD CONSULTANTS

To be determined

1. Objective

To meet the nutritional requirements of its largely vegetarian population qualitative and quantitative improvement of livestock herd and milk production is a very important need in India.

The major objective of the sub-project is to use embryo transfer technology as a mechanism for enhancing the genetic manipulation of specific useful traits in order to increase animal productivity with special emphasis on buffaloes and cows. Research activities are directed to the generation of a greater number of offspring from genetically superior males and females in a much shorter period and transferring viable technology for field application all over India.

2. Participating Institutions

USA

1. Colorado State University, Fort Collins
2. University of Georgia, Athens
3. Embryo Tech, Inc., Hughson, California
4. University of Wisconsin, Madison
5. Louisiana State University, Baton Rouge
6. Utah State University, Logan
7. USDA Laboratory, Clay Center

3. Components

Areas identified in the sub-project include:

- a) Superovulation and synchronization of donor and recipient animals.
- b) Collection of ova and embryos for implementation of basic research for in-vitro fertilization, embryo culture, cryopreservation, sexing, cloning, engineering, embryo environment interaction and embryo, uterine secretory interactions.
- c) Transfer of viable technology for field application.

Essential components of the program are:

1. Studies on superovulation and synchronization of donor animals with emphasis on dairy animals in different regions of the country.
2. Superovulatory responses and endocrine profile in animals subjected to different synchronization treatments for assessing individual breed responses and optimization of synchronization of drug schedule.
3. Studies on embryo collection techniques and culturing of embryos.
4. Cryopreservation of Embryos.
5. Factors affecting ova production and evaluation of ova/embryos.
6. Development of methodologies for sexing and cloning of embryos.
7. Development of methodologies for genetic engineering aspects of embryo transfer through utilization of embryos from large and small animals.

4. Sub-project Implementation

The PIL for the project was issued on January 9, 1987.

The overall implementation of the sub-project is coordinated by Deputy Director General (Animal Science) of ICAR. A coordination committee to continuously monitor and evaluate the project is as follows:

1. Deputy Director General (AS), ICAR, Chairman
2. Vice Chancellors GBPUAT, HAU and APAU or their representatives
3. Directors IVRI, NDRI, CIRB, CIRG or their representatives.
4. Senior Scientist Animal Nutrition Member Secretary/
Sub-Project Leader: Dr. Kiran Singh, ADG Animal Science
Lead Consultant to be determined.

5 . PROGRESS OF THE PROJECT

A. Management Team

Winrock developed detailed plans and schedules for the visit of the management team to begin in early April. However, in late March it was decided to postpone the visit till late April.

The management team visited the U.S. from April 24 to May 1987. It consisted of Dr. Kiran Singh (ADG) Dr. N.K. Bhattacharya, Director Central Institute for Research on Goats, and Dr. Amrish Kumar, Pant Nagar University. Their visit took them to leading research institutions and to several private sector firms engaged in commercial embryo transfer. Their visit to USDA Animal Disease Isolation facility at Plum Island gave them an opportunity to discuss details of a planned collaborative research program to use embryo transfer to avoid transmission of serious diseases in international exchange of animal germ plasm. On return the team did considerable work in developing specifications for the equipment that is yet to be imported.

B. Workshops and Coordination - Committee Meeting

The subproject was approved on December 18, 1986 by the DEA and the PIL issued on January 9, 1987. A planning workshop was held on March 17 - 18 at Tirupati (AP). Two U.S. consultants, Dr. R.P. Elsdon and A. K. Karihaloo, participated in

the workshop. The workshop participants discussed the relevant topics and developed detailed plans for research in this area. The consultants helped identify the U.S. laboratories that the management team should visit.

C. Coordination Committee. The coordination Committee meeting was held on October 12, 1987.

D. Staff. All the staff of the subproject at different centers is reported to be in position.

E. Training. In the subproject document a provision to train 49 persons with a total duration of 409 person weeks has been made. Of this number, 15 persons (263 person weeks) were to be utilized in the first year itself. So far, apart from the management team (3 person, 15 weeks) only 3 persons have visited the U.S. from September 25, 1987 to October 31, 1987. Dr. M.L. Madan and Dr. G.C. Jain were from NDRI and one, Dr. I.V. Mogha from IVRI. Dr. G.C. Jain is now working at CIRB, Hissar.

One scientist was to go from each of the other participating institutes. The person from IVRI was to go for training in cloning, and the others were identified to go in non-surgical embryo collection and Transfer to Colorado State University, Fort Collins and Washington State University, Pullman, Washington. But all the participants went to the laboratory of Dr. Karihaloo in California.

F. Consultants

In the subproject document a total provision of 15 consultants for 45 person months had been made. No consultant was expected in the first year of the project.

Two consultants, R.P. Elsdon (Colorado) and Dr. A.K. Karilialoo (California), came to India from March 10 - 31, 1987. They participated in the workshop at Tirupati (AP) and visited a number of other institutes.

G. Equipment

So far, no equipment has been received. All the participating institutes have sent their requests along with complete lists of needed equipment. These are being processed. Procurement of equipment is expected to begin in April - June, 1988.

TABLE C-I
Financial Summary

The financial summary for the subproject for the period ending December 1987, plans FOR January - March 1988, AND also the projection for 1988-89 are given below.

A. USAID input (\$ 000)

<u>Component</u>	<u>LOP Target</u>	<u>Cumulative Total Through Dec. 1987</u>	<u>Plans Jan-March 1988</u>	<u>Plans 1988-89</u>
1. U.S. Scientists to India	675	50 (7.4)	0	60
2. Indian Scientists to U.S.	841	53 (6.3)	0	(8.9) 211
3. Workshop etc. in India	32	0	0	(25.1) -
4. Equipment (imported)	638	0	0	638
TOTAL	2186	103 (4.7)		(100.0) 909

Figures in parentheses denote percent of total.

B. ICAR input (Rs. 000)

<u>Component</u>	<u>LOP Target</u>	<u>Cumulative Total Through Dec. 1987</u>	<u>Plans 1988-89</u>
1. Staff Salaries	5,310	744	NA
2. Research Equipment	523	150	NA
3. Operational Res.	2,869	420	NA
4. Contingencies	503.5	278.3	NA
5. In Country Travel	219	21.2	NA
6. Workshop etc.	247	40	NA
7. Maintenance - office equip vehicles	513	48	NA
TOTAL	10,184.5	1701.5	

In the first year, the pace of expenditure has been slow, particularly USAID input. The expenditure has been only 4 to 7 percent. The components are import of equipment, training and consultants which take time to finalize. Next year expenditure is expected to be about 42 percent.

6. Salient Findings

Even though the project is only one year old, work has been initiated in all centers except the Central Institute of Buffalo Research.

At IVRI an international course on embryo transfer technology for a period of one month starting from November 6, 1987 was conducted. At the same institute, work on purification of hormone and studying the impact of superovulation inducing hormone on the ovarian function is in progress. Out of 24 animals that were given superovulation treatment, 19 responded, 59 embryos were recovered in various stages, 22 were transferred to recipient animals (cattle). The number of pregnancies is reported to be eight. A donor herd of 50 animals has been established consisting of half and three-fourths cross with two exotic breeds (Jersey and Holstein) and one local (Haryana).

At the Central Institute for Research on Goats, work on synchronizative superovulation, embryo collection and transfer, and embryo culture micro-manipulation is in progress with goats.

NDRI The technology of superovulation, synchronizative and embryo transfer in cattle has been standardized. A training course has been conducted.

Pant Nagar Center There has been wide variation in superovulatory response between different animals. The studies on non-surgical collection of embryo are in progress as catheters and hormones have been recently procured.

A.P.A.U. Tirupati Successful embryo transfer techniques have been demonstrated in cross-breed cattle.

HAU, Hissar Methods of oestrus synchronization have been attempted in buffaloes.

Non Project Institutes

Punjab Agricultural University though not a part of the subproject, it is ahead of other centers except Anand in embryo transfer technology in buffalo. Their staff members have received their training in Karihaloos' lab but they have been working for some years on embryo transfer technology in collaboration with Bulgarian scientists. Embryos were transferred in 15 recipients including 8 in the Punjab Agricultural University. Pregnancy tests conducted on April 15 showed that two were pregnant.

7. Critique

1. The choice of center leaves much to be desired. Out of the seven centers, five are in northern India, and three in one small state, Haryana. All the four central institutes working on cattle, buffalo and goat have got a center, though one of these institutes is yet to have necessary facilities.

2. Some of the centers like NDRI, IVRI have sizeable support from other projects like the Biotechnology Project of the Department of Biotechnology; and the UNDP Project of Advanced Centers. Within ICAR, there seems to be little coordination between subject matter divisions handling ARP project and the Education Division handling UNDP Project for Advanced Centers. When two projects having similar objectives are in operation at the same station simultaneously it becomes difficult to monitor the contribution of any one of the projects.
3. There is much less stress on basic work with the result that most of the centers are following more or less the same technique. Some of this duplication could be avoided.

8. Recommendations

Punjab Agricultural University which has good facilities should be given a center for work on buffaloes.

ANNEX C-6

BIO-DEGRADABLE WASTE

FULL TITLE	Conversion of Biodegradable Animal Waste for Livestock Feed
BUDGET (USAID)	\$1,339,000
BUDGET (ICAR)	\$13,710,184 (Rupee Equivalent)
IMPLEMENTATION DATE	April 1, 1987
PARTICIPATING INSTITUTIONS	<ol style="list-style-type: none">1. Punjab Agricultural University (PAU), Ludhiana2. National Dairy Research Institute (NDRI), Karnal3. Haryana Agricultural University (HAU), Hissar4. Kerala Agricultural University (KAU), Trichur5. Bombay Veterinary College (BVC), Bombay
LEAD CONSULTANT:	Dr. J.P. Fontenot, Virginia Polytechnic Institute and State University, Blacksburg

Objectives

The basic objective of the subproject is to increase the quantity and quality of feeds from nonconventional resources to meet the nutritional requirements of Indian livestock. Research activities are directed to the development of simple microbial techniques, processing and equipment to convert waste materials into economic feeds for providing improved and nutritive rations to animals. The subproject also envisages the dissemination of proven technologies to the villages, and small industries in rural areas.

Specific Program

Research activities are directed to investigate the biodegradation and utilization of wastes from slaughterhouses, large animals, aquatic animal industries and poultry into quality animal feeds after relevant toxicological studies on animal feeds obtained from biodegradation of waste products. Essential components of the program are:

1. Identification and screening of microbial strains of bacteria, fungi, yeasts and algae capable of rapidly degrading

the animal wastes into Single Cell Protein (SCP) or into useful animal feeds.

2. Evaluation of toxicological and nutritive value of animal wastes and resultant products as animal feeds.

3. Determining economics and means of including these new feeds into practical livestock rations.

4. Transferring the proven and viable technologies to small industries in rural areas, farmers, livestock owners and landless laborers.

Participating Institutions (USA)

1. Purdue University, Lafayette
2. University of Illinois, Urbana
3. Auburn University, Auburn
4. Virginia Polytechnic Institute and State University, Blacksburg

Implementation

Subproject Coordination

Overall implementation of the subproject is coordinated by the Deputy Director General (Animal Science) of ICAR: Coordination Committee of the following six members will monitor and evaluate the project.

1. Deputy Director General (AS), ICAR - Chairmen
2. Director, NDRI, Karnal - Member
3. Vice Chancellor KAU, Trichur - Member
4. Vice Chancellor HAU, Hissar - Member
5. Vice Chancellor MPKV, Akola - Member
6. Senior Scientist, All India Coordinated Project - Member
Secretary on Animal Feeds

Sub-Project Leader Dr. Kiran Singh, Assistant Director General
(Acting), Animal Science, ICAR,
Krishi Bhawan, New Delhi - 110 001

Design

The Indo-US Subcommittee of Agriculture in its second meeting in 1984 listed conversion of biodegradable farm and animal wastes for livestock feed on its priority list. In 1985 ICAR proposed that a subproject on the animal waste component be designed. It was anticipated that such a project would be coordinated with the "All India Coordinated Research Project (AICRP) on Utilization of Agricultural By-products and Industrial Waste Materials for Evolving Economic Livestock Rations". The

AICRP has been in existence since 1967. In June 1985, Dr. A.D. Tillman, retired Oklahoma State University animal nutritionist, came to India to help with the project design. Initially, he visited all of the institutes proposed. Then, in consultation with AICRP, the design proposal was completed in August, 1985.

The preparation of the design proposal followed detailed study of available wastes, and existing programs, with the intention of finding new avenues of research. The following divisions of effort were identified:

- I. ICAR Coordinating Unit
- II. Toxicological studies on animal feeds obtained from biodegradation of wastes (NDRI) Karnal
- III. Biodegradation of wastes from slaughter house into animal feeds (BVC) Bombay
- IV. Biodegradation of wastes from large animals into animal feeds (HAU) Hissar
- V. Biodegradation of wastes from aquatic animal industries into animal feeds (ICAU) Trichur
- VI. Biodegradation of wastes from poultry into animal feeds, (PAU) Ludhiana

The budget provides for (in 5 year project):

1. Travel for observation, study tours, international conferences and workshops.
2. Training in the U.S. of 14 scientists for 6 months each.
3. Equipment in the amount of \$483,600 USAID and 1, 237,000 Rs. GOI.
4. Ten consultants for a total of 40 weeks.

Actions To Date

After implementation of the project in January 1987, Drs. Tillman and Fontenot came to India for 3 weeks to visit the participating institutions, assist in planning for a management team visit to the U.S., and suggest a design for a workshop. They also participated in the coordinated project workshop, February 22-24 and assisted in preparing training proposals.

Following this, a Management Team composed of 1) Dr. K. Pradhan, Professor of Animal Nutrition (HAU) 2) Dr. M.L. Punj, Project Coordinator, AICRP, (NDRI), and 3) C.L. Arora, ABC, ICAR

went to the U.S. during the period April 7 -28, 1987. Their itinerary included visits to 14 USDA, University, and private laboratories in which animal nutrition research is being done. They also met with Drs. Tillman, Fontenot, and Williams (WW) to discuss their tour findings, training implications, and to develop equipment specifications. Elements from their report were included in the work plan of the project design.

At the time of the midterm review, no training has been done, and equipment to be purchased on USAID funds is being prepared for bid. Nominations are being processed for the first trainees to the U.S.

Dr. Joseph Fontenot has been selected by ICAR as a continuing consultant for this project.

The team visited NDRI and HAU to discuss the research progress. NDRI has reserved ample space for a toxicology laboratory which awaits both a scientist and equipment. At HAU, some encouraging preliminary research is underway on farm animal wastes. Sources and estimated annual yield of cattle, buffalo, pig, sheep, goat, chicken and duck wastes have been compiled, and the chemical composition of cattle and buffalo wastes has been analyzed. Additionally, microbiological and parasite analysis has been done on the cattle and buffalo wastes. No research has yet started at CIRB, Hissar.

A report from Kerala AU (Trip Report 12/1/87) indicates that the 7 staff posts are filled. Five staff members to be trained have been nominated. No equipment has been received, since equipment specifications are not complete. The Department of Microbiology has initiated research on microbial agents which are capable of converting fish wastes to animal protein. The Department of Nutrition has started analysis of prawn, frog meal, and snail wastes. Preliminary results indicate that all three have high protein content (32-66%), and initial feeding is underway for use as poultry or swine rations.

The BVC, Bombay subproject has been held up because state approval has not yet been granted.

At PAU (Ludhiana) the two AICRF scientists have been transferred to full time on the USAID project. In addition, four other PAU scientists are collaborating in technology transfer, evolving economic poultry rations, pure culture technology, and isolation and culture of pathogenic organisms. Eight of nine non-professional positions are filled. The GOI inputs are being expended primarily for the positions on the project, and for recurring contingencies such as feed, fodder, supplies, and equipment purchased in India.

Major current research components at PAU involve processing of poultry waste by fermentation and deep stacking, use of pure cultures for fermentation of poultry waste, and evaluation of biomass as feed for poultry and swine. There will be difficulty evaluating the baseline for USAID sponsored research, since research on poultry litter has been done at PAU since 1982.

Researchers at PAU pointed out that the equipment list for use of \$50,600 has been prioritized and also modified from the original project list. None has been obtained from the USAID fund, but some has been supplied by ICAR funds.

During the first year of operation, 3.7% of the USAID budget was committed, and 13.4% of the sanctioned GOI budget. All of the USAID budget expenditures were for consultants to India. Most of the GOI expenditures were for salaries. Ten percent of the GOI research equipment budget of Rs.523,000 was expended. If the projections of expenditure of \$854,000 (primarily training and equipment) are met, by April 1989 the sub-project will have expended 64% of its USAID budget.

Critique

The project design has been exemplary. It was jointly prepared by the AICRP committee and Dr. Tillman. It has assigned clearly different research topics, without duplication, to different institutions, in locations where adequate supplies of the particular wastes exist.

The record does not show the reason for the delay from August, 1985 until December 1986, when ICAR transmitted it to USAID for approval. It was approved by ICAR in June 1986, transmitted to DEA, and approved by DEA in December 1986.

The report of the Management Team is also very detailed. It is one of the best of the subprojects in this regard. The report lists U.S. institutions at which the specified training of the subproject can be done, as well as recommended length of training, and U.S. institutional contacts. It also gives considerable detail on specifications of equipment which were worked out with the U.S. consultants during the Management Team visit.

Dr. Cummings and Barton visited the lead consultant, Dr. Fontenot, at VPI. His interest and enthusiasm for the Indian subproject is inspiring. He has a keen desire to see it progress to the point where technology transfer, as well as collaborative research can occur. ICAR has made an excellent selection of their lead consultant.

There are 11 of 59 positions for the project that have not yet been filled by GOI. This includes 3 of 13 scientist

positions. At a time that both training and equipment purchase are being accelerated, this can have adverse effects on attaining the project goals. The toxicology laboratory at NDRI will not be able to function without the Toxicologist, who has not yet been appointed or trained.

Also of concern is the slowness in getting approval from the state for the participation of BVC, Bombay. There is \$116,000 of equipment and four scientist trainees scheduled for this location.

A consequence of the delay from 1985 to 1988 in proceeding on equipment purchase is that the equipment which can be purchased within the estimated budget must be cut back. The units have been asked to prioritize.

We suggest that:

1. If a delay occurs between project design and consideration for implementation, an inflation factor should be applied to the equipment budget, and reconsideration given to equipment priorities.

2. Unfilled positions should be filled as soon as possible or the training schedule will not be met.

3. A means should be found to determine whether BVC, Bombay will participate in the project.

Therefore, ICAR requested on April 9, 1986 that a two year subproject on training be approved under the training purpose of ARP, with an original target of 50 ASU trainees.

Objectives

To develop agroforestry in India, GOI decided to develop forestry curricula and departments in selected State Agricultural Universities following three objectives:

1. To provide individual faculty members/officials of State Agricultural Universities of India an introduction to the integration and management of forestry education, research, and technology transfer.
2. To develop and strengthen the individuals' academic and technical capabilities to facilitate their performance as forest educators and scientists.
3. To maintain long term professional development of the individuals.

Specific Program

In consultation with ICAR, USAID identified US institutions having strong forestry curricula and departments for the training of over fifty faculty members/officials of State Agricultural Universities. Detailed training scopes developed jointly by ICAR and USAID both for silviculture and forest genetics are:

1. Management and Functioning of Forestry Departments in Agricultural Universities: Individuals will be assigned to a specific US college/department administrator and will be integrated into the department faculty. They will participate in the deliberations of various administrative and academic committees of the department and will be associated with planning and administration of forestry academic, research and extension programs within and outside the department and university.
2. Strengthening Individual Academic and Technical Capabilities: Individuals will be assigned to the department faculty member for technical training in silviculture/tree genetics. They will take selected course work, participate in seminars, assist the department teaching faculty in course work, laboratory instruction and field instruction program of undergraduate students, graduate field tours and ongoing research activities of faculty colleagues.
3. Strengthening Long Term Professional Development: Active participation of individuals under training in a workshop/conference to be organized at the mid-point of training

period in USA followed by annual meetings in India of the Indian Forestry Faculty in addition to membership in professional societies.

Participating Institutions (USA)

State Universities of Ohio (Columbus), Utah (Logan), Michigan (East Lansing), Mississippi (Mississippi), North Carolina (Raleigh) and Oregon (Corvallis)

Universities of Minnesota (St. Paul), Florida (Gainesville), Idaho (Moscow), California (Berkeley), Texas (College Station), Auburn (Alabama) and Virginia Polytechnic Institute (Blacksburg)

Implementation

The overall implementation of the subproject will be coordinated by the Deputy Director General (Education) of ICAR, New Delhi

Sub-Project Leader Dr. Maharaj Singh, Deputy Director General, (Edu.), ICAR Bhawan, Pusa, New Delhi- 110 012

The design proposal was prepared by Dr. Charles Hatch, who was on the staff of USAID in 1985-86, and who is a professor of Forestry at the University of Idaho. He received some assistance from Dr. JoEllen Force, also from the University of Idaho, who was in India on another USAID assignment, as well as from Indian Counterparts.

The subproject has specific actions to be done under each objective. Each trainee is to be a member of the forestry department faculty in the U.S., take at least 7 units credit course work, conduct some research, attend national forestry association meetings, and visit field sites. The design also provides for a midterm meeting in the U.S. for trainees to share expenses and make a critique of progress.

The duration of the approved sub-project is two years.

Actions to Date

Immediately following approval of the subproject, in April 1986, ICAR requested nominations from the State Agricultural Universities for the 1986-87 training. These were processed, and in September, 1986, 18 Indian Faculty members were sent to the United States. In the interim, Winrock had contacted the National Association of Forestry Schools and Colleges, solicited from its membership, and selected and negotiated with 9 colleges to each take 2 trainees on contract. A coordinator was designated from each college faculty.

The 18 Indian trainees were given a two week orientation in Washington, D.C. before going to their assigned colleges. The trainees met at Winrock Headquarters in Arkansas in January 1987 for the midterm workshop. All have completed their training and returned to the Forestry Departments in their respective universities in India.

In the spring of 1987, nominations were again solicited. The first group of 17 trainees in this group went to the U.S. on August 1. They spent 3 weeks at the University of Florida before going to their respective colleges. In Florida they received a short course introducing them to computers, as well as an orientation on forestry departments and research methodology in U.S. universities. In September, 1987 another 13 trainees were sent to the U.S., but because classes were ready to start, they did not have an orientation session. All 30 of the 1987-88 trainees met at the University of California, Berkley on March 3-5, 1988 for the midterm workshop. They will return to their respective universities next summer. Exhibit C-7-I lists the Indian trainees, home institution, date of departure, and U.S. training institution. Table 1 indicates the number of faculty members by Indian University who will have completed the one year U.S. Forestry Education by August 1988.

EXHIBIT C-7-I

Indian Faculty Forestry Training 1986-88

NAME	INDIAN INSTITUTE	DEPART/PERIOD	US INSTITUTE
P.B. Kale	PKVK, Akola	Aug, 1986	Univ. Idaho
O.A.A Pillai	Tamil Nadu AU	(1 Year)	"
A.M. Mukewar	PKVK, Akola	"	Mississippi S.Univ
C.S.P. Patil	Univ Ag Sci, Dharwad	"	"
H.M. Khajoria	Punjab AU	"	N.Carolina S.Univ
R. Jambulingam	Tamil Nadu AU	"	"
S.S. Gill	Punjab AU	"	Univ. Florida
A.M. Chandrasekaria	Univ Ag Sci, Dharwad	"	"
K.N. Chavan	KonKan AU	Aug, 1987	Mississippi S.Univ
S.T. Khajjidoni	Univ Ag Sci, Dharwad	(1 Year)	"
U.S. Sharma	JNKCC, Jabalpur	"	"
K. Sudhakara	Kerala AU	"	"
S.K. Malik	GB Pant AUT	"	Texas A&M Univ.
P.K. Mishra	JNKVV, Jabalpur	"	"
R.S. Vinaya Rai	Tamil Nadu AU	"	Virginia PI&SU
N.K. Vijayakumar	Kerala AU	"	"
P. Chandra Deka	Assam AU	"	Univ California(B)
D.K. Khurana	Y.S. Parmar UHF	"	"
L.C. Babu	Kerala AU	"	"
M.N. Borgohain	Assam AU	"	"
H.S. Khara	Punjab AU	"	"
R. Subbiah	Tamil Nadu AU	"	"
S.D. Upadhyay	JNKVV, Jabalpur	"	"

R.K. Nayital	Y.S. Parmar UHT	"	Univ. Idaho
S.S. Sagwal	Sher-e-Kashmir UAT	"	"
R. Kumar	Haryana AU	Sept. 1987	Auburn Univ.
S.T. Naik	Univ Ag Sci, Darwad	(1 year)	"
V.M.N. Srinivasan	Haryana AU		"
K.S. Bangarwa	Univ Ag Sci, Dharwad		Michigan S. Univ
K.S. Bhatia	Tamil Nadu AU		"
R.S. Dhanda	Haryana AU		"
M.P. Diwakar	C.S.Azad UAT		"
M. Saleem	Punjab AU		"
N.K. Verma	Konkan AU		"
S.L. Madiwalar	Univ Ag Sci, Dharwad		Oregon S. Univ.
P.R. Rajput	G.B.Pant UAT		"
R. Ramsingh	Haryana AU		"
S.K. Singh	Birsa AU		"

EXHIBIT C-7-II

FORESTRY TRAINING 1986-88

<u>Institution</u>	<u>Number Trained</u>
1. Assam A.U. (Gauhati)	2
2. Birsa A.U. (Bihar)	3
3. Chandra Shekar Acad U.A.T. (Kangur)	1
4. G.B. Pant U.A.T. (Pantnagar)	4
5. Haryana A.U. (Hissar)	3
6. Madya Pradesh A.U. (Jabalpur)	3
7. Kerala A.U. (Trichur)	4
8. Maharashtra A.U. (Akola)	4
9. Punjab A.U. (Ludhiana)	4
10. Maharashtra A.U. (Dhapoli)	2
11. Kashmir A.U. (Srinagar)	4
12. Tamil Nadu A.U. (Coimbatore)	5
13. Karnataka A.U. (Dharwad)	5
14. Himachal Pradesh A.U. (Solan)	4
	<u>48</u>

Forestry Education Project Design

In addition to the forestry education described above, the subproject has been used as a funding base for a series of consultant visits, workshops, and design teams with an objective of preparing a comprehensive design proposal for a joint Indo-U.S. project on "SAU Forestry Education Development: Collaboration, Strengthening & Excellence".

The first consultant Dr. Skck, a Forestry Research Administration Specialist, came to review and discuss goals and objectives of the SAU Forestry Education program in December 1986. He also addressed issues relating to collaborative programs, and developed initial concepts for a design agenda for a more comprehensive project.

A forestry workshop of the 18 1986-87 Trainees at Morrilton, Arkansas in January 1987, was also used as a resource for inputs from trainees on aspects of the design. Three Indian foresters, (M. Singh/Hans/Khosla) came to the U.S. to participate in this workshop, as well as to visit U.S. forestry institutions. Subjects discussed at the workshop included:

- Recommendations to the project design team
- Faculty development needs and opportunities
- Development of SAU undergraduate programs in forestry
- Research and graduate education development
- Cooperation within India
- International cooperation
- Linkages with Agroforestry

Dr. Maharaj Singh also participated in the India design of the project, after attending the Arkansas workshop.

During the period March 2 - April 10, 1987, a joint US/GOI design team worked in India on a project proposal. These included:

John C. Gordon, Dean, Yale University
Maharaj Singh, Deputy Director General (Educ), ICAR
Arnett Mace, Jr., Director University of Florida
Charles Hatch, Forestry Advisor, USAID
Dean Gjerstad, Associate Professor, Auburn University

In addition, Robert L. Youngs, Forest Products Specialist, was brought in for advice on upgrading research capacities at various forestry research centers and institutes.

The product of the above design activities has been a report "Project Design SAU Forestry Education Development: Collaboration, Strengthening, Excellence." It addresses the rapid production of faculty, information, and facilities to:

1. Develop 25 SAU forestry departments, 17 granting a B.Sc. forestry or a B.Sc. Agriculture with an elective in forestry, by the end of 1995, each capable of graduating 20 students per year.
2. By the same time, develop 12 departments granting an M.Sc. in forestry and six granting a PhD. in forestry to produce future SAU faculty and ICAR and FRI researchers.

The project proposal includes as Phase I the training of 51 (now 48) Indian SAU faculty in the current subproject. However, the total project provides for 208 faculty with overseas experience of 12-18 months during the period 1988-95.

The proposed Forestry Education Project cost is \$34.8 million U.S., with \$20.4 million proposed for USAID, and \$14.4 million for GOI support. The proposal is currently under review in ICAR.

While the original subproject was approved in April 1986 to train 50 SAU faculty in two years, the call has gone out for nominees for the 1988-89 U.S. college training.

The original approved budget for the Forestry Training subproject was \$2.7 million, of which \$1.0 million was designated for the initial forestry training (Phase I) and \$1.7 million reserved for the next phase after more formal planning has occurred. However, the budget for the period thru December 1987 reflects an expenditure of \$2.22 million, leaving a balance of \$480,000, unless budgetary adjustment occurs. The estimated

expenditure for the period through March 1989, if attained, would require \$2.82 million.

Critique:

The Forestry Education and Training subproject has met an urgent need of the Indian government for accelerated training of current faculty to expand the capacity of 14 State Agricultural Universities in forestry education. It is commendable that in 1986, USAID gave approval for subproject implementation within three weeks of receiving the proposal from ICAR. Within four months, 18 candidates had been nominated by the SAUs, cleared by ICAR and DEA, and had received from Winrock, the essential documents and tickets for travel to the U.S. Concurrently, Winrock had identified U.S. institutions, negotiated contracts, and prepared an orientation workshop. The same process occurred with 30 trainees in the 1987-88 college year. By August 1988, 48 SAU faculty will have returned to their home universities, having fulfilled the foreign training objectives of the subproject. Dr. Maharajah Singh, the Indian subproject leader, expressed satisfaction with the results thus far.

Drs. Cummings and Barton met at the University of Idaho with Drs. Charles Hatch and JoEllen Force, both of whom participated in writing the subproject. There also, they talked to Mr. R.K. Nayital and Mr. Sewa Singh Sagwal, both of whom are Forest Nursery trainees. At Virginia Polytechnic Institute, they met with International Agriculture Associate Dean, Howard Massey, Jr. and Dr. R.E. Adams, Head of the Department of Forestry, as well as Mr. S.V. Rai and N.K. Vijaya Kumar, both of whom are Forest Genetics trainees.

The following comments or constructive suggestions come from the U.S. university faculties:

1. The orientation on arrival in the U.S. is very important. More emphasis should be given to preparing the Indian faculty for the social and economic environment they are entering.

2. The Winrock role has been generally helpful. A problem the first year of keeping funds for off-campus travel in the Washington office, was modified the second year, giving each institution the funds for off campus travel of its trainees. This has cut red tape. Budget modifications, if needed, are handled with dispatch.

3. Indian faculty performance as faculty members, as students, and in research has been good.

4. The U.S. university faculties would appreciate having feedback from India on the success or lack of success of the

training experience. A few Indian faculty have written back. A more formal report after return might lead to constructive improvement.

5. Those who attended the mid-term workshop were enthusiastic about it.

From the Indian Faculty Trainees, the following comments or suggestions were made:

1. A general satisfaction with the faculty status in the U.S., the courses taken, and the research experience.

2. Concern about the shortness of the training, so much more to learn and limitations on travel.

3. Appreciation for the opportunity to attend the American Association of Forestry meeting.

4. The shortness of time between notification and the time to leave India has caused distress. (This has also come out in meetings in India.)

5. The faculty appreciate the mid-term opportunity to get together to share experiences and to critique.

6. They would like to see more India forestry experience among U.S. professors.

7. It would have been helpful to have been transferred to their own forestry faculty before going.

8. They find it hard to visualize collaborative research as a consequence of this project.

Recommendations

1. SAU faculty should be identified for this program at least 6 months in advance of the U.S. departure.

2. They should be transferred to the Department of Forestry of their own university and given an orientation on Indian forestry before the U.S. training.

3. Notification of the date of departure and location of U.S. institution should be given at least 2 weeks ahead.

4. It would be better to change to a July-July year in the U.S. This would permit a 2 month group orientation experience at a U.S. university preparatory to the social, economic, and academic environment which they will be in for the ensuing year.

They would be better adjusted when entering classes at their assigned institutions in September.

5. All U.S. forestry courses should be taken for credit. This will establish a stronger attitude of discipline in the academic work, and will assure more rigorous attention to the short term conversion to forestry.

6. Provision might be made for special cases where an additional semester would give greater qualification for the SAU forestry teaching.

7. Since very few U.S. forestry faculty have much knowledge of the Indian agroforestry, or social, and economic situations, some provision should be made for U.S. forestry faculty to come to India for short term forestry consultancies or visiting professorships. This would give greater orientation to their teaching programs on applications of forestry principles in the Indian environment. It could also lead to collaborative research.

8. Attention must be given to the longer term consequences of the intensive short term forestry training. This may be adequate for college teaching of introductory forestry, but can lead to mediocrity nationwide. Immediate attention must be given to development of several SAU's with faculties that have strong agroforestry background for training to advanced degrees. This will give India the capacity to do follow-up training for those who have had the short-term U.S. experience as well as to develop undergraduate through graduate programs. It will also enhance research capacity.

9. Opportunities should also be found for All-India workshops and conferences on agroforestry. These would offer excellent springboards for U.S. forestry faculty involvement.

The above recommendations go beyond the scope of the current subproject under review. Technically, it is at the point of reconsideration. A means must be found to continue the high priority faculty training program, which dictates a need for reallocation in the current ARP budget. If a new project is jointly approved by ICAR and USAID, it will undoubtedly take over the training functions now in this subproject. In the interim, many of the above recommendations can be considered for incorporation in the present subproject.

With the national priority on agroforestry, a separate forestry education project which builds stronger infrastructure in forestry departments in Indian universities, and greater opportunity for international collaboration should be a joint Indo-U.S. priority.

ANNEX C-8

PLANT GENETICS RESOURCES

FULL TITLE	Plant Genetics Resources
BUDGET (USAID)	\$200,000
BUDGET (ICAR)	(Rs.'000) None
IMPLEMENTATION DATE	(Informally) September, 1986
PARTICIPATING INSTITUTIONS	National Bureau of Plant Genetic Resources, New Delhi
LEAD CONSULTANTS	To be determined

Objectives

The pre-project will contribute to the strengthening of the national crop germplasm conservation and management program by providing support to design a project to accomplish:

- expanded and more effective collection of plant genetic resources;
- more effective exchange of plant genetic resources;
- improved quarantine facilities for exchange of healthy plant materials;
- expanded evaluation and characterization of available germplasm;
- utilization of computer-based programs for data processing, storage and retrieval;
- training programs to improve the competence of staff responsible for crop germplasm, preservation and exchange.

Specific Program

It is proposed that selected U.S. consultants with expertise and background in management and operations of a national germplasm system will assist in the design of a project to accomplish the above objectives. The subproject may also support management team travel to the U.S., special training, and associated expense.

Participating Institutions (USA)

ARS, USDA National Plant Germplasm Laboratories (others to be identified)

Implementation

In September 1986 three U.S. consultants (Skrdla/Roos/Kahn) came to India for two months for the purpose of preparing a subproject design. Working jointly with the NBPGR staff, they prepared a comprehensive proposal. After considerable review, this proposal was considered to be too broad and to need refinement, since it was apparent that the program would be too large to be a subproject under ARP. A project design would be needed.

In May 1987, three more U.S. consultants (Pino/Jones/Mau) were in India for six weeks. They prepared a comprehensive project proposal titled "Project Paper, India, Plant Genetic Resources (PGR) Project (386-0513) January 1988."

In February 1988, two more U.S. consultants came to India. Dr. Phillip Stanwood reviewed the needs of the NBPGR for expansion of its cryopreservation (ultra low temperature) storage as a part of the above proposal. His report is entitled "Cryopreservation of Plant Germplasm at the National Bureau of Plant Genetic Resources, New Delhi, India, Review, Plans and Recommendations, March 11, 1988."

The other consultant, Dr. Jimmie Mowder, reviewed the present and needed facilities, staffing, and procedures for establishing a computerized data bank. His report is entitled "Automation Needs for the National Bureau of Plant Genetic Resources, New Delhi, India. Review, Plans and Recommendations, March 1988."

Actions to Date

The above three reports are under review by USAID. The project would do the following:

Primary Purpose

To assist India's efforts to develop fully the physical, administrative, technical and financial resources of NBPGR so that it and institutions it supports can manage professionally a national plant germplasm system which can fully sustain all aspects of exploration, collection, preservation, and exchange (nationally and internationally, public and private) of plant germplasm.

Anticipated Accomplishments will include:

- a. A comprehensive inventory of all of the 121 working germplasm collections located throughout India will be completed.
- b. Considerable progress will have been made in upgrading the quality of these collections.
 1. At least 100,000 accessions will have been upgraded at non-NBPGR working collection sites, with surplus of these collections sent to the base collection in New Delhi.
 2. At least 60% of the NBPGR's own working collections will have been regenerated/recollected with proper accessions sent to the base collection.
 3. Plans and programs will be in place to complete the remaining regeneration/collection in both NBPGR and non-NBPGR sites.
- c. NBPGR plant exploration and collection work will be properly functioning based on annually revised five year "rolling" plans.
- d. A standardized germplasm data base management system will have been established by NBPGR and will be used at Delhi headquarters and at three selected regional NBPGR centers. It will also be used in at least 10 key agricultural research centers and universities.
- e. The capacity for long-term storage of up to 600,000 accessions will have been put in place.
- f. The NBPGR will have become internally capable of managing germplasm programs in India, with only occasional outside assistance, particularly in areas of new scientific techniques.
- g. Plant germplasm will be much more readily available than it is today to all scientists working with crop improvement in the public and private sector.

A corollary purpose is to enhance India's regional and global capacity in plant genetic resource conservation and use by:

1. Establishing an international training program in exploration, collection, and conservation of plant germplasm;
2. Providing an effective plant quarantine program;
3. Playing a leading role in development of regional and global genetic resources workshops and conferences;

4. Building linkages, research collaboration and germplasm exchanges;

5. Having the capacity to foster and support international research collaboration.

The proposed budget of the project will be 31.7 million US\$, of which USAID would supply \$13.0 million, and GOI would supply \$18.7 million, over a period of 5 years. USAID components would be for equipment, training, construction, short-term technical assistance, collaborative research, joint exploration programs, monitoring and evaluation, and project implementation and management support.

Critique

Plant Germplasm Conservation has been on the Indo-US Subcommission on Agriculture priority list since its second session. Collaboration between the two countries has a long history through the PL 480 and rupee fund projects so the working relationships between the USDA and ICAR have already been functioning at a modest level.

The NBPGR has already made significant steps towards upgrading its national center in New Delhi. In that location can be found a nucleus of staff and equipment, and a good organization for management of the diverse aspects of germplasm conservation.

The NBPGR has five divisions:

1. Plant Exploration and collection with nine base centers
2. Germplasm Evaluation with six regional stations and an experimental farm
3. Germplasm Conservation with modest short and long term storage
4. Germplasm Exchange
5. Plant Quarantine with three stations.

In addition, at New Delhi it has established a Tissue Culture Repository for clonal propagation and storage. There is a small component of computerized data base management at the central headquarters only.

In recent years the U.S. has made great advances in storage technology, germplasm conservation procedures, data bank management, crop assignment, germplasm enhancement, and in cryopreservation, all of which lend themselves to direct technology transfer.

The ARP project has provided a mechanism for bringing the two groups together for planning an Indian resource that will not only serve its own needs, but which will be a model program regionally and globally. The importance of India's germplasm resources as centers of origin of some of the world's major crops will thus be preserved. It is commendable that the U.S. consultants which have come to assist in the design are among the most knowledgeable in the world in their areas of expertise. They have been actively involved in the development of the U.S. National Plant Germplasm system during the past twenty years.

The Plant Genetic Resources preproject has made a valuable contribution in the design proposals prepared within the past two years.

An early decision should be made on the implementation of a project to improve India's germplasm resources program. Consideration might be given to utilizing the subproject for training while the larger proposal is pending.

ANNEX C-9

AGROFORESTRY

FULL TITLE	Agroforestry Research
BUDGET (USAID)	(Proposed) \$1,869,000
BUDGET (ICAR)	(Proposed) None
IMPLEMENTATION DATE	Pending
PARTICIPATING INSTITUTIONS	To be Selected
LEAD CONSULTANTS	To be Determined

Objectives

The sub-project focuses on supplementing and strengthening agroforestry research in India in order to improve agro-eco-system and forest wealth of the country in addition to increased income opportunities for farmers particularly those with small holdings on rainfed and marginal lands.

In order to strengthen agroforestry research ICAR has launched an All India Coordinated Research Project on Agroforestry (AICRPA). India's recognition and implementation of agroforestry research and development, and US strength in tree genetics, propagation, physiology and ecosystem analysis are particularly complementary and could lead to a fully collaborative partnership. In view of this the basic objective of the subproject is to supplement and strengthen the AICRPA activities of ICAR.

Specific Program

The subproject builds on the three-tier design (national, regional and local centers) of AICRPA and focuses primarily on areas (germplasm, ecosystems, post graduate education, and research) where Indo-U.S. collaboration would be particularly useful on a long term basis. Major program components are:

1. Increasing the number of scientists qualified for agroforestry research through short-term training, continuing education, specialized training and initiation of post graduate (M.S. and Ph.D.) programs in agroforestry at selected universities.
2. Creating a quantitative agroforestry format and model for data accounting, generation of hypotheses and prediction of system behavior.

3. Initiating ecosystem-level studies of agroforestry systems at two AICRPA Regional Centers.
4. Initiating an agroforestry germplasm collection, screening and propagation program at all AICRPA Regional Centers.
5. Involving local centers and a social science team in analyses of the needs and behavior of agroforestry clients (farmers and policy makers), in developing technologies for making results of agroforestry research available and intelligible to scientists, and in developing methodologies for evaluating agroforestry systems which incorporate economic, social and environmental factors into the analysis.
6. Creating an analytical laboratory at the National Center with capability to undertake sophisticated analysis of ecosystem components (plant, soil, water, and microbes).
7. Creating a computer-based expert system at the National Center that links individuals and institutions needing information about agroforestry systems and their components with the subproject data base and scientists.

Participating Institutions (USA)

Universities of Minnesota (St. Paul), Florida (Gainesville), Washington (Seattle), Yale (New Haven), California (Berkeley), Missouri (Columbia), Georgia (Athens), Idaho (Moscow); State Universities of North Carolina (Raleigh) Michigan (East Lansing) and Virginia Polytechnic Institute (Blacksburg).

Subproject Coordination

Overall implementation of the subproject is coordinated by the Deputy Director General, ICAR in-charge of the agroforestry program. A coordination committee of following members will monitor and evaluate the project:

1. Deputy Director General, Incharge of Agroforestry Research, ICAR - Chairman
2. Deputy Director General (Edu.), ICAR - Member
3. Director National Research Center - Member
4. Three Directors of ICAR institutes having programs in Agroforestry - Members
5. Two Directors of Research of SAUs having programs in Agroforestry - Members

6. Two Heads of Departments of Agroforestry at SAUs having programs in Agroforestry - Member
7. Joint Advisor (Agriculture), Planning Commission - Member
8. Asst. Director General (Agroforestry), ICAR - Member Secretary

Subproject Leader

To be determined

Actions To Date

The subproject proposal was originally suggested by ICAR in June 1985. Two U.S. consultants (Dr. Gordon and Promitz) came to India in June-July 1986. They prepared a design proposal for USAID in August 1986.

The budget components are:

Training

8 Indian Trainers to U.S. (total 60 months)	\$144,000
12 Indian Scientists to U.S. (18 months each)	400,000
Institutional Support	<u>200,000</u>
Subtotal	744,000

Collaborative Research

4 U.S. Scientists/year for 4 years for 3 months	120,000
8 Indian scientists/yr for 4 years for 3 months	<u>240,000</u>
Subtotal	360,000

Equipment (National and 6 Regional Centers) 670,000

Workshops in India	40,000
Other U.S. Scientists	35,000
Miscellaneous	<u>20,000</u>
Subtotal	95,000

Total 1,869,000
=====

USAID transmitted the proposal to ICAR in August 1986. TAG approved it in December, and PAMC in June 1987. DEA cleared it in December 1987. It now awaits USAID decision on PIL.

Critique

This project has been too long in the decision process. If approved now, it will not have the five year span in LOP of ARP.

Specific Program

The subproject aims at strengthening the cooperating centers of All India Coordinated Research Project on Agrometeorology with regard to equipment and training of project personnel besides conducting agrometeorology research and dissemination of information. Essential components of the research program are:

1. Research on improved forecasting specifically to meet the requirements of farming community, both rainfed and irrigated. It will involve analog modelling of historical weather data, collaboration with other agencies engaged in related weather forecasting research/operation and establishment of computerized data bank and analytical capability at each research center.
2. Simulation modeling of crop/soil/weather/water/supply/management interactions.
3. Development of 'Response Farming Package' by combining findings from forecasting and simulation modelling studies.
4. Create working linkages with All India Coordinated Research Projects engaged in carrying out on-farm trials/demonstrations and develop an operational research effort to bring research findings to farm level.

Budget

The Components are:

1.	<u>Training</u>	<u>USAID</u>
	Four person study tour of six week Sixteen scientists from fifteen institutions to be trained in U.S. for six months each	\$ 408,000
2.	<u>Equipment</u>	
	For 15 locations (including a central computer)	\$ 902,000
3.	Consulting Services	<u>\$ 300,000</u>
	Total	<u>\$1,610,000</u>

Participating Institutions (USA)

Universities of Nebraska (Lincoln), California (Berkeley), Wisconsin (Madison) and Connecticut Agri. Exp. Station (New Haven).

State Universities of Michigan (Lansing), Kansas (Manhattan), Arizona (Tuscon) and Washington (Pullman).

Subproject Coordination

The overall implementation of the subproject is coordinated by the Deputy Director General (SAE) of ICAR. A coordination committee to continuously monitor and evaluate the project is as follows:

1. Deputy Director General (SAE), ICAR - Chairman
2. Asst. Director General (Agronomy), ICAR - Member
3. Director, Central Research Institute for Dryland Agriculture, Hyderabad - Member
4. Dr. A. Krishnan, ICAR National Fellow in Agrometeorology - Member
5. Mr. A.S.N. Sastry, Senior Scientist (Ag. Meteorology), IARI, New Delhi - Member
6. Mr. B.V. Ramana Rao, Project Coordinator (Ag. Meteorology), ICAR - Member Secretary

Subproject Leader

Mr. B.V. Ramana Rao, Project Coordinator, Indian Council of Agricultural Research, Krishi Bhawan, New Delhi - 110 001

Subproject Consultant

To be determined

Present Status

There were two consultants, Dr. Ian Stewart and Dr. Fabian Polcyn, who came to India in January 1986 (on other funds) to participate in subproject design. The proposal has been approved by DEA and awaits USAID issuance of an PIL.

Critique

The proposal is one that offers 16 institutions the opportunity for significant training and equipment from USAID, as well as access to consulting services. If it is to be implemented within the current ARP, the decision must be made soon.

The team has no expertise in this subject. However, the investment of such a significant sum in equipment might have justified an independent peer review to 1) ensure that the central computer concept and its use are valid, 2) evaluate the proposed plans for simulation and forecasting, and 3) assess the potential for farm level impact.

ANNEX C-11

INTEGRATED NUTRIENT MANAGEMENT

FULL TITLE	Integrated Nutrient Management (INSAM)
BUDGET (USAID)	(Proposed) \$2,499,850
BUDGET (ICAR)	Not specified
IMPLEMENTATION DATE	Pending
PARTICIPATING INSTITUTIONS	Not Selected
LEAD CONSULTANTS	To be determined

Objectives

To develop the most efficient fertilization - cropping systems technologies to maximize economic productivity per unit area of available land for improved efficiency of nutrient use in multiple cropping systems.

Actions To Date

Two consultants, Drs. Hanson, Baird and John Malcolm, came to India on March 10, 1987 for a month to assist in design of the subproject. The subproject proposal was produced in April 1987. In June 1987 it was sent to ICAR. No comments have been received from ICAR.

Critique

This draft will need much redesign before a subproject can be developed. There are no real objectives and only a generalized work plan. An ICAR work plan is required.

The proposed budget includes:

Equipment	\$ 495,000
Training	1,518,250
Consultancy	486,600
Total	<u>2,499,850</u>

There is no indication of where the equipment would be located, what training is required by institution, or how the consultant needs were derived.

It is apparent that this proposal will not be in condition to be considered as a subproject in the near future.

In March 1987 a draft design subproject was sent to ICAR and USAID. Subsequently a joint proposed subproject was issued by ICAR and USAID in July 1987.

This joint proposal is still awaiting action in USAID. It has not moved through the required ICAR approvals.

Critique

This subproject proposal has two elements that are recommended that are not found in other subprojects. The first is the recommendation that \$1,322,000 is budgetted for a contract with a U.S. based project entity that would provide needed U.S. short-term scientific personnel, associated equipment, and support for in-country and U.S. based training and study tour facilities that are to be programmed by the in-country logistics office. It further recommends the choice of contractor be a university or university consortium.

The other element of the proposal is that a competitive grants be set up on subproject funds for relevant research by ICAR scientists. This might also fund specialized training not available in India, or postdoctoral study tours.

The concept of contracting with a U.S. based project entity is the same as is currently done by Winrock International in the MSS. It can be argued that such a contract with a university or consortium might make more U.S. scientists available than a private company, since the university would have a specific commitment of its staff. On the other hand, a special MSS of this type in the ARF would be duplicating services now provided by Winrock. If other subprojects had such contracts ICAR would find itself dealing with more agencies. There would be additional help required. If proliferation of contracts of this kind occurred, then a super PIU, or separate PIUs might be required to handle working with different contract offices. The arrangement that a university or consortium contract might make university staff more readily available for collaborative research and foreign assignment may be correct.

The conduct of a competitive grants program is attractive from the standpoint of stimulation of initiative in proposal preparation and of creating competition for excellence between researchers and between institutions. It should be realized, however, that such a program will require administration, time and effort for peer review, assessment of progress, and a mechanism for special fund disbursement and monitoring of fund use.

A major problem in making a decision now on the OFWM proposal has been caused by the delays thus far. The subproject was proposed by ICAR in May 1985, but a design team did not meet

until January 1987. The original proposal was drafted in February 1987, jointly modified by ICAR and USAID by July 1987, but still is awaiting action. The term left in the current ARP is only four years. Subproject implementation must be for a shorter term unless a strategy decision is made to have a new ARP after 1992.

ANNEX C-13

FARM EQUIPMENT MANUFACTURING

FULL TITLE Farm Equipment Manufacturing
Technology Centers (FEMTC)

BUDGET (USAID) (Proposed) \$553,100

BUDGET (ICAR) Not specified

IMPLEMENTATION DATE Pending

PARTICIPATING
INSTITUTIONS:

1. Central Institute of Agricultural
Engineering, Bhopal
2. Punjab Agricultural University, Ludhiana
3. Tamil Nadu Agricultural University,
Coimbatore

LEAD CONSULTANTS To be determined

Objectives

1. Develop a stronger linkage between research activities, manufacturing and crop production to reflect the farmers' needs in the machines manufactured.
2. Improve the process of developing appropriate farm equipment by focussing attention on the most important items and the critical design features and management aspects.
3. Transfer improved manufacturing technology to manufacturers through better manufacturing processes and practices.
4. Improve the ability of manufacturers to select and obtain appropriate high quality materials and component parts.
5. Improve the quality of manufacturing and adoption of appropriate standards.
6. Improve the distribution system of new machines and replacement parts through better communication and cooperation between manufacturers and concerned state and central governmental agencies.
7. Improve the productivity and on farm management of appropriate machines.

Specific Program

Establishment of three Farm Equipment Manufacturing Technology Centers with appropriate attention to objectives on manufacturing technology, prototype development, adaptation to mass manufacture, farm testing, technology transfer to manufacturers, and assistance in the form of workshops, demonstrations, and public information media.

Coordination Committee

Appropriate representation from ICAR administration, Center Directors, Project Coordinators, engineers, farmers and manufacturing industry.

Collaboration

Numerous national and international institutions, organizations, and centers.

Actions To Date

A design team from the U.S. composed of Drs. Herrington and Ghran, with Dr. David Mears, USAID/Delhi and a counterpart Indian team prepared the proposal in April 1987. The subproject proposal with budget details was completed in August 1987. Since that time it has been under review by USAID.

Critique

This proposal is exceptionally well designed in all aspects. The composition of the proposed coordinating committee includes administrators, scientists, as well as farm and manufacturer representatives. The work plan is well detailed. Collaborators, both internal as well as external, are identified. The effort is concentrated at three geographical centers.

The proposed budget places the largest component with GOI for facilities, staffing, and incountry equipment. The USAID component of \$563,100 would be used for U.S. consultants, equipment, nine training scholarships, study tours, and workshops.

This subproject should be moved to decision as soon as possible, since only four years remain in the ARP commitment. The USAID investment would be relatively small, and offers promise for a beneficial return in a subproject designed to stimulate small business.

ANNEX C-14

TISSUE CULTURE

FULL TITLE

Tissue Culture

IMPLEMENTATION DATE .

The most recent MSS Quarterly
Report indicates "in preparation"
for this proposed sub-project

ANNEX D

Comparison of Major Features of ARP, FERRO, and STI
(prepared by Ms. Kerri-Ann Jones)

	<u>ARP</u>	<u>FERRO</u>	<u>STI (Agriculture Section)</u>
<u>Establishment</u>	1980 design process of project started in response to subcommission	1960 - Established for use of PL 480 Funds	1980 - Established based on Gandhi-Reagan Visit; Senior Scientific Panels established in both countries; Program renewed thru 1990
<u>Choice of topics</u>	Identified by Indo-US ag. Sub-commission (mutual interest)	Identified by Indo-US Ag Sub-commission (mutual interest)	Identified by Senior Scientific Panels (SSP) (Mutual interest)
<u>Thrust</u>	Generation of basis for developmental technology	Generation of basis for developmental technology	Basic or fundamental research on frontiers of science
<u>Choice of Investigator/ Institutions</u>	Identified during project development process (Indian side-limited to ICAR institutions and State Agricultural Institutions)	Proposals submitted from any research institute (public or private) U.S. collaborator identified by USDA	Identified by SSP on both sides (expanded with difficulty)
<u>Peer Review Procedures (1) During Project Selection</u>	N/A (?)	Reviewed at ICAR Reviewed at USDA (does a non-participating scientist review?)	Reviewed by ICAR technical meeting convened by SSP; reviewed by AID/W
<u>Activities Supported</u>	Equipment, training, consultancy, technical assistance	Research in India Visits by US collaborating scientists to India Translation of scientific documents Workshops	Research activities in India and US Travel of participating scientists

Comparison of Major Features of ARP, FERRO, and STI
(prepared by Ms. Kerri-Ann Jones)

	<u>ARP</u>	<u>FERRO</u>	<u>STI (Agriculture Section)</u>
<u>Review Process During Project</u>	AID mid-project evaluation process Workshops; NAARM Management Review	Visits by USDA collaborators FERRO office does administrative review	Annual SSP review; Workshops annually; NAS is oversight agent
<u>Funding Levels</u>	\$ 1-2 million/subproject	Only Rs. available Range of grants - Rs. 650,000-11,500,000	U.S. Scientists - range \$17,000-\$75,000/ grant/year - Total 1987-\$500,000 Indian side - Total-\$2 million
<u>Source of Funding</u>	USAID and GOI	USDA's Congressional allocation of excess currency (2)	Costs in US - USAID Costs in India - Indian Department of Science and Technology
<u>Duration</u>	3-5 years (dependent on sub-project)	3-5 years	Ongoing

(1) Peer review is used in several forms in the Mission. The definition of peer review used here is the objective review by a non-participating individual(s) with technical expertise. This is not the review of the topic but the actual research to be conducted.

(2) As of this year FERRO funds will be allocated from the U.S.-India Fund (USIF)

ANNEX E

EVALUATION TEAM MEMBERS

Chemonics provided R. W. Cummings, D. W. Barton, W. K. Gamble and A. L. Brown under an IQC Delivery Order. D. R. Bhumbra and D. P. Singh were provided by USAID/India under personal service contracts, but participated in all aspects of the evaluation as full members of the team.

Ralph W. Cummings (Team Leader)
B.Sc., Ph.D.

Dr. Cummings' outstanding international career includes the highest technical and managerial positions in agricultural universities, foundations, and research centers in the U.S., Latin America and Asia. For ten years, he served the international agricultural research centers as: Acting Director General, International Irrigation Management Institute (IIMI) (1983-1984); Chairman, Technical Advisory Committee, Consultative Group for International Agricultural Research (CGIAR/TAC) (1972-1977); Founding Director General, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) (1972-1977); Director General, International Rice Research Institute (IRRI) (1972).

For the Rockefeller Foundation, Dr. Cummings was Field Director and Principal Representative in India (1957-1966), then Associate Director for Agricultural Sciences (1964-1968). He also served the Ford Foundation as Program Advisor in Agriculture for Asia and the Pacific (1971-1972).

His academic career included early work at Ohio, Cornell, and North Carolina State universities. At NCSU (1942-1956), he became successively professor, department head, assistant director, associate director, and director of the N.C. Agricultural Experiment Station; served as Chief of the N.C. Agricultural Research Mission to Peru; and later (1971-1973) as Adjunct Professor.

Dr. Cummings has served as trustee and member of the governing boards of nine research centers, foundations and institutes. His honors include four honorary doctorates, two from Indian universities, as well as service awards, memorial lectures, and fellowships in learned societies. Several of these awards are from Indian institutions, including adoption of the name Cummings Laboratory for the Cereal Research Laboratory of the Indian Agricultural Research Institute.

Throughout his career, Dr. Cummings has served as chairman or member of study teams, review panels, boards, commissions, and

councils (some for as long as four years) involved in agricultural education, research and development. He is widely sought as a consultant for The World Bank, foundations, private firms, foreign governments, AID and the International Agricultural Research Centers community.

Donald W. Barton
B.Sc., Ph.D.

Dr. Barton joined Cornell University in 1951 as associate professor in horticulture. When he retired in 1983 he had been professor, department head, Director of the State Agricultural Experiment Station, and, for fifteen years, Associate Director of Research. In these years, he also served on executive and planning and research committees (some for as long as eight years) of the National Association of State Universities and Land Grant Colleges, the Northeast Experiment Station Director's Association, the U.S. Department of Agriculture/State Agricultural Experiment Stations, New York State, and Cornell University.

In the international field, Dr. Barton served the International Rice Research Institute (IRRI) as visiting Director of Research Administration. He has been a member of consulting teams and study groups reviewing research, extension and education programs in Ghana, Afghanistan, Nigeria, Bangladesh, Indonesia, China, and the Philippines. Dr. Barton is a Fellow of the American Society of Horticultural Science. He has published more than forty articles.

D. R. Bhumbra
B.Sc., M.Sc., Ph.D.

Dr. Bhumbra's distinguished career includes many senior technical and managerial assignments as educator, investigator and administrator: Executive Director, Society for Promotion of Wastelands Development (1982-1984); Project Director, Lab to Land Programme, ICAR (1980-1981); Agricultural Commissioner, GOI (1978-1980); Deputy Director General for Soil, Agronomy and Agricultural Engineering, ICAR (1974-1978); Director, Central Soil Salinity Research Institute, ICAR (1969-1974); Dean, College of Agriculture, Punjab Agricultural University (1966-1969); and Head, Department of Soils, Punjab Agricultural University (1964-1966).

Dr. Bhumbra received a number of awards and honors for outstanding work in research and education. He has been member and/or chairman of fifteen national committees and task forces, and served as member and/or leader of nine international GOI commissions. He has been an international consultant for WB and UN/FAO. Dr. Bhumbra has authored more than 150 publications.

Albert L. (Scaff) Brown
B.Sc., M.Sc.

Mr. Brown has thirty years of experience in managing agricultural development, including 19 years with AID in major policy making and management positions, and 13 years as senior manager in three private consulting firms. Major areas of programmatic expertise are agricultural policy, rural development, development planning, evaluation methodology and interdisciplinary program management.

Mr. Brown's consulting experience was acquired as Deputy Director of Chemonics International Consulting Division (since 1936); Director of International Management Consulting Services, Coopers & Lybrand (1985-1986); and International Vice President, American Technical Assistance Corporation (1969-1980). His AID assignments include service as Chief of Rural Development for Latin America and the Caribbean (1980-1985), for Brazil (1968-1969), for Guatemala (1961-1964), for Honduras (1959-1961), and a livestock advisor and Deputy Chief in Colombia (1955-1959). Mr. Brown was also Assistant Director, Deputy Director, and Director, Office of Institutional Development for Latin America and the Caribbean (1965-1968). He taught range management at the University of Arizona (1948-1952) and served as a range management advisor to UN/FAO in Mexico (1953-1955).

Mr. Brown was a member of the Senior Foreign Service, holder of the Outstanding Career Achievement Award, and a Princeton Fellow in Public Affairs. He has produced more than 150 journal articles, popular articles and consulting reports, on most phases of agricultural development. His primary geographic expertise is Latin America, but consulting assignments have also been carried out in Africa, Asia, the Near East and Europe.

William K. Gamble
B.Sc., M.Sc., Ph.D.

Dr. Gamble's extraordinary international career includes multi-country service with the Ford Foundation, topped off by leadership of two international agricultural research centers: Founding Director General, International Service for National Agricultural Research (1980-1985); and Director General, International Institute of Tropical Agriculture (IITA). Ford Foundation assignments include: Representative for West Africa (1972-1975); Representative for Colombia and Venezuela (1970-1972); Representative for Mexico, Central America and the Caribbean (1960-1970); Program Advisor for Agriculture for Mexico and Central America (1963-1966); Program Advisor for Agriculture at Headquarters (1962-1963); Program Advisor on Agricultural Research, Education and Extension to Burma (1961-1962); and Senior Advisor to the Burma State Agricultural Institute (1955-

1959). Dr. Gamble also taught at Iowa State U, North Dakota State U, and Cornell U, where he acquired his Ph.D.

Dr. Gamble is co-author of the book Agricultural Development in Mexico and the author of numerous articles and presentations on agriculture. He was a member of the Task Force on International Assistance for Strengthening National Agricultural Research, and has carried out extensive work on agricultural missions in Africa, Asia, Latin America, the Middle East and the South Pacific., His many consultations include assignments with UN/FAO, World Bank, several universities, and private firms.

D. P. Singh

B.A., M.A., LL.B.

Dr. Singh's distinguished career as educator and agricultural development planner and manager includes prestigious posts in many fields: Chairman, State Council of Agricultural Research and Education (1981-1983); Vice Chancellor, Rajendra Agricultural University (1977); Chairman, National Seeds Corporation and State Farms Corporation of India (1974-1976); Vice Chancellor, Govind Ballabh Pant University (1966-1975); Joint Secretary, GOI Planning Commission (1963-1966); Chief of Agriculture and Community Development Division, GOI Planning Commission (1961-1963); Director, Planning, Research and Action Institute (1954-1957); Deputy Development Commissioner for Community Development (1952-1954).

Earlier professional assignments included: Lecturer in Agricultural Economics and Estate Management, Government Agricultural College (1940-1941); State Civil Service, Uttar Pradesh (1941-1945); Responsible Development Officer, Pilot Project on Rural Development (1948-1951); District Magistrate and Collector (1951-1952).

Dr. Singh received a wide variety of national and international honors for outstanding service to agriculture, including an LL.D. from the University of Illinois, and a D.Sc. from G.B. Pant University. He was also named a Fellow of the Royal Swedish Academy of Agriculture and Forestry. He has been member or chairman of twenty Indian boards, commissions or task forces. International consultancies have included service as UN Community Development Expert in Syria and U.A.R. (1957-1961), and membership on worldwide panels on rural development (1976) and education (1977-1978). He has written more than 100 technical and popular publications.

ANNEX F

PLACES VISITED AND PERSONS CONSULTED

- Meetings of Ralph Cummings and Donald Barton with:
- March 14 Chemonics orientation, Washington, D.C.
Dr. Floyd Williams, Coordinator, Winrock International
- March 15 Dr. Richard Blue, Deputy Director, USAID - Delhi
Dr. Orville Bentley, Assistant Secretary of
Agriculture, USDA
Dr. James Walker, Program Officer, OICD
Dr. David Bathrick, Director, Office of Agriculture
USAID
Dr. Floyd Williams
- March 16 University of Illinois, Champaign-Urbana

Dr. Harold Kaufman, director, INTSOY
Dr. A.I. Nelson, INTSOY
Dr. John Nicholaides, Director, International Programs
Dr. M. Ristic, Professor, College of Veterinary
Medicine
Dr. G.C. Shove, Professor, Dept. of Agr. Engineering
- March 17 University of Idaho, Moscow

Dr. Charles Hatch, Professor, College of Forestry
- March 18 Mr. Tom Deckert, Assistant Director, Postharvest
Institute for Perishables
Dr. JoEllen Force, Associate Professor, College of
Forestry
Dr. Charles Hatch
Dr. Nayital, Indian Forestry Trainee
Mr. Sagwal, Indian Forestry Trainee
- March 21 Virginia Polytechnic Institute and State University -
Blacksburg

Dr. P.H. Massey, Associate Dean for International
Development
Dr. R.E. Adams, Head, Department of Forestry
Dr. R.S. Vinaya Rai, Indian Forestry Trainee
Dr. N.K. Vijayakumar, Indian Forestry Trainee
Dr. J.P. Fontenot, Professor, Department of Animal
Science

- March 22 Washington D.C.
- Dr. John Pino, National Science Foundation
 - Dr. Quentin Jones, (retired), ARS, USDA
 - Dr. Michael Korin, ADO, USAID
 - Dr. Tish Butler, Chief, Evaluation AS/NE USAID
 - Dr. James Lowenthal, Project Design USAID
 - Dr. Helen Gunther USAID
 - Dr. William Sugrue, USAID
 - Dr. Alexander Decker, USAID
- March 24 Delhi, India (Cummings & Barton)
- Dr. John Becker
 - Dr. Mark Smith
 - Dr. John Grant
 - Ms. Meena Datta
 - Dr. Guy Baird
- March 25 Dr. Ron Pollack
Group USAID meeting (Brown, Decker, Baird, Mears, Datta, Pollack, Surwato, S. Singh)
- March 28 (Cummings, Barton, D.P. Singh, Bhumbra)
- Dr. I.P. Abrol, Deputy Director General (Soil & Eng) ICAR
 - Dr. R.S. Paroda, Deputy Director General (Crops) ICAR
 - Dr. K.I. Chadha, Deputy Director General (Horticulture) ICAR
 - Dr. R.K. Arora, Director, National Bureau of Plant Genetic Resources, ICAR
 - Dr. A. Alam, Assistant Director General (Agr. Engineering) ICAR
 - Mr. R.N. Bakeley, Mission Director USAID-Delhi
- March 29 (Cummings, Barton, D.P. Singh, Bhumbra)
- Dr. Robert Jackson, USDA/FERRO
 - Dr. Maharaj Singh, Deputy Director General (Education), ICAR
 - Dr. Kerri Ann Jones, Science Advisor, Bureau of Science & Technology, USAID
- March 30 (Barton, B.P. Singh, Bhumbra)
- Dr. R.M. Acharya, Deputy Director General (An. Sciences) ICAR

April 2 (D.P. Singh, D.W. Barton, B.P. Srivastava)

National Dairy Research Institute, Karnal

Dr. R. Nagarcenkar, Director
Dr. S.A. Singh, Senior Scientist, Dairy Technology
Division,
Dr. K.L. Arora, Scientist, Dairy Technology Division
Dr. A.K. Sharma, Dairy Technology Division
Dr. D.D. Sharma, Head, Dairy Cattle Nutrition Division
Dr. B.N. Gupta, Senior Scientist Dairy Cattle
Nutrition Division
Dr. M.L. Madan, Head, Dairy Cattle Physiology Division
Dr. C.R. Bularishnan, Senior Scientist, Dairy Cattle
Genetics Division
Dr. D.K. Mathur, Senior Scientist, Dairy Bacteriology
Division
Dr. Sunita Grover, Jr. Scientist, Dairy Bacteriology
Division
Dr. S.R. Anand, Head, Biochemistry Division
Dr. S.M. Dutta, Senior Scientist, Biochemistry Division
Dr. K.N.S. Sharma, Senior Scientist, Computer Center

GBPUAT

Dr. Mahatam Singh, Vice Chancellor
Dr. S.C. Modgal, Director of Research
Dr. B.P.N. Singh, Professor, Department of Post Harvest
Dr. Y.C. Agrawal, Professor, Department of Post Harvest
Processing and Food Engineering
Dr. B.K. Mital, Professor and Head Department of Food
Science and Technology
Dr. Gurmukh Singh, Associate Professor Department of
Food Science and Technology
Dr. Amresh Kumar, Professor, Project Leader, Embryo
Transfer Technology Project
Dr. S. N. Mauriya, Professor, Embryo Transfer
Technology Project
Dr. R.P. Singh, Professor of Horticulture and
Coordinator Agro Forestry Project
Dr. Om Parkash, Senior Research Officer, Agro Forestry
Dr. O.P. S. Vyas, Junior Research Officer, Agro
Forestry
Dr. B.C. Saini, Junior Research Officer, Agro Forestry

April 3 Haryana Agricultural University, Hissar

Dr. Har Swarup Singh, Vice Chancellor, Director of
Research

April 4 Dr. R.D. Sharma, College of Animal Science
 Dr. S. Dhar, College of Animal Science
 Dr. S.L. Gupta, College of Animal Science
 Dr. D.V. Malhotra, College of Animal Science
 Dr. B.P.L. Singh, College of Veterinary Sciences
 Dr. K. Pradhan, College of Animal Sciences
 Dr. Kripal Singh, College of Animal Sciences
 Dr. S.P. Singal, College of Animal Sciences

Central Institute for Research of Buffaloes

Mr. Parvin Kumar, Jr. Scientist

(RN Bhumbla, R.W. Cummings)
Indian Veterinary Research Institute

A. Embryo Transfer Technology

Dr. V.K. Taneja, Project Coordinator
Dr. Umashanker, Senior Scientist
Dr. L.P. Nautiyal, Senior Scientist
Dr. K.L. Sahni, Senior Scientist
Dr. Greesh Mohan, Scientist
Dr. P.C. Sanyal, Scientist
Dr. J.K. Pandey, Senior Scientist
Dr. V.P. Varsney, Scientist
Dr. A.C. Mazumdar, Postgraduate

B. Blood Protista

Dr. N.N. Sharma, Head, Animal Science
Dr. A.K. Mishra, Scientist
Dr. G. Subramanian, Senior Scientist
Dr. V.K. Srivastava, Senior Scientist
Dr. R.V.N. Srivastava, Scientist
Dr. J.R. Rao, Scientist
Dr. G.C. Bansal, Scientist

C. Administration

Dr. B.B. Mallick, Junior Director
Dr. P.N. Bhat, Director

(D.P. Singh, D.R. Bhumbla, A. Brown, R. Cummings, D. Barton)

USAID, Delhi

Mr. Chuck Antholt
Dr. David Mears
Mr. John Becker
Dr. Mark Smith

Winrock International, Delhi

Dr. Guy Baird, India Coordinator, Winrock International
Mr. M.A. Nair, Administrative Assistant
Mr. S. Isaac, Procurement Officer

April 6 ICAR

Dr. N.S. Randawa, Director General

IARI, STI

Dr. N.N. Goswami, Director

U.S. Embassy, Science Office

Dr. S. Ahmed Meer, Science Counselor
Mr. S.I. Dutt, Administrative Officer

April 7 National Bureau for Plant Genetic Resources

Dr. R.K. Arora, Director
Mr. P.P. Khanna, Head, Division of Germplasm
Preservation
Dr. M.N. Koppap, Head, Division of Plant Exploration
and Collection
Dr. T.A. Thomas, Head, Division of Germplasm Evaluation
Dr. B.P. Singh, Head, Division of Germplasm Exchange
Mr. Ramnatm, Head, Division of Plant Quarantine
Dr. K.P.S. Chandel, Plant Tissue Culture Repository
Dr. M.L. Maheshwari, Coordinating Officer
O.P. Gautam

April 8 (D.P. Singh, D.R. Bhumbra, A. Brown, D. Barton)

Central Research Institute for Dryland Agriculture

Dr. R.P. Singh, Director
Dr. G.S. Reddy, Agronomy
Dr. C. Sriram, Soil Science
Dr. B.V. Ramana Rao, Coordinator, Agrometeorology
(and 27 of Institute staff)

National Academy of Agricultural Research Management

Dr. K.V. Raman, Director
Dr. S. Kishore, Professor
Dr. K.V.S. Rao, Professor
Dr. V.R. Rao, Professor
Dr. R.K. Samanta, Associate Professor
Mr. G.C. Sharma, Senior Admin. Officer
Dr. M.P. Chandrasekharove, Professor
Dr. T. Baaguru, Associate Professor
Mr. K.V. Murali, Farm Manager
Dr. S.N. Saha, Professor
Dr. M.P. Singh, Professor
Dr. M.M. Anwar, Associate Professor
Dr. K.P. Reddy, Associate Professor
Dr. P. Manikanda, Associate Professor
Dr. G. Matravi, Professor

April 8 Andra Pradesh Agricultural University

Dr. A. Appa Rao, Vice Chancellor

April 9 International Crops Research Institute for the Semi-Arid Tropics

Dr. L.D. Swindale, Director General
Dr. J.L. Monteith, Director, Resource Management
Dr. Y.L. Nene, Acting Program Director
Dr. J.P. Moss, Principal Cytogeneticist
Dr. L.J. Reddy, Plant breeder
Dr. V.M. Ramraj, Plant physiologist
Dr. J.M.J. deWet, Program Director, cereals
Dr. C.T. Hash, Jr., International Intern
Dr. H.C. Sharma, Entomologist
Dr. C. Johansen, Principal Agronomist
Dr. K.B. Srinivasan Assistant Director General

April 11 Institute of Horticultural Research, Bangalore

Dr. R.M. Pandey, Director
Dr. S. Ethiraj, Senior Scientist, Microbiology
Dr. B.S. Bhargava, Senior Scientist, Leaf Analysis
Laboratory
Dr. S.J. Singh, Scientist, PHT
Dr. Shanta Krishnamurti, Senior Scientist, PHT
Physiology
Dr. E.R. Suresh, Scientist
Dr. B.A. Villana, Junior Scientist, PHT
Dr. A. Medan, Scientist, PHT Economics

April 11 (DP Singh, RW Cummings, William Gamble)
and 12 Central Institute for Agricultural Engineering, Bhopal

Dr. T.P. Ojha, Director, CIAE
Dr. Nawab Ali, Project Director, SPU
Sri B.S. Bisht, Process Engineer
Sri S.D. Kulkarni, Process Engineer
Dr. A.P. Gandhi, Biochemist
Sri R.T. Patil, Process Engineer, Pilsb Plant
Dr. Jaswant Singh, Process Engineer, Technology
Transfer
Sri P.C. Bargale, Process Engineer, Chemical Engineer
Dr. K.C. Joshi, Process Engineer, Food Technology
Sri L.K. Sinha, Process Engineer, Food Engineer
Shri Vishnu Tamini, Economist
Shri Sanil Kumar Dwinedi, Process Engineer
Dr. Kachru, Head Process Engineering
Dr. P.S. Bhatnagar, Project Coordinator, Soybean
Cultivation, Indore, M.P.

April 14 Mid-Term Report to USAID

April 18 Mr. Trehan, Department of Economic Affairs
Dr. Tom Bredero, Senior Agriculturalist, World Bank
Dr. V. Kumar, UNDP (FAO)
Mrs. A.C. Karna, UNDP

April 19 Meeting at ICAR

Dr. M.M. Malhotra, Senior Scientist, PIU
Dr. G.L. Kaul, ADG, Horticulture
Dr. A.G. Alam, ADG, Agricultural Engineering
Mr. M.A. Nair, Administrative Officer, Winrock

April 20 Mr. Amrish Mehra, Pant Nagar Products Pvt. Ltd.

April 21 (N.R. Bhumbra, DP Singh William Gamble, D. Barton)
Punjab Agricultural University, Hasndhiana

Dr. Sukhdev Singh, Vice Chancellor
Dr. S.S. Gill, Add'l Director Research (VAS)
Dr. K.S. Nandpuri, Director Research
Dr. M.S. Tiwana Head, Animal Science
Dr. Y. Bhattacharynlul I/C TED
Dr. A.S. Khehra, Associate Director Research
Dr. A.S. Grewal, Animal Phathologist

April 22 Dr. S.S. Gill, ADR
Dr. M.S. Tiwana, Head, Animal Science
Dr. G.S. Makkar, I/C
Dr. P.N. Langer, Principal Investigator
Dr. J.S. Sandhu, Poultry Scientist
Dr. P.K. Trehan, Poultry Scientist
Dr. M.S. Bhullar, Dairy Scientist
Dr. O.S. Parmar, Dairy Scientist

April 23 Post-Harvest Technology IARI

Dr. S.K. Ray, Coordinator PHT Coordinated Project
Dr. B.S. Maini, Scientist, Processing
Mrs. Vijay Sethi, Scientist, Microbiology
Dr. A.K. Chakravorthy, Scientist, Storage Physiology
Dr. D.S. Khurdia, Scientist Processing
Dr. H.S. Sharma, Scientist Engineering
Dr. R.K. Pal, Scientist, Coordinating Unit

April 28 Briefing with ICAR

Dr. N.S. Randawa, Director General
Dr. K.I. Chadha, Deputy Director General, Horticulture
Dr. A. Alam, Assistant Director General (Agricultural Engineering)
Dr. Singh, Deputy Director General, Education
Dr. M. Malhotra, Senior Scientist, PIV
? Assistant Director General, Agroforestry
Dr. J. Becker
Dr. J. Grant
Ms. M. Datta
Dr. D. Bruce

Final Report USAID

Mr. R.N. Bakley, Mission Director
Dr. J. Becker
Dr. C. Anholt
Dr. M. Smith
Dr. B. Srivastava
Dr. J. Grant
Dr. R. Pollock
Dr. D. Mears
Dr. D. Bruce
Dr. Adlakah
Dr. S. Singh
Mrs. Elizabeth Malard
Dr. Barry Primm
Miss Sharon Holt
Dr. Peter Amato

ANNEX G
DOCUMENTATION

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