PD-AAT-532

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A = Add, C = Change, D = Delete — Amendment Number

DOCUMENT CODE: 3

COUNTRY/ENTITY: Bureau for Science and Technology

2. PROJECT NUMBER: 936-4143

3. BUREAU/OFFICE: Office of Agriculture — 10

4. PROJECT TITLE (maximum 40 characters): R&D of Improved Seed Production & Utilization

5. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 93

7. ESTIMATED DATE OF OBLIGATION (Under 'B' below, enter 1, 2, 3, or 4): A. Initial FY 86 B. Quarter C. Final FY 92

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 86 B. FX	C. LC	D. Total	LIFE OF PROJECT E. FX	F. LC	G. Total
AID Appropriated Total	529		529	5,586		5,586
(Grant) S&T Bureau	360		360	3,420		3,420
Other U.S. 1. Missions/Reg.Bureaus	169 *		169 *	2,166*		2,166 *
Other U.S. 2. Buy-Ins						
Host Country						
Other Donor(s)						
TOTALS	$529		$529	$5,586		$5,586

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) FN	112	011		-0-		3,420		3,420	
(2)									
(3)									
(4)									
TOTALS				-0-		3,420		3,420	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 070, 012, 013, 031

11. SECONDARY PURPOSE CODE: 121

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BF	R/AG	TECH	TRNG			
B. Amount	1,086	1,152	1,162	220			

13. PROJECT PURPOSE (maximum 480 characters)

To improve capabilities in LDCs for the efficient production, conditioning, distribution and utilization of seeds of new and improved food and feed crop varieties.

14. SCHEDULED EVALUATIONS: Interim MM 11 YY 88; MM YY; Final MM YY

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [ ] 941 [ ] Local [ ] Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of 1 pages 3* Amendments)

* Funds contributed by missions and/or regional bureaus under separate project authorities.

[redacted]

17. APPROVED BY: Signature — Title: Dr. J. S. Robins, Agency Director for S&T/FA — Date Signed: MM 10 DD 17 YY 85

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

PROJECT AUTHORIZATION

ENTITY : Bureau for Science and Technology

PROJECT TITLE : R&D of Improved Seed Production and Utilization

PROJECT NUMBER: 936-4143

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the "R&D of Improved Seed Production and Utilization" project involving centrally funded planned obligations not to exceed $3.42 million in grant funds over a period of seven years from FY 1986 to FY 1992 subject to the availability of funds in accordance with AID/OYB allotment process, to help finance foreign exchange and local currency costs for the project. The project may also include such additional funding up to $2.166 million, contributed for this purpose by regional bureaus, A.I.D. missions, and AID/W offices, other than S&T/AGR.

2. The goal of this project is to increase the quality and quantity of food and feed crop production in LDCs to meet the growing food demands of the ever increasing world population. The purpose is to improve the capabilities of the LDCs for efficient production, conditioning, distribution and utilization of seeds of improved food and feed crop varieties. The goal and purpose will be accomplished by assisting LDC governments, parastatals, extension services, and private sector entities, and national, regional and international organizations to develop and adapt improved seed production and utilization techniques that are aimed at increasing crop production. The four components of the project are: 1) applied research with special emphasis on constraints which inhibit production and utilization of improved seeds in the LDCs; 2) training programs of varying intensity, duration, depth and emphasis ranging from graduate degree at the Ph.D. level to in-service and on-the-job training in LDCs; 3) technology transfer to provide problem solving assistance and technical transfer and informational services to missions, LDC governments, national and international organizations and institutions; and 4) maintaining and expanding linkages to a "network" of human and technical resources with U.S. public and private organizations and institutions involved in seed technology and related operational areas, LDC private and public institutions, and regional and interregional organizations.

3. The cooperative agreement and the companion ordering contract which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with AID regulations and delegations of authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as AID may deem appropriate.

[redacted]

4. Source and Origin of Commodities, Nationality of Services

Commodities financed by AID under the project shall have their source and origin in the cooperating country 1/ or the United States, except as AID may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have the cooperating country(ies) or the United States as their place of nationality, except as AID may otherwise agree in writing. Ocean shipping financed by AID under the project shall, except as AID may otherwise agree in writing, be financed on flag vessels of the United States.

1/ Each developing country where training or other assistance takes place under the project will be deemed to be a cooperating country for the purposes of permitting local cost financing.

J. S. Robins
Agency Director for Food and Agriculture
Bureau for Science and Technology

Date: 10/17/85

Clearances:	S&T/AGR	: A. R. Bertrand		Date: 10/3/85
	S&T/AGR/AP	: R. I. Jackson		Date: 10/2/85
	S&T/AGR	: F. Li		Date:
	GC	: A. Mattice	phone	Date: 10/2/85
	S&T/PO	: G. Eaton		Date: 10/16/85

[redacted]

ACTION MEMORANDUM FOR THE AGENCY DIRECTOR FOR FOOD AND AGRICULTURE, BUREAU FOR SCIENCE AND TECHNOLOGY

FROM : S&T/AGR, Anson R. Bertrand

SUBJECT: Authorization for R&D of Improved Seed Production and Utilization Project 936-4143

Problem: Your approval is requested for a seven-year (FY 1986 to FY 1992) project on R&D of Improved Seed Production and Utilization which requires an authorized life of project cost of $3.42 million from the Agriculture, Rural Development and Nutrition Account, Section 103 of the Foreign Assistance Act of 1961, as amended. The Office of Agriculture is recommending that the project be implemented initially under a five-year cooperative agreement (CA) and companion ordering contract (COC) with Mississippi State University (MSU) Seed Technology Laboratory (STL). At the end of the third year an indepth evaluation will be performed by a team of technical experts in seed production and utilization. The decision to extend the CA beyond the fifth year will be dependent on the recommendations of the evaluation team and the availability of funds.

Discussion: The purpose of this new project is to improve the capabilities of the LDCs to efficiently produce, harvest, process, condition, and distribute seeds of improved and/or superior crop varieties to the farmers. It is the world's farmers, not governments nor private companies, who produce the food, feed, fiber and biological fuels needed. Seed programs fulfill their service function only when millions of farmers are able to obtain and plant good quality seeds of improved crop varieties.

The purpose will be accomplished by assisting LDC governments, parastatals, extension services, private sector entities, and national, regional and international organizations to develop and adapt improved seed production and utilization techniques that are aimed at increasing crop production. This new project will finance adaptive research, multi-level training ranging from technical to the Ph.D. level, technology transfer and networking in a variety of activities specifically designed to provide the LDC farmers with improved varieties of seed.

In 1956, AID's predecessor agency, ICA, recognized the need for seed programs in LDCs and selected STL-MSU to implement such a program. Since 1950 the seed technology program at MSU has been recognized as a world renowned center for seed technology. Its program includes all phases of research, teaching/training, technology transfer, and maintaining and expanding a worldwide network of scientists and institutions. Teaching and training courses include a short course for seedsmen, seed improvement training course, undergraduate (B.S.), special non-degree, and M.S. and Ph.D. programs. Research is conducted within the Mississippi Agricultural and Forestry Experiment Station (MAFES), and covers most areas of seed technology which are major constraints in LDC crop production; i.e., seed production, harvesting,

[redacted]

drying, processing, storage, quality evaluation and control (including testing). Research is organized on a project basis and is supported by State and Federal grants as well as funds and equipment from the private sector.

Graduates of the technical training courses and M.S. and Ph.D. graduates hold important positions in the developing countries and international organizations. These graduates form the center of the expanding network of U.S., LDC and international scientists and institutions in seed production and utilization.

During the project design stage, it become apparent that a cooperative agreement and a companion ordering contract with MSU-STL is the most efficient and economical method to successfully implement the scope of work outlined in the attached project paper (Attachment A). The cooperative agreement will provide the assistance to MSU-STL to: 1) strengthen its resource base in international seed technology developed over the past three decades of cooperation with the Agency and other donors; 2) expand the level and range of its collaboration with U.S., LDC, regional and international institutions; 3) provide assistance for establishing and improving the supply, quantity and quality of seeds available to farmers to increase yields and improve production efficiency of food and feed crops; and 4) provide course offerings for LDC students at the Mississippi State University.

The companion ordering contract will provide missions, regional bureaus and AID/W offices with short to medium-term technical advisory services for: 1) planning, designing and evaluating programs and projects concerned with seed production and supply; 2) in-country and regional training programs; and 3) testing research results in LDC environments. The practical experiences and on-site information and insights gained during activities under the ordering contract will be fed directly back into the MSU-STL's training programs, academic curricula, informational development activities, and the applied research agenda developed and implemented under the cooperative agreement. It is also intended that the need and opportunity for contract work will be identified by the cooperator in its work under the CA and proposed to the Office of Agriculture, regional bureaus and missions for approval and funding. In addition, MSU may receive requests for assistance directly from the Office of Agriculture, regional bureaus, other AID/W offices, missions and/or LDCs.

The predecessor project was evaluated in July 1983 by a team of seed scientists and experts who strongly recommended continuation of the program with MSU-STL at a level commensurate with the demand for seed production and utilization services. The Agricultural Sector Council reviewed and unanimously endorsed the project paper on August 27, 1985. A copy of the endorsement is attached as Attachment F.

A memorandum to SER/AAM has been prepared which explains limitation of sources for this award and describes STL-MSU's capabilities to provide the needed services through a cooperative agreement (Attachment D). S&T/AGR's FY 1986 OYB will contain $360,000 for this project, as does the FY 1986 Congressional Presentation. A Congressional Notification has been prepared and will be submitted early in October 1985.

[redacted]

S&T/AGR has consulted with SER/AAM, who advises that it is likely that a noncompetitive selection of MSU-STL will be approved for the Companion Ordering Contract (COC). Memorandum requesting this selection is attached as Attachment E.

If a noncompetitive selection of MSU-STL for the COC is not approved, we will ask SER/AAM to compete the contract, limiting competition to universities, if that is possible under the Federal Acquisitions Regulations. If it is not possible to limit competition that way, SER/AAM will conduct a full competition for this contract.

Recommendation:

1. That you sign the project authorization (Attachment B)
2. That you sign the Project Data Sheet (Attachment C)
3. That you sign the attached memorandum to Mr. Phillip Casteel, SER/AAM requesting negotiation only with MSU-STL for a Cooperative Agreement. (Attachment D)
4. That you sign the attached memorandum to Mr. Phillip Casteel, SER/AAM requesting negotiation only with MSU-STL for a Companion Ordering Contract. (Attachment E)

Attachment:
- A. Project Paper
- B. Project Authorization
- C. Project Data Sheet
- D. Memo to SER/AAM for Cooperative Agreement
- E. Memo to SER/AAM for Companion Ordering Contract
- F. Sector Council Endorsement Sheet

Clearance:	S&T/AGR/AP:	R. I. Jackson		date 10/2/85
	S&T/AGR :	F. Li		date 10/2/85
	GC :	A. Mattice		date 10/2/85
	S&T/PO :	G. Eaton		date 10/11/85

S&T/AGR:MMozynski:9/04/85:Revised 9/30/85:235-8922:WANG 2216f

[redacted]

RESE .CH AND DE\ LOPM NT OF

Improved Seed Production and Utilization

Table of Contents

	Page
Acronym Listing	i
Preface	1
1.0 Project Rational, Perceived problem, Background, Goal, Purpose, and Beneficiaries	2
1.1 Project Rationale	2
1.2 Perceived Problem	3
1.3 Prior Involvement of MSU-STL	4
1.4 Project Goal	8
1.5 Project Purpose	8
1.6 Beneficiaries	8
2.0 Project Description	9
2.1 Applied Research	9
2.2 Training	12
2.3 Technology Transfer	13
2.3.1 Problem Solving	13
2.3.2 Technical Transfer and Information	14
2.4 Building Networks	15
2.5 Private Sector	17
3.0 Relationship to A.I.D. Policy and Strategy	19
3.1 Improving Country Policies	19
3.2 Development of Human Resources and Institutional Capacity	19
3.3 Expanding the Role of the Private Sector	19
3.4 Providing Food Aid and Food Security	19
3.5 Conformity with S&T's Ribbon Project Approach	20
3.6 Conformity with Regional Bureau Priorities	21
3.7 Relationship to Other S&T Projects	21
3.7.1 Office of Agriculture Projects	21
3.7.2 Office of Energy	22
3.7.3 Office of Rural and Institutional Development	22
4.0 Cost Estimate, Financial Plan and Person Months	22
4.1 Cost Estimates	22

Table of Contents

4.2 Summary Obligational Schedule 23
Table I - Summary by Fiscal Year 23

4.3 Summary Budget Tables 23
Table 2 - Summary Cost by Project Components 24
Table 3 - Summary Cost by Line Item Expenses 24
Pie Chart - By Project Components 25

4.4 Annual Projection by Person Months 26
Table 4 - Persons Months per Year 26

5.0 Method of Implementation 27
5.1 Cooperative Agreement 27
5.1.1 Priority Research 27
5.1.2 Strengthening LDC & International Institutions 27
5.1.3 Training 27
5.1.4 Technical Advice and Assistance 27
5.1.5 Technical Handbooks and Literature 27
5.2 Companion Ordering Contract 28

6.0 Implementation Plans 29
6.1 S&T/AGR Project Management Responsibility 29
6.2 Management Responsibility & Qualification - MSU-STL 30
6.2.1 Management Responsibility 30
6.2.2 Qualifications, Including Key Personnel, Facilities and Equipment 31
Research Qualifications 31
Technology Transfer Qualifications 32
Training Qualifications 32
6.3 Country Selection Criteria 33
6.4 Schedule of Project Events 33
6.4.1 Scope of Work for Seven Years 33
Adaptive Research 33
Training 34
Technology Transfer 36
Problem Solving Assistance 36
Tech. Transfer and Informational Services 37
Building Networks 37
Private Sector 39
6.4.2 Annual Work Plans 40

Table of Contents **Page 3**

7.0 Project Monitoring Plans **41**
- 7.1 Reporting Requirements 41
  - 7.1.1 Trip and Technical Reports 41
  - 7.1.2 Annual Activity Reports 42
  - 7.1.3 Technical and Research Reports 42
  - 7.1.4 Annual Expenditure Reports 42
  - 7.1.5 Impact Analysis Report 42
- 7.2 Project Review and Evaluation 43
  - 7.2.1 Management Reviews 43
  - 7.2.2 Indepth Evaluations 43

8.0 Project Analysis **44**
- 8.1 Factors Affecting Project Selection and Further Development 44
  - 8.1.1 Socio-Economic Context 44
  - 8.1.2 Social Considerations 45
  - 8.1.3 Women in Development 46
- 8.2 Socio-Cultural Feasibility 47
- 8.3 Economic Considerations 47
  - 8.3.1 Justification of Investment 48
  - 8.3.2 Alternative Approach 48
- 8.4 Alternative Implementation Strategies 49
  - 8.4.1 International Institutions 49
  - 8.4.2 Private Sector 50
  - 8.4.3 Missions Funding on an Ad-Hoc Basis 50
  - 8.4.4 One Institution 50
- 8.5 Expected Project Benefits 51
- 8.6 Relevant Experiences with Similar Projects 52
- 8.7 A.I.D. Support Requirements 52
- 8.8 Relationship to Mission Programs 53

9.0 Initial Environmental Examination **53**

References **54**

Appendices

Appendix	I	Log Frame
Appendix	II	Budget by Project Component
Appendix	III	Budget by Line Item Category
Appendix	IV	Key Personnel
Appendix	V	Network and Linkages
Appendix	VI	Summary of Cable Responses
Appendix	VII	Quality Control System
Appendix	VIII	Environmental Threshold Determination
Appendix	IX	Summary of MSU-STL's Previous International Activities
Appendix	X	Resources at MSU-STL
Appendix	XI	List of Students in Agronomy - Seed Technology - Fall 1984
Appendix	XII	Research Literature

IRC:MMozynski
8/12/85

ACRONYM LISTING

AID	Agency for International Development
AVRDC *	Asian Vegetable Research and Development Center
CAP	Central American Peace Scholarship
CIAT *	International Center for Tropical Agriculture
CIGRAS	La Universided de Costa Rica
CIMMYT *	International Maize and Wheat Improvement Center
CA	Cooperative Agreement
CATIE	Tropical Agricultural Research and Training Center
CRSP	Collaborative Research Support Program
DARP	Diversified Agriculture Research Project
EA	East Africa
FAO	Food and Agriculture Organization
FCRI-Bogor	Central Food Crops Research Institute - Indonesia
FS	Forest Service, USDA
GSC	Ghana Seed Company
GTZ	German Technical Assistance Agency
IADB	Inter-American Development Bank
IARC	International Agriculture Research Centers
IDB	International Development Bank
IDA	International Development Association
IBRD	International Bank for Reconstruction and Development
IDRC	Canadian International Development Research Center
ICRISAT *	International Crop Research Institute for the Semi-Arid Tropics
IITA *	International Institute of Tropical Agriculture
INIPA/FRM	National Institute for Agricultural Research and Extension Foundation Reproduction Materials (Peru)
IPB	Institut Pertanian Bogor, Indonesia
LDCs	Less Developed Countries
KSC	Kenya Seed Company
KSU	Kansas State University
MAFES	Mississippi Agriculture and Forestry Experimental Station

MOSSRL	Mississippi Official State Seed Regulatory Laboratory
MSIA	Mississippi Seed Improvement Association
MSU	Mississippi State University
NAPP	National Agricultural Production Program (Egypt)
PP	Project Paper
R&D	Research and Development
REDSO/ESA	Regional Economic Development Service Office/ East Africa
ROCAP	Regional Office for Central America and Panama
S&T/AGR	Bureau for Science and Technology, Office of Agriculture
STL	Seed Technology Laboratory
UNDP	United Nations Development Program
UPCA	University of the Philippines, College of Agriculture
WARDA *	West African Rice Development Association
USDA	United States Department of Agriculture

* International Agriculture Research Centers

IRC:MMozynski
8/12/85

IMPROVED SEED PRODUCTION AND UTILIZATION

Preface - The Office of Agriculture and the Director for Food and Agriculture are proposing a new seven-year "Improved Seed Production and Utilization" project for $5.586 million. Improved seed as used in this project paper refers to good quality seed of improved and/or superior crop varieties produced, conditioned and stored so as to maintain germination at a level that will produce a uniform stand of vigorous seedlings for planting. Seed production and utilization as used in this project paper refers to harvesting, conditioning, processing, storage, testing, quality control, distribution and marketing.

The $5.586 million includes $3.42 million from S&T/AGR and $2.166 million from missions, regional bureaus and other A.I.D./W offices under the companion ordering contract. In addition, MSU is committed to contribute $1.696 million to this project bringing the total for the seven year period to $7.282 million.

It is recommended that the Seed Technology Laboratory (STL) at Mississippi State University (MSU) be selected to implement this project under an initial five-year cooperative agreement and a companion ordering contract. Since 1950 the STL has been recognized as a world renowned center for seed technology. This Seed Technology program at MSU has a three-fold purpose: teaching/training, research and service. Teaching and training courses include a short course for seedsmen, seed improvement training course, undergraduate (B.S.) special non-degree, and M.S. and Ph.D. programs. Research is conducted within the Mississippi Agricultural and Forestry Experiment Station (MAFES), and covers most areas of seed technology. Special emphasis, however, is given to the areas of seed production, drying, processing, storage, quality evaluation and control (including testing) which are major constraints in the LDCs. Research is organized on a project basis and is supported by State, Federal and grant funds from the private sector.

In addition, STL works closely with and provides a variety of services to U.S. seed producers and suppliers in the private sector; i.e., advice and assistance on seed operations, information materials, individual training programs, short courses, and problem identification. The U.S. private sector in turn donates a major portion of the research equipment to MSU.

Since 1972, MSU and other Mississippi State agencies have invested more than $2.0 million in State appropriated funds on this complex of modern research and training facilities which serves as an informational and resource center

for seed technology and provides technical and advisory services unequalled elsewhere for applied research and theoretical, practical and operational training. Additional State investments are made annually to maintain and install the latest technological facilities and equipment for research and training activities.

The STL is under the Agronomy Department of MSU and implements technical and support activities involved in the production and supply of seed: i.e., harvesting, conditioning, processing, storage, testing, quality control, distribution and marketing. Although agronomic crops such as corn, rice, sorghum, wheat, other cereals, and soybeans receive major emphasis, attention is also given to seeds of forage and pasture, vegetable, and forest species.

While STL is an integral part of Agronomy, the program in seed technology at MSU has been multidisciplinary since its beginning in 1950. The Departments of Agricultural, Biological Engineering and Agricultural Economics are major, long-term cooperators. Other departments, laboratories and agencies located at MSU participate in various seed research projects, training courses, graduate study programs, and service work. These include the Mississippi State Seed Testing Laboratory, Mississippi Seed Improvement Association (certification agency), Foundation Seed Stocks, Forest Tree Seed Laboratory (FS, USDA), Extension Agronomy Department, and the Departments of Horticulture, Biochemistry, Forest Resources, and Plant Pathology and Weed Sciences. The management and qualification of STL are covered in detail in Section 6.2.2 below and the resources in place at MSU are contained in Appendix X.

1.0 Project Rationale, Perceived Problem, Background, Purpose, Goal, and Beneficiaries

1.1 Project Rationale To grasp the importance of seeds to farmers, one must understand that seeds are essential to the survival of mankind. They store the highest genetic potential that science can develop and are vital ingredients in modern agriculture. They are programmed, like computers, to hold and give back specific characteristics. Seeds of improved varieties permit the farmers to produce larger crops with more nutritional value than would otherwise be possible. To reach the LDC farmers with these improved varieties, seed production and utilization systems must be established and maintained.

1.2 Perceived Problem: A seed production and utilization system must be understood for what it is - a "service" to farmers. The world's farmers, not governments nor private companies, produce the food, feed, fiber and biological fuels needed. Seed programs fulfill their service function only when millions of farmers are able to obtain and plant good quality seeds of improved crop varieties.

A.I.D. and other donors/lenders have long recognized the importance of getting better seeds to the LDC farmers through improved seed production and utilization systems to increase food and feed crop production. Yet, reasonably well established and balanced seed systems have emerged only in a few countries; e.g., Thailand, Korea, Brazil, India and Colombia. In other LDCs, conditions have improved, but inadequate systems continue to constrain development. Technical and economic assistance will be needed for many years to reinforce investments already made or even to take the initial steps to develop seed programs especially in African countries. Some of the constraints faced by many LDCs are:

- Seed supply has not been seriously addressed by some LDCs who appear unaware of the technologies that can increase production.
- Limited corps of knowledgeable and skilled operators and managers.
- Available technology is not appropriate or needs adaptation to LDC conditions.
- Unresolved technical problems that impede development and greatly limit operational efficiency.
- Private Sector involvement has been limited.
- Inadequate and sporadic developmental support.

The establishment of a seed production and utilization system that is adequately supportive of agricultural development requires:

- An enlightened national policy on seed production and supply.
- Informed and careful planning by LDC policy and decision makers.
- Effective and efficient organization of operational seed program.
- Close and effective cooperation and coordination among several operational elements in the public and private sectors.
- Trained managers, technicians and workers.
- Adequate facilities and equipment.
- A satisfactory quality control program.
- A continuous flow of technical information and support.

- An adaptive research capability to resolve technical problems.
- Effective and continuous promotion system.

- An adequate demand assessment and utilization intelligence capability.
- An effective distribution and marketing system.
- A commitment of adequate support over a long enough period to permit establishment of seed program/industry.

Only a few of the LDCs have sufficient experience in the technical, managerial and economic dimensions of seed production and utilization systems to fulfill the requirements outlined above without external help in the form of adaptive research, training, technology transfer and networking which draws on the expertise of scientists from the US, LDC national, regional and international organizations and institutions. In many countries in Latin America, South Asia and Africa, sound agricultural development programs are just getting underway. As these programs progress, seed production and supply systems will become increasingly important. Unless adequate arrangements are made to supply the farmers with seeds of new varieties, agricultural production will be severely limited. The following countries have started seed programs that will require considerable assistance: Paraguay, Dominican Republic, Bolivia, Haiti, Honduras, Peru, Guyana and Guatemala in Latin America; Ghana, Nigeria, Tanzania, Kenya, Niger, Botswana, Zambia, Burkina Faso and Cameroon in Africa; Morocco in the Near East; and Burma, Sri Lanka, Pakistan and Nepal in Asia. In addition, periodic assistance also will be required by many of the countries that have established reasonably effective seed programs; e.g., Colombia, Ecuador, Costa Rica, and Panama in Latin America; Indonesia, Thailand and the Philippines in Asia; and Egypt in the Near East.

1.3 <u>Prior Involvement of MSU-STL</u> - A.I.D.'s predecessor Agency, ICA, recognized the need to initiate seed programs in selected LDCs decades ago. In FY 1956 ICA and the Foreign Agricultural Service, USDA asked MSU to organize and conduct a 6-week "Special Training Course in Seed Improvement" for participants from cooperating countries. The first course was held in June - July 1956 and has continued on an annual basis to the present. Through the 1985 course, 454 participants from 71 countries have taken this course and approximately 98 percent of them have returned home to hold responsible positions in seed programs. A listing of participants and their sponsoring countries who have attended the Special Course from 1956 - 1984 is in Appendix IX.

After the first two "Seed Improvement Courses" in 1956 and 1957, it became apparent that some mechanism was needed to follow-up on the returning participants and to provide more direct technical assistance in the seed area. Trainees returning home literally besieged STL with requests for technical information, advice, facility designs, equipment specifications, and consultative visits. Since most of these requests for assistance arose out of AID-Mission sponsored or financed programs in the LDCs, and MSU could not provide the assistance requested wholly from its own resources, a contract was signed on March 18, 1958 to provide LDCs with technical assistance and services in the area of seed program development. A list of institutions in LDCs assisted by MSU to develop training programs in seed technology is attached on Page 5 of Appendix V. The arrangements with MSU have continued under several contracts and one cooperative agreement. The latter will expire on November 15, 1985.

Under the previous arrangements with A.I.D., MSU provided through 1984 direct in-country assistance and services (234 visits) to 54 countries, advisory and informational services through correspondence and reception of visitors to over 15 additional countries and training opportunities (B.S., M.S., and PhD degrees) to 244 students from 56 countries. MSU specialists have spent more than 5000 days during 234 consultative visits to the LDCs on a variety of tasks related to establishment of seed programs and industries. The general types of assistance and services provided under the MSU-AID agreements have included assistance in: planning, organizing and implementing seed programs and projects; designing seed facilities; equipment specifications and installation; technical management of seed production, conditioning, storage and quality control operations; training ranging from in-service, on-the-job operational training of base-level supervisory personnel to PhD degree programs in Agronomy-Seed Technology; economic and technical analyses to determine the need for and feasibility of seed units and facilities; informational materials and services on all aspects of seed technology; and adapting new technology for seed operations under warm, humid conditions; i.e., the humid sub-tropics and tropics. More information and examples of the types of assistance and countries involved are given in Appendix IX.

The training programs have been very successful. MSU graduates are holding responsible positions in both the public and private sectors of the LDCs and international organizations. A MSU graduate has been the Director of the

Bureau for Plant Industry in the Ministry of Agriculture in the Philippines. The Director of National Seed Service in Nigeria is a MSU graduate. MSU graduates hold practically all of the high level positions in the public and private sector seed industry in Brazil and Thailand. In FAO, the principal officer in the Investment Center is a MSU graduate. Three MSU gradutates designed a World Bank seed production and marketing project for Burma in 1984. In Indonesia, MSU graduates hold responsible positions in the Ministry of Agriculture and Research Coordinating Center at Bogor and are implementing a World Bank financed seed program for soybeans, corn, peanuts, sorghum, mungbeans and wheat.

Successful programs have been initiated in the Third World with the MSU assistance. For example, in Brazil, under an A.I.D. project, MSU seed specialists assisted in the design of a seed production and supply industry program which was later funded by an IDB loan. As a result of this program, Brazil developed a model seed industry. In India, three to four MSU specialists assisted the National Seeds Corporation to develop a very successful program. In Honduras, MSU assisted the Escuela Agricola Panamericana to develop a seed training center for ROCAP to conduct several regional training courses. MSU assisted the Government of Thailand to implement an A.I.D. - loan financed seed development project which A.I.D, the World Bank and others have indicated is a very successful project and a model for other countries.

In July 1983 a team of seed production and distribution experts evaluated the previous project and commended STL for the excellent service it has provided to the missions, bureaus, LDCs and international organizations and institutions at a minimum cost to A.I.D. The team strongly recommended continuation of the program at MSU at a level commensurate with the demands for seed production and utilization services. It pointed out that the scientists at STL are not only outstanding in their field, but have a continued interest in the programs they have assisted. They place emphasis on helping the LDCs and they willingly share their research results and knowledge with others without concern on who gets the credit.

On April 23, 1985 the PID for the new project was unanimously approved by the members of the Sector Council for Agriculture with the understanding that more emphasis will be placed on the private sector. This revised project paper expands the private sector activities previously funded under

Project 931-0203, Seed Program and Industry. A program to assist the private sector is no problem for the scientists at STL as they have been working closely with the private sector in the U.S. and in the LDCs where the Governments have initiated and supported programs in this field. In addition, STL will be contacting firms and Participating Agencies implementing private investment projects funded by the Office of Rural Development and Institutional Development. These projects are discussed in Section 3.7.3 below.

In May 1985 a cable was sent to Missions requesting comments on the new project, an indication of future needs for assistance, and the level of mission anticipated "buy-ins". All of the Missions responded favorably and recommended the continuation of the project. While most of the Missions were not in a position to indicate the level of funding that would be provided, many did indicate that there will be a future need for MSU-STL to provide technical assistance, research and training. S&T/AGR has estimated the requirements at approximately $2.2 million over the seven-year period or $1.347 million for the initial five-year ordering contract. The Mission responses are summarized in Appendix VI.

This new project will place emphasis on adaptive research, multi-level training, technology transfer and networking in a variety of activities specifically designed to provide the LDC farmer with improved varieties of seed. It will assist LDCs to develop the capabilities and to gain the experience needed to develop and support viable seed production and utilization systems in both the public and private sector by:

- Assisting in the development, further development and/or reorganization of seed programs in seven or more LDCs
- Providing training and/or technology transfer opportunities for 60 or more persons from LDCs at the B.S., M.S. or Ph. D. levels; 21 or more persons for one to 6 months special training courses at MSU; 100 or more participants in an 9-week Special Course on Seed Improvement at MSU; 100 or more participants in regional and/or in-country training courses; 60 or more persons from LDCs for visits/technology transfer sessions of one to 5 days.
- Assisting with the institutionalization of seed research and training programs in six selected LDCs which are representative of the three regions.

- Transfer of technology in the form of a semi-annual seed research and development report to 350 recipients, four definitive and up-to-date handbooks on operational components of a seed industry, three sets of guidelines on specialized operations and 200 plus reprints and updated informational leaflets on various aspects of seed technology.

- Improving the effectiveness and efficiency of technologies and methodologies for the production, drying and storage of maize, sorghum, soybean, peanut, bean/cowpea and wheat seeds under humid, subtropical and tropical conditions.

- Collaborating with the CIAT Seed Unit, CIGRAS (University of Costa Rica), EMBRAPA (Brazil), IITA's proposed seed unit, Kasetsart University (Thailand), IPB (Indonesia), UPCA (Philippines), Massey University (New Zealand), University of Edinburgh, (United Kingdom), Kansas State University and the production CRSPs and others in the development and implementation of training programs, identifying and resolving seed problems and adapting and transferring technologies.

1.4 Project Goal The project goal is to increase the quality and quantity of food and feed crop production in LDCs.

1.5 Project Purpose The project purpose is to improve the capabilities in the LDCs for efficient production, conditioning, distribution and utilization of seeds of new and improved food and feed crop varieties.

1.6 Beneficiaries The ultimate beneficiaries , however, are the farmers in terms of increased and more efficient production in the first year and for three to five years thereafter, because seed are multiplied rather than consumed in the production process and farmers have been saving seeds for thousands of years. Every farmer persuaded to increase the variety of his food crops and supplied with appropriate seed would reap benefits in terms of improved nutrition for his family and increased production for marketing. Indirect beneficiaries are rural and urban consumers.

2.0 Project Description - This new project will impact directly on A.I.D.'s Policy and Strategy and complement bilateral seed production and utilization programs by undertaking field research, supporting long-term U.S. based research for workable LDC adaptation, providing academic and technical training, transfering technology and providing technical assistance and building networks of production and seed utilization specialists, policy makers, international institutions and aid donors in Asia, Near East, Africa, and Latin America.

This project will support a balanced program at MSU-STL of applied research, technology transfer and informational services, multi-level training and progressive networking to assist with development and improvement of capabilities in the LDCs for the effective and efficient production and distribution of improved varieties of seeds to the commerical small farmers. It will provide the services of highly skilled and experienced scientists such as agronomist-seed technologists, agricultural engineers and agricultural economists to missions and host governments to assist in the development and/or adaptation of technically sound and economically viable methodologies/technologies for increasing the quantity and quality of seed supplies to farmers in the LDCs, especially those in warm, humid, or extremely dry climates. The project will be implemented under an initial five-year cooperative agreement and companion ordering contract for the same period. The components and expected outputs of the project are given below.

2.1 Applied Research - Applied research has been a minor, but important aspect of the previous project. The phase "applied research" does not properly define the type of work undertaken in the past. Perhaps, "development of essential technology" would be more descriptive, for basically, the research has been concerned with the development of certain technologies and methodologies that do not exist in the LDCs, but which are crucial for resolution of technical problems in the seed sub-sector in the LDCs, especially those with humid or extremely arid tropical or sub-tropical climates.

This new project will place more emphasis on the research aspects for efficient production, conditioning, distribution and utilization of seeds to improve the systems of the public and private sector for getting new seed varieties to farmers.

The research undertaken will be predominately of an applied nature and designed to: 1) solve problems that impede the production and/or supply of seeds in the LDCs; and/or to 2) improve the effectiveness and efficiency of the operations. The research will be performed at MSU where crops, climatic conditions and seed problems are similar to those in many LDCs; and at collaborating LDC institutions and at international organizations such as the IARCs. Special emphasis will be given to establishing and implementing collaborative research with the crop production CRSPs at MSU, the collaborating U.S. Universities, and on-site in the LDCs. The MSU-STL will fully utilize its position and long established relationships to draw on resources from public and private institutions and companies in the U.S. and the more advanced LDCs such as India, Brazil and Thailand to facilitate and enhance the program of applied research.

The research activities will focus on the following:

- Seed multiplication, production and harvesting procedures that minimize field deterioration, incidences of seed borne diseases, and the storage time required for the seed; i.e., time from harvest to planting.
- Simple, but effective systems or procedures for drying seed to safe moisture levels for storage using renewable energy sources.
- The most efficient systems for seed storage of different kinds and quantities of seed based on moisture proof packaging materials, dehumidification, and treatments (such as antioxidents and enzyme inhibitors) that extend the longevity of seed under warm humid conditions
- Quality assurance and control criteria, standards and operational procedures adaptable to different scales of production, crops, and climatic zones.
- Better conditioning procedures and quality evaluation methods for seed of tropical forage crops.
- Improvements in farmer seed selection and storage practices with emphasis on varietal purity, freedom from disease, and maintenance of germination.
- Identification of inherent properties of seeds associated with superior resistance to weathering, longevity and emergeability under multiple seedbed stresses for breeders to incorporate into improved varieties, as appropriate.

- Analysis of economic aspects of seed production and supply in the LDCs to identify and define policies that constrain or foster the entry of the private sector, and to establish assessment methodologies for determining the economic feasibility of private seed enterprises in terms of seed kinds and level of agricultural development in the country or areas therein.

Approximately half of the applied research activities will be accomplished by a corps of 20-plus LDC professionals working on graduate degrees at the MSU-STL under close supervision of the STL staff. This corps of graduate students will represent, in effect, a every substantial "buy-in" component by an array of institutions and agencies funding the students; e.g., World Bank, FAO, UNDP, A.I.D. missions, and other bilateral donors. In academic year 1984-85 there were 5 , LDC students enrolled in M.S. and Ph.D. degree programs in Agronomy-Seed Technology at MSU. With the specific emphasis on applied research in this project, the research efforts of these students will be harnessed and coordinated to accomplish a substantial portion of the applied seed research needed. After graduation and return to their countries, participants in appropriate settings can be engaged in collaborative research back in their home institutions. Where appropriate and possible, graduate students will do their academic work at MSU and their research on-site in collaboration with LDC and regional institutions, the IARCs and the CRSPs.

The expected outputs of the research component are: 1) improved, but simple and inexpensive technologies/methodologies for on-farm seed multiplication, production and harvesting for maize, soybeans, beans/cowpeas, rice, and sorghum; 2) improved technologies and methodologies for commercial scale production of good quality seeds of maize, soybeans, beans/cowpeas, rice and sorghum under warm, humid and extremely arid conditions; 3) least cost systems for storage of small (to 100 kg) and large (to 1000 MT) quantities of seed under warm, humid conditions; 4) appropriate quality assurance, evaluation and control systems for maize, soybeans, beans/cowpeas, wheat and sorghum; 5) cost effective non-petrol seed drying systems - one small scale (to 100 kg) and one large scale (5-20 MT; 6) identified and defined policy issues that constrain or promote private sector entry in seed production and supply; and 7) assessment methodologies for determining the economic and technical feasibility of seed operations.

2.2 Training - Training programs of varying intensity, duration, depth and emphasis have been and will continue to be designed and implemented at MSU and at national and international institutions with the help of MSU scientists. These training programs will range from graduate degree work in Agronomy-Seed Technology at MSU to in-service or on-the-job training at the LDC operational level. Special attention will be given to improving existing seed technology courses and establishing new courses to meet the requirements of LDC agricultural education institutions. Regional training courses and workshops will be held at national, regional and international centers; e.g., CIAT where a Seed Unit has an intensive training program supported by workshops and collaborates technically with A.I.D. to lay the foundation for a seed technology network in Latin America. At least one in-country or regional training course will be given each project year.

As in the past, special and degree training at MSU will be primarily funded by sources outside the project, by the missions, LDCs, national and international organizations and other donors or the participants themselves. The participants in degree training programs have been sponsored from practically all of the LDCs and most of them return to their home countries to employment within the seed program/industry. MSU provides a maximum of 25 slots at any one time for LDC degree trainees in Agronomy-Seed Technology and 5 special (one to six months) training slots for non-degree trainees. MSU assists applicants in excess of available slots to gain enrollment at other universities and assists worthy applicants in obtaining financial assistance from charitable and voluntary organizations and other institutions if these applicants are from LDCs which have few, if any, trained seed technologists, but cannot pay for the courses.

The 9-week Seed Improvement Course will continue annually at MSU for a maximum of 20 participants with tours to other locations. Finally, during the course of the project, MSU will develop comprehensive teaching/training packages of audio-visual, and textural materials on seed certification, seed testing, seed conditioning, seed storage and seed marketing. See Appendix IX for additional information on the previous training activities.

It is expected that under the ordering contract, missions, regional bureaus and AID/W offices other than S&T/AGR will fund in-country and regional training and training-of-trainers courses, training demonstrations, and special courses at MSU and in-country. The cooperative agreement will partially fund the salaries of the scientists and support staff, provide financial assistance to LDC students funded from other sources to obtain necessary materials as required to complete their course studies, and fund

LDC graduate students to undertake research at MSU and in their home countries on efficient production, conditioning, distribution and utilization of seeds. MSU's contribution will fund seed conditioning equipment and certain supplies needed for the successful implementation of this project. In addition, MSU provides scientific advisory assistance and financial support to students, and funds publications in scientific journals and special training courses not covered in the above.

2.3. Technology Transfer - Under technology transfer, MSU will continue to provide problem solving assistance, technical transfer and informational services to missions, LDCs governments, national and international organizations and institutions. In the process of providing assistance, MSU scientists will also collect information on successful seed production and utilization models which may be appropriate for further research development and adaptation in other LDCs. Thus, there will be a continuous feedback of information from and to MSU and LDCs under this project.

2.3.1 Problem Solving - Under problem solving, MSU will provide the services of the most appropriate experts and scientists to LDCs upon request from S&T/AGR, missions, LDCs and regional bureaus. These experts and scientists will be drawn from the STL, other Departments of MSU, and from other sources as appropriate to implement and successfully complete the various assignments to be funded under A.I.D. The development of improved crop varieties and their introduction into the agricultural systems of the LDCs, along with a "package" of essential practices and inputs, continues as a major tactic of the strategy for increasing world food and feed supplies. In accord with this strategy, substantial crop breeding and cropping systems improvement programs are underway in the LDCs, IARCs, and developed countries. Problem solving assistance will include the following important areas of seed production and utilization necessary to provide seeds of the improved varieties to the farmers:

- Planning, organizing, reorganizing and implementing seed production and supply programs or projects and their integration into the over-all LDC strategy for agricultural development, including extension services, contract farmers and parastatal and private organizations.
- Indentifying, analyzing, and recommending solutions to managerial, financial and operational problems in seed production, harvesting, drying, processing, quality control and testing, storage and distribution.
- Advising LDC governments to plan for emergency seed programs to minimize the impact of drought on the seed production industries.
- Analyzing staff, equipment and seed facility requirements and/or recommending: 1) types, capacity and location of facilities for seed

production, drying and storage units, processing and packaging plants; 2) quality control and research laboratories, certification agencies and foundation seed programs; and 3) capital investment requirements and operational costs.

- Designing and preparing technical specificiations for the physical facilities and equipment required for seed production and marketing operations, and assisting in the installation and operation of this equipment. The physical facilities and equipment could include: 1) seed handling and drying systems; 2) normal and long-term storage units; 3) processing (cleaning, treating, and packaging) plants; 4) quality control and research laboratories, and 5) seed production units.
- Providing advise on the economic feasibility of producing seeds.

2.3.2 Technical Transfer and Information - Under this component, technological developments and research results will be analyzed by scientists familar with LDC problems and conditions to identify those applicable and appropriate for adaptation and exploitation for resolving seed problems in the LDCs and/or improving the efficiency of operations. Appropriate technology will be transferred to and disseminated in LDCS through technical assistance, visits, training courses and workshops, reports and specially prepared informational materials. For example, in 1970, a handbook on "Seed Program Development" was published which provided the rationale and justification for seed program development in LDCs. It described the elements of a seed program, outlined the steps needed to establish a program, and emphasized that seed programs must be integrated in the overall agricultural development strategy of a country to maximize production. The concepts and ideas advanced in this handbook were responsible for the widespread recognition in the international arena that an organized seed production and utilization system is essential for substained agricultural growth, and that comprehensive planning and programming are needed to establish a successful seed program. More specifically this project will provide the following which will be designed specifically for LDC resources and environments:

- The Handbook on Seed Processing and Handling published in 1968 will be extensively revised for use as a reference and training manual.
- Handbooks on Seed Drying and Seed Storage incorporating the latest methodologies and technologies in these fields will be prepared.
- Quality Assurance and Control Methods in Seed Enterprises Handbook will be prepared on comprehensive system for private and public operations.
- Research results demonstrated to LDC researchers, Agency employees, farmers and agribusiness firms.
- Workshops and conferences will be held

26

- A semi-annual research and development report will be distributed to missions, regional bureaus, LDC government and private institutions, and international organizations. This research report will provide information on sources of new technologies and technical information, recent research findings at MSU and other institutions. It will list and review events of interest to seed workers, including training courses, scheduled workshops and international meetings and conferences to foster worldwide collaboration among teachers and scientists working in the areas of seed technology, training and research.
- Guidelines for maintenance of seed varieties, field inspections, and breeder and foundation seed production will be published.
- Research findings will be published in scientific journals and disseminated to IARCs, LDC and regional institutions and missions.

2.4 Building Networks - The MSU-STL has long established linkages to a "network" of human and technical resources within Mississippi State University, the State of Mississippi and the U.S. public and private organizations and institutions involved in seed technology and related operational areas. As set forth in Appendix V (Networking), the MSU-STL is also the hub of a very extensive, but mostly informal network of persons, units and institutions in more than 35 LDCs with especially close and resourceful linkages with CIAT; CIGRAS (University of Costa Rica); Kasetsart University and the Seed Division, Department of Agricultural Extension, Thailand; IPB (Bogor), Indonesia; UPCA (Philippines), EMBRAPA and the Rural University, Pelatos, Brazil; WARDA, and more recently IITA. The MSU-STL was also a member of the Sorghum and Millet CRSP until mid-1964, and continues to cooperate closely with INTSORMIL. It has mutual interests with the Peanut and Beans and Cowpea CRSPs and the expertise which could be extremely helpful in the furtherance of the work of these CRSPs. Under this CA, linkages will be formalized into operational seed research and training networks in the Caribbean Basin, South America, Asia and Africa. These, in turn, will be linked into a global network made up of the more dominant players such as CIAT, IITA, institutions in Costa Rica, Brazil, Thailand, Indonesia, Philippines, WARDA and possibly India, if the Indian Government develops National Seed Center.

To formalize, expand and maintain an operational seed research, training and technology transfer network. a strong, adequately supported leadership from MSU-STL is required. In addition, capable collaborators with prospects of

mutual benefits, and adequate support for the LDC participating scientists, technologists and institutions must be available. In this regard, MSU-STL will provide backstopping assistance to its graduates and trainees to maintain a collaborative relationship after they return to their home countries to the extent funds and staff time are available. Innovative and indirect initiatives and measures such as organization of special working groups, study visits at MSU for LDC scientists to update their knowledge and skills, collaboration on graduate programs with academic work and final write-up at MSU and field research in LDCs will be required to foster and strengthen the linkages desired.

In selected cases, where an adequate educational and/or research setting is available (e.g., CIAT, University of Costa Rica, Institute of Agriculture-Bogor, Indonesia, Kasetsert University, Thailand, several universities in Brazil and India), graduate students could pursue much of their field research in an LDC setting. The course work, computations and analyses, thesis writing and degree taking could be at MSU. Funding would be required for the instructor and professors to travel to the LDCs to review the work of the participants. The added benefit of this arrangement (course work at MSU and research in LDC setting) would be collaborative networks and cooperation with LDC institutions.

In addition, applied research activities would be accomplished in collaboration with partners-in-research in selected LDCs, IARCs and the CRSPs. Depending on the availability of funds, STL could establish within months a very effective collaboration with Kasetsart University in Thailand, UPCA, Los Banos in the Philippines, IPB-Bogor in Indonesia, University of Costa Rica, Escuela Agricola Panamericana in Honduras, CIAT and several agricultural universities in Brazil and India. While very substantial collaboration could be effected just through timely visits and special efforts to maintain contact, some funding for exchange visits of the participants involved in the research could be very effective. Likewise funds for acquisition of non-locally available supplies, a modest amount of specialized equipment, and repair of equipment would also be needed. From MSU contacts with certain missions and LDC officials, it is hoped that the Latin America Bureau will provide some funds for collaboration with CIAT because of the regional orientation. Likewise, ROCAP will probably be interested in "buying-in" on the part of the Escuela Agricola Panamerica (Honduras) and the University of Costa Rica. The Indonesian, Thailand and/or Philippine Missions might "buy-in" on behalf of the collaborators in their countries.

2.5 <u>Private Sector</u> - Finally, but very importantly, this project will promote, support and assist private sector initiatives and operations in seed production and supply in appropriate LDCs such as those in-place and on-going in India, Thailand, Brazil, Colombia, Kenya, Venezuela and the Philippines, and starting up in Egypt, Indonesia, Nigeria and Ecuador. MSU's track record in collaboration and cooperation with private sector components of the seed industries in the United States and other agriculturally advanced countries is well established. The MSU-STL is an internationally recognized model of a specialized public sector unit established (1950) to provide technical assistance, training, and research services to a component of a national agri-business complex (U.S. seed industry) and this role continues. It was and remains involved in the development of public-private sector collaborative seed industries in a number of countries. In Thailand, for example, under an AID-loan funded project, a MSU technical assistance seed team working with the Department of Agricultural Extension, MOA, RTG, since 1978 on seed program/industry development is playing a crucial role in the development of a very substantial private seed industry (6 companies). The private sector has been so successful that some companies have recently extended operations to Indonesia. This "Thai model" was studied in 1983-84 by the A.I.D.'s Bureau for Private Enterprise and the World Bank. In earlier projects, A.I.D.-funded MSU teams of experts were instrumental in persuading the Government of Brazil to establish policies favorable for private sector participation in seed production and supply (1964-74), and in the development of a private sector seed support industry in India; i.e., equipment manufacture and supplies (1968-71).

MSU will draw fully on its long established linkages with and experiences gained from the U.S. seed trade, trade associations, and related agri-business and connections in other agriculturally advanced or advancing countries including Brazil, India, and Thailand to promote, support and assist an expanding private sector role in seed production and supply in LDCs where conditions are suitable. These efforts will be in cooperation with other relevant Agency-funded projects such as the Agricultural Marketing Systems and Institutions (936-5313), the Industrial Promotion and agribusiness development project (936-4053), and the Small Enterprises Approach to Employment project (931-1090) to address the full spectrum of possibilities for private sector involvement ranging from "micro-entreprenuers"; i.e., farmers saving seed for sale to neighbors, to partnerships between local investors and multi-national seed breeding and marketing firms.

21

The specific ways in which this project will promote and assist the private sector include the following:

- Identification and explanation of policy changes needed to facilitate or permit the involvement of the private sector entrepreneurs in seed production and supply.
- Development and validation of assessment methodologies and criteria for establishing the economic and technical feasibility of private sector seed operations.
- Identification of a suitable incentives package for private investors such tax "holidays", exemption from import duties on equipment and foreign exchange for import of equipment, and credit for financing capital and operational costs.
- Provision of training opportunities and informational materials for private sector personnel.
- Technical assistance to private seed companies in design of seed facilities, specification of equipment, technical operations and utilization.
- The resolution or lessening of problems through research and technology transfer.

The advances made in minimizing risks through improvements in the methodologies and technologies of seed production, conditioning, and storage under the collaborative work with LDCs and international institutions will, of course, be fully available and applicable to private sector operations.

The annual work plans prepared by MSU-STL in implementation of this project will include a specific section detailing efforts and activities that are or will be directed at expanding and assisting private sector involvement in seed production and supply in target LDCs during the work year.

3.0 Relationship to A.I.D. Policy and Strategy: The objectives of A.I.D.'s Food and Agricultural Policy and Strategy are to enable LDCs to become self-reliant in food, assure food security and contribute to broadly-based economic growth. This project is consistent with these objectives and the four (4) elements of the policy listed below:

3.1 Improving Country policies - This project contributes in a fundamental way to food self-reliance and food security. It fosters and assists LDCs with the development and improvement of policies, institutions, technologies and manpower resources needed to improve seed supply - an input delivery system vital for sustained growth of the agricultural sector. It impacts directly on the wide array of development assistance efforts underway to improve the supply and variety of foods available to people in LDCs.

3.2 Development of Human Resources and Institutional Capacity This project will strengthen human and institutional resources in the seed production and supply systems which will support overall agricultural development efforts in LDCs. Public and private sector components of the seed program/industry will be strengthened through the use of adaptive research, training, technology transfer and networking.

3.3 Expanding the Role of the Private Sector - This project promotes efficiencies of private sector seed operations and improves the climate for investment by reducing the risk factor through direct assistance in adaptive research, training, technology transfer and networking with LDC institutions and organizations. MSU has an unequalled track record in collaboration/ cooperation with the private sector by training participants at MSU and providing in-country and on-the-job training in seed production and supply operations at regional, national and international centers. For example in Thailand under the current project, MSU started working with the Government in 1978 to increase production of rice, corn, soybean and peanut seed. At that time only 1,000 tons of seed were produced annually by the public sector. Today over 20,000 tons are produced annually and of that amount, 10,000 tons, mostly hybrid corn seeds, are produced by the private sector. In addition, these private sector producers have expanded their business into Indonesia where they are producing over 1,000 tons of hybrid corn seed annually.

3.4. Providing Food Aid and Food Security: This project contributes in a fundamental way to food self-reliance and food security by assisting

LDCs to develop and/or improve seed production and utilization systems to provide farmers with improved seeds which will increase the quantity and nutritional quality of food.

3.5 Conformity with S&T's Ribbon Project Approach - This project will continue the ribbon approach established under the previous project to link with and support the efforts of a range of bilateral, regional, and global projects related to seed production and marketing systems. There are many benefits of this ribbon approach. Some of the benefits are listed below:

- By pooling the resources and scientific personnel of individual projects, each has access to a much greater level of interdisciplinary expertise which is especially beneficial for projects in small and poor LDCs. The results in one country can be effectively applied to other countries of a similar environment.
- International collaboration results in a holistic approach and effort which increases efficiency and productivity. International linkages provide countries with new information, ideas, and technologies and contribute to breaking down the barriers of scientific isolation so commonly found in the LDCs.
- The pooling of regional expertise and infrastructures greatly cuts the costs required by individual projects and nations to develop their own programs.
- Sharing of expertise among several aid donors and international institutions (i.e; IBRD, IFDC, CIAT and CIMMYT) promises in the long-term to reduce the LDCs' dependency on any one donor for assistance.

Under the terms of the predecessor project, MSU collaborated very successfully with missions and regional and international institutions. Assistance provided by MSU specialists was crucial for the sound development of the CIAT Seed Unit which was funded by the Swiss Development Corp. MSU provided the technical assistance to this Seed Unit to initiate six annual courses on seed technology, including breeding and basic seed production and conditioning. In addition, workshops have been held to discuss small farmer seed needs, seed enterprise management and seed research and training. S&T/AGR has recently responded to a request from IITA for MSU to assist in the development of a regional West African seed unit. Assistance was provided and a proposal developed for submission to the IITA Board, and prospective donors.

This new project will logically interface and network with ongoing CRSPs in sorghum and millet, bean and cowpea and peanut. The development of appropriate linkages with the CRSPs would permit collaboration with other

32

countries in which CRSP activities are underway, e.g., research on cowpea seed technology in Guyana. Other areas for linkages and collaboration include the agricultural research project in India and the seed technology research project in Indonesia. In addition, there are many more LDCs and international institutions which could benefit from limited participation in this network and which would be willing and able to provide the necessary funding if MSU can continue to provide assistance in an effective and efficient manner.

3.6 **Conformity with Regional Bureau Priorities** - This project gives priority to crop production - an agricultural research priority designated by the regional bureaus. Further, it supports and complements key A.I.D. agricultural projects in agricultural production and supply systems in less favorable environments; minimum-purchased-input systems; and postharvest systems to prevent losses of seeds during processing and storage. It also strengthens LDC institutional capability by providing technical assistance and academic, technical and on-the-job training at MSU and at LDC national, regional and international institutions.

3.7 **Relationship to Other S&T Projects** - Under the new project, MSU-STL will collaborate with institutions and organizations implementing related projects funded in the Bureau for Science and Technology to draw on the expertise and research results already achieved and to avoid duplication of effort.

3.7.1 **Office of Agriculture projects** - The following projects have been identified as possible candidates for collaboration:

- Postharvest Grain Systems with Kansas State University for seed drying, processing and distribution.
- Agricultural Policy Analysis with Abt Associates for agricultural policy constraints.
- Technology Transfer and Feedback Systems with the University of Illinois to utilize models and case studies to assist in the implementation of its technical transfer components.
- Farming Systems with the University of Florida to focus more attention on the role of small producers in the process of national development.
- Soybean Utilization and Research with the University of Illinois to assist LDC private businesses and government entities in the utilization of soybean seeds.
- Fruits and Vegetables with the University of Idaho to improve preservation of root, tuber and vegetable seeds after harvest.

- Food crop CRSPs; e.g, sorghum/millet with the University of Nebraska; beans and cowpeas with Michigan State University; and peanuts with the University of Georgia.
- N-Fixation - Symbiotic with the University of Hawaii where inoculants are being used for nitrogen fixation to increase crop production

3.7.2 Office of Energy

- Renewable Energy Application where the use of bioenergy is being investigated which may prove useful in for drying seeds.

3.7.3 Office of Rural and Institutional Development

- Employment and Enterprise Policy Analysis with Harvard Institute for International Development where policy issues which affect employment are being investigated. There is a possible intervention opportunity in this project for MSU-STL to promote seed industries in the private sector.
- Small Enterprise Approach to Employment with Michigan State University where the purpose is to strengthen and expand programs of organizations which assist small and micro-entrepreneurs. MSU-STL may be able to utilize this project to assist small and micro-entrepreneurs to establish seed businesses.
- A.T.International II with Appropriate Technology International is providing assistance in the identification, design, financing and/or implementation of pilot projects involving an innovation in appropriate technology to solve problems related to seed production and utilization. It is possible that the methodologies developed under the seed production and utilization project can be given to A.T. International for application in the LDCs.
- Industrial Promotion and Agribusiness Development with Arthur Young & Company, Boles World Trade, and the Industry Council for Development to develop more effective promotional approaches that can be used by A.I.D., host governments, and private sector organizations to stimulate agribusiness and industrial development.
- Decentralized Management and Finance for Development with Syracuse University to help developing countries mobilize local resources and implement systematic programs to organize and finance decentralized development.

4.0 Cost Estimate, Financial Plan and Person Months

4.1 Cost Estimates - The total cost of this seven-year project is estimated at $7.282 million, which includes a core budget of $3.42 million to be funded under a cooperative agreement by S&T/AGR, an expected $2.166

34

million to be funded under the companion ordering contract by missions, regional bureaus and other AID/W offices, and $1.696 million to be contributed by MSU towards achievement of the purpose and objectives of the project as cost sharing. The cost estimates are based on the calculated level of effort (personnel, travel and allowances, supplies and services and other requirements necessary to achieve targeted outputs of the types and magnitude as set forth in the logical framework of the project. However, the cooperative agreemena and companion ordering contract will be initially funded for five-years in accordance with the Federal Acquisition Regulations

It should be noted that in the past substantial contributions from various sources have been made to support the objectives of the previous project and it is expected that this support will continue under the new project. It is estimated that up to $3.1 million will be contributed from various sources to the success of the new project; e.g., $0.8 million to finance the 100 trainees expected to attend the annual Seed Improvement Training Courses (8 weeks) at MSU; $1.7 million to finance approximately 140 years of participant academic and special training at MSU; and $0.3 million to finance participants at regional and in-country training courses, workshops and conferences. These activities currently are and will continue to be financed directly by the missions, LDCs, IBRD, UNDP, FAO, and similar institutions and by private and charitable organizations; and $0.3 million from LDC institutions, international organizations and donors to finance local costs in the LDCs associated with collaborative activities in research, training and technology transfer.

4.2 Summary Obligational Schedule The following obligational schedule is designed to meet estimated project requirements.

Table I
(In thousands)

	FY86	FY87	FY88	FY89	FY90	FY91	FY92	TOTAL
S&T/AGR	360	396	436	480	528	581	639	3,420
Missions 1/	169	203	278	338	359	392	427	2,166
STL/MSU	207	215	233	242	256	266	277	1,696
Total	736	814	947	1,060	1,143	1,239	1,343	7,282

1/ Includes funding from mission, regional bureaus and other AID/W offices from a combination of programmed and unprogrammed sources and will be implemented under the companion ordering contract.

4.3 Summary Budget Tables

The following tables cover the total seven-year budget by Summary Costs by Project Components (Table 2) and Summary Cost by Line Item Expenses (Table 3). The funding of the research component from all souces is estimated at 31 percent of the total; training, 23 percent; technology transfer, 39 percent; and networking, 7 percent. A pie chart is included on page 25 and the annual budget by project components is attached as Appendix II and by line item category as Appendix III.

Administrative costs are estimated at 8.4 percent for each activity. MSU's contribution in cost sharing over the seven-year period is estimated at $1.696 million or 50 percent of S&T/AGR's funding of the cooperative agreement. Budget details by line item are in Appendix III, and under the input section of the Logframe, Appendix I.

Table 2
Summary Costs by Project Component
(In thousands)

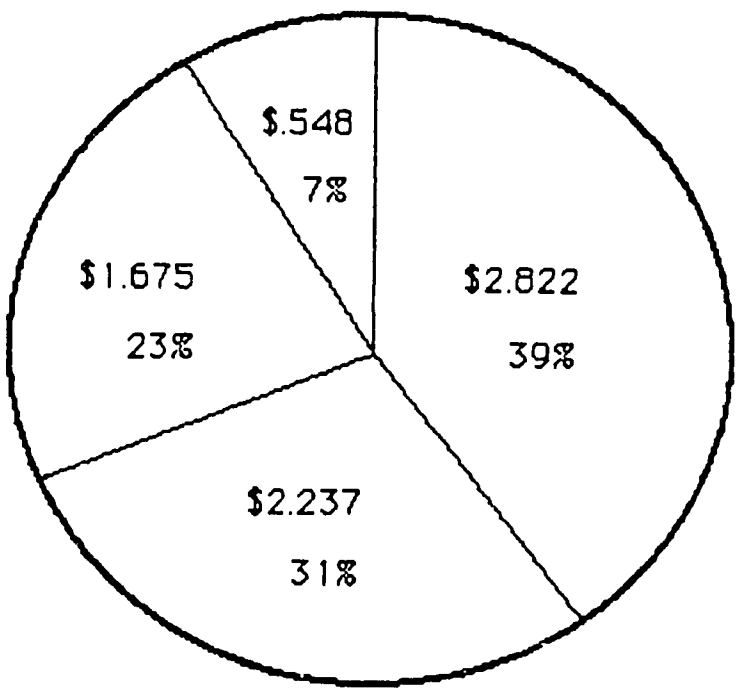
Activity	Cooperative Agreement S&T/AGR	MSU	Total	Ordering Contract	Total	Percent
Research	$1,152	$ 760	$1,912	$ 325	$2,237	31 %
Tech. Transfer	1,162	250	1,412	1,410	2,822	39 %
Training	684	560	1,244	431	1,675	23 %
Networking	422	126	548	-0-	548	7%
Total	$3,420	$1,696	$5,116	$2,166	$7,282	100%
(Admin. Support, incl. in above)	(410)	(203)	(613)	-0-	(613)	(8.4%)

Table 3
Summary Costs by Line Item Expenses
(In thousands)

Activity	Cooperative Agreement S&T/AGR	MSU	Total	Ordering Contract	Total
Salaries	$1,623	$893	$2,516	-0-	$2,516
Fringe Benefits(18.4%)	299	164	463	-0-	463
Consultants	-0-	-0-	-0-	815	815
Travel & Allowances	335	43	378	550	928
Direct Costs	268	57	325	235	560
Indirect Costs (35.4%)	895	409	1,304	566	1,870
Equipment	-0-	130	130	-0-	130
Total	$3,420	$1,696	$5,116	$2,166	$7,282

Improved Seed Production & Utilization R&D

Components By Millions Of Dollars and Percentage



Technology Transfer	$2.822	39%
Research	2.237	31%
Training	1.675	23%
Networking	.548	7%
Total	$7.282	100%

4.4 Annual Projection by Persón Months - The following table lists by activity, discipline, and/or type of employment the person months to be funded by S&T/AGR and MSU in support of this project. Please note, that it is estimated that S&T/AGR will fund under the cooperative agreement a total of 70 person months of services annually; while MSU plans to contribute 35.0 person months from its own resources for the same period to assure successful achievement of the goal and purpose defined in the Logical Framework, Appendix I. The qualifications of the key personnel to be working under the new project are listed in Appendix IV.

Table 4
Persons Months per year

	S&T/AGR	MSU
Director, International Programs	1.5	1.0
Agronomist-In-Charge, Seed Technology Labatory	5.0	2.0
Economist	3.0	2.0
Agronomists/Seed Technologists	17.5	8.0
Seed and Management Specialists	-0-	4.0
Agronomist	-0-	3.0
Research Associate	6.0	1.0
Agricultural Engineer	3.0	2.0
Support Staff - Clerical Staff	18.0	2.0
Technical Support	12.0	4.0
Graduate Students	4.0	6.0
Total	70.0	35.0

5.0 Method of Implementation - This project will be implemented under an initial five-year cooperative agreement and companion ordering contract to support a wide range of bilateral, regional and global initiatives, activities and projects aimed at improving the systems, technologies and LDC capabilities for production and supply of food and feed crop seeds. The objective of the Cooperative Agreement is to: 1) assist MSU to strengthen its resource base in international seed technology developed over the past three decades of cooperation with the Agency and other donors; 2) expand the level and range of its collaboration with U.S., LDC, regional and international institutions; and 3) provide assistance to establish and improve the supply, quantity and quality of seeds available to farmers which will increase yields and production efficiency of food and feed crops.

5.1 Cooperative Agreement - The assistance to be provided under the CA will strengthen the MSU-STL in the following areas:

5.1.1 Priority Research - To plan and implement priority research at MSU and in LDCs to apply improved methodologies and technologies of seed production, conditioning, storage, and quality assurance and control under warm, humid and extremely arid conditions in LDCs.

5.1.2 Strengthening LDC and International Institutions - To upgrade scientific capability in LDC, regional and international institutions to undertake problem solving research for the efficient and economical production of seeds, to provide adequate training centers; and to leave the institutions with the improved capacity to continue programs after this project terminates.

5.1.3 Training - To develop training materials and programs and provide training opportunities for LDC participants and staff of international organizations that work in the LDCs. This area will provide assistance in all phases of seed technology ranging from in-country training courses to Ph.D. programs and will assist in the development of national and regional capabilities in the seed training area.

5.1.4 Technical Advice and Assistance - will be provided in seed program/industry development and technical operational areas to the Missions, LDC institutions and international cooperators.

5.1.5 Technical Handbooks and Literature - MSU-STL will produce and selectively distribute handbooks, guidelines, research and technical papers and a semi-annual seed research and development reports on the

several areas of seed technology to LDCs and appropriate U.S. and international agency personnel and units, and will assist appropriate LDCs and agencies and international organizations to adapt and translate the materials into their languages.

5.2 Companion Ordering Contract S&T/AGR's recommendation for the companion ordering contract to the cooperative agreement is based on section 6.302-3 of the Federal Acquisition Regulations (FAR) for the selection of a non-competitive contract which cites: full and open competition need not be provided for when it is necessary to award the contract to a particular source or sources in order to establish or maintain an essential engineering, research, or development capability to be provided by an educational or other nonprofit institution of a federally funded research development center.

This ordering contract provide missions, regional bureaus and other A.I.D./W offices with short to medium term technical and advisory services for: 1) planning, designing and evaluating programs and projects concerned with seed production and supply; 2) in-country and regional training programs; and 3) testing research results in LDC environments. The practical experiences and on-site information and insights gained during activities under the ordering contract will be fed directly back into the MSU-STL's training program, academic curricula, informational development activities, and the applied research agendas developed and implemented under the CA. It is also intended that the need and opportunity for contract work will be identified by the cooperator in its work under the CA and proposed to the office of Agriculture, regional bureaus and missions for approval and funding. In addition, requests may be received directly from the Office of Agriculture, regional bureaus, other A.I.D/W offices, missions and/or LDCs for negotiation and assistance. The field work contracted will be primarily project design and evaluation, collaboration in adaptive research and field testing/validation of technologies and methodologies, in-country and regional training, and demonstrations of new and/or improved approaches and systems for management, marketing and relevant data processing.

be managed by S&T/AGR in consultation with the Sector Council for Agriculture and the regional bureaus, as required. Current A.I.D. staff and procedures are adequate to implement this project. The project manager will spend approximately 15 percent of the time managing the project. Missions and LDC requests for assistance under the ordering contract will be channelled by the regional bureaus through S&T/AGR to MSU-STL.

As indicated on page 7, second paragraph, a cable was sent to all missions describing research, training, technology and networking activities to be continued under the new project. The responses were favorable and all missions which require assistance in Seed Production and Utilization indicated a strong desire to have the services continued. S&T/AGR has estimated the requirements for mission "buy-ins" at $2.166 million over the seven-year period or $1.347 million for five-years. The responses received are summarized in Appendix VI.

6.0 Implementation Plans

6.1 S&T/AGR Project Management Responsibility - This project will The project manager will ensure that the objectives of the project are achieved, facilitate acquisition of mission requests and funding, monitor project operations, approve certain administrative actions within the project, maintain close liaison with the grantee, and communicate regularly with the Agronomist-in-Charge at STL and the MSU Director of International Programs. Specificially, the project manager will be responsible for the following actions:

- Prepare for MSU-STL a listing of mission projects involving or concerned with seed production and supply. This list to be updated annually in time to permit MSU-STL to consider this information when developing the annual work plan.
- Prepare for MSU-STL a listing of all S&T projects which are related to seed production and supply or that generate data that may be used by MSU-STL in the development of programs and research.
- Maintain contact with regional bureaus and missions to identify and expedite receipt and response to requests for assistance in improved seed production and utilization and related matters.
- Communicate directly with the Agronomist-in-Charge at MSU-STL on matters related to mission requests or other information required in the performance of the Agronomist-in-Charge's duties.
- Establish liaison with project managers in project areas set forth in Section 3.7 above and assist MSU-STL to develop relationships with project contractors and grantees.
- Approve consultants hired by MSU-STL under the Cooperative Agreement and the Companion Ordering Contract.
- Monitor project operations by assuring the MSU-STL reports meet the reporting requirements as set for th in Section 7.0 below.
- Schedule and coordinate project evaluations.

- Clear travel requests for MSU-STL professionals travelling to LDCs.
- Approve the annual work plan, including research to be undertaken by the LDC graduate students under the project.
- Monitor progress of the annual work plan and overall program.

6.2 Management Responsibility and Qualifications - MSU-STL

6.2.1 Management Responsibility - The administrative structures of MSU-STL are adequately staffed and have the facilities and procedures to design and implement research projects, provide technical services, transfer technology, disseminate critical information on seed production and supply systems, train participants and expand the current network of LDC and international collaborators. The facilities and equipment at MSU essential for achieving the objectives of this project are listed in Appendix X.

The MSU management responsibility will rest with the Agronomist-In-Charge, MSU-STL who under the supervision and in coordination with the Head, Department of Agronomy, the Director, MSU International Programs, and the MSU Vice-President, Agricultural, Forestry and Veterinary Medicine will be responsible for the following functions:

- Designing the annual work plan in collaboration with the S&T/AGR Project Manager and obtaining final approval prior to implementation.
- Maintaining close working relationships and communicates regularly with the S&T/AGR Project Manager.
- Developing and implementing the required reporting structure to conform with the project reporting requirements.
- Overseeing the timely completion of all reports set forth in the reporting requirements section of this project paper.
- Proposing for approval by the S&T/AGR project manager new MSU-STL staff persons to implement the activities in this project paper.
- Selecting consultants and securing approval of S&T/AGR project manager and the user missions.
- Selecting and approving graduate students for funding under the cooperative agreement who meet the academic qualifications of MSU and who have been nominated for acceptance by the relevant Graduate Student Review Committee at MSU.

Day-to-day management responsibilities will include, but not be limited to, the following actions:

- Selecting and assigning staff and/or consultants for specific research, technological transfer, training, and network building activities at MSU.

- Selecting and assigning staff and/or consultants for field activities outside MSU for research, technology transfer, training and network building activities.
- Selecting and approving staff and/or consultants to participate in seed training programs, workshops and seminars sponsored by various national and international organizations.

6.2.2 Qualifications, including Key Personnel, Facilities and Equipment Under this project, the MSU-STL's highly competent and experienced staff will continue the activities being undertaken at and by MSU to improve LDC capabilities in seed production and supply operations and to extend and expand these activities as set forth above in Section 5.0 - Method of Implementation. The qualifications and language capabilities of the STL scientists to be working under this project are included in Appendix IV. Many of the scientists are proficient in Spanish and Portugese. Two read French very well and speak French fairly well. In this regard, an effort will be made by the grantee to ensure French capability among the scientists during the life of this project. Activities which have been undertaken in the past are listed in Appendix IX.

The MSU-STL will organize and coordinate multi-disciplinary research aimed at improving the effectiveness and efficiency of technologies and methodologies for seed production, conditioning and storage, especially under the warm humid or extremely arid conditions that prevail in most LDCs. This research will involve collaboration with staff from: 1) other sections of the Agronomy Department (Crop Science and Soil Science); 2) the Departments of Agricultural and Biological Engineering, Agricultural Economics, Entomology and Plant Pathology and Weed Science; 3) the Mississippi Cooperative Extension Service within MSU; 4) the associated State agencies such as the Mississippi State Seed Regulatory Laboratory, and the Mississippi Seed Certification Agency; and 5) the extensive and long-established network of cooperators in the U.S. seed trade, agricultural equipment manufacturing industry, and scientists and units in other universities and USDA services.

- **Research Qualifications** - Areas of developmental and applied research in the MSU-STL program include seed production, conditioning (drying and processing), treating, packaging, storage, quality evaluation, assurance, and control procedures, and economic aspects of these areas including management and feasibility analyses. More basic research interests and activities are in seed physiology and deterioration, inherent improvements in seed quality, especially longevity and emergeability, and inter-relationships among micro-environmental components and seed in the

seed bed. The applied research is focussed on technological and methodological improvements in seed operations and problem-solving for main agronomic crops such as rice, corn, sorghum, cowpea, peanut, soybean, and wheat, and the warm season forage grasses. The research undertaken in Mississippi to resolve state problems is usually equally applicable to the many LDCs with warm humid climates because most of the major technical programs in seed production, conditioning (drying) and storage are associated with rain and warm temperatures during the harvest period and high humidity and temperature during the storage period. The long term focus of applied research in the MSU-STL on problems and areas relevant to the LDCs has produced an unsurpassed data and informational base and expertise for the resolution of technical problems related to seed production and supply.

- **Technology Transfer Qualifications** - The MSU-STL is the recognized international center for seed technology generation, processing and dissemination. It has functioned in this capacity for the U.S. seed industry and allied organizations since 1951, and to an increasing number of the less developed countries since 1956. Most of the seed workers and specialists in the LDCs have received their main training at MSU or in training courses elsewhere organized and/or assisted by MSU. The MSU-STL's position as the hub of seed technology in the U.S. permits it to harness and focus the best resources available anywhere in the world on seed problems and training and for the transfer of appropriate technology.

The MSU-STL maintains training and informational materials on a variety of topics and areas in seed technology. These are regularly updated as new technology becomes available. Thousands of copies of these materials have been distributed to LDC units and participants since 1956.

Under technology transfer or technical assistance and services, MSU has responded to more than 250 requests for assistance from 54 countries under a series of agreement with the Agency. Most reponses involved more than one MSU-STL staff person.

- **Training Qualifications** The MSU-STL offered the first known seed training course for LDC participants in June-July 1956. This "Special Course on Seed Improvement" has continued on an annual basis since 1956 and is recognized as outstanding in its field and so successful, that former participants are sending their sons to MSU to take the course. The long and extremely productive involvement of the MSU-STL in training of participants from the LDCs is documented in the statistical summaries in Appendix IX. Additionally, the MSU-STL has been involved in more than 60 in-country and regional training courses with a total participant enrollment above 1200.

The demand for training at MSU leading to B.S., M.S. and Ph. D degrees is very high. Presently, more than 40 students from many LDCs are enrolled at MSU. The CA will permit MSU to maintain its present large number of LDC graduate students, with some expansion possible under contracts with the Missions and/or funding from other sources. Special non-degree training programs for one to 12 months have been provided to 61 participants from 21 countries.

6.3 Country Selection Criteria While it is not possible at this time to schedule country activities, Section 1.0 and the summary of Mission responses (Appendix VI) identifies certain countries which are possible candidates for assistance. To assure that MSU-STL responds to requests from countries which have the greatest need and to efficiently and effectively utilize the highly qualified staff at MSU-STL, it is necessary to establish criteria on which to base the selection and priority of activities to be undertaken. There follows an illustrative listing criteria which may be considered for providing assistance in collaborative research efforts, training, technology transfer, demonstrations of improved methods and network building.

- A strong mission agriculture program with an interest in, and available resources for the promotion of seed production and utilization as defined in the missions' Country Development Strategy Statements.
- LDC interest in, and available resources for, seed program and industry development.
- Regional Support Offices that have expressed interest in seed production and utilization activities; e.g., REDSO/EA, REDSO/WA, ROCAP and SADCC.
- Technical considerations; e.g., crops involved, seed production, processing and distribution problems defined and ecological zones.
- Past MSU-STL experience in the requesting country and known problems and available counterparts to assist in the scope of work and implement the programs once they are in place.

6.4 Schedule of Project Events

6.4.1 Scope of Work - Specific activities under this project will include, but are not limited to the following activities:

Adaptive Research - The research aspects of seed production and utilization will be substantially increased under the new project. The research activities will focus on the following:

- Seed multiplication and production procedures that minimize field deterioration, the incidence of seed borne diseases, and the storage time required for the seed; i.e., time from harvest to planting.
- Identification of inherent properties of seed that contribute to resistance to weathering and superior storability and emergeability for incorporation by breeder into improved crop varieties.
- Simple, but effective systems or procedures for drying seed to safe moisture levels for storage using renewable energy sources.
- Efficient systems for seed storage of different kinds and quantities of seed based on moisture proof packaging materials, dehumidification, and treatments (such as antioxidents and enzymes inhibitors) that extend the longevity of seed under warm humid conditions.
- Quality assurance and control criteria, standards and operational methods adaptable to different scales of production, crops, and climatic zones.
- Better conditioning procedures and quality evaluation methods for seed of tropical forage crops.
- Farmer seed selection and storage practices with emphasis on varietal purity, freedom from disease, and maintenance of germination.
- Policy reforms and assessment methodologies for promoting and assisting private sector entry into seed production and supply.
- Evaluating the role of extension, credit, price, and marketing on seed production and supply and collecting data for base line analysis.

Approximately half of the applied research activities will be accomplished through effective use of a corps of 20-plus LDC professional working on advanced degrees. Presently there are 42 enrolled at MSU for M.S. and Ph.D. degrees from every region of the Third World. With increased emphasis on research, MSU will establish cooperative research programs in LDCs to work with these returning graduate students. Some adaptations of research findings at Mississippi will, of course, be necessary in certain agro-climatic conditions.

The 20-plus graduate students involved in relevant research will, in effect, represent a substantial "buy-in" component of the project by an array of institutions and agencies funding the graduate training programs; e.g., World Bank loans, IDB loans, FAO, UNDP, A.I.D. missions, and other bilateral donors.

Training - Training programs of varying intensity, duration, depth and emphasis will be designed and implemented at MSU and at national and international institutions with the help of MSU scientists. Special attention will be given to improving existing seed technology courses and establishing new courses to meet the requirements of LDC agricultural educational

46

institutions. Regional training courses and workshops will be held at national, regional and international centers; e.g., CIAT where a Seed Unit has an intensive training program supported by workshops and collaborates technically with A.I.D. to lay the foundation for seed technology networks in Latin America. These training programs will range from graduate degree work in Agronomy-Seed Technology at MSU to in-service or on-the-job training at the LDC operational level. Specifically, training courses will include the following:

- Seven annual 9-week Seed Improvement Courses for a maximum of 20 participants per year.
- Admission to B.S. degree programs for qualified, eligible and financially supported participants, estimated 20 LOP.
- Graduate programs in Agronomy-Seed Technology at the M.S., Masters of Agriculture and Ph.D. degrees - maximum of 25 slots continuously available; estimated 60 LOP.
- Special training programs - non-degree from one to six months - maximum of 5 slots per year.
- In-country and regional training courses from 2-3 weeks - 2 per year.
- Complete sets of audio-visual and audio-tutorial text for basic training in selected areas in seed technology. One each on the basic principles of seed certification, seed testing, seed conditioning, seed storage, and seed utilization
- Training-of-trainers workshops at MSU and/or in LDCs and IARCs - 2 LOP.

The participants attending special training programs and undertaking degree training at MSU will be funded primarily by sources outside the project, except for special advisory services of the core staff, special supplies and training materials. The funding will be obtained from Missions, LDCs, national and international organizations and other donors or the participants themselves. Participants in degree training programs have been sponsored from practically all LDCs and most of them return to their home countries to employment within the seed program/industry. MSU provides a maximum of 25 slots at any one time for LDC degree trainees in Agronomy-Seed Technology and 5 special 6-month training slots for non-degree trainees. MSU will help applicants in excess of available slots to find other universities for enrollment. In addition, MSU will assist worthy applicants who cannot pay for the course in obtaining financial assistance from charitable and voluntary organizations and other institutions if these applicants are from LDCs which have few, if any, trained seed technologists. A few graduate students will be selected for partially funding under the CA to assist with the research work. See Appendix IX for information on the previous training program.

Technology Transfer - MSU has provided and will continue to provide problem solving assistance and informational services to LDCs governments, national and international organizations and institutions. In the process of providing assistance, MSU scientists will also collect information on successful seed production and utilization models which may be appropriate for further research and development and adaptation in other LDCs. Thus there will be a continuous feedback of information from and to MSU and LDCs under cooperative agreement and ordering contract.

Problem solving assistance will be provided by the most appropriate experts and scientists to LDCs upon request from S&T/AGR, missions, LDCs and regional bureaus. These experts and scientists will be drawn from the STL, other Departments of MSU, and from other U.S. and international sources as appropriate to implement and successfully complete the various assignments funded under this project. Problem solving assistance will include the following important areas of seed production and utilization to provide improved seed varieties to the farmers:

- Planning, organizing or reorganizing and implementing seed production and supply programs or projects and their integration into the over-all LDC strategy for agricultural development.
- Indentifying, analyzing, and recommending solutions to managerial and operational problems in seed production, harvesting, drying, processing, quality control and testing, storage and distribution.
- Analysing the LDC requirements and recommending solutions on the: 1) types, capacity and location of facilities for seed production, drying and storage units, processing and packaging plants; 2) quality control and research laboratories, certification agencies and foundation seed programs; and 3) capital investment requirements and operational costs.
- Designing and preparing technical specificiations for the physical facilities and equipment required for seed production, conditioning, storage and utilization operations, and assisting in the installation and operation of needed equipment. The physical facilities and equipment could include: 1) seed handling and drying systems; 2) normal and long-term storage units; 3) processing (cleaning, treating, and packaging) plants; 4) quality control and research laboratories; and 5) seed production units.

Technical Transfer and Informational Services - Technological developments and research results will be continually analyzed by the scientists familar with LDC problems and conditions to identify those applicable and appropriate for adaptation to LDC environments. Appropriate technology will be disseminated to LDCS through technical assistance, visits, training courses, workshops, reports, and specially prepared informational materials. Informational materials will be maintained, updated, and disseminated to LDCs. More specifically the following will be accomplished during the seven year period.

- The Handbook on Seed Processing and Handling published in 1968 will be revised and expanded for use as a reference and training manual.
- Handbooks on Seed Drying and Storage incorporating the latest technologies in this field will be prepared.
- A Handbook on Quality Assurance and Control in Seed Enterprises will be prepared.
- A semi-annual seed research and development report will be distributed to missions, regional bureaus, LDC government and private institutions and international organizations to provide information on sources of new technical information, technologies, and recent research findings at MSU and other institutions. In addition, it will list events of interest, including scheduled workshops and international meetings and conferences to foster collaboration among scientists working in the area of seed technology.
- Guidelines for maintenance of seed varieties, field inspections, and breeder and foundation seed production will be prepared and published.

Building Networks - Under the previous project, STL established a hortizontal network of U.S., LDC and international scientists and institutions in seed production and utilization. Continuing this network in seed production and utilization is a logical, cost effective step to increase the probability of substantial payoffs in terms of innovative technologies for seed production, conditioning and storage in the humid subtropics and tropics.

STL will continue formal and informal networks and linkages during the seven year period with the following:

- CIAT - to collaborate with the Seed Unit in the preparation of training materials (audio-tutorials and audio-visuals) and research (graduate students at MSU will perform their field research at CIAT on problems of mutual interest), and assist with training courses and workshops.
- IITA - to collaborate closely in the development of its Seed Unit and in implementation of its program. In addition, it is expected that CIAT will provide assistance to IITA based on its experiences in developing a successful seed unit.
- WARDA - Presently, the senior seed specialist at WARDA is completing his Ph.D. at MSU. Collaboration in seed research will be established on his return to WARDA in early 1986.
- Federal Rural University, Pelotas and the University of Sao Paulo, Agriculture "Piracicaba, Campinas, Brazil - to assist with the development of graduate programs in Seed Technology and train staff members at the universities. A second phase to this collaboration is expected as the graduate programs of the two universities expand to serve as "third country" academic training centers for students in the region.
- Escuela Agricola Panamericana (EAP), Zamorano, Honduras - to upgrade the seed training and research activities.
- Center for Grains and Seeds (CIGRAS), University of Costa Rica - to assist in the regional training courses, prepare informational materials (in Spanish) and continue collaborative work in applied research.
- Institute Agriculture Bogor (IPB), Indonesia - to continue collaboration in training and applied research.
- Seed Division, Department of Agriculture Extension, and Kasetsard University, Thailand - to continue collaboration in applied research, technology transfer and training.

Other potential members of the network include:

- Asian Vegetable Research and Development Center (AVRDC), Taiwan.
- International Maize and Wheat Improvement Center (CIMMYT), Mexico.
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India.
- International Fertilizer Development Center (IFDC), U.S.
- University of Southwest Sumatra (the rector is a Ph.D., MSU Seed Technology graduate).

- University of the Philippines College of Agriculture.
- "State" Universities in India and proposed "National Seed Center".
- Edinburgh School of Agriculture, United Kingdom.
- Massey University, New Zealand
- Tropical Development Research Institute, U.K.
- International Institute of Seed Pathology, Denmark,
- Seed Industry Development Group, FAO

- Sorghum and Millet CRSP
- Bean and Cowpea CRSP
- Peanut CRSP
- Kansas State University

Private Sector - There is no doubt that the private sector should and will become increasingly involved in seed production and supply in the LDCs, especially in the use of hybrid, non-traditional and speciality crops and varieties. This project will promote and assist increased participation of the private sector in seed supply in the LDCs where political, technical and economic conditions are favorable to include assistance to public sector agencies with divestiture of inefficient and ineffective public seed operations. Special attention will be given to changes in government policies and regulations needed to permit or facilitiate involvement of private entrepreneurs in seed production and supply, development of assessment methodologies for establishing the technical and economic feasibility of private seed operations, technical assistance to private sector seed companies, provision of training opportunities for private sector workers, and resolution or lessening of technical problems and risks through research. In addressing the issues of an expanding private sector role in seed production and supply in LDCs, MSU will draw on its long experience in working with the private seed industry in the United States, other agriculturally advanced countries, and LDCs; i.e., an existing "network," and in promoting and assisting private sector seed companies in Brazil, Thailand and India under previous or continuing agreements and contracts. Most importantly it will collaborate closely with other Agency funded projects looking into the broader area of agricultural input supplies and supply systems with focus on the role of private enterprises, such as Agricultural Marketing systems and Institutions (936-5313); Industrial Promotion and Agribusiness Development ((36-4053); Agro-Industrial Development (931-1121) and new relevant projects as they come on stream.

6.4.2 Annual Work Plans - MSU-STL will develop the annual work plan as a working document to guide the operations and achievements expected from the project. It will be submitted to S&T/AGR for approval each project year. The first plan will be submitted to S&T/AGR no later than 30 days after cooperative agreement is signed and will cover the period November 16, 1985 to December 31, 1986. Thereafter, the annual work plans will be on a calender year basis to conform to MSU's research project reporting procedures, with the workplan due 60 days in advance of the period; i.e., by November 1.

S&T/AGR will review the contents of the work plan submitted, ask for points of clarification, if required, and grant final approval of the contents as proposed or modified by agreement between MSU-STL and S&T/AGR. This process of review and approval will be completed not later than 30 days after receipt of the original work plan from MSU-STL..

This annual work plan will include, but not be limited to, the following with final details agreed on by the S&T/AGR project manager and the Agronomist-in-Charge at MSU-STL.

- A list of activities to be undertaken (including private sector initiatives) during the year, categorized by project component; i.e., research, training, technology transfer and networking.
- The number and description of each activity listed.
- The projected beginning time frame for execution of the activity.
- The projected ending time frame for completion of the activity.
- The projected expenditure of person-months of input for each activity.
- The projected stage of activities at the end of the work plan or the projected output at the end of the work plan.
- Specific qualifications which may be required for certain activities given that many of the activities within the project are predicated on the amount of Mission funding to be obligated for project activities.
- Baseline data on pricing, policy, marketing and agricultural inputs will be collected to the extent necessary to complete economic analysis and within the availability of funds for this project.
- Attachments to the work plan may include, but not be limited to the following: PERT charts, specific activity reports, and time qualifications conditions.

7.0 Project Monitoring Plans - Expected project outputs, the annual work plan, specified reports, and project reviews and evaluations will provide the basis for monitoring progress. The monitoring plans cover reporting requirements and project review and evaluation.

7.1 Reporting Requirements - MSU-STL will submit the following reports containing the contents as specified within the required time frame to assist S&T/AGR in the monitoring of project activities.

7.1.1 Trip and Technical Reports - Trip reports will be prepared of each TDY assignment or trip to LDCs. The report will contain information in the following format: 1) summary of logistical information composed of type of activity, geographical area of activity, dates of TDY, and team composition; 2) summary of objective of TDY including attached scope of work, as appropriate; 3) summary of activities of TDY; 4) summary of any technical report resulting from TDY; 5) summary of identifiable techniques or information which could be transferred to other LDCs; and 6) summary of future potential needs of, or opportunities for, assistance to LDCs or Missions, including possible networking potential. One copy of this report will be forwarded to S&T/AGR not later than 30 days after the staff member returns to MSU. The trip report shall not exceed 4 pages.

In cases, where a technical or research report will be prepared (as outlined in 7.1.3 below), a one to two page trip report with notification that technical report is in preparation will suffice. Technical reports prepared on technical assistance, problem solving and technology transfer assignments will be prepared and submitted to the Mission, LDC entity, as appropriate, and S&T/AGR within 60 days after completion of assignment in desired number of copies.

7.1.2 Annual Activity Reports - An annual activity report will be submitted to S&T/AGR within 60 days after completion of the annual reporting period. This report shall contain, but not be limited to the following and will specify whether the activity was in the public or private sector: 1) a summary of research projects and activities conducted under and in conjunction with this project; 2) a summary of technological transfer and information activities conducted under and in conjunction with this project; 3) a summary of training activities undertaken under and in conjunction with this project; 4) a summary of network activities; and 5) staff time devoted to specific project components. In addition, appropriate annexes will be attached to document covering the preceding areas, as required. This annual activity report will be forwarded to S&T/AGR in five copies.

7.1.3 Technical and Research Reports - Reports on research funded under the project will be submitted to S&T/AGR and collaborators within 90 days of completion of work or at a logical reporting stage, along with recommendations relating to publications. Manuscripts of research articles to be publiched by MSU will be submitted to S&T/AGR for review, but approval by MSU and collaborator, if any, shall be paramount in deciding on publications. Articles prepared for submission to refereed journals will be submitted to S&T/AGR for information and comment, but MSU and journal review processes shall determine acceptability of article for publication. Handbooks and other informational materials prepared under the project will be submitted to S&T/AGR for review in manuscript form and processed by standard editorial procedures at MSU. In all cases, 10 copies of publications or reports shall be submitted to S&T/AGR within 30 days of date of publication (or receipt of reports) along with plans for distribution to missions, LDCs and collaborators.

7.1.4 Annual Expenditure Reports - MSU-STL will submit annual expenditure reports by: 1) project line item; and 2) estimated distribution by project component. The format will be collaboratively developed by S&T/AGR project manager and the Agronomist-in-Charge at MSU-STL who will seek the advice of the Comptroller, MSU-MAFES.

7.1.5 Impact Analysis Report - An annual report will be submitted as an annex to the annual activity report (see Section 7.1.2 above) which summarizes the impact of MSU-STL activities in the public and private sector in terms of seed production, processing, distribution and utilization. This will provide a feed-back system for meansurement and evaluation of the

impact of services and training provided. The impact analysis is herein defined as a measurement of results generated by activities undertaken by MSU-STL in accordance with the project description in the project paper and the scope of work in the cooperative agreement and under ordering contracts. For the most part, the impact analysis will be qualitative in nature, and quantified only as appropriate and will cover activities funded under this project or the previous project only to the extent that they can be measured without the extra expenditure of project funds. Once an individual activity is measured, then it will be deleted from further consideration. This report will be submitted as an Annex to the Annual Activity Report.

Other Reports may be required as mutually agreed by S&T/AGR and MSU.

7.2. Project Review and Evaluation - The activities described in this project paper represent a continuing long-term effort to assist missions, LDCs, regional and interregional institutions and the private sector in the development and/or adaptation of technically sound and economically viable methodologies/technologies for increasing the quantity and quality of seed supplies to farmers in the LDCs, especially those in warm, humid, or extremely dry climates. Teams of experts who have evaluated the predecessor project have strongly recommended continuing the research, training, technology transfer and networking activities. Therefore, S&T/AGR expects to continue supporting this arrangement with MSU-STL consistent with A.I.D. priorities as long as: 1) LDCs, regional and interregional institutions and the LDC private sector continue to require assistance in seed production and utilization; 2) MSU-STL continues to be the most appropriate institution to provide this assistance; and 3) MSU-STL continues to provide research, training, technology transfer and networking of the highest quality. Future funding, of course, will be subject to the availability of funds.

7.2.1 Management Reviews will be undertaken annually by the S&T/AGR project manager in consultation with MSU-STL, missions, regional bureaus and other institutions, as appropriate. Since such reviews may involve visits to Mississippi State University or specific LDCs, the review process will be funded by S&T/AGR. Such annual reviews will be undertaken after submission of the annual reports as described in Section 7.1.2 above. The annual reports (activity and impact) will become an integral part of the review process.

7.2.2 Indepth Evaluation will be scheduled at the end of the third year of implementation to determine the future funding of the project. it will be conducted by a team of experts in seed production, processing, distribution, and utilization and will include, but not be limited to, the following:

- Examinating the validity of the assumptions in the Logical Framework.
- Determining the effectiveness of the project by looking at the impact this project has had on relieving constraints to effective production, distribution, and utilization of seeds in LDCs.
- Examining the methodologies used for achieving the outputs.
- Highlighting unforeseen internal or external factors that have specific adverse or beneficial impact on LDC seed production and utilization systems.
- Determining if technology was successfully transferred to the LDCs national, regional, and international organizations and institutions.
- Examining the effectiveness of A.I.D. management of project to assure achievement of project outputs.
- Examining alternative approaches to improving seed production and utilization systems in LDCs.
- Determining if expenditures correspond to the scope of work as defined in the annual work plan.
- Recommending appropriate changes in the project design and/or work plans as might be needed to bring them in line with changes in project concept and assumptions.
- Determining the future direction and funding of the project.

The S&T/AGR project manager will be responsible for arranging and coordinating the indepth evaluations with MSU-STL 90 days prior to the scheduled evaluation. MSU-STL will provide the necessary documentation; including financial accounts, annual reports, research documents and other materials as required for the successful completion of the evaluation. In addition, MSU-STL will provide assistance to the evaluation team while it is at MSU. S&T/AGR will fund all evaluations.

8.0 Project Analysis

8.1 Factors Affecting Project Selection and Further Development

8.1.1 Socio-Economic Context - Agriculture and the rural sectors dominate the economies of the LDCs and to improve these economies increases in crop production are essential. One essential and crucial input to increasing food production is the use of improved varieties of seeds. This is the easiest innovative input to increasing production as it does not require drastic changes in local farming practices.

This project will strengthen national, regional and global capability to develop and implement economically efficient, socially acceptable and environmentally sound programs for producing, processing and distributing food and feed crop seeds. It will expedite these programs by providing for adaptive research, training, technology transfer and networking.

8.1.2 Social Considerations - This is not a crop production project, as such. Rather, it involves applied research, training, technology transfer and informational services, and networking which impacts directly on: 1) public and private institutions in the LDCs involved in and responsible for seed supply; and 2) other development assistance projects and agricultural improvement programs that depend in any way on seed as the delivery system for increasing agricultural production of major food and feed crops.

Project activities will continue to be instrumental in improving the effectiveness and efficiency of seed production and supply programs and enterprises, and in developing/improving the in-country support services needed to establish a balanced, responsive, and responsible seed industry; e.g., applied research, training, and quality control.

Improvements in seed production and supply systems will benefit other development projects and programs by easing the constraint imposed on development by inadequate supplies and low quality seed and/or permit start-up of programs that have been delayed because of inadequate seed supplies.

It is difficult, indeed impossible, to specifically quantify the impact of these activities, except in terms of the number of seed programs assisted, persons trained, informational materials disseminated, papers published, etc. This is true because the activities focus on a link - a crucial link - between research (crop improvement) and the extension of its results to farmers. Increases in yield resulting from use of improved varities are usually credited entirely to breeding and crop improvement research even though there would be no benefits if seed of the improved varieties were not producted and distributed. Similarly, the extent to which improved varieties and cropping systems are adapted by farmers and impact on production is credited to both research and extension even through seeds were the delivery system. Despite difficulties in quantifying benefits it can be stated without

qualification that the activities under the previous agreements have had a significant impact in essentially every country in which crop production has been increased or maintained in the face of disease and other pest through the use of superior crop varieties or diversified through introduction of new crops.

The ultimate beneficiaries, of course, are the farmers who have been saving seeds for thousands of years. It can be assumed that practically every farmer supplied with improved seed and persuaded to use the new varieties will benefit in terms of: 1) efficient utilization of seed, 2) increased production by 10-50 percent; and 3) increased income; and/or 4) more nutritional food for his family.

8.1.3 Women in Development - Women play an important role in the rural agricultural sector in most of the LDCs. Many of the farming families are headed by women who may manage the financial concerns of the family. In this role, they are frequently the ones who make decisions as to what will be purchased from family funds, including new varieties of seed. Women are especially involved in the production of food crops for the family, as opposed to market crops, such as cotton, sugar cane, groundnuts which are handled by men. The benefits from planting seed of improved varieties of food and feed crops, therefore, will impact strongly on women and children in terms of greater quantify and better quality of food, and increase in disposal income. Since women have an important influence on the varieties of food crops planted, and are usually responsible for "seed saving", a portion of the applied research and technology transfer activities will be structured to attract the attention of the women decision makers and to facilitate her seed saving activities.

Use of improved seed produces higher crop yields which in turn create more jobs at harvesting time. Since women and their older children are especially active and proficient in crop harvesting, they will find more temporary employment opportunities in a progressive agricultural system which utilizes improved seeds as the key input.

8.2 Socio-Cultural Feasibility - The socio-cultural factors that could detract from the project's effectiveness are limited, but important. The following have been considered in the development design of this project.

- Careful attention will be given under the research component to technologies which are designed to meet the needs of the end-users, the farmers and to remove production and marketing constraints. Research will be oriented toward developing economically viable and socially acceptable technologies which can be adapted to the conditions of the LDCs.
- The training and information programs will take into account the economic and social dimensions of the proposed new technologies. For example, the use of a new hybrid seed is usually more expensive and may requires a substantial change in cultivation practices. Information and training programs will give emphasis to the use of new hybrid seeds.
- The role of technical assistance is to: 1) advise, guide, stimulate and assist decision makers and coordinators with implementation of research programs; 2) establishment linkages with public and private multi-national seed and agri-chemical companies, U.S. institutions, seed research groups at the national and international levels; 3) provide short-term assistance at timely intervals; and 4) schedule training programs MSU and at LDC national, regional and international centers. These activities involve interaction with all levels of society and therefore, STL will draw on the expertise of the social science Departments of MSU, as needed, for certain tasks. This expertise will be required in the case of identifying constraints and recommending solutions where difficult social situations exist or where farmers are reluctant to change their farming practices to incorporate innovative ways to increase crop production.

8.3 Economic Considerations - The following types of economic considerations are relevant to this project: 1) whether investments in improved seed production and utilization systems are economically justified; and 2) what are the alternative approaches to increasing the quality and quantity of food and feed crop production in LDCs to raise income of commercial small farmers.

8.3.1 Justification of Investment - This project impacts directly on A.I.D.'s Food and Agricultural Policy and Strategy by assisting LDCs to become self-reliant in food, assuring food security and contributing to broadly-based economic growth. Given the important role of seed in agricultural development and the extent to which development efforts and rehabilitation programs are limited by inadequate supplies of seed, a project which provides assistance to remove these constraints will have significant impact on increasing the world's food supply. It is generally accepted among seed scientists and agriculturalists that good quality seed of improved varieties will increase production from 5 to 10 % and thus render benefits far greater than farmers' cost of the seed which usually amounts to only between 2 to percent of total expenditures made by farmers employing improved production practices. Improved seeds help assure that more costly fertilizer, water and labor inputs produce desired increases in yields and farm income. When the use of improved seed involves changes to a superior variety, yield increases can be expected on the order of 25 - 50 percent in many environments and under certain conditions.

The returns from the use of improved seeds by farmers are well documented in the research literature (See Appendix XII) and manifested by the large investments made by private seed production and marketing firms in developed countries. (See Sections 2.5, page 17 and 3.3, page 19 above). Similar returns are attainable with improved seed production and handling technologies in the developing world and are being achieved already in Mexico, Brazil, India, Korea and Thailand (see Section 6.4.1, page 39 above).

Investments in improved seeds which increase production by only 5 percent could contribute substantially to food security in the LDCs. However, it cannot be overlooked that increases in production must also be accompanied by an improved distribution and supply systems if the food and feed products are to disseminated to the consumers. While this aspect of the agricultural economy is not addressed in this project, it must be addressed by LDC decision makers as farmers start using the improved varieties to increase their crop production.

8.3.2 Alternative Approach - An alternative approach to addressing constraints to increasing the quality and quantity of food and feed crop production in LDCs is investments in other agricultural inputs, such as fertilizer, water and manpower to compensate for low productivity. These inputs are more costly to the farmer than the use of improved seeds with less fertilizer and water. In fact, many LDCs are not realizing the growth in agricultural production because the farmers do not have access to viable

improved seed to justify the expense of using other inputs. Large areas of irrigated lands go unplanted in the LDCs in part because suitable seeds are not available. Farmers in remote and marginal growing areas need improved seed varieties to assure adequate crop yields and income.

The cost-effectiveness of investments in this project and in national seed production and utilization systems is likely to be quite high given that such investments have tended to lag behind expenditures for more costly crop production inputs.

Seed program/industry development is a slow process and despite substantial progress in certain LDCs, inadequate seed supplies continue to be major constraints to crop production in most countries of the Third World. In addition, there are no alternatives to the types of assistance which this project will provide; i.e., adaptive research, training, technology transfer and networking to strengthen national, regional and global capability to develop and implement economically efficient, socially acceptable and environmentally sound programs for producing, processing, distributing and marketing food and feed crop seeds. There are, of course, an array of alternative implementation strategies which have been explored. These are discussed below:

8.4 <u>Alternative Implementation Strategies</u> - The following alternative approaches were considered in selecting the implementation strategy and only the last one is considered to be appropriate for this project.

8.4.1 <u>International Institutions</u> - The international institutions were considered, but rejected because these centers do not have the competence, facilities, equipment or experienced scientists to provide LDCs services to develop and maintain improved seed production and marketing systems. CIAT does have a seed program, but it is not of the magnitude needed to provide assistance on a worldwide basis. IITA is currently working on a seed training, research and technology transfer unit with the help of MSU-STL. This center will not be able to provide the services required. The World Bank seed projects have been primarily of capital transfer type which do not satify the needs of the LDCs for technical assistance and training. FAO and some of the other bilateral development assistance programs have been involved in technical assistance, training and informational service activities in the seed sector without success.

8.4.2 Private Sector - The U.S. private sector was considered, but rejected as it is too specialized (mainly in vegetable and hybrid seeds) and has little expertise in humid tropical conditions. Moreover, it has limited experience in areas of communications and marketing intelligence and promotion in the LDCs. Furthermore, U.S. private organizations do not have the sophicated facilities and equipment required for training LDC participants that are available at the Seed Technology Center at MSU and they have little experience in technology transfer and informational services.

8.4.3 Missions Funding on an Ad-Hoc Basis - Ad-hoc funding by the missions was considered, but rejected as this would not accomplish the project objectives of developing an integrated, long-term approach to the problems or solutions of developing and improving seed production and marketing systems. The continuity and coordination of efforts would not exist, even in the short-term. MSU would not be able to build up the capacity to respond expeditiously to mission requests and thus would not be able to provide the fast turn-around for which it is well known and will continue to be possible under the new project.

8.4.4 One Institution - The selection of one institution with existing fully equipped facilities and extensive worldwide experience and established network is considered the most efficient and economical solution to providing the needed assistance to LDCs to establish and maintain seed production and utilization systems. S&T/AGR is recommending MSU-STL as the implementing agent for this project as it is recognized worldwide as the major center for seed production and utilization training and research. Its modern facilities are unequalled elsewhere for theoretical, practical, and operational training in seed technology, applied seed research, and as a base for technical assistance and advisory services. The staff at MSU has extensive international experience dating back three decades. Networks and linkages have been established with public and private U.S., LDC, regional and international institutions and organizations in the seed production and utilization systems. No other institution is comparably qualified to effectively and economically implement the proposed project.

8.5 Expected Project Benefits - The benefits of seed production and marketing systems to crop based agriculture are generally understood and appreciated. In most LDC, scientists and administrators know that improved seeds are key and crucial inputs for increasing the production and efficiency of crops and to realize benefits from improved seeds, the farmers must use them to replace the less productive ones. An adequate seed production and utilization system must be in place in order to get the seeds to the farmers. Attached as Appendix VII is an example of an intensive quality control system which might be considered for certain LDCs. At the other extreme, a system might be used which only requires seed labeling prior to distribution.

In addition, seeds are a key input in the "technological package" assembled by the extension workers for farmers. If improved seeds are not available in this package, crop production will not be significantly increased. While the genetic potential (inherent properties) of seed is paramount in terms of yield improvement, the quality (physical and physiological) of the seed planted has an impact on production. Good quality seed of a crop variety can increase yield 5 - 10% over low quality of the same variety, and production efficiency by a even greater extent.

An infrequent, but very important benefit of an adequate seed production and supply system is the country's ability to recover from the wake of natural disasters. A fully supportive seed production and supply system can supply the seeds needed for rapid rehabilitation - often in time to permit crop production in the same season. Still another benefit of an adequately supportive seed production and supply system is its capacity to expedite and facilitate the introduction of "new" crops into the country or into the cropping systems. Farmers have experience in "seed saving" for traditional crops, but not for new crops. Some years, therefore, are required for farmers to gain experience needed to successfully save seeds of crops new to them. A seed production and supply system serves very well to produce, maintain and supply seeds of "new crops" during the years when farmers gain experience and periodically, thereafter as even better varieties are released. Some varieties are so short-lived in some climatic zones (e.g., soybean seed in the humid tropics) that very innovative seed supply procedures must be developed to get the seeds to the farmers in time for the planting season.

Specific benefits to LDCs from the use of high quality seed of improved varieties include the following:

- Increases in total yield resulting from: 1) the introduction and distribution of superior seed varieties or hybrids replacing inferior varieties in the cropping pattern of the country or sub-region; 2) higher physiological quality of planting seed; 3) less reinfestation of land with weed seed; and 4) higher quality and purity of the crop because of less contamination from other varieties and more uniform maturation, thus fewer immature and/or weathered seeds.
- An efficient seed industry which not only serves in agricultural development, but also as a mechanism for rapid rehabilitation of agriculture in the wake of natural disaster such as floods, drought, and epiphytotics of plant diseases.
- Reduction in the costs of production resulting from: 1) using one-half or less than the traditional seed requirements during planting; and 2) more efficient utilization of fertilizers, irrigation and pesticides because of greater uniformity of emergence and growth, better stands and more vigorous plants.

8.6 Relevant Experiences with Similar Projects - This proposal for a new CA with MSU grew out of the successful country models developed under the previous project, Seed Program and Industry Development and the existing need in the LDCs for continued assistance to develop and implement seed production and utilization systems to get improved seed to the farmers. The current project is scheduled to terminate on November 15, 1985. In the past the program has focussed primarily on technical assistance; whereas, the emphasis of this new project will be on research and networking with other national, regional and international organizations and institutions. Several of the activities, experiences and accomplishments which were realized from the previous agreements are listed above in paragraph 1.3 on pages 4 - 7 and in Appendix IX.

8.7 A.I.D. Support Requirements - This project will be managed by S&T Agriculture in consultation, as required, with representatives from the Agriculture Sector Council and other AID/W and mission technical and professional staff. The present A.I.D. staff and procedures are adequate to manage this project. The project manager will maintain liaison with the

grantee and communicate with the Project Director/Coordinator systematically and will give prior approval before activities are undertaken. Duties and responsibilities of the project manager are listed in paragraph 6.1 above on pages 28 - 29.

8.8 Relationship to Mission Programs - This project will maintain and extend to LDCs the skills and knowledge of the scientists at the Seed Technology Laboratory which have been developed over three decades. These scientists will be available to LDCs, missions, regional bureaus and national, regional and international institutions and organizations to develop and maintain improved seed production andutilizations systems in both the public and private sector. Research will be conducted at MSU and LDC field sites by these scientists and LDC graduate students and adapted to country specific situations. S&T/AGR will provide the core funding under the cooperative agreement. The companion ordering contract will provide a mechanism for mission, regional bureaus and other AID/W offices to "buy-in" and obtain services from STL-MSU.

9.0 Initial Environmental Examination: This project is designed to increase the quality and quantity of food and feed crops in LDCs to raise income of commercial small farmers. It provides applied research, training, technology transfer and networking activities in both the public and private sectors to strengthen human resources and institutional capacity to develop and implement economically efficient, socially acceptable and environmentally sound programs for producing, processing, distributing and marketing food and feed crop seeds. To the extent that the project involves the use of chemically treated seeds or integrated pest management techniques, the grantee will establish that none of the activities will involve the use of pesticides that fall in the restricted category in the U.S. or have been banned, suspended or withdrawn from use for agricultural purposes in the U.S.

In all other respects, the project will have minimal or no direct effect on the environment and is exempt from the Environmental Procedures 22 CFR 216.2 for the reasons described in 22 CFR 216.2 (c) (i), (iii), (2), (i), (ii), (iii), (v) and (xiv). A negative determination was approved by the Agency Director for Food and Agriculture on July 25, 1985. (attached as Appendix VIII.)

REFERENCES

Douglas, Johnson E. 1980	Successful Seed Programs: A Planning and Management Guide
Seeds, 1961	The Yearbook of Agriculture
Evaluation 1983	Team Evaluation Report
CIAT 1984	A Summary of Major Achievements during the Period 1977 - 1983
Proceedings	1982 Short Course for Seedsmen

IRC:MMozynski
7/29/85