PN-ABJ-612

Winrock International

IMPROVED SEED SYSTEMS FOR AFRICA

Prepared by:

Dr. Fred Bentley
Mr. Robert Griffiths
Dr. Gary Reusche

IMPROVED SEED SYSTEMS FOR AFRICA

Prepared by:

Dr. Fred Bentley
Mr. Robert Griffiths
Dr. Gary Reusche

Funds for the preparation of this report
were provided by:

International Fund for Agricultural Development
The Swiss Development Cooperation
The United States Agency for International Development
Winrock International

REVISED DRAFT

IMPROVED SEED SYSTEMS FOR AFRICA

A Study and Proposals

A Report Prepared for:

Winrock International
Petit Jean Mountain, Route 3
Morrilton, Arkansas 72110, U.S.A.

November 1985
Revised May 1986

TABLE OF CONTENTS

		Page
	ACRONYMS AND ABBREVIATIONS	i
	ACKNOWLEDGMENTS	ii
	DEFINITIONS AND EXPLANATIONS OF TERMS	v
	ITINERARY AND ACTIVITIES OF THE SEED UNIT STUDY TEAM	vii
	EXECUTIVE SUMMARY AND RECOMMENDATIONS	xi
I.	A STUDY AND PROPOSALS FOR ESTABLISHMENT OF SEED UNITS AT TWO LOCATIONS IN AFRICA	1
	INTRODUCTION AND RATIONALE	1
	CIAT SEED UNIT	3
	AFRICAN NEEDS	4
	TERMS OF REFERENCE	5
	PROPAGATION OF OTHER CROPS	6
II.	CURRENT STATUS OF AFRICAN SEED SYSTEMS	8
	INTRODUCTION	8
	REGIONAL DIFFERENCES	9
	DONOR SUPPORT FOR SEED SYSTEMS	11
	OBSERVATIONS AND COMMENTS	12
	Plant Breeding	12
	Cultivar Evaluation and Release	15
	Multiplication	16
	Conditioning	18
	Marketing	19
	Certification and Legislation	22
	Quality Assurance	23
	Legislation	24
	Government Policies	24
	Training	25
	Present Needs and Problems	25
III.	THE INTERNATIONAL AGRICULTURAL RESEARCH CENTERS AND OTHER INTERNATIONAL SUPPORT IN RELATION TO SEED ACTIVITIES	28
	MAJOR AFRICAN IARCs	28
	IITA	28
	ILCA	31
	WARDA	33
	OTHER IARCs IN AFRICA	34
	ICRISAT	34
	CIAT	39
	CIMMYT	41
	CIP	43
	IRRI	45
	ICARDA	45
	IBPGR	45
	IFPRI	46
	ISNAR	46

Page

IARCS SUPPORT OF SEED PROGRAM DEVELOPMENT 46
OTHER INTERNATIONAL SUPPORT TO SEED ACTIVITIES IN AFRICA . 51

IV. COMPLEMENTARY SUPPORTIVE REQUIREMENTS FOR SUCCESSFUL SEED SYSTEMS 55

ADEQUATE VARIETY TESTING PROGRAMS 55
MINI-KIT TRIALS 56
PERSONNEL AND SUPPORTING SERVICES 57
OPERATING BUDGETS 58
SEED AND GRAIN PRICES 59
FUNDING FOR SEEDS PRODUCED BY SEED UNITS 60
OVERVIEW 61

V. PROPOSAL OF STUDY TEAM 62

INTRODUCTION 62
COUNTRY REACTIONS TO ASU CONCEPT 63
Western Africa 63
Southern and Eastern Africa 63
Ethiopia 63
HISTORY OF ASSISTANCE TO AFRICAN SEED SYSTEMS 66
DIFFERENCES BETWEEN THE CIAT SEED UNIT AND THE AFRICAN SEED DEVELOPMENT STRATEGY 66
STUDY TEAM PROPOSALS FOR SEED UNITS IN AFRICA 69
Conceptual Descriptions of WASU, EASU, AND RFs . . . 71
Organization and Management 71
The Value of Semiautonomy 73
The West African Seed Unit (WASU) 75
WASU Activities 76
Training 76
Seed multiplication 77
Promotion and technical assistance 77
Applied research 77
Communication and information service . . . 78
Probable Divisions of Responsibilities Within WASU 78
Activities at IITA 79
Activities at the Sahelian Centre 80
Flexibility and Staff for WASU 80
The East African Seed Unit (EASU) 81
The Regional Facilitators Concept and Locations . . . 83
Review of Activities
Infrastructure, Staff, and Budget Details for WASU and EASU 85
Considerations and Criteria Upon Which the Proposals for Locations of WASU and EASU are Based 85
Location for the East African Seed Unit (EASU) . . . 86
Location for the West African Seed Unit (WASU) . . . 86
Alternative Locations for WASU 88

Page

VI. FACILITIES NEEDED TO IMPLEMENT STUDY TEAM'S PROPOSALS . . 90

INTRODUCTION 90
FACILITIES FOR WASU, IN IVORY COAST 91
Possible Sharing of WASU Facilities and Resources at Bouake 91
Headquarters at Bouake 92
Seed farm in millet/sorghum region 93
Improvement of Facilities at IITA, Ibadan 93
Facilities for production of breeder and prebasic seed 94
Vegetatively reproduced species program 96
Improvement of facilities at the Sahelian Center . . 97
Field Facilities for Regional Facilitators 97
Accommodations for RFs 98
Facilities for EASU at ILCA in Ethiopia 98

VII. QUALIFICATIONS PROPOSED FOR PROFESSIONAL STAFF OF WASU AND EASU 103

STAFF QUALIFICATIONS FOR WASU AT BOUAKE 103
Coordinator and Technical Assistance Officer 103
Production and Conditioning Technologist 103
Quality Assurance and Training Technologist 104
Marketing and Management Specialist 104
Seed Pathologist 105
General Requirements 105
STAFF QUALIFICATIONS FOR EASU AT ILCA, ADDIS ABABA 105
Unit Head or Senior Seed Technologist 105
Seed Technologist (Forage Crop Specialization) . . . 106
General 106
STAFF QUALIFICATIONS FOR REGIONAL FACILITATORS 106
Facilitators for Eastern and Southern Africa 107
Facilitators for Western and Central Africa 108

VIII. PROPOSED IMPLEMENTATION PLANS FOR SEED UNITS IN AFRICA . . 110

INTRODUCTION 110
PROPOSED IMPLEMENTATION PLAN FOR WASU 110
Ivorian Discussions 110
Sequential Conceptual Implementation Plan 110
PROPOSED IMPLEMENTATION PLAN FOR EASU 112

IX. BUDGET ESTIMATES FOR THE SEED UNIT PROPOSALS 116

BUDGET ESTIMATES FOR WASU 116
BUDGET ESTIMATES FOR EASU 117

Page

X. OUTLINE OF WORKSHOP TO CONSIDER PROPOSALS FOR AFRICAN SEED UNITS 122

INTRODUCTION 122
PROPOSED WORKSHOP PROGRAM 122
FOOTNOTES TO PLAN 124
Invitees 124
Working Groups 126
Field Trip 127
Cost Estimates for Workshop 127

REFERENCES 130

APPENDICES
1. Terms of Reference for African Seed Team 132
2. A Feasibility Study Relating to SADCC Request for Donor Support for a Seed Productivity and Supply Project 136
3. Selected Quotations From a Paper by Jutzi (1985). . . 138
4. Criteria and Evaluations for Location of Seed Units 142
5. Proposed Building Areas at Costs -- Seed Technology at IITA, Preliminary Estimate, May 1985 156
6. Expanded Descriptions of Proposed Activities of Seed Units 167
7. Comments and Suggestions from Center Directors and Donors 174

LIST OF TABLES

Table		Page
1.	Stages in seed program development	10
2.	Intensity of IARCs contacts with West, East, and South African countries	47
3.	Situation of production and distribution of quality seed of selected crop groups	68
4.	Breeder and basic seed production on-station at IITA, Ibadan	95
5.	Generalized list of IITA on-station needs for seed conditioning	96
6.	ILCA equipment available to the Herbage Seed Unit	99
7.	Capital to be purchased for the Herbage Seed Unit	100
8.	Construction costs for facilities for the Herbage Seed Unit	102
9.	Training plan for the Herbage Seed Unit over 5 years	114
10.	Incremental staffing for the Herbage Seed Unit	115
11.	Staffing pattern for seed unit at IITA	118
12.	Budget summary for seed unit at IITA	119
13.	Projected 5-year budget for Herbage Seed Unit	120
14.	Conceptual costs for minimal workshop	127
15.	Estimated budget for workshop in IITA seed unit proposal	129

LIST OF FIGURES

Figure		Page
1.	Relationships of WASU and EASU	72
2.	Bar chart of WASU conceptual development	113

ACRONYMS AND ABBREVIATIONS

AFSU	African Forage Seed Unit
ASDG	African Seed Development Board
ADSO	African Seed Development Organization
ASU	African Seed Unit
CDC	Commonwealth Development Corporation
CIAT	Centro Internacional de Agricultura Tropical (International Centre for Tropical Agriculture)
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo (International Maize and Wheat Improvement Centre)
CIDA	Canadian International Development Agency
EASU	East African Seed Unit
FAO	Food and Agriculture Organizations (of the United Nations, Rome, Italy)
GOIC	Government of the Ivory Coast
HYV (or HYVs)	High Yielding Variety (or Varieties)
IADS	International Agricultural Development Service
IARC (IARCs)	International Agriculture Research Centre(s)
IBRD	International Bank for Reconstruction and Development
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICW	International Centres Week
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
IITA/ASU	IITA's African Seed Unit
ILRAD	International Laboratory for Research on Animal Diseases
IRRI	International Rice Research Institute
kg	kilogram
mt	metric ton (1000 kg)
MOU	Memorandum of Understanding
RF (RFs)	Regional Facilitators(s)
RFV	Regional Facilitator for Vegetative Propagation
SADCC	Southern African Development Coordination Conference
USAID	United States Agency for International Development
WARDA	West Africa Rice Development Association
WBG	World Bank Group
WASU	West African Seed Unit

ACKNOWLEDGMENTS

During the extensive travels and discussions of the Study Team in the course of preparation of this report, many agencies and individuals generously made very useful contributions and were liberal in giving of their time to the team. Because of the large number of persons the team met, often under circumstances which made it impossible to obtain the names of some significant participants, it is not possible or practical to acknowledge individually all who have contributed to this report by assisting us. Our grateful acknowledgments and genuine thanks are therefore expressed in both general and specific terms as follows:

At Centro Internacional de Agricultura Tropical (CIAT) in Cali, Colombia

Mr. Johnson E. Douglas (Director of the CIAT Seed Unit), Dr. Adriel Garsy (Assistant Director), and their associates

Dr. John L. Nickel (Director General of CIAT), Dr. Douglas Laing, and several other senior scientists of the Institute

In Dakar, Senegal

Mr. Richard Caldwell, USAID
Mr. Theirno Fall and M. Ousmane Ba of the Division de la Production et du Controle des Services

At Bambay

M. Massaly Fanara, Phytotechnician and Seed Production Officer

In Liberia

At WARDA:
Dr. J. E. Johnston, Director, Research and Development Dept.
Dr. S. A. Botchey, Agronomist
Dr. A. O. Abitarin, IITA/WARDA liaison scientist and several other senior officers

At the Cereal Agricultural Research Institute:
Dr. A. Paye, Acting Director
Mr. J. Q. Subah, Research Coordinator, and several other officers

At the Smallholders Rice Seed Program:
Mr. V. G. Tyler, Jr., Seed Improvement Officer

In Abidjan, Cote d'Ivoire

Dr. Brian Gray, the World Bank
M. N'Dri Brou Benoit, National Seed Service, Ministere du Development Rural
Mr. Gerald Theus of Pioneer Seeds
Mr. Koffi Goli, Charge de Recherche at Bouake (north of Abidjan)

In Ouagadougou, Burkina Faso

Mr. Loumassi Yago, Director, National Seed Service
Dr. V. Aggrawal, IITA/SAFGRAD leader (Kamboinse)
Dr. C. M. Pattanyake, ICRISAT Regional Director
Mr. Albert Ouedrago, Assistant to Mr. Roger Bloom, USAID Agricultural Officer

At IITA in Nigeria

Dr. J. W. Pendleton, Deputy Director General
Dr. D. E. Iyambo, Director, Dept. of Agricultural Sciences, Nigerian Ministry of Science and Technology (and Vice-Chairman of IITA Board of Trustees)
Mr. S. L. Claassen, Assistant Farm Manager
Many officers, program scientists, and others

In Ibadan

Dr. A. Joshua, National Seed Service of Nigeria

In Nairobi, Kenya

Mr. John W. Koehring, Director, REDSO/USAID
Mr. William Faught, Economist, REDSO/USAID
Mr. R. A. Kirkby, IDRC
Mr. J. B. K. Kilagat, Director, and Mrs. L. Neuranger of the National Seed Quality Control Service
Messrs. Matonya, Okido, and Ebuga of the Kenya Seed Co.

In Harare, Zimbabwe

Mr. T. C. Cavanaugh, General Manager; Mr. Jimmy Young, Production Manager; Messrs. Barry McCarter and Mike Caulfield, Plant Breeders, all of Seed Co-op Co. of Zimbabwe
Messrs. Rob Oliver and Ron Fenner, Research Specialist Services, Ministry of Agriculture

At ILCA, Addis Ababa

Dr. Peter Brumby, Director General
Dr. John Tothil, Head of Forage Legume Agronomy Group
Dr. Samuel Jutzi, Highland Program Agronomist
Several officers, program scientists, and others

In Addis Ababa

Mr. Gugsa Endeshaw, Production Manager, Ethiopian Seed Corp., and Mr. Zewke Bishaw, Seed Technologist
Dr. Hailu Gebre-Mariam, Cereal Breeder/Agronomist, and Mr. Lulseged Gabrehrivot, Forage Agronomist, of Institute for Agricultural Research
Mr. Alemeyehu Mengistu, Senior Pasture Agronomist, Ministry of Agriculture

At Winrock International, Arlington, Virginia, U.S.A.

Dr. J. H. Maner
Many office staff members

C. F. Bentley
R. G. Griffiths
G. A. Reusche

DEFINITIONS AND EXPLANATIONS OF TERMS

Categories of Seeds

- Breeder seed: a class of seed in a seed certification program that is produced under the supervision of plant breeder(s).

- Basic seed: a class of seed in a seed certification program produced by multiplication of breeder seed and intended for production of certified seed.

- Certified seed: a class of seed that has been certified to conform to standards of genetic purity established and enforced by a seed certification authority; and that is the direct descendent of breeder, basic or certified seed, and is intended for production of certified seed or for purposes other than seed production.

- Commercial seed: seed intended for crop production that has not been produced under a seed certification program.

- Cultivar: a distinct true breeding strain (variety) or an agricultural, horticultural or plantation crop.

- Cutting: a severed plant part used for vegetative propagation of the plant from which it was taken.

- Hybrid: the first-generation cross produced by controlling pollination of two varieties, lines or species.

- Variety: a distinct true breeding strain (cultivar) of an agricultural, horticultural, or plantation crop.

- Vegetative propagation: reproduction (multiplication) of an individual plant or of a cultivar by means of cuttings (i.e., without use of seeds).

As Used in this Report the Terms

- "improved crop varieties" and "HYVs" include both crop varieties (cultivars) and hybrids.

- "food grains" refers to cereal and legume grains, and in the African context the specific crops are primarily barley, beans, cowpeas, maize, millet, rice, sorghum, soybeans, and wheat.

- "seed system" refers to every aspect of all activities entailed in the multiplication, drying, conditioning (processing), storage, distribution, inspection, testing, regulation, and certification of crop varieties received from plant breeders in order to make available to farmers for planting seeds of such varieties that are of consistent high quality and purity.

- "varieties" is used to include hybrids where that term is applicable. Thus, if referring to maize -- "the varieties" -- should be taken to mean -- "the varieties and(or) hybrids" -- etc.

Clarification of the Use of Bouake

This report proposes the location of the "West African Seed Unit" (WASU) in the Ivory Coast. However, formal discussions regarding that matter have not been held and so there is no definite knowledge regarding where in the Ivory Coast the WASU will be located when the expected agreement is made with the Ivorian government. It is anticipated that the WASU may be located at either Yamoussoukro or at Bouake (pronounced B-waugh-Kay). In order to simplify this report, Bouake (typed without the accent) is used to refer to whatever location may eventually be decided upon for the WASU proposed for establishment in Ivory Coast -- assuming that the expected agreement is reached with the Government of the Ivory Coast (GOIC).

ITINERARY AND ACTIVITIES OF THE SEED UNIT STUDY TEAM

11 August - 20 September, 1985

August

Sunday, 11	Arrive in Arlington, Virginia, U.S.A. Background reading.
Monday-Tuesday, 12-13	Arlington, Virginia. Briefing and preparations at Winrock International. Consulted World Bank officials.
Wednesday, 14	Travel to CIAT, Cali, Colombia.
Thursday-Friday, 15-16	Visit Seed Unit and CIAT officers.
Saturday, 17	Travel: Cali-Miami-New York-Dakar.
Sunday, 18	Arrive Dakar, Senegal. Short briefing (Caldwell USAID); background reading.
Monday, 19	Dakar. Visited Division de la Production et du Control des Services (at Hann). Met USAID Director Ms. S. J. Littlejohn and Howard Lubell, agricultural program leader.
Tuesday, 20	Dakar. Visited Bambey agricultural research station and seed conditioning plant at Dioubel. Travel: Griffiths to Liberia, Bentley and Reusche to Ivory Coast.
Wednesday, 21	Griffiths to Monrovia, Liberia. Visited WARDA senior staff and facilities at Ferndale.
Thursday, 22	Visited Cereal Agricultural Research Institute, WARDA facilities, and IFAD supported Small Holder Rice Seed Project.
Friday, 23	Departed for Lagos.
Saturday, 24	Travel to Lagos and IITA, Ibadan.
Wednesday, 21	Bentley and Reusche -- Abidjan, Ivory Coast. Met group of 25 at World Bank arranged meeting. Discussions with: Mr. N'Dri, Ministry of Rural Development; Mr. Gerald Theus, Pioneer Seed Co.; Mr. James Benson, U.S. agricultural attache; Ms. Diana McLean, REDSO agronomist; Dr. Brian Gray, World Bank.

Thursday, 22	Travel to Ouagadougou, Burkina Faso. Visited Director YAGO, National Seed Service, and an associate.
Friday, 23	Ouagadougou. Visited: Dr. Vas Aggarawal (IITA/SAFGRAD); Dr. C. M. Pattanyake (ICRISAT); Mr. Diagne of FAO.
Saturday, 24	Ouagadougou-Abidjan-Lagos-ITTA Ibadan (arrived 18:00 Sunday).
Sunday, 25	Met Mr. E. J. R. Hazleden, General Manager, Agricultural Seeds of Zaria, Nigeria in the evening.
	TEAM REUNITED
Monday, 26	IITA. With Messrs. Pendleton and Claassen of IITA, visited Dr. Joshua, Director Nigeria National Seed Service; later toured IITA facilities. Met Dr. D. E. Iyamabo, Nigerian Ministry of Science and Technology. Meetings with IITA personnel and visits to some laboratories.
Tuesday, 27	IITA. Met personnel of IITA programs and visited tissue culture laboratories. Discussed Study Team's emerging concept of WASU with senior IITA officers. (A coup in Nigeria delayed departure for Ethiopia.)
Wednesday, 28	IITA. Departure delay continued. Additional IITA discussions. Report preparations.
Thursday, 29	IITA and Lagos Airport. Departed IITA at 16:00 and airport having been reopened, team was able to depart at 01:30.
Friday, 30	Travel: Lagos-Addis Ababa-Nairobi. Arrived in Nairobi in time to contact USAID before closing and program for Kenya continued as planned by them. Reception fo team to meet some seed interested people at home of RESDO Director Koehring.
Saturday, 31	Kenya. Travel to Nakuru to visit National Seed Quality Control Service there before continuing to Eldoret for night.

September

Sunday, 1	Kenya. Travel Eldoret to Kitale for meeting with officials and tour of facilities of Kenya Seed Co. Returned to Nairobi, arriving 20:30.
Monday, 2	Nairobi. Met group of 25 at USAID arranged meeting. Discussion continued entire morning. Visited ILRAD to visit principal administrator, ILCA office, and a CIP scientist. Viewed ICIPE training center at Dudu Ville, on outskirts of Nairobi. Telephoned ILCA headquarters Addis Ababa to reschedule visit to that Center.
Tuesday, 3	Nairobi. Concluding discussions with REDSO/USAID. Arranged new travel schedule and ticketing. Report planning and work.
Wednesday, 4	Travel to Harare, Zimbabwe. After arrival contacted Ministry of Agriculture and Seed Co-op Co. to ascertain schedule arranged for team. Continued report preparatory work.
Thursday, 5	Harare. Meetings and discussions with senior officials of Seed Co-op Co. of Zimbabwe Ltd. Visited and toured research station, conditioning facilities and storage of Seed Co-op.
Friday, 6	Harare. Visited scientists in Research and Specialist Services, in Ministry of Agriculture. Viewed crop breeding plots. Travelled to a farm to see and discuss grower/contractor unique on-farm seed maize conditioning. Completed ticketing arrangements. Report work.
Saturday, 7	Harare to Nairobi. In Harare awaited Mr. Kyomo, Director of SACAR of SADCC for discussion with him but he did not come. Departed for Nairobi at noon.
Sunday, 8	Nairobi-Addis Ababa. Arrived at ILCA at 12:00. Departed at once for visit to Debra Zeit Substation. Toured facilities and field plots.
Monday, 9	ILCA. Spent morning with ILCA staff discussing the Institute's proposal for a Forage Seed Unit. Visited Ethiopian Seed Corp. in afternoon.

Tuesday, 10	ILCA. Visited Office of Director, Ethiopian Institute of Agricultural Research (in Addis) accompanied by Dr. Jutzi of ILCA. Met at ILCA with representatives of IAR (2), MOA and ESC, plus ILCA personnel. Concluding meeting with Messrs. Brumby, Lothil, and Jutzi. Team review and consolidation of views and plans.
Wednesday, 11	Travel from Addis Ababa, Ethiopia, to London.
Thursday, 12	Travel from London to Arlington, Virginia.

EXECUTIVE SUMMARY AND RECOMMENDATIONS

INTRODUCTION

The seed unit established at CIAT in 1979 has been outstandingly successful in helping to improve seed systems in Latin America. It conducts a comprehensive program of training, technical assistance, and information related to all components of the seed system from the development of improved crops by plant breeders to the general availability of high quality seeds of those varieties for planting by farmers. The results have been a marked increase in the use of quality seeds of improved varieties by farmers in Latin America.

In sub-Saharan Africa, per capita food production has been declining since 1970 and the use of improved crop varieties has been, with few exceptions, disappointingly low. Although the International Agricultural Research Centers have not made a significant difference in the overall food situation in Africa, the accumulated reserve of technological innovations ready for testing and adoption is signification. The introduction and testing of germplasm originating from the International Agricultural Research Centers through the network of national agricultural research programs is resulting in an expanded array of improved varieties and potential improved varieties to be used by African farmers. It is this more dynamic national-international crop research effort, and the need for widespread adoption of new cultivars that places great urgency on the need for accelerated growth of national seed programs and viable seed industries in countries within the region. Without a stronger seed sector many of the results from this research, improved varieties, will not be used and have even less possibility of reaching the smallholder.

Based on the suggested relevance of the CIAT Seed Unit to needs of Africa, IADS prepared a preliminary statement and made initial approaches to prospective donors for support of an African Seed Study.

With the collaboration of the Swiss Development Corporation, which was interested in a coordinated effort in seed improvement in Africa before taking a bilateral decision, and assistance of the Director General of ILCA, which developed a proposal for a herbage seed unit, arrangements were made for an informal meeting of Center Directors and donors to discuss the need for a seed unit in Africa. With favorable response and support from Center Directors and donors at the meeting, IADS prepared a proposal for centers and the Swiss Development Corporation review and obtained financial support form the Swiss Development Corporation, IFAD, and USAID to carry out the study. A study team was assembled to ascertain where there was interest in and a need to establish in Africa a seed unit comparable to the one at CIAT.

The study team was instructed to focus on food grain crops. If the team found a need and desire for a seed unit, it was to outline proposals regarding the structure, activities, location, staffing, infrastructure and equipment, and funding needed for an initial 5-year period of operations. Additionally, the study report was to include detailed proposals for a workshop at which the report and its recommendations would be considered.

After briefing in Washington 12-13 August, 1985, the study team visited the CIAT seed unit and eight African countries in a 4-week period. This report was submitted 31 October, 1985.

CONCLUSIONS

With a few exceptions, the Study Team found that seed systems in the African countries visited are inadequate. In most countries, high quality seeds of improved varieties are rarely used.

In western Africa, seed systems are generally rudimentary. There was strong interest in establishing a seed unit that would function like the CIAT seed unit. All types of training, technical assistance, and effective methods of multiplication of breeder seed to provide basic

seed were the things of greatest interest. The ability to offer services in French was considered essential for the seed unit.

In eastern and southern Africa, seed systems are rather well developed for maize and a few other food crops in several countries. However, even in such countries, usage of improved varieties by farmers varies from crop to crop. Other countries of the region have inadequate seed systems.

In eastern and southern Africa, there is interest in training and in technical assistance to overcome or cope with some problems that are perceived as inhibiting increased production of quality seeds of improved varieties for export. However, there was no expressed desire to have a seed unit of the CIAT type. It was noted by contrast, that the SADCC group of countries in southern Africa had recently requested donor support for a study of "seed productivity and supply" for which the proposed terms of reference resemble somewhat those for the study reported on herein. However, that proposed project development study calls for a projection of seed needs by crops and countries to the end of the century.

RECOMMENDATIONS

Subject to the availability of funds for a minimum initial period of 5 years, to the flexibility in activities and programs which this study recommends, and to realistic positive consideration by both national governments and donors of the complimentary supportive requirements for successful seed systems (Section IV of this report), the Study Team recommends a five component seed system development program: African Seed Development Board, African Seed Development Organization, West African Seed Unit, East African Seed Unit, and Regional Facilitators.

African Seed Development Board (ASDB)

To ensure strong linkages among all activities and develop policies compatible with the concerned IARCs and national/regional seed programs as well as monitoring progress, an African Seed Development Board should be established. The board would consist of IARC crop program leaders with selected and rotational representation from national seed programs and seed industries in the regions. This should ensure effective two-way communication and an appreciation of national and international views on strategies for varietal improvement and seed production, as well as development of national seed programs and private seed industries.

African Seed Development Organization (ASDO)

This would interpret and implement the policies of the above board. It would consist of two seed units located in West and East Africa with subunits which have specialized crops and(or) seed production techniques of forage production and vegetative reproduction. The organization through its units has responsibility for supporting national or regional programs. This will involve training assistance, promotion of the development of seed industries and the provision, on request, of necessary technical support. The organization would be based in the West Africa unit whose head would be ASDO coordinator.

West African Seed Unit (WASU)

Apart from hosting ASDO, the main thrust of this unit will be to meet the demand for basic seed production, technical assistance, and training for national seed programs currently unavailable in the region. A complete seed production unit is required to help demonstrate all aspects of an entire seed system, for basic seed increases, and for training of staff for national programs.

Subject to negotiation of an appropriate memorandum of agreement with the government of the Ivory Coast, it is recommended that a West Africa Seed Unit be established in Ivory Coast as a semiautonomous unit contracted for support services to an appropriate lead IARC in the region or a nonprofit international agricultural development organization.

Crops covered would include those of ILCRISATs Sahelian Center's mandate and those for which IITA has world and regional responsibilities. Existing facilities at IITA for vegetative reproduction of crops should be utilized and encouraged as well as the potential to produce, under humid conditions, seeds of crops handled by WASU. The potential of the sub-Sahelian center should also be investigated.

East African Seed Unit (EASU)

It is recommended that an East Africa Seed Unit be established at ILCA, Ethiopia, in accordance with the proposal prepared by ILCA, provided there is the great flexibility in number and timing of activities as advocated by the study team. This unit will concern itself with forage seed but also will deal with other mandated crops in the region.

Regional Facilitators (RFs)

It is recommended that two Regional Facilitators, one attached to the EASU and one attached to the WASU, be appointed within 2 years of the establishment of that unit. They would spend over half of their working time in eastern and southern Africa (V. 83). A third Regional Facilitator for vegetatively propogated crops, would be appointed on secondment to IITA and based in central Africa, possibly in Zaire.

If, for whatever reasons, the recommendations to establish a West African Seed Unit in the Ivory Coast is not implemented, the study team has no specific alternative proposals. However, because the establishment of a seed unit is vital for increasing food production in western

Africa, a supplementary study might be made to determine the feasibility of locating the unit in Niger, Senegal, Cameroon, or elsewhere in the region.

PERSONNEL, INFRASTRUCTURE, COSTS, AND IMPLEMENTATION

The proposals made in this report have not been discussed with the government of the Ivory Coast and, additionally, the report recommendations may be changed substantially in the planned workshop. The personnel proposals (Sections V and VII) for both the West African Seed Unit and the East African Seed Unit are quite specific, although subsequent discussions may lead to some changes or adjustments. However, details regarding the infrastructure needs for the West African Seed Unit will continue to be quite speculative until there have been discussions with the Ivory Coast about the sharing or complementarity of facilities and land if the unit is, in fact, to be located in that country (Section VI).

Personnel

A staff of seven professionals is proposed for the West African Seed Unit. Five of them would be based at the unit's headquarters at Bouake. In addition, one Regional Facilitators would probably be located in eastern or southern Africa and a Regional Facilitator for Vegetative Propogation would probably be based in Zaire or nearby. Support staff requirements are not detailed. There is no specific proposal to increase staff at IITA for augmentation of activity related to vegetative methods of reproduction of root crops nor other food crop seed production.

The staffing proposals for the East African Seed Unit are those of the 1984 ILCA proposal plus one Regional Facilitator.

Infrastructure

Details regarding the building, machinery, land, and equipment needs for the West African Seed Unit located in Ivory Coast are provided in Section VI. Those listings assume the unit will be self-sufficient and will not share facilities or resources with the proposed Ivorian national seed service facility. The requirements listed therefore represent the maximum likely requirement. If there is sharing with the Ivorian agency, as is foreseen, the unit's infrastructure costs will be considerably reduced.

The only capital costs associated with the Regional Facilitators will be for office furnishings and equipment, and perhaps for transportation.

For East African Seed Unit the infrastructure requirements are those proposed by ILCA in 1984.

Implementation

Section VIII details proposals for implementation of the recommendations to establish the African Seed Board Organization and Seed Units.

However, before the proposal to establish the West African Seed Unit can be considered, there must be discussions and negotiations with the government of Ivory Coast as soon as possible. Assuming a favorable outcome from those discussions, a detailed program for the implementation of the proposal is given in Section VIII. A bar chart summarizes those suggestions.

For the East African Seed Unit, the ILCA proposal included a table that sets out the program of implementation, and that table is included in Section VI.

Cost Estimates

The cost estimates in this report are speculative. The Study Team members had no personal experience with costs such as those entailed in the proposals to establish the Africa Seed Units. Moreover, because of the short term of their consultancies, the team did not have time to search out such data. Moreover, events beyond the team's control reduced the post-tour time for report preparation to less than 25% of what had been scheduled. For those reasons, the budget details contained in the IITA and ILCA proposals for establishment of seed units have been used as the basis of the cost estimates in this report.

Cost estimates given in Section VII may be summarized as follows, in each case for the initial 5 years of operations:

African Seed Unit:

Cost Estimates for WASU,
Based on the IITA Seed Unit Proposal of 1985

		$,000's
Total budget for proposed IITA seed unit (see tables 9 and 10)		
Total personnel including training	$3,949	
Total other operating and capital costs	4,591	
	$8,540	

Guesstimates for costs of WASU at Bouake location; based on projections from the IITA proposal, but with seven principal staff

Total cost guess for proposed WASU at Bouake		$12-20,000
Total personnel including training	+ $6,000	
All other costs if no sharing of of resources with Ivorians	+$15,000	
All other costs if resource sharing with Ivorians	$ 6-10,000	
	$12-20,000	

Cost Estimates for EASU, Based on the
ILCA Herbage Seed Unit Proposal of 1984

Total estimated costs (see table 11 of this report)		$3,701
Total personnel including training	$1,878	
All other operating and capital costs	1,823	
	$3,701	

Workshop Proposal

Section X of this report provides details for the proposed workshop. It is suggested that there be a 5-day workshop at some site in West Africa during the fall of 1986. The cost of the workshop might be $40,000 to $60,000, although a minimal workshop might be held for less than $20,000.

ALTERNATIVES

If the recommendation for WASU as described is not accepted, it is recommended that the alternatives proposed (V. 88) be considered. However, the foregoing recommendations which provides for the headquarters for WASU to be in Ivory Coast is recommended.

I. A STUDY AND PROPOSAL FOR ESTABLISHMENT OF SEED UNITS AT TWO LOCATIONS IN AFRICA

INTRODUCTION AND RATIONALE

During the past two decades the global increase in food production has exceeded the unprecedented rate of world population increase. However, since the beginning of the 1970s, or earlier in some cases, population in Africa has increased more rapidly that food crop production because there has been little improvement of methods of food crop production and yields have increased little, if at all.

The major portion of the increase in world food production has come from higher yields and, to a lesser extent, from the cropping of additional lands. FAO (1984) estimates that 72% of the world increase in food production in the years ahead will likely come from the use of fertilizers, improved crop varieties and other inputs, and that only 28% of the increase is expected from the development of new lands. The FAO publication foresees relatively the same relationship continuing until at least the year 2000.

Although fertilizer use is given credit for over 50% of the yield increases that have been achieved, the FAO publication emphasizes that improved crop cultivars of higher yield potential have been the major key to the better yields. This is because local (traditional) crop varieties give, with few exceptions, much smaller yield increases per unit of fertilizer than do the new high yield varieties (HYVs) when both types of varieties are grown simultaneously under the same conditions. Fortunately, even without fertilizer, HYVs in some places out-yield most local varieties.

However, the yields obtainable with improved HYVs are dependent on the quality of the seeds as well as on their genetic potential and the environments in which they are grown. Poor quality seed results in

relatively poor yields for both local and HYVs. Thus, systems ensuring that farmers have seeds of high quality are fundamental to good yields and exploitation of the genetic potential of the varieties and hybrids they use.

The International Agricultural Research Centers (IARCs) have contributed greatly to increases in world food production through the development of improved high yielding varieties (particularly of beans, maize, millet, potatoes, rice, sorghum, and wheat). Of course, plant breeders and geneticists world-wide have also made fundamental and specific contributions to the development of improved higher yielding food crops in their own countries and for the benefit of all people.

Unfortunately, there has not been an adequate or equitable use by farmers of the new HYVs. That is because of the lack, in most developing countries, of effective systems for multiplication, quality control, conditioning, and distribution to farmers of seeds of improved grain varieties and hybrids. Thus HYVs may not be readily available to many farmers who know about them. Of course there are large numbers of farmers who are unaware of the new HYVs and their superior yield potential under ordinary farm conditions. Others may be disinterested because of lack of market incentives to produce a surplus for sale. Additionally, some farmers lack confidence in the reliability of seeds received from public agencies. Moreover, farmers who use their own crops for seed often need knowledge, advice, or assistance regarding methods which prevent unnecessary reduction in the quality of the seeds they select due to the adverse effects of improper drying, storage, and so forth. Farmers are interested in learning new procedures which will maximize the quality, and therefore the yield potential, of the seeds they produce for themselves. Promotion and infrastructure are needed to overcome such adverse seed handling conditions -- and to exploit more adequately the superior yield potentials of improved crop varieties.

One regional example of where these problems were addressed was Latin America where a "seed unit" was established to tackle them.

CIAT SEED UNIT

In the late 1970s there was concern about the limited availability and use of improved crop varieties in Latin America. The seed industry of the region was inadequately developed and some countries were in need of assistance to develop national seed systems. As a result a seed unit was established at CIAT (Cali, Colombia) in 1979. The Swiss Development Cooperation funded the seed unit as a special project for an initial 5-year period, and in addition, CIAT provided considerable institutional support.

The objectives of the agreement with the Swiss Government were:

"To create a Seed Unit at CIAT to:

1. Train personnel in government and private institutions, primarily from Latin American and Caribbean countries, in various aspects of seed industry and seed program development.

2. Extend technical collaboration to countries in the region interested in seed program development, with the aim of expanding the production of high quality seed of improved cultivars at all levels, from the breeder to the commercial stage, with main emphasis on, but not restricted to, the commodities with which CIAT works.

3. Conduct specific research in seed technology highly relevant to CIAT commodity interests and relevant to problems of the impact areas.

4. Provide CIAT with a single unit to cooperate with commodity programs in multiplying, processing, storing, and distributing advanced experimental material, or breeder and basic seed, to collaborating countries for their further multiplication."

The satisfaction of the donor with the accomplishment of the CIAT Seed Unit has resulted in extension of Swiss funding support to 1986.

The CIAT Seed Unit was subject to external evaluation at the time of the 1985 CIAT Quenquennial review. The general summarizing assessment of the CIAT Seed Unit (Chapter VII, page 93 CIAT Quenquennial Review) was:

"The Seed Unit has made a very significant impact on the seed industry of Latin America in a period of only five years. It has responded to a major need of the region by developing an excellent training program, improving seed technology, providing basic seed, and increasing communication among seed professionals. The continued evolution of the activities of the Seed Unit demonstrates that it is dynamic and responsive to the needs of its clienteles. The Panel commends the staff of the Seed Unit and those who have contributed to its development."

AFRICAN NEEDS

In 1983 Johnson Douglas, Director of the CIAT Seed Unit and author of the IADS Development-oriented Literature Series book, "Successful Seed Programs: A Planning and Management Guide," wrote to the directors of IADS to update them on the progress of the CIAT Seed Unit and to express the opinion that something of a similar nature might prove equally useful and relevant to the needs of Africa. Following this suggestion IADS prepared a preliminary statement and made initial approaches to prospective donors, including the Swiss Development Corporation.

The Swiss Development Corporation (SDC) with an interest in seeing a coordinated effort in seed improvement in Africa before taking a bilateral decision, supported the IADS initiative. The SDC and the Director General of ILCA, whose staff prepared a proposal for a herbage seed unit at that center, made arrangements for the initial meeting which was held during the Centers Director's meeting in Washington in November 1984.

At the informal breakfast meeting, the desirability of exploring the question of establishment of a seed unit (or units) in Africa was discussed. The International Agricultural Development Service (IADS) was asked to prepare a paper to facilitate further discussion and decisions regarding ways and means to improve the capabilities of African countries to produce and use high quality seeds of important crops. A draft proposal for the study was circulated to the IARCs and following approval of it, funding for the study was sought. Three donors, -- the International Fund for Agricultural Development (IFAD), the Swiss Development Cooperation, and the U.S. Agency for International Development (USAID) -- contributed equally to funding of the study (with potential for backup by Winrock International). Winrock International (a new agency composed of three formerly separate agencies including IADS) engaged the authors of this report as short-term consultants to constitute an "African Seed Study Team" to prepare a background paper, that would serve as a basis of discussion on ways and means to assist African countries to improve production of high quality seeds of food grain crops. The proposed program for a workshop which is expected to result in decisions to seek funding for and establishment of a Seed Unit (or Units) in Africa, was to be included in the study report.

TERMS OF REFERENCE

If there were a need and desire for a seed unit similar to the one at CIAT, the Seed Study Team was asked to visit representative countries in western, eastern, and southern Africa to determine: interest in the possibility of establishing a seed unit or units; the need for and possible initial activities of any proposed units; the resources and budget needed for an initial 5-year period of operation of units(s) proposed; alternative possible location(s) for the Seed Unit(s); and, finally, proposals for location(s), timing, and program(s) for workshop(s) where national representatives, potential donors, and scientists from IARCs and elsewhere would consider the study report and its proposals.

If the result of the study is a decision, based on agreements of the workshop, which will lead to the establishment of seed unit(s) in Africa with assured funding for an initial 5-year phase, it is expected that the initial phase will be followed (subject to satisfactory performance of the Seed Unit(s)) by subsequent phases of equal or greater length.

The specific terms of reference for the team constitute Appendix 1.

PROPAGATION OF OTHER CROPS

This study was intended to be concerned with food grain crops. The terms of reference for the study do not specifically address the topic of food crops that are reproduced by vegetative cuttings or by tissue culture such as cassava, yams, and some other crops of great importance in certain developing countries -- especially in parts of Africa.

Because IITA is already extensively engaged in research on and multiplication methods for vegetative reproduction of four of the Institute's mandate crops (cassava, cocoyams, sweet potatoes, and yams) the Study Team proposes that the IITA vegetative reproduction activities be included as a sub-unit of a proposed African Seed Development Organization to be discussed in this report. An increase in resources for that work at IITA appears to be justified.

ILCA has recently initiated research and development on high-yielding low-input forage legumes and grasses. Early successes of that work have stimulated much interest by farmers because for many of them cash income from livestock exceeds cash income from grain by two or more fold. Interest in improved forage crops has become so high that a forage crops network for Africa has been formed. As a result of the new interest in improved forage crops, ILCA developed a proposal in 1984 for the establishment of a forage crop seed unit at the Institute's headquarters. It is proposed that the seed unit engage in multiplication of breeders seed

for improved forage crops and the conditioning of such seeds. The proposed unit would also do training and outreach work as those activities relate to the forage crop seed system.

Vegetables too are important foods in most countries. They may be grown from seed or cuttings and they may also be transplanted as seedlings. However, because of the great number of vegetable crops, and the complexities of the methods for their reproduction, the Study Team has not dealt with the problems of seed and methods of reproduction for vegetables.

It is suggested that, depending on the support for and the progress of the Seed Unit(s) to be proposed, it may be desirable to commission a study in the future to deal with the needs and problems of other food crop varieties possessing superior genetic qualities. Perhaps such a study might be considered at the time of the review recommended in this report for about three years after the commencement of operation of he seed units proposed in this study.

The team made no attempt to consider seed problems or reproduction methods for cash and plantation crops such as the beverage crops, cotton, and so forth.

II. CURRENT STATUS OF AFRICAN SEED SYSTEMS

INTRODUCTION

This overview of seed systems in Africa is based primarily on visits by the Seed Unit Study Team to eight African countries during the period of 10 August to 11 September 1985. However some documents or reports received or reviewed by team members have also contributed to the appraisals herein.

The current status of seed production and use in sub-Saharan Africa varies greatly from country to country. An extreme example of seed program development problems is Chad where the combination of recent internal strife and drought has resulted in loss of all germplasm collections and most seed stocks. Additionally, agricultural research related to crop improvement was thoroughly disrupted. As a result, in some areas even local grain varieties were not available for planting in 1985. At the other end of the spectrum is Zimbabwe, which has had an effective seed industry for decades. There, privately-operated crop breeding and seed production activities have resulted in the use of single cross maize hybrids since 1960, making Zimbabwe one of the first countries in the world to use that technology on a commercial scale.

A study of quality seed multiplication, supply, and use by FAO (1985 A) reports that of 84 countries surveyed in seven regions of the world, the "situation of production and distribution of quality seed of selected crop groups" was least developed among the 25 African countries evaluated when compared with the other six groupings of the remaining 59 countries. In Africa, the pasture seed situation was much less satisfactory than for food and vegetable crops. The pasture seed situation in Africa was generally markedly inferior to that situation in the other six regional groups.

A detailed characterization of each country visited would be impossible because the Study Team spent only 2 to 4 days at any given location during its tour. However, observations of the Team and excellent cooperation on the part of all those who met with the Team, (who generally represented the key figures involved in the various countries visited) permitted the Team to obtain a rough picture of the overall situation. The Team assumes that the countries visited, and other countries familiar to the consultants, constitute a satisfactory sample of the state of development of seed systems in the regions concerned.

Development of seed systems is an evolutionary process and four stages have been proposed in the excellent work edited by Dr. Johnson Douglas (1980) entitled "Seed Program Development." The stages as defined by Douglas are quoted in table 1.

REGIONAL DIFFERENCES

The region of western and central Africa, composed of 24 countries, represents the least developed region of the continent in terms of he current stage of seed program development. Nearly all of the western and central African countries, with the possible exceptions of Senegal, Ivory Coast, Nigeria, and Cameroon, would be classified in Douglas' Stage I and II. Even in the more developed countries mentioned, if Stage III has been achieved, it is not uniform over a range of crops. For example, Nigeria might be classified as being at Stage III in terms of its maize program, but would be at Stage I or II for millet. Of the 24 countries in this region, 15 are francophone.

Kenya alone could be considered to be clearly at Stage III among the 10 countries of the northern, eastern, and central east African regions. Kenya has been a leader in terms of seed programs in Africa and has many of the characteristics of a mature seed industry. Indeed, the marketing structure used by the Kenya Seed Company could well serve as a model for

other countries. By contrast, many countries of those regions are struggling simply to produce high quality seed and have seldom achieved effective marketing procedures for improved seeds.

Table 1. Stages in Seed Program Development[1]

Stage I.	Agricultural research and development are ineffective, limited, or just getting underway. Most varieties of basic food crops are traditional, as are production practices. Nearly all farmers save their own seed, but a plant breeding department may be distributing small quantities of improved varieties of some crops.
Stage II.	Agricultural research and development are underway. Improved varieties of basic food crops are being developed and are beginning to replace traditional varieties. Use of production inputs, such as fertilizer, is limited but improving. A few farmers and seed production units are multiplying seed. The limited quantities of seed available are a constraint upon improvements in crop production.
Stage III.	Agricultural research and development are well established and productive. High-yielding varieties of basic food crops are rapidly replacing traditional varieties in the most productive areas of the country. Production inputs are widely used, although usually not at the most efficient levels. Many components of a seed program exist, and the supply of seed ranges from fair to adequate. Seed quality may be poor, distribution remains relatively inefficient, and farmers use much less seed than is available for distribution. Some private seed enterprises are being formed.
Stage IV.	The agricultural sector is well advanced. The national seed policy is reexamined, special attention is given to developing and strengthening commercial seed production and marketing, a seed law is in force, and links are established with related and supporting institutions and groups.

[1] Quoted from Douglas (1980).

Of the 12 countries in southern Africa, Zimbabwe is undoubtedly at Stage IV and is probably the only Stage IV country in the sub-Saharan region

(if South Africa is excluded). The seed industry in Malawi has been cited as one of the more developed systems in the region because reasonable levels of seed quality and self-sufficiency have been attained.

Thus, in terms of seed system development most of the sub-Saharan countries would be in Stage I or II of table 1. There are a few notable exceptions such as Kenya, Zimbabwe, and perhaps Malawi. However, industrial or export crops -- such as cotton, oil palm, and coffee -- are not considered in this assessment of national food crop seed systems in the regions discussed.

DONOR SUPPORT FOR SEED SYSTEMS

There has been much donor assistance to seed systems in many developing countries. FAO (1985) reports that during the period 1973-1984 over $150 million was provided to projects in 80 countries by only three agencies. Under the current Agricultural Rehabilitation Program for Africa (ARPA) over 40 seed-related projects are funded at a cost exceeding $30 million and over $15 million of additional projects await funding (FAO, 1985). However, in spite of such large-scale assistance to seed systems, these programs have been of short (2 to 3 years) duration and not resulted in sustainable and effective seed production and distribution systems. The situation in sub-Saharan Africa continues to be unsatisfactory as described in the preceeding section.

The paucity of self-sustaining successful projects, resulting from efforts by various donors to promote and assist the general use of high quality seeds of adapted superior varieties, has been attributed to the large proportion of projects which have been short-term or too sophisticated, or disjointed, or single factor or uncompleted. Douglas (1980), commenting on such problems states, "...there are far too many attempts to establish Stage III or Stage IV seed programs when a country is only able to handle Stage I or Stage II." For example, seed legislation has sometimes been pushed at an early stage when there is little for which

such legislation is required. Or, massive multiplication schemes have sometimes been designed for crops and varieties that had not been tested for their marketability at the farmer level. Finally, donors have sometimes discontinued their support before seed system projects were mature enough to be self-sustaining.

Some of the foregoing problems result in situations where countries have certain components of a seed system, but the systems may not be continuous, lacking one or more essential components. Perhaps they suffer from lack of adequate multilocational and on-farm trials, or there may have been unwise varietal releases. Such problems are exacerbated in adverse years (drought, etc.) when the shortage of seed of even local varieties may cause serious problems at national or international levels. Unfortunately, at such times it has sometimes been politically expedient to provide "seed" of very low quality to alleviate the situation but with subsequent serious adverse effects on seed systems and(or) farmer confidence in public programs.

OBSERVATIONS AND COMMENTS

Seed systems are concerned with every seed related activity from the time plant breeders develop new improved varieties until supplies of quality seeds thereof are consistently available to even the smaller farmer for planting -- and at nonexploitive prices. Obviously, there are many components to seed systems and some of them merit discussion in relation to current seed problems in parts of Africa.

Plant Breeding

Plant breeding efforts of some type are on-going in all the countries visited. The major emphasis in the breeding program in any given country is on the cereal crops which are of primary importance to the

country. The success of a breeding program is measured by the development of a suitable "product to sell," whether by a public or private seed enterprise, and is quite variable.

Perhaps the most notable success in sub-Saharan Africa has been in the development of maize hybrids and varieties. The well-known successful seed systems in Kenya and Zimbabwe are based largely on hybrid maize. Hybrid technology requires yearly purchase of seed. The very attractive economic returns to farmers who use hybrids creates a market that is profitable to private seed enterprises. Kenya, Zimbabwe, and more recently Ivory Coast and Nigeria have either developed or are in the process of developing efficient systems for the production of maize seed. Pioneer Overseas, an international seed company, is in the process of establishing a research farm in Ivory Coast where it will soon begin marketing hybrid maize. Agricultural Seeds Ltd., a new Nigerian concern, is gearing up to meet a growing market there.

In countries with effective seed systems, "fact sheets" which describe the characteristics and adaptations of recommended varieties are usually available. Such compilations of data and information assist farmers and their advisors in the selection of recommended crop varieties for planting. During the tour in Africa, the study team encountered such information on only two occasions. Although there were clear indications of interest in "fact sheet" type information, effective action needed to compile and distribute such data was generally lacking.

The need to combine the use of HYVs with inputs (such as fertilizer) in order to achieve yield expectations was generally understood intellectually, but in most countries marketing and credit programs have not taken this relationship into consideration. Sometimes HYVs are distributed by public agencies without inputs, resulting in little or no advantage to the farmer. In other cases, fertilizer has been supplied for local varieties which do not give the profitable yield responses of the HYVs.

Such "promotional" procedures may indeed be counterproductive, resulting in skepticism and future caution on the part of farmers.

When new improved crop varieties have been tested and accepted under the procedures established by some type of "variety approval committees," breeder seed obtained from the agencies which develop approved new varieties must be increased in order to produce sufficient seed of the new varieties to meet needs of farmers.

Inadequate availability of quality breeder seed was cited as a frequent problem in several countries. This constraint usually resulted from irregular deliveries of breeder seed for initial multiplication, or breeder seed was said to lack suitable uniformity. The purification and maintenance of quality breeder seed is an on-going issue that requires more attention and cooperation of breeders and basic seed producers.

The Study Team learned that plant breeding by private seed companies is only being done in countries that are at an advanced stage of seed system development (Stage III and IV) and where government policy permits the companies to earn a reasonable return on investment. It should be noted, however, that plant breeding by private companies is generally limited to cash or export-oriented crops and hybrids. New variety development by the private sector is not done for many traditional food crops which remain a responsibility of the public breeding sector.

One plant breeder said there are frequently unreasonable expectations of various governments and donor agencies of improved varieties. A HYV by itself will not solve the problems associated with low yields, but that is sometimes expected. Moreover, in a number of interviews, it became apparent that breeders are seldom concentrating their efforts on the development of varieties specifically intended for low-input production. It was contended that too little attention is given to the small farmer's risk-avoidance philosophy and to the suitability of local varieties. For example, sorghum farmers in the Sahel are reported to

have large numbers of narrowly adapted varieties well suited to small farmer preferences. After 10-years experience in Africa, one breeder suggested that breeding objectives need to focus on varieties for micro-climates rather than one or a few varieties which it is hoped will be suitable for vast areas.

There was said to be a lack of market research to guide breeding objectives and a rather general failure to do extensive on-farm testing as a feedback and validation mechanism. That would permit breeders to periodically re-define their objectives to meet the needs of their clientele. If breeders spend years developing varieties that are not well received, for whatever reason, then the objective was not well chosen.

Cultivar Evaluation and Release

Extensive evaluation of cultivars through multilocational trials and on-farm tests is a prerequisite for the rational introduction of improved HYVs. Varietal release committees, if existent in the countries visited, frequently could not base their action on facts generated by the cultivar evaluation system. Another aspect of cultivar evaluation, regional trials comparing materials available from surrounding countries or from countries with similar agroecological zones, was particularly weak. It was agreed that something needs to be done to improve that situation.

Because of limited budgets, shortage of qualified personnel and lack of other needed resources, government agencies are often unable to conduct adequate programs of variety trials and on-farm tests for newly developed or introduced varieties. None of the countries visited mentioned the activities of nongovernment organizations (NGOs) and their potential to play a role in the evaluation of new germplasm. NGOs are generally not oriented towards technology development but rather towards the exploitation of available technology. They are potentially a valuable source of information and cooperation for the screening of new

varieties at the farmer level. They can provide feedback to research organizations regarding the acceptance of such materials and packages.

One private seed enterprise has a limited program of testing its varieties regionally, so as to ensure that any seed sold for a particular region will be suitable. It was agreed that importations of seed into a particular region should be based on data establishing the appropriateness of the varieties for the region. However such evaluation and comparisons are best done under the supervision of unbiased agencies without entries in the tests. In practice, such a procedure is little used in spite of the lip-service to it. Nonetheless, seed enterprises interested in the development of export markets favor unbiased variety testing programs.

Multiplication

Seed multiplication schemes take various forms in the countries visited. Some involve multiplication by state agencies or state farms, others involve contract production by small farms, and some base their activities on contracts with large farms. Countries at Stage III and IV of development usually multiply seed through the use of well-trained and experienced growers who farm comparatively large tracts of land.

The Team was told in some countries that state-run seed farms were established to meet special needs in the seed system, such as basic seed production or seed production on irrigated land. However in some countries there were complaints that state seed farms were not meeting the needs for multiplication of improved varieties. In much of Africa, a serious constraint to seed production in recent years has been the drought. Unfortunately, seed production shortfalls in drought years have created a situation in some countries where ordinary farm grain was collected, cleaned, and bagged for sale as planting material. The origin and genetic makeup of such grain was generally unknown and

mixed. If such planting materials do not perform well, farmers will not forget that it was provided as supposedly "improved seed."

The response of governments to disasters such as drought has sometimes included the distribution of seed to those unfortunate enough to have eaten their seed reserves. This disaster relief activity has sometime included "free" distributions of seed, and in some cases it has adversely affected long-term programs of introduction, distribution, and use of improved germplasm. Disaster relief and seed system development are not distinguished in such cases.

The private seed industries of Kenya and Zimbabwe, and perhaps some others, feel they could serve a role in the multiplication of food crop seeds of adapted varieties in drought years. When drought occurs there is usually a sudden demand in some areas for seed of crops such as sorghum and millet which are quick growing and rather drought tolerant. Seed companies do not have stocks of such seeds and demand of that kind is not known until it is too late to produce seed to meet it. As a result, there is a keen interest in the establishment of a system of revolving seed stocks that could be available when the need arises. However, the private companies insist that the establishment and funding of such a system is a responsibility of government even if private seed companies are asked to execute the programs.

Seed multiplication by small farms was said to present many difficulties. The problems include lack of sufficient operating funds, poor price incentives, the difficulty of maintaining adequate isolation in village fields, low input availability, and the large supervisory and inspection staff needed to manage such schemes. The private seed enterprises interviewed based their contract production on better educated farmers with large farms. One private company even arranges financing for farm equipment and helps manage the farms of growers until such time as they are able to continue unassisted.

None of the countries in Seed Program Development Stage I or II reported that their multiplication strategy utilizes the ability of small farms to produce and store their own seed. Indeed, seed schemes often appeared to be designed to make small farms dependent on a supply of seed from outside sources. Farmers are not likely to accept such systems unless they have absolute confidence that seed will be delivered on time. The "spread effect" of improved germplasm into the rural sector from neighbor to neighbor was not a defined multiplication strategy in the seed systems described to the Study Team. Such a system could be developed by wide distribution of small quantities of improved seed, relying on small farmers to increase the improved seed for their own use, and with subsequent spread to neighbors.

Some seed imports and exports occur in the sub-Saharan region, but only on a limited scale. One company stated that seed production could be tripled in one year if there was a definite export market. Many of the countries visited tended to view imports as a short-term solution to crises. There was little awareness of the regional advantages of climate and efficiency of scale that would permit a seed company to exploit market potential by more efficient seed production in favorable climates.

Conditioning

The facilities and equipment for seed conditioning are important components of seed systems. Some conditioning facilities for the cleaning, sizing, treatment, and bagging of seed were available in all of the countries visited. Many were at government projects and were managed by government agencies. Some excellent facilities seen would not look out of place in the United States or Europe. Zimbabwe seed producing farmers have conditioning equipment on their farms which is fabricated locally and is well adapted to the availability of farm labor and the need for timely handling of the seed crop.

However, a variety of problems affected the performance of some seed conditioning facilities seen by the Study Team.

- In some cases conditioning equipment was not appropriate for the seeds concerned, or its use was badly misunderstood. Sometimes the seed equipment was not of a good design. There was a clear desire for better understanding of imported equipment, and to have hands-on training on such machines.

- One facility visited was only used a few weeks a year, and the labor requirement to condition small quantities of seed was relatively high. A smaller through-put capacity and a correspondingly smaller labor requirement would have been an advantage.

- Frequently, the bagging equipment was designed for bags of 40 kg to 90 kg only and did not permit the filling of small bags of 2 kg to 5 kg. However, the most successful seed enterprises in sub-Saharan Africa market large quantities of seed in the smaller bags, which are appropriate for small farms.

- Some seed conditioning plants were located in remote areas where utilities were a problem. In some cases such facilities had broken down, and the condition plants were idle.

- During the conditioning process, chemical seed treatments are frequently added. The treatment may be one or a combination of soil fungicides, soil insecticides, and storage insecticides. Some of the chemical used routinely are quite toxic. The use of such chemicals did not appear to be based on applied research to establish the need for their use.

Marketing

Successful seed systems depend on having a quality product to sell at an affordable price to purchasing farmers. But even high quality seeds

require an effective marketing program if they are to reach farmers who can profit from their use. Thus the most successful seed systems in sub-Saharan Africa were those that actively marketed their product. In general, however, the marketing and promotion of the seed "product" was one of the weakest links in the delivery of HYVs to farmers.

Perhaps the most noticeable deficiency in many of the seed systems encountered was inadequate knowledge of the customers and of the market potential. Often there was little reliable data upon which to estimate seed demand. The situation has sometimes led to the production of seed that could not be sold. However, the Team did not hear of cases where farmers could not buy seed of a particular improved variety because the demand exceeded the supply.

In some countries visited the public seed service did not consider it their job to promote the seed they produced. This was perceived to be the responsibility of the extension service, or of regional development agencies, or of some other government agency. For some seed services the objective seemed to be high quality seed, packaged in 50 kg bags with appropriate labelling, and delivered to another agency which would then distribute the seed to farmers.

Promotional activities, including the development of printed materials, demonstrations of new varieties, and other methods designed to highlight the advantages of HYVs offered for sale need to receive a great deal more attention on the part of the seed producers. After the seed system has produced a product, it then needs to spend more time marketing such seed. Successful private seed enterprises had the only marketing and management specialists encountered during the mission.

The import/export aspect of marketing is seriously hampered by the general lack of regional variety trials. Responsible seed system professionals rightly hesitate to import seed of unknown varieties, and reputable seed companies will protect their business image when

considering the export of seed into a region where adaptation trial data are not available.

Price policies have powerful effects on seed systems. The price paid to the seed grower and the sale price of the seed to farmers influence both the quality of seed produced and the ultimate use of seed by the farmers. If seed is priced below the market price for grain, seed may be diverted to consumption channels. Moreover an unduly low price for seed may reduce its worth in the eyes of the farmers. Yet high prices for seed will limit sales! Thus pricing policies within government-run seed systems frequently disrupt efforts to establish soundly managed seed enterprises. Most of those interviewed said government policy makers needed to be better informed about the needs, importance, and requirements of the seed industry.

Only a few countries had a wholesale/retail structure that permits small businessmen an opportunity to market seed within local communities. When such marketing mechanisms did exit, small village businessmen sold a great deal of quality seed to their everyday clientele. Such seed was sold at very small markups and served the needs of farmers very well. In such systems, the wholesalers and customers operate on a cash basis, and as a result, seed is reasonable priced.

Some government seed programs have been costly. When seed was provided to extension organizations and regional development societies which in turn distributed the seed to their network of agents, nonpayment for the seed received by farmers was sometimes a serious problem. For example, in one country a debt of US $1 million for nonpayment of seed was reported. In another country such a distribution scheme seemed to be working well.

Although the question of royalties to be paid to private seed companies for the use of varieties developed by their research were discussed in

one country, that is not yet an issue in seed pricing in sub-Saharan Africa -- a situation not likely to change in the near future.

Certification and Legislation

Seed certification programs, which include field inspections by qualified seed specialists, existed in only a few of the countries visited. Many of the countries initially or solely multiply seed on state farms. In cases where a state agency produces the seed and the same state agency regulates the quality of the product through certification-like activities, the result is not viewed as a true certification scheme. When that is done, the system of checks and balances that are normally understood to be a major role of a certification agency do not exist. A certification agency is essentially an external quality control mechanism to ensure maintenance of standards and the integrity of the seed system.

Most of the countries visited have developed systems that resembled the internal quality control procedures of a private company. Such a situation appeared to make it politically difficult for a state agency to take firm positions on quality standards because it amounts to self-criticism. In a well-developed seed system, competition dictates that impartial quality control standards be high in order to maintain and build a confident market. In many of the countries visited, the only competition facing the government-run seed system was the capacity of farmers to produce their own seed. In one country, it was stated that the seed produced through state farms was inferior in germination capability and other quality standards to seed produced by farmers for their own use.

In one state-run system, small quantities of seed were multiplied and then tested regionally by extension organizations. If the variety was favorably received by the farmer, larger scale multiplications were undertaken on large state-run seed farms. This system worked to a degree, but it was not wholly satisfactory and now the management of the

state-run farms is being transferred to a commercial enterprise with the government being one of the stockholders. When the seed is multiplied by the state, no outside certification agency assures that the quality standards are maintained. This is the responsibility of the internal quality control on the state-run farms. When seed production farms operate commercially, an impartial service is needed to monitor and certify the quality of the seeds produced.

In one country, a well-developed certification program centered around one crop. Most of the seed is grown regionally by farmers and then collected by the state-run seed service. The system requires a large staff for effective operation. Recently, however, the government decided to totally restructure that seed system to permit a larger role for the private sector. However, the seed certification procedure under the new system has been fully developed.

Quality Assurance

Quality assurance is concerned with the standards established for such characteristics as seed viability, and freedom from diseases, extraneous matter, weed seeds, and contamination by the presence of other varieties. Such determinations are made in specialized laboratories.

Most of the countries visited had adequate seed testing laboratories and they appeared to be operational although, in general, they seemed to be underutilized. In some cases the sophistication and costliness of the equipment available seemed to exceed the requirements for the amount of work to be done (or being done).

In nearly every country, quality standards for production and testing were based on published literature. Some countries questioned the appropriateness of such standards, but lack of data seemed to prevent any meaningful attempt to define standards appropriate for the specific country. Very few examples of field inspection rejections were heard of during the mission, and it seems likely that in some cases there is very

little meaningful application of quality standards whether during field inspections or laboratory analyses.

Legislation

Most countries were interested in the subject of seed legislation. Much of the interest centered around laws for seed certification, imports of seed, plant quarantine, and plant variety protection. Little interest was shown in marketing laws such as truth-in-labeling legislation. Less than half of the countries had seed legislation, but most were contemplating legislative actions. It was not clear how much legislation was expected to help some countries at their present stage of seed program development. Douglas' book suggests that it is best not to legislate until it is needed to achieve a specific objective.

Government Policies

As reported to the Study Team, policies of governments are unanimously pro-seed in the countries visited. There appears to be a real appreciation of the importance of quality seeds for the agricultural health of the nation. This recognition of the value of seeds, however, did not necessarily translate into policies that enhance the development of efficient seed systems. In fact, one of the most discussed seed system needs was to educate and inform decision-makers about the various aspects of seed program development, and the short- and long-term implications of the policies adopted.

In the countries visited, the role of government in the seed system varied greatly. Differences were in the degree of government intervention. Government intervention ranged from participation as a shareholder in commercial seed companies to total control of production and quality control of seeds. In one country, private seed companies are required to produce for domestic purposes a percentage in excess of the demand forecast for the following year. Export of seed from the country is not permitted until the specified seed reserve is in storage. In

some countries, the government annually sets the price ceilings at which private seed companies are authorized to sell their seeds. Other countries visited had no interest in private seed companies. Sometimes government appeared to be involved in the production of seed by default because no private companies had developed for whatever reason. There was no evident awareness that public seed multiplication programs are preventing entry of private enterprise into the seed system.

Training

Effective seed systems require a wide variety of personnel with specialized qualifications. The reliable multiplication of new varieties, as well as the maintenance of the quality and integrity of varieties over the years depends on personnel skilled in growing such seeds without contamination by weeds, impurities, or other varieties. Growers who can remove (rogue) off-types to maintain the uniformity of varieties and inspectors who can verify the quality and varietal purity of growing crops are important to effective seed systems. The conditioning and seed quality testing, as well as phytosanitary controls, are other essential components requiring skilled people. Administration of seed certification programs, marketing, and seed promotion are also important aspects of seed systems.

Without exception, the countries visited expressed very high interest in training programs t increase the number and qualifications of the many types of skilled people needed for effective seed systems.

Present Needs and Problems

Arising from the foregoing review of the various stages of development of the seed systems in the regions discussed, the present needs and problems may be summarized as follows:

- In Africa there is great variation in the stage of seed system development between countries and even between regions. They range from Stage 1 (first) to one country at Stage 4.

- In general, but with exceptions, seed systems are at earlier stages of development in eastern and southern Africa.

- Although there has been a great deal of assistance to seed systems of sub-Saharan Africa, rather few projects have been self-sustaining continuing successes. Some projects have been short-term, or too sophisticated, or disjointed, or single factor, or incomplete.

- Plant breeding programs were sometimes criticized for inadequacy and(or) lack of suitable orientation.

- Inadequate programs of on-farm testing of "new improved varieties" and failure to employ suitable inputs (especially fertilizer) in such tests were frequently reported (see Kirkby 1984). There were also complaints about too little regional testing of varieties.

- There were some complaints about insufficient availability of details regarding characteristics and adaptations of recommended varieties.

- Procedures for "approval" of new varieties recommended for use vary considerably from country to country.

- Quality of programs for multiplication of seed of new approved varieties were reported to be quite variable and frequently unsatisfactory.

- Sometimes imported seeds distributed when there have been serious seed shortages have been of poor quality and have had some adverse effects.

- Facilities, equipment, and quality for seed conditioning are variable.

- Marketing and promotional programs for improved varieties, and for export of seeds to regional neighbors, are generally under-developed.

- Legislation regarding seed systems, and for seed certification systems, is highly variable and lack of sufficient and suitably trained personnel was a frequent problem.

- Some government policies or programs have had adverse effects on seed systems.

- In every country visited there was a very high interest in training for seed system personnel.

III. THE INTERNATIONAL AGRICULTURAL RESEARCH CENTERS AND OTHER INTERNATIONAL SUPPORT IN RELATION TO SEED ACTIVITIES

The national research programs in Africa are receiving increasing assistance through the International Agricultural Research Centers (IARCs). The introduction and testing of germplasm originating from these centers through the network of national agricultural research programs is resulting in an expanding array of improved varieties and potential improved varieties to be used by African farmers. It is this more dynamic national/international crop research effort that places even greater urgency on the need for accelereated growth of the seed programs and seed industries in the region. Without a stronger seed sector many of the results from this research, improved varieties, will not be used.

MAJOR AFRICAN IARCS

As reported in the "CGIAR March 1985 Newsletter," four of the IARCs are located in Africa. Three of these centers have programs that can benefit directly from increased effort on seed research and development work. These three centers and their program interest are:

IITA

The International Institute for Tropical Agriculture, located in Ibadan, Nigeria, and the first center established on the African continent in 1967, has a global mandate for research on farming systems and on cowpeas, yams, and sweet potatoes. They also work in close cooperation with other centers and have regional responsibility for cassava, rice, maize, and soybeans. Most of IITA's research is concentrated in Africa and currently they are developing ways to improve regional farming systems through more productive and ecologically sound alternatives to traditional system of bush fallow and shifting cultivation. Along with

research to improve crop production and farming systems, IITA also has emphasized socioeconomic aspects of agricultural development.

With the cooperation of national and regional programs in Burkina Faso, Cameroon, Zaire, Rwanda, and Nigeria, IITA is conducting on-farm adaptive research and on-farm trials managed by farmers in various countries. During 1984, IITA also opened a new substation on a 50-hectare site in the Republic of Benin.

IITA's cowpea program has continued to develop lines and varieties for both seed and green pod production that are adapted to the various ecological zones of Africa and resistant to the diseases and pests of the area. Many diseases reduce cowpea yields, but six are most widespread and devasting: yellow mosaic, aphid-borne mosaic, brown bloch, septaria, scab, and anthracnose. Through systematic screening of world germplasm, IITA scientists have identified several sources of resistance, and these are being used in their breeding program. Two important pests are bruchids, the major storage pest, and striga, the parasitic weed that completely kills nonresistant varieties. IITA has developed several lines with good levels of resistance to both striga and burchids. These lines have large seeds and are available with a rough white or brown seed coat preferred by consumers in Burkina Faso and other regions. These lines have been crossed with others with multiple disease and insect resistance to further improve and stabilize their yields.

Although striga resistance seems to be complete in lines seeded in Burkina Faso, the emergence of striga in Mali, Niger, and Nigeria on lines found to be resistant in Burkina Faso suggests that there is more than one strain of the parasite.

As part of their worldwide responsibility for cowpea, IITA is establishing global lines and an international network for distribution and testing of new improved breeding lines. Three international trials were distributed to collaborators in 28 African countries. This distribution

has led to rapid development of cowpeas in many countries. Several varieties of IITA-bred cowpeas have been released in Togo, Burkina Faso, Nigeria, and Tanzania. At present, selected varieties are being multiplied in Zambia, Zimbabwe, and Botswana for release to farmers. The rapidity and efficiency of multiplication, conditioning, and distribution of these new, adapted varieties depend on the national capability of the seed sector.

Collaborative programs in maize (CIMMYT), rice (IRRI), and soybeans (INTSOY) are also important activities at IITA that require the production and handling of seed of improved lines and varieties. Through staff from these centers stationed at IITA headquarters, IITA provides the infrastructure and assumes much of the regional responsibility for these crops, especially in those ecological zones where they are integral components of farming systems programs.

The vegetatively propogated species that are integral to food supply in much of Central Africa including sweet potatoes, yams, cocoyams, and cassava are receiving major emphasis at IITA. New vegetative propogation methods developed at IITA have significantly expanded the opportunities for international distribution and testing of new IITA materials. IITA is developing an expanded capability in vegetative propagation methods and facilities that will serve as a center for these activities in Africa.

IITA has produced breeder and basic seed and sold it to World Bank funded ADPs, river basin development authorities, state governments, commercial companies, and farmers within Nigeria. Several African national seed services have approached IITA for seed and material has been supplied to three of them. They have a senior staff member with 50% of his time on seed and two junior staff members with 100% of their time on seed activities.

ILCA

The International Livestock Center for Africa was established in 1974 in Addis Ababa, Ethiopia, to assist national efforts in tropical Africa. These efforts include carrying out research and development on improved livestock production and marketing systems, training regional livestock specialists, and gathering documentation useful to the African livestock industry. ILCA is focusing on systems analysis and management approaches and techniques rather than individual commodities in four ecological zones -- arid, sub-humid, humid, and highlands. ILCA's Humid Zone Program is based at IITA where the two centers are cooperating on research for farming systems in which animals play an important role.

Recent drought in sub-Saharan Africa has highlighted the urgent need to achieve substantial and sustained increases in food crop production. Livestock support overall farm productivity by supplying cash for farm and household purchases, draught power and manure, and a measure of income security in times of crop failure, when livestock can be sold in exchange for grain. The strength of these interactions between crop and livestock on African smallholder farms makes gains in crop production heavily dependent upon increases in livestock production.

Constraints to improved livestock output are associated with marked seasonal fluctuations in the nutritional status of cattle and consequent variations in reproduction, calf growth, and calf mortality. Agronomic studies aimed at improving the quality of livestock feed continue to be emphasized by ILCA in the various regions and agroclimates of Africa. The Forage Legume Agronomy Group (FLAG) at ILCA are investigating, evaluating, and promoting the introduction of more productive plants, particularly legumes, into African livestock production systems. To date FLAG has identified, acquired, and screened suitable legume lines at a range of sites throughout Africa. This work provides seed and technical advice for ILCA's field programs, national research, and development organizations throughout sub-Saharan Africa.

An important aspect of the group's work is the acquisition, collection, maintenance, and multiplication of forage germplasm. These activities are intended to make forage germplasm of high potential freely available to research and development workers in sub-Saharan Africa. ILCA has been designated by IBPGR as the center to hold base collections of certain African forage species of high economic value. These include members of the genera Neonotonia, African Trifolium, Cenchrus, Digitaria, and Chloris.

Over 1,300 lines of leguminous germplasm were acquired in 1984 from organizations such as the International Center for Tropical Agriculture (CIAT), the University of Florida, the Commonwealth Scientific and Industrial Research Organization (CSIRO), and the United States Department of Agriculture (USDA).

Eleven collection trips were made in Ethiopia in 1984. Four of these were made to collect native legume species used as browse by local farmers. Erythrina species were found to be the most widely planted, particularly Erythrina brucei. Twenty-six species and 98 lines of browse germplasm were collected.

Five of the collection trips were done in collaboration with CIAT whose staff were collecting Brachiaria and Andropogon germplasm. These trips yielded 375 lines of 30 grass and legume species. Rhizobium strains associated with highland Trifolium species were also collected. Nodules have been sent to a number of laboratories for isolation of effective Rhizobium strains for promising Trifolium lines.

Another ILCA-CIAT collection trip was undertaken in the eastern and southern areas of Kenya. This yielded 42 species and 173 lines of grasses, and 40 species and 255 lines of legumes. ILCA staff also participated in a 2-month collection trip made by the International Board for Plant Genetic Resources (IBPGR) in Niger. This trip was intended to save forage germplasm threatened with genetic erosion; 108

forage lines were collected. Most of the group's collection activities have been supported financially by IBPGR.

ILCA's expanding activities in forage testing and seed production have highlighted their need for increased and improved facilities for producing, conditioning, storing, and distributing seeds of forage species, varieties and selections that are shown to have comparative advantages in the different agroclimatic zones of Africa. They propose a forage seed unit that will also provide the training, technical assistance, and backstopping required to strengthen and develop national public and private seed programs and industries that can supply forage seed for farmers in their countries.

WARDA

The West African Rice Development Association, located in Monrovia, Liberia was established in 1971 as a regional organization to promote self-sufficiency in rice growing in 15 countries of West Africa including Benin, Burkina Faso, Chad, Ivory Coast, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Sinegal, Sierra Leone, and Togo. WARDA, in cooperation with IRRI, is developing improved rice varieties adapted to the region's agroclimatic and social conditions and is developing improved farming systems that are appropriate to these regional conditions. WARDA's program concentrates on four systems of rice production -- mangrove swamp rice (somewhat saline conditions), irrigated rice, upland (rainfed) rice, and deep water rice.

In addition to its research activities, WARDA is involved in activities assisting the development of seed programs and industries and accelerating the use of good seed of improved varieties. WARDA center/headquarters coordinate the activities of the various components of the center's seed programs which include germplasm collection, evaluation and initial seed increase, breeder seed production, seed quality

control, training in seed multiplication, certification and collaboration with other international and regional intergovernmental organizations such as IRRI, IITA, MULPOC, CILSS, and ECOWAS.

The new center of WARDA's seed quality control activities are at their seed testing laboratory located at Fendall, Liberia about 28 kilometers from WARDA headquarters in Monrovia. Training courses in seed quality control, multiplication, and certification are held for collaborating scientists every two years. Three WARDA scientists devote 30% to 50% of their time to seed activities.

OTHER IARCS IN AFRICA

Nine other centers have staff stationed in Africa engaged in a variety of activities in cooperation with national research institutions and ISNAR is working on a country-by-country basis in assessing national agricultural research programs.

ICRISAT

The International Crops Research Institute of the Semi-Arid Tropics headquarters are at Patahcheru, India, 26 km northwest of Hyderabad, but it also has scientific staff posted in nine countries of Africa. Principal operations with resident staff in Africa are in Burkina Faso, Kenya, Malawi, Mali, Niger, Nigeria, Senegal, Sudan, and Zimbabwe. The main base for ICRISAT's future work in Africa will be at the New Sahelian Center near Niamey, Niger. Other scientists are posted at experiment stations of cooperating countries. ICRISAT has more than 22 scientific staff posted in West Africa and 6 in Southern and Eastern Africa.

The crops researched by ICRISAT for the semi-arid tropics of Africa are sorghum, pearl millet, and groundnuts. Groundnut is a cash crop in the region, however, sorghum and millet are primarily subsistence food

crops; over half of the total production of each -- in some places all of it -- is consumed on the farms where it is grown. ICRISAT sorghum and millet varieties have been released to farmers in different parts of the world including Africa. Other lines of these two crops as well as those of groundnuts did well in advanced national trials and moved a step near release.

ICRISAT scientists are making progress in developing resistant lines and in identifying causal factors of diseases, insect, and weed pests. This effort could lead to the development of more resistant lines for all three crops important in Africa.

Sorghum. ICRISAT has a regional sorghum network in West Africa, a Southern African Regional Sorghum Improvement Program based in Zimbabwe and Cooperative Sorghum Regional Trials in Eastern Africa.

The West Africa regional sorghum network operates from the Sahelian Center and has cooperative research programs in many West African countries including Burkina Faso, Mali, and Cameroon. During 1984 substantial advances were made in developing breeding lines and refining selection criteria for sorghums adapted to West African conditions. Research included breeding to screen for *Striga hermonthus*, shoot fly, stalk borer, head bud, and midge resistance; to identify seedling drought resistance; and to develop and identify elite genotypes for national programs.

A regional sorghum and millet improvement and training program was launched at Bulawayo, Zimbabwe, during 1984. Work on farm development and assembling crop nurseries for testing got underway. Links were established for evaluation of material at locations in Botswana, Malawi, Tanzania, Zambia, and Zimbabwe. Testing of lines began at Matapos research station and at a sewage farm in Bulawayo, where sewage treatment assures water for irrigation of precise experiments for breeding parental lines.

Seeds of promising lines are being increased for use. The regional program has been set up in response to a request from the 9-country Southern African Development Coordination Conference (SADCC). The ICRISAT team there will eventually comprise seven principal scientists, a farm development specialist, and an administrative officer.

Some 5,500 entries from around the world are seeded in Botswana, Zambia, Zimbabwe, and Malawi. These locations offer severe drought stress, wet humid environment and almost ideal conditions. Seed of selected entries from this introduction nursery are being increased to support a regional sorghum nursery. Over 1,000 entries from ICRISAT Center are being screened and evaluated for resistance to leaf bright.

The main objective of the Eastern African Cooperative Sorghum Regional Trials is to test the performance of varieties in major sorghum ecological zones in Eastern Africa. In 1983/84, four independent trials for high, intermediate, and low elevations, and very dry lowlands, were organized and distributed to 50 locations in the region. The trials were grown by national programs of Ethiopia, Kenya, People's Democratic Republic of Yemen, Somalia, Uganda, Yemen Arab Republic, and Zimbabwe. All were evaluated for grain yield and quality.

In Sudan, ICRISAT sorghum hybrid Hageen Durra 1 did well during the drought, and its seed is being multiplied on a large scale at the inititative of Sudanese agricultural officials. Under irrigation, Hageen Durra 1 yielded 5.190 kg per hectare, compared with 1.110 kg produced by the local variety. Enough seed was produced to plant 50,600 hectares in 1984, but the authorities would like to plant it on 6 to 10 times that area in 1985.

Seeds of two ICRISAT sorghums were multiplied in Cameroon, based on 4 years of varietal adaptation testing by SAFGRAD at the Maroua research station of Cameroon's Institute of Agricultural Research. Sorghum 38-3, an elite selection from ICRISAT, gave stable yields in those tests, proving tolerant of the most prevalent pest and diseases. Its white

grain and early maturity (95 to 100 days) were liked by farmers. The other variety, E 35-1, improved from an Ethiopian source, also has excellent grain quality and avoids grain mold.

Elsewhere in West Africa, seeds of two ICRISAT sorghums are being multiplied. Framida, a variety developed from ICRISAT's germplasm collection, which is resistant to the parasitic weed Striga, is being grown in Burkina Faso and Togo, and ICRISAT's ICSV 1002 in Burkina Faso. Farmers' tests with ICSV 1002 in Burkina Faso showed good yield stability under drought.

Pearl Millet. In the Sahel of Africa, one of the most hostile environments for crop production, ICRISAT is establishing a foothold against drought and the advance of the desert. In their third year of experiments with millet at the new Sahelian Center, ICRISAT scientists have been able to identify and test millet germplasm that yields 4 to 6 times as much grain as traditional varieties under severe drought conditions. During the severe drought of 1984, the average yielded at the Sahelian Center with millet cultivar CIVT was 800 kg per hectare, compared with average yield of about 200 kg under traditional farming in the region.

In cooperation with USAID's Semi-Arid Food Grains Research and Development Project (SAFGRAD), ICRISAT's maize/millet intercrop package was tested on 15 farmers' fields in the Sikasso region of Mali; the intercrop yielded 45% more grain that the sole crops for the same area.

Three ICRISAT varieties, developed in cooperation with the Institut National de Recherches Agronomiques du Niger (INRAN) at the Tarna research station at Maradi, Niger, are being considered for release to farmers in that country in 1985, based on their performance in multilocational trials.

The Institut du Sahel has recommended two ICRISAT pearl millet varieties for farmers' field trials in millet-growing countries of the Sahel in

1985, based on 3 years of multilocational trials in the region, coordinated by that institute.

In the same trials, five other millet varieties have given better and more stable yields than the local varieties. Preliminary evaluation of 92 pearl millet hybrids at Sadore indicated that hybrids can potentially give higher yields than improved varieties, and the six most promising hybrids will be evaluated further.

Trials in Burkina Faso have identified promising materials for further testing and adaptation. Two pearl millet varieties with low susceptibility to downy mildew disease did well in the 700 mm to 800 mm annual rainfall zone, as did two other pearl millet lines in the 600 mm to 700 mm zone. Two other varieties showed promise for late planting.

Two millet varieties developed from ICRISAT material were recommended for release in Senegal, where two varieties released earlier -- IBMV 8001 (ICMV 2) and IBMV 8004 (ICMV 3) -- continued to yield more than 20% above the standard, Souna III. Both varieties were planted on more than 1,000 hectares in 1984, a significant coverage for Senegal. Senegal farmers' wives reported that the improved varieties produced more couscous (a steamed preparation) and tasted better than local varieties.

In Sudan, the ICRISAT-developed pearl millet, Ugandi, escaped severe drought conditions because of its earliness and gave much higher yields than local cultivars. More seed is being produced to meet farmers' demands.

Groundnut. ICRISAT's regional groundnut improvement program for Southern and Eastern Africa, based in Malawi, had outstandingly good regional yield trials. This reflects a rapid and significant broadening of the genetic base of groundnuts in the region. Trials at six locations -- two each in Malawi and Zambia, and one each in Mozambique and Zimbabwe -- helped identify 19 promising lines with sequential branching and 4 with alternate branching habits.

Several ICRISAT lines identified earlier for disease resistance moved ahead in testing by national programs. Two rust-resistant groundnut lines were promoted to an advanced stage in multilocational tests of the Indian National Program. Another ICRISAT groundnut gave the top yield -- averaged over eight locations -- in disease-resistance trials of the Indian program, while eight new lines were entered for similar trials.

Rust, early leaf spot, and late leaf spot are the three most serious diseases of groundnut worldwide. In continued screening against those three foliar diseases, 50 lines with resistance to rust were identified; these will be screened further. Screening for resistance to early leaf spot was given high priority in Southern Africa; but no line with a useful level of resistance could be identified in the 2,000 tested this year.

Rosette virus disease is another major problem specific to groundnuts in Africa. Analysis of seasonal rosette development yielded valuable information that will be used to design rosette screening nurseries. Equally valuable information to help identify and detect the two viruses causing rosette was developed in collaboration with four institutions in Nigeria, Scotland, West Germany, and the U.S.A. Experiments using this information have begun in Malawi and Nigeria to study the survival and spread to the disease and to improve control measures.

CIAT

Dry beans (*Phaseolus vulgaris L.*) form an important part of the diet of people in Eastern Africa. They are an important protein source for lower income families or where animal protein is not available. Production and productivity increases of dry beans are lagging behind the population increase, endangering adequate nutrition of many people.

Three regions are now distinguished in Africa with respect to bean research: The Great Lakes (Rwanda, Burundi, and the Kivu Providence of

Zaire); Eastern Africa (Ethiopia, Kenya, Somalia, and Uganda); and Southern Africa -- comprising the SADCC group of countries (Tanzania, Malawi, Mozambique, Zambia, Swaziland, and Zimbabwe being the most important for beans).

The CGIAR has asked CIAT to assume worldwide responsibility for collection, preservation, and improvement of bean germplasm. As most of the bean production is centered on small farms, the Bean Program objectives are to develop scale-neutral production technology which will overcome major production restraints. This is pursued by breeding for disease and pest resistance, improvement of the plant architecture, and less reliance on chemical fertilizers. Breeding for climbing bean varieties adapted to associate cropping with maize is also an important component of the program activities.

The CIAT Bean Program's outreach staff in Africa, which began in Rwanda in 1983 with one person, has been expanded to seven. Five staff members, including a breeder, agronomist, pathologist, nutritionist, and anthropologist/agronomist, are stationed in Rwanda. Two staff members, including an agronomist and plant pathologist, are attached to the Eastern African Bean Project. Additional staff are planned to supplement those in the eastern region and staff will be placed in the southern region.

The germplasm improvement strategy involving CIAT breeding program and African regional and national programs will seek to produce crosses to incorporate specific resistance factors into African-adapted backgrounds, both local germplasm and materials introduced from CIAT. CIAT's large germplasm collection and ideal growing conditions allow four generations to be produced yearly at CIAT headquarters. This will serve the African network well. The seed for trials can be multiplied rapidly and sent in bulk to Africa for local selection of segregating populations. In the Great Lakes region, some materials are now entering final stages of varietal testing. Once these and other varieties are

ready for release, local support and capability for multiplication, conditioning, and distribution of these new varieties to small farmers will be required.

The participants at the workshop on the "Potential for Field Beans in Eastern Africa" held March 9-14, 1980 in Lilongwe, Malawi concluded that "one of the major constraints in bean production within the region is the nonavailability of high-yielding, disease and pest resistant clean seed at reasonable prices in the areas of production. Therefore, the panel concluded that the main needs are:

- production and storage of larger amounts of quality seed
- extension information to farmers on the use of this seed
- reliable and regular supply of quality seed located in convenient production centers
- more emphasis on production of seed for the small farmers as opposed to large farmers, as well as teaching farmers how to produce and store high quality seed."

CIMMYT

The International Maize and Wheat Improvement Center located in Mexico has several ongoing programs in Africa. The maize program is working in both West Africa and Southern and Eastern Africa. Efforts in West Africa are being carried out by two senior scientists working jointly on a regional program with IITA in Nigeria, two senior scientists working with the SAFGRAD program in Burkina Faso and two senior scientists working in a bilateral program in Ghana.

Eastern Africa programs in Tanzania and Zaire are being supported by CIMMYT staff located in Kenya. More recently CIMMYT established a Southern African regional program from its new base in Harare, Zimbabwe.

The senior staff members assigned to regional programs in Africa have important research and training responsibilities, in addition to their

liaison activities between CIMMYT headquarters and developing country national programs. The shifting of certain research responsibilities from headquarters to the staff posted in regional programs is an important element in CIMMYT's strategy to expand its research activities on important germplasm development and crop management problems of Africa not easily addressed in Mexico.

Streak virus, which is among the most serious disease problems of maize in Africa, is receiving special emphasis. Since 1980 CIMMYT has been engaged in a joint effort with IITA in Nigeria to combat maize streak virus (MSV) disease. The magnitude of yield losses varies from season to season and depends on the percentage of plants infested and the growth stage at the time of infestation. Yield losses can be controlled to some extent through agronomic practices such as timely planting and treatment of seed with systemic insecticides, but a more effective and practical solution to the problems, and the one being sought by the CIMMYT/IITA African Maize Program based in Nigeria, is to identify, develop, and introduce MSV tolerant, high-yielding, adapted varieties into national programs for widespread distribution among African farmers. Excellent progress has been made. A reliable screening technique has been developed, sources of streak resistance identified, and resistant varieties placed in the hands of national maize researchers.

Promising developments from the CIMMYT QPM (Quality Protein Maize) Program are taking place in Africa. In Senegal, seed of QPM materials Obregon 7740 and Temperate White QPM is being increased and widely evaluated in on-farm tests and will probably be recommended for large scale adoption by farmers.

CIMMYT germplasm is being released by National Programs in Africa. As shown in the following table, varieties of CIMMYT germplasm have been released in 12 countries:

Country	No. of Varieties
Benin	1
Cameroon	1
Ghana	4
Kenya	3
Lesotho	2
Malawi	1
Nigeria	1
Senegal	2
Swaziland	1
Tanzania	4
Burkina Faso	1
Zaire	5
	26

CIMMYT scientists agree that a major factor in the widespread utilization of new improved maize varieties in Africa will be the ability of national programs to efficiently increase seed availability and distribution. Only a few countries have the trained staff and seed facilities required to multiply, condition, and distribute the new varieties and hybrids.

CIP

The International Potato Center, located in Peru, has five staff members posted in Africa to assist potato research in Rwanda and Burundi. In Rwanda, nearly 4,000 tuber families and a group of 23 clones or varieties were introduced from CIP, Lima. The germplasm was evaluated by the National Potato Program (PNAP). In Burundi, two CIP introductions have been named as varieties (Muziranzara and Ndenamagara) and were released in 1984.

CIP also cooperates with a country network, PRAPAC (Program Regional d'Amelioration de la Culture de Pomme de Terre en Afrique Centrale), which includes Burundi, Rwanda, and Zaire and was established in 1982 to carry out research and training activities.

Good seed potatoes of improved varieties are of great importance in Africa. Research on the socioeconomic and anthropological aspects of seed systems and seed tuber technologies was carried out in Rwanda. An economic evaluation of the National Potato Program (PNAP) indicated that this program generated an internal rate of return of 40% for the period 1979-1985. This meant that the money invested in the production and distribution of improved seed yielded more than twice the return offered by typical investment projects (15%) in Rwanda.

The National Potato Program of Rwanda is currently producing about 250 tons per year or 30% of its annual requirements of basic seed, but with the new 300-hectare seed farm being developed by CIP and Rwandese scientists, PNAP will have the capacity to produce the remaining requirements.

In Burundi, where CIP has a resident scientist, a series of on-farm trials were established by the research institute (ISABU) to verify advantages of improved seed. Although 1984 was a difficult drought year, the combined package of improved variety plus good, clean seed gave an average yield increase of 50% in the 59 trials harvested. One of the immediate objectives of the program is to develop national seed farms for multiplying new varieties recently released.

Three countries in West Africa, Togo, Cape Verde, and Senegal, have taken tentative steps to initiate seed programs based on newly selected or improved varieties. In these countries, where high temperature occur between one harvest and the next planting season, optimum methods for storing seed without cold storage will need to be investigated. Elsewhere in Africa -- Ethiopia, Malawi, Malagasy, and Tanzania -- CIP's

regional postharvest specialist in Nairobi has been assisting national scientists in designing low-cost stores for seed as well as consumer potatoes to be tested in on-farm trials.

CIP scientists have concluded that "Seed production remains the key factor for making improved varieties available to farmers. Any national program that intends to issue its own varieties must develop the capacity to produce good seed."

IRRI

The International Rice Research Institute is located in the Philippines. Through its International Rice Testing Program it provides advance rice materials to WARDA and other interested national institutions. IRRI also has liaison scientists located in IITA in Nigeria.

ICARDA

The International Center for Agricultural Research in the Dry Areas, located in Syria, has principal responsibility to work with developing countries around the world on barley, lentil, and faba bean improvement and has regional responsibility for durum and bread wheat in cooperation with CIMMYT and chickpeas with ICRISAT. Since its establishment in 1977, ICARDA has become a major partner with national programs, providing support to institutions and scientists working on wheat and barley. It has a team of researchers working on breeding, pathology, agronomy, physiology, grain quality, and training.

ICARDA has formal cooperative agreements with 12 countries in the region and is cooperating extensively with Ethopia, Somalia, and Sudan.

IBPGR

The International Board for Plant Genetic Resources, located in Rome and responsible for promoting an international network of genetic resources

centers, has sponsored several collection missions in various African countries, notably in West Africa, and has assisted in the establishment of several national genebanks in African countries. To help promote awareness of its overall objectives and to provide effective leadership for IBPGR-supported activities within Africa, it has appointed regional officers in West Africa (Burkina Faso) and East Africa (Kenya).

IFPRI

The International Food Policy Research Institute located in Washington, D.C., works on policy issues relating to food and agriculture. IFPRI is currently devoting approximately 35% of its research to African projects.

ISNAR

The International Service for National Agricultural Research, located in The Hague, assists developing countries to improve their national agricultural research capability. To date ISNAR has completed assessments of Burkino Faso, Ivory Coast, Kenya, Madagascar, Malawi, Rwanda, and Somalia.

IARCS SUPPORT OF SEED PROGRAM DEVELOPMENT

The CGIAR reports these IARCs have 251 international staff members working in West, East, and Southern Africa. This professional staff addresses the technical constraints to crop production in Africa. Much of the results of this research needs to be introduced and carried to farmers through seed of improved varieties. Even in the livestock improvement research, seed must play a role in the development of improved pastures. The intensity of the IARC's contacts with countries in sub-Saharan Africa is illustrated in table 2.

Table 2. Intensity of IARCs contacts with West, East, and South African countries.

COUNTRIES	CIAT	CIMMYT	CIP	ICARDA	ICRISAT	IFPRI	IITA	ILCA	IRRI	ISNAR	WARDA
Botswana	●	●	●		●●			●			
Burundi	●●	●	●●●				●	●			
Centr. African R.								●			
Ethiopia	●●	●	●●	●●	●						
Kenya	●	●●●	●●●	●	●●●	●	●	●●●	●●●	●●	
Lesotho							●				
Malagasy			●●●				●	●●●		●●	
Malawi	●	●●	●●		●●●		●	●	●●	●	
Mozambique		●	●		●						
Rwanda	●	●	●●●		●		●●	●		●●	
Somalia		●		●	●		●			●●	
Sudan		●	●●	●●	●●●			●			
Swaziland		●	●●		●		●				
Tanzania	●	●	●●		●	●	●	●●	●●		
Uganda	●	●	●		●	●●	●		●		
Zambia	●	●●●	●●●		●	●●	●		●		
Zanzibar											
Zimbabwe	●	●●			●●●	●	●	●		●	

Table 2 (cont.).

COUNTRIES	CIAT	CIMMYT	CIP	ICARDA	ICRISAT	IFPRI	IITA	ILCA	IRRI	ISNAR	WARDA
Angola		●	●								
Benin		●●	●			●	●●	●			●●●
Burkina Faso		●●	●	●	●●●	●	●●	●	●		●●●
Cameroon		●	●●		●		●●	●	●●	●	
Cape Verde				●	●						
Chad								●			
Congo		●					●	●			
Gabon		●			●		●				
Gambia	●	●			●		●	●●	●		●●●
Ghana	●	●				●	●	●			●●●
Guinea								●			●●●
Guinea-Bissau		●	●					●	●		●●●
Ivory Coast	●	●			●	●●	●	●●	●	●	●●●
Liberia			●●				●●	●	●●		●●●
Mali		●●			●●●		●	●●●			●●●
Mauritania			●		●		●	●			●●●
Niger		●			●●●		●	●●●			●●●
Nigeria	●●	●●●	●	●	●●●	●●●	●●●	●●●	●●●		●●●
Senegal		●	●●		●●	●●	●	●●	●●		●●●
Sierra Leone		●	●●			●	●	●	●		●●●
Togo		●	●●				●				●●●
Zaire	●●	●	●●●		●	●●	●●	●	●	●	

The CGIAR newsletter says, "These research efforts have had some success, for example, drought resistant sorghum in the Sudan, pest and disease resistance strains of cassava, and highly productive lines of cowpeas. But the centers have not made a significant difference in the overall food situation in Africa." Although limited impact is seen today, the accumulated reserve of innovations ready for testing and adoption is significant. The International Center Directors see the need for a continual flow of productive, easily applicable new technologies that can be maintained through the partnership of national and international research efforts. The center directors identified seven critical areas of concern that need to be addressed in order to utilize these technologies. The second point on the list developed by the center directors is, "Need for viable seed industries, necessary for widespread adoption of new cultivars."

The IARCs have a comparative advantage in assisting seed research and development activities because of their ability to provide long-term continuity and consistency of effort to national programs. Their links with national research programs can contribute to improved ties between research scientists and people in the seed sector. The IARCs have a demonstrated capability to substantially contribute to the trained human resource base for their respective commodities. Similar contributions can be made to the training of people in the seed sector.

Thus, the IARCs with program activities in Africa are in an excellent position to contribute significantly to the development of the seed programs and seed industries in the west, east and south portions of he region. The 251 professionals with the IARCs can contribute to the development of the needed agronomic technology for seed production for all of the crops with which the CGIAR system deals. The breeders in the program can contribute to the methodology used for the preparation of variety descriptions to facilitate seed multiplication and for maintaining breeder seed. Already some of the IARC crop programs multiply breeder seed and basic seed for use by national programs. The pathologists and entomologists can contribute to guidelines for the multipli-

cation of seed free of seed-borne diseases. The economists can provide useful information on solutions to economic constraints to seed production and on the spread of improved varieties.

In addition, the commodity programs can identify crop specialists and junior staff members who can carry special responsibilities for seed-related activities with respect to their commodity. These people could either be at those centers located on the continent or in regional projects tied to centers. The three centers in the region already have some staff devoted to these activities.

The seed research and development needs in Africa are many and quite diverse. The countries differ greatly, and the kind of training and complementary assistance provided needs to be molded to meet their individual needs. Yet, the task of human resource and seed sector development is so great that a regional and subregional strategy is needed. It would be wasteful and highly confusing for each of the IARCs involved in Africa to undertake seed development work on a commodity-by-commodity basis. A plan to link the many needs and resources available into a long-term seed sector development effort is required.

A plan that combines the existing strength of the IARC's programs with seed specialists working out of regional and subregional locations is required. The objective would be for these seed specialists to work with and complement the existing IARC staff. Together they would contribute to national seed program and industry development using a multicommodity approach depending upon the needs and interest of the national programs. Providing this seed technology and production component as a planned strategy can facilitate an accelerated achievement of the CGIAR's goal "to contribute to increasing sustainable food production."

OTHER INTERNATIONAL SUPPORT TO SEED ACTIVITIES IN AFRICA

IFAD

The International Fund for Agricultural Development (IFAD), since the beginning of its operations, has concentrated its loan operations and technical assistance grants in the poorest food-deficient countries. So far, out of the total 44 poorest food-deficient member countries 39 have received 88 loans representing 58% of total loan operations. To date, 25 African countries have received loans for agricultural and rural development and fisheries projects.

IFAD continues to adjust its country priorities to provide assistance to the most needy countries. While focusing on the poorest food-deficient countries, IFAD has also been able to extend its activities to cover the poorest segments of the population in other developing countries.

In areas where direct agricultural production support has been found suitable, IFAD has financed agricultural development projects where the main objectives have been to increase food production, family income, and employment. In those projects where women are directly involved in productive components, arrangements have been made to deliver related services to them.

IFAD projects have focused on the delivery of services to small holder farm families and have included adaptive research, extension, training, irrigation, credit, livestock and fisheries, and cultural practices. Most of these projects have included the provision of seeds and planting materials of improved plant varieties. New variety screening, seed multiplication and diffusion of seedlings and seeds of improved varieties have played an important role in the success of many of IFAD's programs. They continue to be concerned with national seed systems that are capable of supplying quality seeds to farmers and that especially reach the small holder.

IBRD/WBG

The International Bank for Reconstruction and Development (IBRD)/World Bank Group (WBG) since 1980 have developed 10 large scale seed projects in Asia and Latin America, but none have been funded for Africa. Although no large scale seed projects have received WB support in Africa, since 1980 at least 64 agricultural development projects in which a seed component is included have been approved for African countries and others are under study.

Van Amstel and Van Gastel in their report on "Seed Program for ACP Countries -- Present Situation and Future Prospects" (June 1985) indicate the "the absence of World Bank-supported large-scale specific seed project in Africa so far may be explained by the comparatively low level of African agricultural development. In particular, the lack of sufficiently improved varieties, adapted to local conditions and farming systems is an important constraint. Moreover the relatively large proportion of subsistence farmers in some parts does not create a large enough seed market to render such projects economically feasible."

FAO

The Food and Agricultural Organization (FAO) has encouraged the development of a comprehensive program to secure a national seed supply. Through their Seed Improvement and Development Program (SIDP), established in 1973, FAO has become involved in hundreds of seed-related projects throughout the developing world. As quoted from the paper by Van Amstel and Van Gastel (1985), its stated objective is "to provide an international framework for systematic efforts, both multi- and bi-lateral, to help speed up the development, evaluation, and release of improved varieties, seed production, quality control, distribution, and consumption in developing countries with the ultimate objective of enabling these countries to establish efficient and comprehensive seed industries of their own." The SIDP "...involved coordination of development assistance at both national and international levels. In

particular it requires the integration of a particular seed industry development plan into the national economic and crop production programs of the developing country concerned, so that it fits into national priorities." (Feistritzer, 1975).

Main FAO/SIDP activities under the program are:

- periodic preparation of inventories of the seed status in FAO-member countries
- assisting in the development of national seed programs
- assisting in the formulation and implementation of seed projects
- training in seed production and utilization and provision of information
- provision of seed and planting material, which will gradually be replaced by the provision for information sources

In selecting target countries for SIDP assistance, priority was to be given to the least developed and economincally most affected countries. For those countries, with seed programs in the early stage of development, projects were recommended which had low initial equipment demands and which needed few technicians; but the projects were kept flexible to allow for expansion.

It is apparent, despite the activities of IFAD, IBRD/WBG and FAO during the last decade, that national seed programs in Africa still require considerable assistance. FAO appears to have been considerably active in supporting named components of country programs. The seed team appreciated this activity especially where continuity through either expansion of the same activity or assistance to other components occurred in the second phase. It is concerned, however, with the apparently increasing limitations of national programs to find necessary resources to complement such activities. This, in some cases, had resulted in countries turning to a multi-donor approach to accelerate support. In such instances perceived needs by both parties may be interpreted differently and a point of reference would be beneficial.

The seed team feels that given the IARCs and their outreach resources combined with multi- or bi-lateral seed assistance offered through various agencies or directly to African countries, seed programs could be advised and(or) coordinated by strategically located seed units. These could well provide the catalyst required to motivate national programs into increased efficiency and self-reliance.

Little attention is paid to regional activity. This may well be due to countries not wishing to become dependent on others during current economic constraints and adverse climates. A need is apparent, however, for regional activities in testing new varieties, for standardizing legislation and marketing or phytosanitary requirements, for facilitating trade and for developing seed security stores. The above mentioned agencies have yet to establish a significant role in this area. Perhaps a seed unit could assist in this respect.

IV. COMPLEMENTARY SUPPORTIVE REQUIREMENTS FOR SUCCESSFUL SEED SYSTEMS

Wherever discussions were held, it was agreed that there are varieties of almost all crops with which seed units in Africa will be concerned, which have markedly better yield potentials than the varieties farmers are now using. However, there are formidable constraints which, to a considerable extent, account for the failure of farmers to use the improved varieties adequately. It was argued that unless several of the constraints concerned are overcome or at least mitigated, prospects are generally low for seed units to attain their objectives in Africa. No simple infusion of donor funds, whether on a bilateral or multilateral basis, is likely to overcome most of the hampering conditions unless donors and African countries take such actions as may be needed.

A few major constraints to de facto use by farmers of improved grain crop varieties and to development of effective seed systems are discussed hereunder. The success of seed units in Africa will depend on effective correction or reduction of some of the constraints described. If national governments and donors are willing to invest in improvements to seed systems in Africa, then some additional funds to reduce or overcome constraints which have important potential to limit or prevent success of seed-related programs seems to be very desirable indeed.

ADEQUATE VARIETY TESTING PROGRAMS

In francophone west Africa there are few, if any, "improved" crop varieties which, if seeded under identical conditions (including low or no inputs) on farmers' fields, will give on the average, yields equal to those obtained by farmers using their own local varieties. The supporting contention for that statement is that farmers are now using many different local varieties which are outstandingly adapted to the microclimatic differences encountered in even small communities.

Similarly, farmers grow carefully selected local varieties that are adapted to the higher fertility around the housing compounds, or to the lower fertility of land away from living area. Additionally, there are varieties in local areas best adapted to the shallow soils, medium depth soils, and the more productive lower slope locations of small fields of only a few hectares. It is argued that when "improved" varieties are grown extensively over all such environmental variations, and without more inputs than farmers use on local varieties, average yields of the "improved" varieties do not equal those of the local varieties -- again on average.

Varietal testing on a regional basis is inadequate. (See also Kirkby 1984). This is an unsatisfactory situation. Due to regional similarities of agroclimatological conditions and soils, grain varieties which are found to be superior in any given country are likely to be well suited to similar agroecological conditions in some neighboring countries. Although plant breeders may feel that varietal testing programs are now adequate, the statements to the Study Team dispute any such contention.

Expanded and coordinated programs of variety trials are desirable. That would require additional investments in human resources, equipment, and supplies, as well as continuing annual operating budgets.

MINI-KIT TRIALS

The study team was told that "improved varieties" by themselves do not lead to farmer adoption of such varieties. No one questioned the statement that "improved" varieties almost always substantially outyielded local varieties if adequate levels and suitable combinations of inputs (preparatory tillage, recommended fertilizer and rates, pesticides, weed control, and so forth) are applied equally to both the improved and local varieties. Farmers are generally very astute and they will adopt improved farming practices, including purchased inputs and HYVs, if they are convincingly shown that the inputs, including improved varieties,

are available to them on a reliable and timely basis and if it is economically advantageous for farmers to employ such production increasing new practices.

In India, at the outset of the Green Revolution, it was clearly proven that awareness of the advantages of adoption of HYVs can be developed by an extensive "mini-kit trial" program. "Mini-kits" are small packages of HYV seeds, plus an appropriate amount of recommended fertilizer and other inputs, that are distributed by extension personnel for farmers to conduct trials on their own farms. Thus farmers are able to compare the performance of the HYVs against local varieties on their own farms. The result was the dramatic acceptance of the new improved varieties in India. Moreover, when the HYVs distributed were seeds of self-pollinated crops, there was an important secondary benefit: farmers usually saved the grain from mini-kit trials for use as seed the following year.

Therefore, extensive carefully planned and conducted programs of mini-kit trials for promotion of HYVs of proved superiority should be used as a means of speeding the on-farm acceptance and use of the seed system's output -- quality seeds of superior yield potential.

"In Africa between 60% and 80% of the agricultural work is done by women, and in some parts they produce as much as 90% of the food." (CGIAR 1985). Since women have such a dominant role in African food production, serious consideration might be given to the training and funding of corps of women to have responsibility for promotion and execution of mini-kit trials within interested countries.

PERSONNEL AND SUPPORTING SERVICES

The establishment and operation of effective seed systems requires, on a continuing basis, a sufficient number of suitably qualified seed technologists and related personnel. The tasks involve activities such

as supervision or execution of seed multiplication, field inspections, seed conditioning and storage, operation of quality control laboratories and phytosanitary procedures, seed certification, and so forth.

In addition to the foregoing types of seed system personnel, it is obvious that supporting resources such as transportation for inspectors, appropriate seed conditioning equipment, quality control facilities, perticides, and suitable conditions for seed storage and other resources are also essential for successful seed systems.

The study team encountered frequent inadequacies of the foregoing resources during the tour in Africa. Every country visited was keenly interested in training to improve the number and(or) the qualifications of personnel in the seed system. Costly sophisticated equipment which was idle or little used due to lack of personnel or qualified technologists was frequently observed. Conditioning equipment and quality control laboratories with deficiencies were also seen. Lack of transportation was reported to have limited or prevented field inspection in some cases. Seed systems entail sequences of related activities. Unless all parts of such systems are suitably staffed and supported, seed systems cannot operate effectively.

OPERATING BUDGETS

A recent report by Institut du Sahel/USAID (1984) has stated that in the Sahel region it will be essential for donors to provide annual operating funds in addition to whatever other donor resources may be provided in support of agricultural research in that region. Donor provided operating funds are said to be essential if facilities, training, and equipment provided by donor assistance programs are to be used effectively. Generally similar conditions clearly apply in some other parts of Africa.

The conditions described above have important implications for any proposals to establish seed units in Africa. Effective seed systems need more than adequate personnel and suitable facilities: seed systems must have operating budgets to cover recurrent costs such as travel, essential supplies, the conducting of variety trials, and the execution of creditable mini-kit programs, and other supportive activities.

The establishment of seed units in Africa with donor funding will not be in itself sufficient to improve the supply, quality, and use of improved seeds by farmers. It will be necessary to have bilateral funding to support the development of components of some national seed systems. These systems should become totally or partially self financed, but initially, bilateral funding might even be needed for operating costs or the initiation of a rotating fund if seed systems in some countries are to benefit substantially from the services and guidance that can be provided by the seed units.

SEED AND GRAIN PRICES

The production of seed is a technical and demanding activity. It therefore costs more to produce seed than to produce grain of the same crop which is meerly intended for market consumption. Successful seed systems are therefore dependent upon incentive seed prices to those producing and marketing quality seeds.

Subsistence farm families sell little or no grain because they consume most or all of what they produce. But high yielding varieties are part of a market economy. Farmers adopting improved varieties normally sell part of their grain production and use the income received for family purposes and for crop production inputs, including quality seeds. Therefore, farmers too require incentive prices for the grain they sell if they are to become users of HYVs.

Clearly seed prices and market prices for grains will determine the extent to which farmers will have available and adopt HYVs.

FUNDING FOR SEEDS PRODUCED BY SEED UNITS

The attention of the seed team was frequently brought to focus on unreliable seed supplies during the initial stages of seed multiplication in a national program. Such problems, they were advised, would result in requests from such countries for temporary "gap-filling" supplies of breeders, pre-basic and basic seed classes. To achieve this, seed units must have carefully established and firmly administered policies if they are to undertake seed multiplication. The team was advised of one case where no payment was received from a national agency for a seed order shipment worth several thousand dollars. In another instance, a government regulation placed a rigid ceiling on the price the national seed service could pay for any kind of seed. That ceiling was approximately one-third of the cost of production to the agency which had produced several tons of a seed on the basis of an order from the national seed service.

The seed team feels obligated to emphasize the opinion that if any seed unit is established in Africa, a clear policy should be maintained from the outset regarding charges to be made for breeder, pre-basic, or other types of seed produced for distribution. It is suggested that there should be full charge for all costs of production and fully adequate depreciation allowances whenever a seed unit multiplies any seed at the request of an agency, whether a public one or a private one.

Such a policy is not without possible disadvantages. It may prevent some needy countries from obtaining quality seeds that may be required in considerable quantities. However, in such cases, willing donors may be available to pay the costs of such seeds for needy countries. Without the recommended policy, a seed unit is likely to encounter very serious financial problems.

OVERVIEW

The items in this section are concerned with potential problems which may adversely affect realization of the benefits which should result from the establishment of an African seed unit or units.

The team has no desire or intention to be overly critical or pessimistic. However, as stated repeatedly in the subsections, the problems discussed, if unresolved, have real potential to adversely affect the basic objective of a seed unit -- the achievement of a much more extensive use of high quality seeds of improved crop varieties by African farmers, thereby contributing to increased food production.

The team hopes that the discussions in this section will alert countries and donors alike to the need for careful consideration of the items discussed so as to minimize the dangers of disappointments regarding results that may flow from investments intended to improve African seed systems.

V. PROPOSAL OF STUDY TEAM

INTRODUCTION

The Seed Study Team visited eight African countries during the period 18 August to 11 September. Section II of this report provided the appraisals resulting from those visits which may be summarized briefly as follows.

In most of the countries of Western Africa, the seed system is inadequately developed even though some of the basic services have been established. Generally the use of HYV's is very low except in the Ivory Coast and Nigeria where there are a few private sector seed companies. In Eastern Africa, Kenya has a rather well developed seed system based primarily on hybrid maize with considerable commercial seed production and some exports; about 80% of the land planted in maize produces HYVs and for wheat the figure is higher. The situation in Zimbabwe in Southern Africa is similar to that in Kenya. In Malawi the seed system produces most of the domestic requirement for maize and some other crops. Although there is commercial seed production in Zambia and some in Tanzania, the seed systems there are less developed than those of Zimbabwe and Kenya. Ethiopia has the Ethiopian Seed Corporation and consideration is being given to some needed legislation, but seed systems as a whole are in an early stage of development and various critical components are largely underdeveloped.

The other countries in that region -- Botswana, Mozambique, Uganda, Somalia, Rwanda, and Burundi -- are also in the early stages of seed program and seed industry development.

COUNTRY REACTIONS TO ASU CONCEPT

Because of the various stages of development of their seed systems, the study team encountered differences in the reactions of African regions to the concept of a seed unit somewhat similar in nature and activities to the one at CIAT.

Western Africa

In Western Africa all of the countries visited expressed high interest in the seed unit concept. Indeed, all five places requested that a seed unit, if established, be located in their country or territory. The greatest interest was consistently in training. There was also keen general interest in the possibility of assistance or a service for the multiplication of breeders and pre-basic seed of new improved varieties to provide larger quantities of reliable purity and high quality for further multiplication as basic seed or for use in on-farm tests. Virtually every country expressed the view that technical assistance from a seed unit and applied research on various problems of seed systems by it would be genuinely helpful. There was unanimous interest in a newsletter and information service for seed systems of the region.

Southern and Eastern Africa

In Southern and Eastern Africa little interest was expressed in a seed unit by the representatives of Kenya and Zimbabwe. In those countries, the system of production and distribution of improved grains and herbage seed, especially of maize hybrids and new wheat varieties, is very effective and efficient. Moderate amounts of various kinds of seeds are exported and there is a keen desire to expand such business which serves primarily neighboring countries.

All representatives encountered agreed that there is a continuing need for trained personnel for the seed system. It was their opinion that with suitable coordination and leadership, training in-country or on a

subregional basis could easily be expanded. It was suggested that workshops held from time to time could be very helpful to the seed industry and information service for the seed systems and industry was definitely of interest. There was strong interest in exploring ways and means to more accurately forecast seed needs, to assess export demand, and in exploring mechanisms for the establishment and operation of seed security reserves.

SADCC has recently solicited donor funding for a project to enable a study intended to assess and project seed needs of countries of that group (see appendix 2). Zimbabwe has been examining the possibility of a seed reserve to meet national and regional requirements when shortages occur.

During the meeting in Nairobi it was suggested that one or two seed system regional facilitators based in the area could meet the various needs indicated above without having a seed unit as such in the Southeastern African region.

The regional facilitator would also help meet needs expressed during a Regional Workshop on the Potential for Field Beans in Eastern Africa in 1980 "for more quality seed." They could work closely with crop specialists of the international centers in that subregion and the national programs to play a catalytic role in accelerating seed sector development.

Ethiopia

The seed system scene in Ethiopia differs from that in the other regions discussed. For food grains, the Ethiopian Seed Corporation is endeavoring to meet the country's needs for such seeds.

There is recent and very high interest in forage crops and seeds for them. That has been sparked by research at ILCA on the collection of herbaceous species followed by determination of their agroecological

adaptation and evaluations of their productivity as forage crops. As a result, several selections of graminae and legumes of superior productivity and suitability as forage crops have been identified and seed production from them is beginning.

ILCA has data obtained from its research in Ethiopia which show an important and close positive link between farm cash income from animal husbandry and improved yields of grain crops.

Improved forage legumes obtain biologically fixed nitrogen, support improved livestock nutrition, help maintain soil quality, and increase production of manure. The resulting greater cash income from livestock has an important role in increasing the purchase of seeds of HYV grains and of the inputs needed for their effective use. Thus, the effective exploitation of the improved forage crops/livestock/HYV grains interrelation is ecologically, environmentally, biologically, and economically desirable, attractive and mutually reinforcing.

Use of improved forages for livestock production contributes to the development of a market economy which enables purchase of HYVs and the inputs needed for their effective use. This is something largely denied to subsistence grain farmers because they usually lack the purchasing power needed to buy seeds of HYVs and to exploit their yield potentials.

At ILCA, the Forage Legume Agronomy Group (FLAG) has made very rapid progress in assembling and screening a large number of grass and legume forage crops (900 in three years' time). Selections with clearly superior yielding ability and other desirable characteristics have been identified. There is now an urgent need to develop a forage crop seed system to enable the rapid multiplication and effective distribution of seeds of improved forage crop varieties and strains. For that reason, ILCA in 1984 proposed the establishment of a forage crop seed unit at that center.

HISTORY OF ASSISTANCE TO AFRICAN SEED SYSTEMS

Substantial activity has been undertaken in numerous attempts to develop viable mechanisms for the multiplication and dissemination of improved HYVs throughout sub-Saharan Africa. Some details are provided by FAO 1985 B. Few, if any, countries have not received high-level technical assistance of usually short, but sometimes of long duration. Most countries have attempted to establish a seed program. In fact, the similarity of the history of attempts to develop seed programs throughout sub-Saharan Africa impressed the study team.

Generally, seed program activities have not achieved the intended results for a host for different reasons. This fact, indeed, underlies the terms of reference for this study. The team recommends that in order to effect significant change and initiate a period of relative continuity and growth in seed programs, an adequate level of sustained assistance over an extended period of time is required.

DIFFERENCES BETWEEN THE CIAT SEED UNIT AND THE AFRICAN SEED DEVELOPMENT STRATEGY

CIAT's Seed Unit was developed to meet the obvious, existing needs of the Latin American seed sector. Its main thrust concerned training, technical collaboration and communication with national programs and the servicing of CIAT commodity programs through seed research and small-scale basic seed production. Latin America had quite advanced seed sectors in five or six countries in 1979 but with most countries, especially the smaller ones, still in the earlier stages of development. FAO Seed Reviews consistently show the Latin America seed sector relatively more advanced than the programs in Africa (see table 3). Only Eastern and Southern African countries appear to have a relatively similar seed status but even here differences among countries are considerable. Western Africa is not so well advanced and considerably more assistance is required in this area. Sub-Sahelian Africa

represents more variations in the tropical agroclimate and dominant food crops (CGIAR March 1985 Newsletter) than are present in Latin America as well in languages and cultures.

For these reasons, the team feels greater involvement will be needed in breeder, pre-basic, and basic seed production and the practical demonstration of seed technology with a range of crops far greater than that offered through the CIAT program. To achieve its objective the African special seed effort must relate to the total international center system but may be associated with one or two lead centers to support its program activities. The need is, therefore, for seed units in Western and Eastern Africa capable of breeder, pre-basic, and basic seed production, training, and technical assistance to help demonstrate and build aspects of an entire seed system often nonexistant in the neighboring countries. This will require a residential complement of senior staff stronger than exists at CIAT. Training is regarded as having equal importance in Africa as in Latin America. The seed units in Africa are, therefore, expected to have similar extensive training facilities to those at CIAT, but the level and types of training would be geared to the competence and needs of the people in the African seed sector. Due to the proposed scale of pre-basic and basic seed production activities and lack of applied seed research in the region, it is expected that a wider range of research will be undertaken than has been true at CIAT. The seed laboratories would be utilized intensively for research, training, and service seed testing. Similarly, considering the number of countries, the range of languages spoken, and the present level of improved seed use, efforts to strengthen seed promotion and marketing will also be on a greater scale than now exists at CIAT.

The effectiveness of the African seed units will depend on their involvement with national, subregional, and regional programs. Examining the CIAT model, it is possible to note that the subregional activities were restricted in the initial stages because the unit was only a project for one center. The presence of regional facilitators

Table 3. Situation of production and distribution of quality seed of selected crop groups.

1979/1980

		Category A			Category B			Category C		
		Cultivar Improvement	Seed Quality Control	Seed Production and Distribution	Cultivar Improvement	Seed Quality Control	Seed Production and Distribution	Cultivar Improvement	Seed Quality Control	Seed Production and Distribution
Crop group	Region (no. of countries)	%	%	%	%	%	%	%	%	%
Food	Africa (25)	12	4	8	88	80	92	0	16	0
	Central America (9)	11	22	0	78	56	89	11	22	11
	South America (10)	90	50	80	10	50	20	0	0	0
Industrial	Africa (25)	16	8	12	64	52	60	20	40	28
	Central America (9)	11	0	11	44	44	33	44	56	56
	South America (10)	80	30	60	20	70	40	0	0	0
Vegetable	Africa (25)	0	0	0	44	36	40	56	64	60
	Central America (9)	0	0	0	44	56	22	56	44	78
	South America (10)	40	20	0	30	70	70	30	10	30
Pasture	Africa (25)	0	4	4	16	24	8	84	72	88
	Central America (9)	0	0	0	11	44	33	89	56	67
	South America (10)	40	30	0	30	60	90	30	10	10

Category A: Advanced level
Category B: Fragmentary or pilot scale operation
Category C: No activity reported

could have contributed to an even more effective program by the CIAT unit. The African proposal intends to insure continuous dialogue and involvement between the units and the national program staff. The facilitators, combined with the seed units' staff to complement them, can accomplish this aspect. The team is aware that their proposals do not constitute a complete answer to the problem. It regards the units and their facilitators as catalysts in the creation, establishment, and running of complete or complementary components of any national seed program.

STUDY TEAM PROPOSALS FOR SEED UNITS IN AFRICA

Components Needed

As a result of the visits by the study team to eight African countries, the team recommends the establishment of two seed units in Africa. The names proposed are the "West African Seed Unit" (WASU) and the "East African Seed Unit" (EASU). EASU would be based at ILCA in Addis Ababa, Ethiopia, and the WASU would be based in Ivory Coast. To ensure similar support services to those of ILCA, the WASU may be required to contract privately or to be associated administratively with one of the regions' centers and thus this center will become the lead center. It is also recommended that the current research on methods of vegetative multiplication for the IITA mandate crops be continued at IITA headquarters, and that any additional facilities and(or) personnel that are needed should be provided there. To assist further development of and improvements in the seed systems of Southern and Eastern Africa, it is proposed that two regional facilitators (RFs), one attached to each of the two seed units, be assigned responsibility for roles in that region. Similarly, it is suggested that a regional facilitator for vegetatively propagated crops (RFV) be attached to the WASU operation at IITA and have responsibility for vegetatively propagated crops in the humid region countries of Western and Central Africa. Close liaison with international center crop specialists operating in the areas should ensure a unified approach to national and subregional seed programs. A subregional coordinating

group involving the seed units, the regional facilitators and IARC representatives would be essential to assure the necessary guidance, monitoring, and feedback to ensure agreed seed program objectives are met. Conceptual descriptions of the WASU, EASU, and of the activities suggested for the RFs are presented hereunder.

The units would be oriented towards two major needs. First, they would provide training assistance to develop national seed programs. Second, they would promote the development of seed industries and provide, on request, the necessary technical support. Depending on the nature of national program requests, assistance may be given on a country, sub-regional, or regional basis. The training assistance and support given to national programs would be available also to private enterprises. Consequently, the units will utilize the resource base of all relevant International Agricultural Research Centers and not limit their activities to the commodities of any one center. The EASU would place a special emphasis on forage seed but also be responsive to crop needs within the region.

To ensure a strong linkage among all activities, develop policies compatible with the concerned IARCs and national programs, and monitor progress, a board consisting of relevant IARC crop program leaders should be established. The board referred to here as the African Seed Development Board (ASDB) should also include national seed program representation from the region to ensure effective two-way communication and an appreciation of national and international views on strategies for varietal improvement and seed production and supply. In this way, matters of policy would be established. This kind of independence also makes it possible for the ASDB to take stands on issues on seed related matters in the best interest of all IARCs and national programs.

Interpretation of policy would be left to the head of the WASU who would have overall responsibility for the total seed effort. To provide a way to identify and integrate the whole effort in Africa the title -- An African Seed Development Organization (ASDO) -- could be used. The two seed units and the regional facilitators would all operate under this

title. The head of ASDO would be the chief officer of WASU. In any case the head should have the needed flexibility to implement program activities and to use resources, especially finance, effectively. Financial support would originate from the CGIAR system, special projects from bilateral or multilateral sources, revenue earned through the sale of pre-basic or basic seed and from other services provided. To avoid an excessive build-up of support staff, it is proposed that backup be provided for specific administrative services from one of the IARCs such as IITA, ICRISAT's Sahelian Center, ILCA, and WARDA. In this way, the team feels the seed program and seed industry development program for Africa would become a satellite or linked activity with the IARCs without having excessive obligations or involvement with any one center.

Consideration has been given to the creation of an entirely independent activity. This would require, as an organization with international responsibilities, certain agreements with the host country and mechanisms for funding that could be difficult to achieve. Using the lead center and linkage mechanism with the IARCs would make it possible to use the umbrella of existing IARC agreements wherever possible.

Conceptual Description of WASU, EASU, and RFs

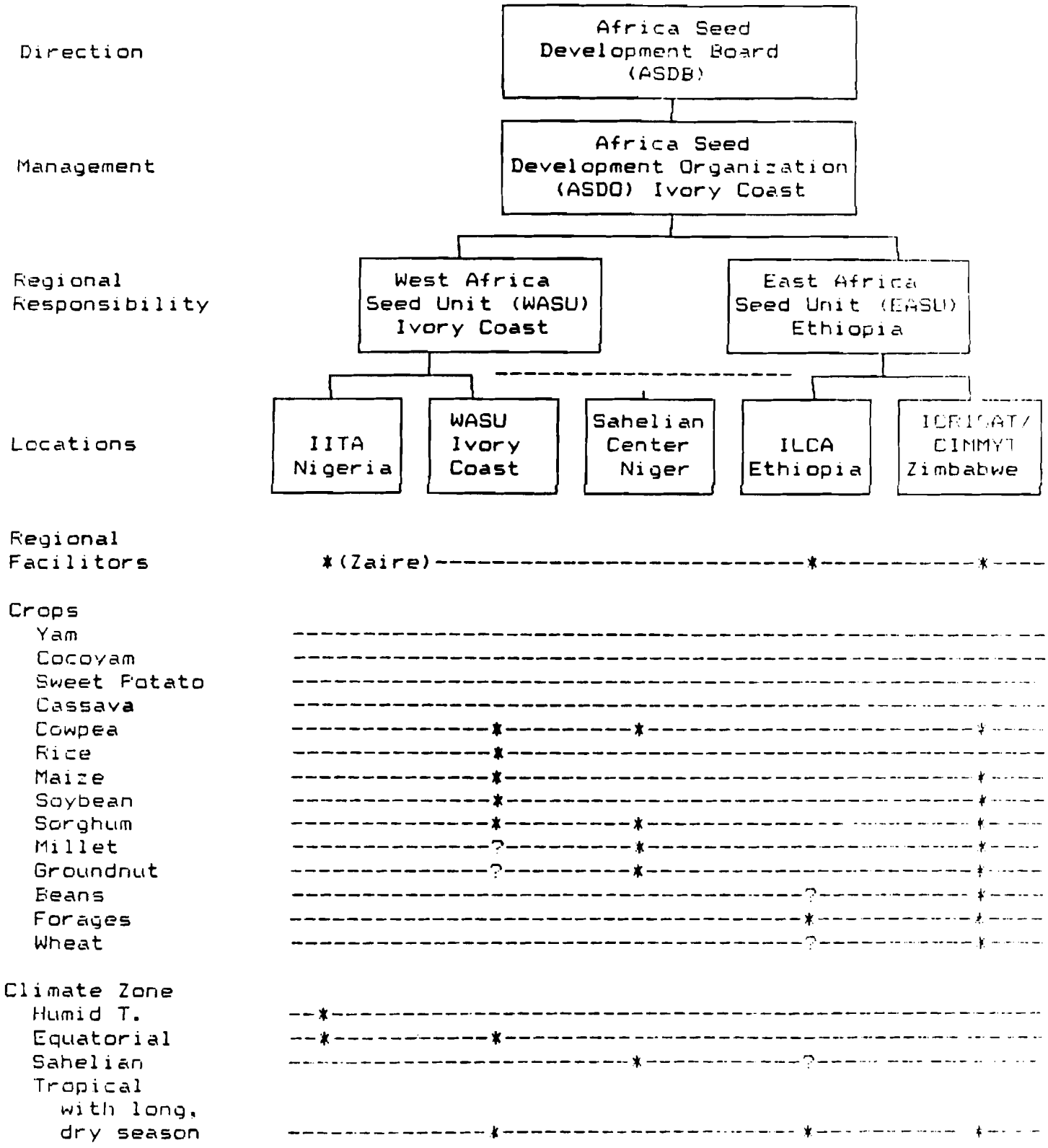
The locations, designation, lines of communication and interrelationships of the proposals described in the foregoing are illustrated below.

See the organizational chart on the following page.

Organization and Management

A major objective in the organization and management of the proposed African seed effort would be to provide the means to have an intergrated approach to assist the development of national seed production and supply systems. Most of the African seed programs and seed industries can benefit substantially from long-term, consistent efforts. An African Seed Development Board is proposed as a way to provide a focal

Figure 1. Relationships of WASU and EASU



BEST AVAILABLE COPY

point for assisting programs especially through the CGIAR system. Lead IARCs should have permanent representation on the board. Other IARCs could have a rotating membership. Representation from countries in the region could be on the basis of one from each of the subregions and would also rotate among countries. Two or three internationally recognized seed, development, and finance specialists could complete the board.

The implementation of the board's policies would be the responsibility of the Coordinator of the African Seed Development Organization. The "Organization" would be the administrative structure through which all other activities are linked. The coordinator of the ASDO would also be the head of the West African Seed Unit as mentioned earlier.

It would be the coordinator's responsibility to develop budgets for all activities related to the ASDO and manage the expenditures through the lead centers. The coordinator would formulate the administrative rules and procedures for the ASDO in consultation with the administration of the lead centers. He also would develop an operational mechanism that assures the wide flexibility required to respond to programming, budgetary requirements, sequencing of staff appointments, and so forth. This proposal, thus, provides for the development of a semi-autonomous ASDO that is closely tied to the CGIAR system. The proposal goes beyond the present organizational structure for the CIAT Seed Unit which is a restricted core project within CIAT. The CIAT Seed Unit does have an ad hoc advisory committee with representatives from outside of CIAT.

The Value of Semi-Autonomy

Seed program and industry development in Africa requires that special attention be given to the organizational linkages and structure used to achieve the planned objectives. The seed emphasis envisioned needs to relate closely to the eight IARCs crop research program activities in Africa. These IARCs have research work on 18 crops in the region. The

seed effort cannot neatly fit within one international center. It would be possible for one center to assume lead responsibility for the effort, but more is required than a single unit attached to that center, as has been outlined.

The seed program and seed industry development effort linked to the programs of the concerned IARCs requires that new funding mechanisms be developed. The normal approach would be for a budget to be developed by and funds channeled through a single center. A better approach would be to develop a single budget for the total seed effort independent of the existing centers' budgets, but linked to the CGIAR system. Funds for the WASU, the EASU, and the regional facilitators would all be a part of this single budget and funding mechanism managed by the ASDO.

The basic seed production activity, regardless of where the seed is grown, should be on a self-supporting basis and managed through a seed production and marketing rotating fund. Contract pre-basic and basic seed production could be arranged for with government agencies or private enterprises to meet national or special crop needs and to assist the development of increased seed multiplication capability. Donor agencies could assist selected national seed projects through contributions to such a seed production mechanism. A degree of semi-autonomy could facilitate these activities.

Some centers with a special interest in seed development on a particular commodity or in an area could choose to fund a crop/seed specialist linked to the total seed effort from their own budgets of special projects. More advanced national programs or seed enterprises within or outside the region could be encouraged to contribute financially to the regional seed effort in special ways. The funding mechanism should be such that all of these possibilities could be achieved. Again, financing mechanisms that go beyond those normally followed by the IARCs would be of value.

The policies and management of a regional seed improvement program would require a high level of flexibility. In establishing the new IARC-related seed program for Africa, a degree of semi-autonomy could help achieve this flexibility.

The West African Seed Unit (WASU)

Figure 1 illustrates the linkage of the WASU to the whole of the ASDO activities. The WASU will be primarily responsible for seeds of grain and vegetatively propagated crops. The major emphasis would be on rice maize, sorghum, cowpeas, groundnuts, yams, sweet potato, and cassava. Attention would also be given to other IARC mandated crops including cocoyam, potato, and millets. The WASU will be established at Bouake in Ivory Coast along the lines of the CIAT Seed Unit, which therefore implies the construction of adequate facilities to support the training and other activities of the unit. In addition, the WASU will, if feasible and acceptable to the Government of Ivory Coast (GOIC), establish a production/training unit on an irrigated seed farm. That seed farm will be a part of the extensive GOIC facilities already in Ivory Coast and it is the object of negotiations with the Commonwealth Development Cooperation (CDC) for further development into an efficient, profitable private seed enterprise.

Subject to the negotiations of an acceptable memorandum of agreement (MOA) with the Government of Ivory Coast (GOIC), the WASU will be located in the savanna zone at either Yamousoukro or Bouake (in order to simplify this report, Bouake will be used hereafter to refer to whatever location may eventually be decided upon for the seed unit proposed for establishment in Ivory Coast) or a more northerly but suitable location with commuting distance of Bouake.

The WASU would be associated with, and work in conjunction with, the Ivorian National Seed Service and the commercially-oriented seed effort now under consideration for financing by the Commonwealth Development Cooperation (CDC) and other potential participants. The WASU, in

coordination with the plans of the GOIC to develop a National Seed Center, will build such facilities as are needed to bring the resources of the combined units to a capacity and level adequate for the international role proposed for the WASU. Section VI provides a listing of the anticipated facility needs for the WASU which includes office and laboratory space, accommodations for trainees, a facility to locate model seed conditioning equipment, and so forth. WASU will have land suitable for seed production within a reasonable commuting distance from the WASU headquarters, preferably at a seed farm within the extensive Ivorian seed farm network. There will also be a small but complete seed conditioning facility to be used for hands-on training and the production of breeder and pre-basic seed for distribution to national programs at their request.

The Ivorian land available under the management of WASU will be irrigated and suitable for the production of cowpeas, maize, rice, soybeans, sorghum, and, if feasible, millet. The proposed agreement with GOIC will provide for additional land for groundnuts, sorghum, and millet production, and other grain crops as needed, to be made available to the WASU by the GOIC at one of the regional seed farms located to the north of Bouake.

WASU Activities

Training. Training will be multifaceted and consist of individual training (post-graduate interns and post-doctoral fellow), group training (short and medium length courses both at the seed center and within countries), and workshops. The major emphasis in training will be on hands-on activities and trainees will receive follow-up visits at their duty post for individualized instruction and assistance to put newly gained skills into practice. The training activities of WASU will be developed in consultation with the staff of EASU, regional facilitator and interested IARC crop specialists to offer an integrated region-wide program.

Seed multiplication. The primary objective of WASU in seed multiplication is to assist national programs to develop the capacity to multiply breeder, pre-basic, basic, certified, and commercial seed. Through training, technical collaboration and cooperation with the IARC staff, this objective can be achieved. However, recognizing the dirth of good quality seed of newer, improved varieties for further multiplication, WASU will multiply breeder, pre-basic, and(or) basic seed to supplement efforts by national programs. These seeds would normally be increased from small quantities of seed received from breeders with the IARCs. In some cases breeder seed supplied from national research programs, universities, and other domestic or import sources will be used. Normally such seed will be for sale to national research or seed programs and basic seed multiplication units in countries. Interested seed multipliers or seed enterprises may also receive seed, assuming such distribution is not in conflict with national government policies. It will be important for WASU to recover fully the costs of such seed multiplication activities. (See the item in Section III entitled "Funding for Seed Produced by Seed Units.")

Promotion and technical assistance. WASU staff will travel regularly into the cooperating countries in West Central Africa to follow-up on graduates of the WASU programs at their duty posts, to promote the rational development of seed programs, to increase the awareness of the value of improved seed at all levels, and to offer a wide range of technical service in the support of national seed programs as well as private enterprises, especially to those contemplating initiating operation. The staff would relate closely with the staff of the IARCs in the region and assist specific seed production efforts that they jointly identify.

Applied research. Initially, applied research at the WASU will be limited to very practical problems in seed systems. Graduate students and post-doctoral fellows will be deeply involved in such activities as development of data to assist policy planners and resolve technical questions and(or) problems. Applied research on field weathering,

drying, storage, pathology, and other areas will add to the basic information and provide for sound recommendations to developing seed enterprises. The candidates for individual training will engage in such applied research under the direction of the senior staff at the center and(or) advisors within university programs within and outside Africa. WASU will search for support to assist degree training and could contribute to the identification of candidates and the management of their program.

Communication and information service. The WASU will be a source of advice and information to all aspects of seed systems. A newsletter for distribution to all interested agencies and individuals will be started as quickly as is practical. Individuals and agencies will be encouraged to submit their questions and problems whether they be concerned with sources of seed for particular crop varieties, insecticides to control pests where seeds are stored, or specialized equipment for the conditioning or bagging of seeds, and so forth. Assistance and encouragement for the formation of networks of seed technologists to facilitate exchanges of information and to foster cooperation will also be a service. Audio-visual materials and publications will be prepared to support the region-wide training effort.

Probable Divisions of Responsibilities Within WASU

The proposed relationships between WASU and the IARCs in the area require some clarification.

Initially, when feasible, applied research will be done at Bouake. The applied research activities there would necessarily be limited to those activities involving equipment and techniques specifically related to the on-going training and production programs located in Ivory Coast. Those facilities, where necessary, will be complemented by the programs and facilities at the "lead" IARC.

Until such time as Bouake staff members are suitably accredited (i.e., acceptable to degree-granting universities as advisors or co-advisors to graduate students doing thesis research), it may be necessary to have an accredited IARC staff member as advisor/supervisor for degree-seeking trainees at Bouake. Until the facilities at Bouake are fully operational, much of the applied research by degree-seeking trainees will probably be done at an IARC.

Activities at IITA. A significant portion of the WASU activities will be undertaken at IITA. These activities will center around the on-station seed production at IITA, Ibadan, and applied research specifically related to seed problems in warm humid climates. The emphasis will be on IITA's grain crops (cowpeas, maize, rice, and soybeans). It is also proposed that the IITA program related to vegetatively reproduced crops be strengthened. Some details follow:

- IITA, Ibadan, has developed methodologies to widely disseminate improved germplasm of vegetatively propagated species. This includes the program of tissue culture and the propagation of disease-free plantlets that are mailed to national programs. Also, new techniques have been developed, such as micro-sets, that will be extremely useful in the rapid propagation of materials after disease-free nurseries are established in strategic regions of target countries. Therefore, a WASU subprogram for research and multiplication of vegetatively propagated food crops of Africa will be based at IITA. The current programs (cassava, cocoyams, sweet potatoes, and yams) will be expanded in scope and resources available in order to meet needs for those vegetatively reproduced food crops throughtout sub-Saharan Africa.

- The multiplication of breeder and pre-basic seed, up to a capacity of approximately 140 metric tons per year of the IITA mandated crops (corn, rice, cowpeas, and soybeans) will be undertaken on-station at IITA to meet principally the needs in Nigeria.

Multiplications to meet seed needs for those crops outside of Nigeria, and also for non-mandated crops, will be undertaken in Bouake. During the visit of the study team, a plan for the upgrading of the seed facilities at IITA was developed in collaboration with IITA personnel and is included in Section VI.

- Applied research on field deterioration, drying, storage, and so forth, of seed in the humid tropics will be undertaken at IITA which has climatic conditions appropriate for such research. A limited amount of seed testing equipment will be required for that work. It is expected that research concerning other issues related to seeds in humid climates will also continue at IITA. In-country research under local conditions will be encouraged.

- WASU printing and publications would be done largely or entirely at IITA.

Activities at the Sahelian Center. The northern areas of WASU's location permit the production of most of the Sahelian food crops. It is envisioned that complementary activities may have to be undertaken to support this activity. The Sahelian center's other resources may also be called upon in terms of applied research, training, and communication.

As the team did not visit the location, further details cannot be outlined.

Flexibility and Staff for WASU

One of the features of the CIAT Seed Unit model that has been cited as a major contributing factor to its success is the relatively small and flexible professional permanent staff, and the engagement of specially qualified short-term consultants to assist the training and other needs of the unit. However, it would be impractical to plan for such extensive use of short-term consultants at WASU. Because of the vastness of Africa, the staff based at Bouake will need to do consider-

able travelling to participate in training courses and to provide technical assistance in other parts of Africa. Moreover, because seed systems in Africa are less advanced than were the ones in Latin America when the CIAT Seed Unit initiated its activities, the WASU staff will face heavier demands on their time at the national level "to get things going." Finally, it will be difficult to engage French speaking seed technologists for short-term consultancies.

The study team, therefore, proposes the following as desirable professional staff positions for the WASU at Bouake. It is recognized that the qualifications of personnel available for appointments may result in some adjustment of the titles or the responsibilities of the positions proposed hereunder. French language proficiency at the S-3, R-3 level or better (FSI rating system: 0 = no knowledge, 5 = native speaker) will be required for all the WASU staff.

- Director and Technical Assistance Officer (Seed Technologist)
- Seed Production and Conditioning Officer (Seed Technologist)
- Quality Assurance and Training Officer (Seed Technologist)
- Phytosanitary and Seed Protection Officer (Seed Pathologist)
- Management and Marketing Officer (Marketing Specialist)

It is expected that the laboratory facility at the WASU will work toward the goal of attaining accreditation in the International Seed Testing Association (ISTA).

The East African Seed Unit (EASU)

The case in support of the proposal to establish EASU is a very strong one. It is well known that since the 1960s there has been a steady and alarming increase in the food grain imports to Africa. During 1985, about 20% of the food grain consumed in Africa will come from imports (Brumby 1985). Much of that imported grain will be provided as food aid on concessional terms. It is inadequately known that African imports of livestock products since the 1960s have been increasing at about the

same rate as food grain imports and much is also obtained as food aid or on concessional terms (Brumby 1985).

For very large areas of sub-Saharan Africa the major source of cash farm income is livestock or their products. The amount and quality of fodder for livestock feed is probably the single most important factor limiting livestock production in such areas. Moreover, there is a direct and positive relationship between cash farm income from livestock and their products and grain yields. That is because cash income from livestock enables farmers to purchase seeds of HYVs and the inputs needed to exploit effectively the yield potentials of those grains. Improved forage crops, if soundly introduced, have high potential to improve livestock performance and production. The study team therefore recommends very high priority for the proposal to establish the EASU with an emphasis on forage seed production. However, the unit would not deal exclusively with forage. Sorghum, millet, beans, wheat, and barley, important in Eastern/Southern Africa, also would be handled at the unit.

Herbage seed technology is so significantly different and specialized (to the proposed WASU) that a separate, and smaller, unit specializing in the small scale reproduction of the forage species is recommended. Breeder, pre-basic, and basic seed of the complementary crops can also be produced on a small scale. The EASU would be located at the ILCA headquarters where storage and some other needed infrastructure is existent or in preparation.

The professional staff at the EASU would initially consist of two persons as proposed in the project document already developed by ILCA. These two professional staff will be assisted by WASU staff and one regional facilitator where necessary to complement and assist the EASU activities.

The EASU at ILCA would be primarily concerned with the seed system as it related to seeds for forage and fodder crops. EASU will deal with all aspects of the forage seed system from multiplication of breeder and

pre-basic seeds, through harvesting, conditioning, storage, marketing, and on-farm use of such seeds. To meet those responsibilities, there would be two professional seed technologists and a full array of the infrastructures and equipment needed for harvesting, conditioning, and storage (at pilot plant scales) of forage and fodder seeds of graminae and legume forage crops as described in Section VI. The complementary crops could be managed with the same equipment if consideration is given to this in the original design. The activities of EASU would include training (conducted at ILCA, in other African countries, and(or) at WASU); multiplication of breeder and pre-basic seeds of forages up to approximately 40 mt capacity per year; promotion and technical assistance for the forage crop seed systems; applied research related to production, conditioning, storage, and use of seeds of forage crops to produce fodder; and an information service for all aspects of the forage crops seed system. Similar support to the complementary crops could be provided as outlined in the activities for the WASU.

The Regional Facilitators Concept and Locations

As described earlier, the seed system in Southeast Africa is much more developed than it is in Western Africa. For example, Zimbabwe, Kenya, and Malawi have commercial exports of seeds in addition to the seed production for their own needs. It was therefore not surprising that in the countries visited in that region, there appeared to be no clear interest nor need for a seed unit with activities and services similar to those of the CIAT Seed Unit. However, that does not imply that all aspects of the seed system are operating smoothly and to the satisfaction of all, especially if the seed scene is viewed on a regional basis in contrast to the conditions in individual countries. At a large meeting in Nairobi, a participant expressed the opinion that one or two seed system specialists should be able to do much for seed systems if they were to act as Regional Facilitators. After a good discussion at that meeting, there was agreement by the participants that the suggestion was attractive to them. Subsequently in other discussions and other countries of the region, something akin to the Regional Facili-

tators was either suggested or there were expressions of support for the idea.

The concept of Regional Facilitators, who would spend the major portion of their time in Eastern and Southern Africa assisting and promoting improvements in the seed systems, can only be described in very general terms at this time. Regional Facilitators would act as catalysts working through in-country and regional networks and using existing facilities of the private or state sector. An initial activity would be the visiting of individual countries and holding of regional workshops to establish an inventory of needs and to discuss ways of solving them. Such visits and workshops would identify the type of technical assistance, training, and information that national seed programs would require and desire. Where needed facilities do not exist on an in-country or subregional basis, the facilitators will have recourse to the seed units. Where crop specialist knowledge is required or vegetatively propagated material or herbage/forage seed is needed, the appropriate IARC personnel would be contacted. It is the opinion of the team that there is need for technical support, training, marketing, and management assistance too.

A highly mobile two-man team would be sufficient to address these problems using existing national personnel and facilities. They could concentrate on marketing and management components of seed systems as well as the technical aspects of seed systems and specialize in training. It is proposed that one RF be linked to the WASU and the other one linked to the EASU. The WASU RF could be located in the Southeast in a location so he/she could effectively link with the IARC regional crops specialists in that area. The EASU RF could be located at ILCA but concentrate on countries in the East African subregion with similar links with the IARC crop specialists.

Most of Africa's humid tropics area is in the Western and Central region and that is where the major production of vegetatively propagated crops occur. In view of the technologists for vegetative propagation of

cassava, cocoyams, sweet potatoes, and yams now available as a result of research at IITA, the concept of developing in-country "seed" systems for vegetatively propagated crops to exploit the new IITA technologies was an obvious one. To meet that need, the study team proposes that a Regional Facilitator for vegetatively propagated crops (RFV) be attached to the WASU and linked to the IITA work on vegetatively propagated crops.

Review of Activities

During the implementation of the foregoing activities of the WASU both in Bouake and Abadan and the EASU at ILCA, unforeseen and unexpected developments will surely affect the course and practicality of the concepts described in the foregoing.

It is, therefore, recommended that late in the third year of the ASDO operation, or during the fourth year of these activities, there should be a review of the program as a prelude to the anticipated Phase II which should follow the initial 5-year period of operation.

Infrastructure, Staff, and Budget Details for WASU and EASU

Specific details of infrastructure and staff requirements and budgets for an initial 5-year period in each case, together with proposed job descriptions and related material concerning each of these proposals, are provided in Sections VI and VII of this report.

Considerations and Criteria Upon Which the Proposals for Locations of WASU and EASU are Based

Because of the diverse activities in which the African seed unit or units will be engaged, many factors should be considered in selecting locations for the headquarters where the training, production, conditioning, and storage will take place. The study team, therefore, prepared an outline of considerations and criteria to be used in

evaluation of possible locations for the seed units. That material is a part of Appendix 4.

The question of where each of the seed units should be located was much simplier for the unit concerned with forage and related crops (EASU) than for the seed unit for the grain and vegetative crops (WASU).

Location for the East African Seed Unit (EASU)

In 1984, ILCA prepared and submitted to donors a proposal for a forage crop seed unit to be based at the institute's headquarters in Addis Ababa, Ethiopia. Many of the support facilities and resources needed for the seed unit as proposed already exist at ILCA and can meet the needs of EASU without ever taxing the existing resources and services. There is ample space for construction of the envisioned infrastructure needed for seed conditioning and any additional housing that might be needed. Existing classrooms and dormitories can meet requirements for any training courses to be held at ILCA. Should growth and success of EASU result in need for additional physical facilities, they can also easily be met. The climatic conditions in Addis Ababa are satisfactory for the drying, conditioning, and storage of seeds. Finally, seeds of most of the kinds of forage crops of interest to the EASU can and will be produced at ILCA headquarters or at its substations which are relatively nearby.

In view of the foregoing, and in the absence of competing proposals, the study team is unreserved in its recommendations that the EASU be based at ILCA headquarters in Addis Ababa, but with a slightly expanded role for complementary crops in that region.

Location for the West African Seed Unit (WASU)

In mid-1985, IITA prepared a proposal for the establishment of a seed unit at IITA headquarters at Ibadan. That proposal focused on the

institute's desire to meet increasing demands for seed unit-like activities which they perceived as necessary to support seed systems related primarily to new cultivars of the four grains (cowpeas, maize, rice, and soybeans) which are developed by the institute. Although the IITA campus is rather crowded, dormitory facilities and services were described as being favorable for the location of the WASU at IITA headquarters. It was stated that in Nigeria, a large variety of crops and climatic conditions would be available to the proposed seed unit. Therefore, it was proposed that if a seed unit were located at IITA Nigeria, the needs of Africa for assistance, training, and support for national seed systems would be well served.

While recognizing that there would be some advantages to having IITA Ibadan as headquarters for the WASU, the study team believes there is a much stronger case for locating headquarters of the WASU in Ivory Coast at Bouake. Rather detailed pros and cons of locating the WASU at Bouake and Ibadan are included in Appendix 4. The major factors deemed to favor the Bouake locations are:

- Temperature and humidity at Ibadan necessitate costly infrastructure and operating costs for drying and for dehumidified cooled storage if needs for storage of seeds without serious deterioration are to be met. Such costly storage requirements do not apply at Bouake.

- At or near Bouake production of groundnuts, millet, and sorghum, as well as the growing of cowpeas, maize, rice, and soybeans for seed can be done more easily than is possible at or near Ibadan.

- Communications of all kinds, hard currency, and costs for transportation of grain all favor the Bouake location.

- Ivory Coast is far advanced in planning for a National Seed Unit to be located at Bouake. Association of WASU with that Ivorian facility will reduce the costs of infrastructure and equipment

requirements and will also enhance the range of quality of resources for training.

- Seed farm locations, with irrigation as may be needed, for multiplication of breeder and pre-basic seeds are readily available at or in the vicinity of Bouake.

- Pioneer Seed Company, after an extensive survey of Western Africa, has decided to initiate its seed activities for that region in Ivory Coast.

- The economic climate for private sector business, the service industries, labor and construction costs, import and export regulations and controls, and shipping costs are all favorable in Ivory Coast.

- The Western African region is predominantly francophone.

- Ivorian representatives at a meeting arranged by the World Bank in Abidjan proposed the WASU headquarters be located in Ivory Coast in association with the National Seed Unit now being planned for Bouake.

The study team therefore recommends that, subject to development of a satisfactory Memorandum of Agreement (MOA) with the Government of the Ivory Coast, the African Seed Unit be based in Ivory Coast but with administrative and other ties to IITA Ibadan or another lead center as described earlier.

Alternative Locations for WASU

It is proposed that the WASU concentrate on the mandated food crops of the IARCs that are of primary interest to the region. Thus, the scope of the unit reaches beyond the original IITA proposal. Yet, IITA would be a logical lead center for the development of the WASU since it already has collaborative arrangements with CIMMYT, CIAT, WARDA, ILCA,

and IRRI. However, due to the criteria listed elsewhere and to the fact that two of the three regional facilitators represent seed activities in the non-humid areas, the site should not involve the tropical humid climate.

The examination of the IARCs program coverage (CGIAR Newsletter, Vo. 5 No. 1, pages 4 and 5) reveals possible site locations in Zimbabwe, Malawi, and Niger (ICRISAT), Benin, Zaire, and Tanzania (IITA), and Kenya (ILCA). Of these only Niger and Benin are located in west Africa. Since a linkage and regional facilitator is already proposed with IITA, an alternative location could be that of Niger. Examination of the team's criteria for location, however, resulted in the rejection of Niger as a main site. Considerable use could, however, be made of the facilities at the ICRISAT Sahel Center and crops (sorghum, millet, and groundnuts) for incountry and regional training. The WASU staff with specialization in production conditioning, quality control, etc., combined with the center's staff, could mount effective program activities for that environment.

If, for whatever reasons, the proposal to locate WASU at Bouake is not accepted or supported, the team does not have specific alternative proposals. However, the study team believes that the concept of WASU is very important in the long-term interests of increasing food production, particularly in western Africa. If that view is accepted, consideration might be given to a supplementary study to examine the feasibility of locating WASU at the ICRISAT Sahel Center, in Senegal, Cameroon, or elsewhere in western Africa, where the range of crops grown and the climatic conditions for conditioning and storing seeds of food grains are favorable without costly drying and cooled dehumidified storage infrastructure being required. Another factor which would need to be considered in relation to any location other than Ivory Coast would be the cost of multiplication of breeder and pre-basic seed and the distribution of the resulting seeds to other countries.

VI. FACILITIES NEEDED TO IMPLEMENT STUDY TEAM'S PROPOSALS

INTRODUCTION

As described in Section IV, the Study Team proposes an African Seed Development Organization with four components of the seed unit activities in Africa, as follows:

1. A West African Seed Unit at Bouake, Ivory Coast, contracted for support services to the appropriate lead center in the region or to a nonprofit international agricultural development organization such as Winrock International.

2. Improvement of "seed" related facilities at IITA, for:
   - Production, drying, conditioning, and storage of seed from multiplication of breeder seeds of IITA developed varieties of cowpeas, maize, rice, and sorghum.
   - Increased activity of IITA related to materials to be distributed for reproduction of cassava, cocoyams, sweet potatoes, and yams by vegetative propagative and tissue culture methods.

3. An East African Seed Unit at ILCA in Ethiopia, for:
   - Production, drying, conditioning, and storage of seed from multiplication of breeder seeds of ILCA developed species of pasture grasses and legumes and forage crops.
   - Potential production, etc., of nonforage crops such as wheat, beans, sorghum, and millet.

4. Three Regional Facilitators to be located in eastern and southern Africa (2) and in central western Africa (1).

This section outlines the facilities proposed to meet the foregoing seed unit activities.

FACILITIES FOR WASU, IN IVORY COAST

In Ivory Coast, there will be facilities at the Bouake headquarters and at the seed farm in the semiarid zone perhaps at Serebou. The respective facilities proposed are summarized hereunder. But first a qualifying explanation.

Possible Sharing of WASU Facilities and Resources at Bouake

During the team's visit a meeting arranged by the World Bank in Abidjan, an Ivorian official suggested that location of an African seed unit at a location being planned for an Ivorian seed service facility would be advantageous. That suggestion seemed to imply a sharing of resources and facilities between the proposed Ivorian agency and the WASU being contemplated. Subsequently, in an Ivorian office, the team was shown draft plans, drawn by a Brazilian firm of architects, for the proposed seed service facilities being planned for Bouake. Those draft Ivorian plans included provision for much of the infrastructure that would be required for an African seed unit such as office facilities, accommodation and services for trainees, seed conditioning equipment and facilities, maintenance and other support services, and so forth.

However, the Study Team was not authorized to discuss with Ivorian officials any proposal regarding the location of the African Seed Unit under consideration. The Study Team therefore did not discuss with Ivorians the apparent implications that there be a sharing or a complimentarity of facilities and resources if the Ivorian seed service facility and an African Seed Unit are established at the same site.

Headquarters at Bouake

The three principal buildings and some miscellaneous needs are:

Building A

- Office space for 5 senior staff professionals
- Office space for 4 locally hired staff
- Office for secretarial pool consisting of 2 secretaries
- One training room for 40 participants equipped with an audiovisual room and simultaneous interpretation facility; the students will sit behind work tables
- One audio-tutorial room
- One general purpose laboratory for training needs
- One research laboratory for seed quality and identification
- One pathology laboratory
- One conference/seminar room
- One drafting room
- One radio, computer, and telex room

Building B

- One model conditioning laboratory
- One conditioned seed storage room
- One storage room
- One maintenance and tool room

Building C

- 20 double-occupancy rooms
- 2 apartments
- One laundry
- One cafeteria
- One general purpose room for recreation

Other Miscellaneous Needs

- Recreational facilities (pool, tennis court, athletic field)
- Maintenance shop
- Security hut
- Garage
- Two buses for transportation of students and staff
- Staff housing (if necessary)
- Perimeter fencing

Seed Farm in Millet/Sorghum Region

Building A

- Staff house for foreman
- 12 double-occupancy rooms
- Field kitchen and laundry
- General room
- Conference and radio room

Building B

- Crop production machinery sufficient to cultivate 100 hectares, including maintenance facility for same
- Sufficient land to permit improved fallow rotations, including the capability to harvest seed crops from the grass/legume fallow areas
- Irrigation equipment as needed

Note: It is assumed power, water, and sanitation facilities exist at the headquarters and at the millet/sorghum seed farm.

Improvement of Facilities at IITA, Ibadan

In view of the uncertainties associated with the possibility of sharing of resources and facilities between WASU and the Ivorian seed service establishment proposed for Bouake, no detailed list of equipment and infrastructure to be required in Ivory Coast has been prepared. However, a very detailed comparable list is included in the IITA Seed Unit

Proposal prepared for the Institute by Mississippi State University (Vaughan and Cortes, 1985). Appendix 5 includes pertinent parts of that document wherein there are estimates of $411,900 for capital equipment, $727,100 for capital construction, and $560,000 as the estimated value of existing IITA capital facilities that would be available to the proposed seed unit if located at IITA, Ibadan.

Facilities for Production of Breeder and Prebasic Seed

Breeder and prebasic seed of the IITA mandated cowpea crop and other crops for which they have regional responsibility are presently produced at Ibadan. However, the facilities are not adequate to meet the needs and upgrading is recommended. The Ibadan seed conditioning and storage facility is envisaged to be solely for the multiplication of small quantities of breeder seed for distribution throughout Africa, and a more important multiplication of prebasic and basic seed to support the specific needs of Nigeria.

Based on consultancies with the IITA farm management staff, a seed production capacity of 140 metric tons/year is recommended (table 4). This quantity is considerably less than the requests that are being made to IITA for seed by Nigerian farmers and seedsmen. However, it is presumed that IITA will monitor the demand for the varieties requested, and when it reaches a level that exceeds IITA's capacity and interest, a suitable private company or companies will be encouraged to meet the growing need. The WASU headquarters will be well equipped to assist enterprises within Nigeria that desire to undertake commercial scale seed production.

Table 4. Breeder and basic seed production on-station at IITA, Ibadan.*

Crop	Metric tons per year
Maize	100
Cowpeas	15
Rice**	15
Soybeans	10

* The tonnages will vary year-to-year.
**Both upland and irrigated.

There will be two types of seed unit related activities at IITA. One type of activity will be concerned with grain crop seeds, and the other with crops propagated by vegetative methods.

The design criteria employed to plan for the upgrading of the Ibadan unit includes: 4 crops to be handled for a total of approximately 140 mt per year (table 4); a relatively large number of varieties per crop and the quantities handled would be correspondingly small; the hot, humid climate at IITA coupled with high value breeder seed requires conditioned cool storage; all conditioning equipment should be of a low capacity to handle relatively small quantities of seed (approximately 0.5 mt/hour); the seed will be packaged both in small (1-20 kg) and large (30-50 kg) bags depending on the need; the conditioning plant layout should minimize damage to seeds and permit rapid cleaning of the equipment between runs with different varieties.

The present facilities at IITA can be supplemented and upgraded to meet the needs of the station. At harvest, a system of box driers could be utilized, each box having a capacity of approximately 1 mt. After the crop is threshed, it can be placed in the boxes and dried to a moisture content suitable for the maintenance of seed quality. It can then be dumped for further conditioning or stored in the conditioned warehouse for bagging at a later time.

There is need to have a capacity to handle at one time the entire 140 mt projected for the IITA station unit.

Based on the team's understanding of the conditioning problems and needs of the IITA station unit, there is need to purchase appropriate equipment to replace the present equipment which is very inadequate for the job that is to be done. A conservative approach to the acquisition of new equipment is proposed. If, in the future, additional equipment needs are identified there is sufficient space to add such equipment. Equipment and other needs are listed in table 5.

Table 5. A generalized list of IITA on-station needs for seed conditioning.

- A box drying system and shelter to handle 10 (1 mt each) at a time.
- A conditioned storage warehouse for both box storage and bag storage (140 mt capacity).
- Air-screen cleaner installed with appropriate surge bin.
- "CONE"-type corn sheller.
- Slurry seed treater.
- Bagging bin.
- Automatic weighing unit(s) suitable for bag weights ranging from 1-50 kg.
- "Box" dump pit in front of air-screen cleaner.
- Appropriate conveying equipment and elevators as required.
- Fork lift.

Vegetatively Reproduced Species Program

The terms of reference for the study team did not include a detailed study of activities to be undertaken in those species reproduced primarily through vegetative means. However, based on consultancies with specialists at both CIAT and IITA, and the perceived need to address important food crops reproduced vegetatively, the team is recommending an increased level of activity to support the germplasm development and disease-free distribution of materials developed at IITA that are reproduced vegetatively.

This increased level of activity takes the specific form of a regional facilitator specialized in the various techniques relating to vegetative reproduction (RFV). The RFV will work primarily in those areas of the

humid and subhumid tropics receiving plantlets from the germplasm unit of IITA. In coordination with national programs, farmer cooperatives and commercial producers, regional nurseries will be established and maintained under optimal conditions for the IITA-produced plantlets. The RFV will then undertake to train groups in the newer techniques developed at IITA for the efficient widespread distribution of the germplasm maintained at the nurseries.

It is suggested that the RFV be based in the central African country of Zaire. In addition to his role in the promotion and propagation of the IITA materials, he will have a liaison role for the other activities of the IITA and WASU headquarters unit identifying those areas of training and collaboration that can be provided from the headquarters team occupied solely with the species reproduced by seed.

Improvement of Facilities at the Sahelian Center

The possibility of sharing resources with the Sahelian Center cannot be discounted. Unfortunately, the team could not visit the center to evaluate its potential and corresponding needs to develop a seed capability comparable to the above proposal of IITA. It may be that the Ivorian location for WASU will be suitable for production of the center's crops and facilities support may be confined to other aspects. Should the WASU location be unsuitable then extra facilities may be required, e.g., irrigation.

Field Facilities for Regional Facilitators

The postings for these positions will be in eastern and southern Africa (2) and west central Africa (2). In both cases, it is expected that only accommodations (office and residence) and supporting services will be required.

Accommodations for RFs

It is proposed that the RFs be posted, in IITA (Zaire), ILCA (Ethiopia), and CRISAT (Zimbabwe). All postings should be associated with the IARCs outreach programs and share common facilities, i.e., administrative and training aspects. To ensure that facilities are commensurate with regional activities, allowances must be made for "topping up," for example, in transport.

Facilities for EASU at ILCA in Ethiopia

As stated in Section V, the proposal for ILCA for "Establishment and operation of a herbage seed production, training, outreach, and research unit" has been prepared (ILCA, 1984). That proposal includes details regarding cost estimates for infrastructure and capital construction based on 1984 prices. In addition, the ILCA document lists "ILCA equipment available to the Herbage Seed Unit" estimated at a value of $54,500. The ILCA estimates of additional capital costs are categorized as being for equipment and for capital works. Tables 6, 7, and 8 which follow are copied without change from the ILCA proposal. The cost estimates herein have not been removed and are not repeated in Section VIII of this report.

Table 6. ILCA equipment available to the Herbage Seed Unit.

Item	No.	Replacement Value (US$)
A. Seed Processing		
Stationary plot threshers	2	10 000.-
Thresher (Medicago seed)	1	7 000.-
Clover thresher	1	6 000.-
Clipper cleaner model 27B	1	4 500.-
K. Peltz air column seed cleaner	1	5 000.-
Spiral separator	1	1 000.-
Miscellaneous	1	2 000.-
B. Laboratory		
Cabinet germinators (Legume Unit)	2	14 000.-
Walk-in germination room	1	5 000.-
Total value of available equipment		54 500.-

a) Note that in addition to these items the Unit will be utilizing land and facilities at Debre Zeit. These are not valued here.

Table 7. Capital to be purchased for the Herbage Seed Unit.

Item	No.	Approx. Cost FOB Supplier (US$)
A. Seed Production and Processing		
Seed cleaner (air, screen indent cylinder type)	1	20 000.-
Specific gravity separator	1	5 000.-
Felt-roll separator	1	8 000.-
Fahr combine harvester (plot size)	1	30 000.-
Heating unit for seed dryer	1	4 000.-
Elevators (bucket type)	3	4 500.-
Indent cylinder separator (lab type)	1	3 000.-
Aspirator (lab type)	1	1 500.-
Disc separator (lab type)	1	500.-
Vacuum harvester	1	4 000.-
Specific gravity separator (lab type)	1	2 500.-
Spiral separator (lab type)	1	250.-
Scalper	1	1 000.-
Seed treater	1	3 000.-
Sewing machine for bag closing	1	800.-
Platform scale	1	1 000.-
Exhaust fans	2	300.-
Portable blower	1	300.-
Bag holder	1	50.-
Bag trolleys	3	300.-
Air conditioner for storage room	2	1 500.-
Dehumidifier	1	1 000.-
Subtotal Seed Production and Processing		92 500.-
Subtotal B/F		92 500.-
B. Laboratory:		
Balance (0.01g - 4000g)	1	1 000.-
Analytical balance	1	2 000.-
Seed blower	1	700.-
Compressor vacuum unit	1	1 000.-
Counting heads	5	500.-
Counting boards	3	300.-
Dividers	2	800.-
Moisture testers	2	1 800.-
Seed driers	5	500.-
Sub-total Laboratory		8 600.-

Table 7 (cont.).

Item	No.	Approx. Cost FOB Supplier (US$)
C. Vehicles:		
3 ton truck	1	15 000.-
Sedan cars	2	18 000.-
Tractor equipped with disc plough lines and disc harrows, sprayer, planter and trailer	1	40 000.-
Subtotal Vehicles		73 000.-
D. Sundries:		
Office furniture, low cost individual items		10 000.-
Subtotal Sundries		10 000.-
Total capital items		184 100.-
10% contingency		18 400.-
Total including contingency		202 500.-
Transport charges to Addis Ababa at 25% of FOB price		50 600.-
Total purchase plus freight insurance to Addis Ababa		253 100.-
Cost of local fabrication of sundry equipment such as silo attachments, rails, dust collectors, workshop facilities, etc.		5 000.-
GRAND TOTAL EQUIPMENT COST		258 100.-

Table 8. Construction costs for facilities for the Herbage Seed Unit.

Item	Cost ($'000 US)
Direct costs to ILCA:	
Basic construction a) (450M2 at $200/m2)	90.-
Silo construction ($1000 each)	5.-
Roofed threshing area (200m2 at $50/m2)	10.-
Road and parking (400m2 at $5/m2)	2.-
Service lines (water, electricity, waste disposal)	3.-
Conversion of part of existing bulk store to seed storage area	20.-
Subtotal	130.-
10% Inflation allowance assuming construction to take place mid 1985	13.-
Technical consulting (15%)	19.-
10% Contingency	13.-
Total construction costs	175.-

a) Includes the following areas (see layout Appendix III)

Laboratory and office	80m2
Storage, warehouse	100m2
Processing zone	270m2

VII. QUALIFICATIONS PROPOSED FOR PROFESSIONAL STAFF OF WASU AND EASU

The following are rather idealized descriptions of the staff qualifications desired for WASU professional staff. With the possible exceptions of the RFs for eastern and southern Africa, bilingual capability, when appointed, will be highly preferred and French capability will be necessary for those stationed at WASU headquarters at Bouake. Unilingual individuals may be expected to take language training.

STAFF QUALIFICATIONS FOR WASU AT BOUAKE

Coordinator and Technical Assistance Officer

Qualification: Postgraduate degree -- M.S. or Ph.D.

Experience: At least 15 years in seed or seed-related activities preferably with extensive experience in developing countries. Experience with regional activities would be an advantage.

Location: Initial orientation at CIAT followed by permanent posting to Bouake.

Production and Conditioning Technologist

Qualification: Graduate or postgraduate degree with specialization in farm management and(or) mechanization (agricultural engineering).

Experience: Considerable experience (15 years) including managing state and(or) private sector arable farms, preferably with optional irrigation facilities. Experience with contract seed production would be very desirable as

would the management of seed cleaning and drying systems.

Location: Bouake.

Quality Assurance and Training Technologist

Qualification: Postgraduate degree (M.S. or Ph.D.) in seed physiology.

Experience: At least several years in managing a seed laboratory and investigating seed problems is required. Knowledge of and experience with seed certification, inspection, and(or) administration expected. Experience in organizing and executing training courses would also be required.

Location: Bouake.

Marketing and Management Specialist

Qualification: A degree in marketing/management, preferably with a postgraduate qualification in agriculture or agricultural economics.

Experience: A considerable experience with various crop commodities, preferably in both private and state sector organizations.

Location: Bouake.

Seed Pathologist

Qualification: A postgraduate degree (M.S. or Ph.D.) in plant pathology.

Experience: Extensive experience with government phytosanitary and seed health stations.

Location: Bouake.

General Requirements

1. Candidates should have experience in more than one agroclimatic zone in the sub-Saharan region of Africa or in similar semiarid areas.
2. Subject to possessing appropriate technical qualifications, preference will be given to those who speak English and French.
3. Considerable travel, probably in excess of 2 months per year will be normal.

STAFF QUALIFICATIONS FOR EASU AT ILCA, ADDIS ABABA

The following are again rather idealized descriptions of the qualifications desired for the two professional positions proposed for the EASU at Addis Ababa. Preference will be given to suitably qualified persons who are bilingual in English and French. If unilingual persons are appointed, they will probably be expected to take training to attain competence in the second language.

Unit Head or Senior Seed Technologist

Qualification: Postgraduate qualification in plant science or botany.

Experience: Extensive experience in herbage/forage crop agronomy and seed production in the various sub-Saharan climatic zones is desired. Active participation in seed system development in a range of countries would be advantageous.

Seed Technologist (Forage Crop Specialization)

Qualification: Graduate in plant science or agricultural botany with specialization in forage crop breeding and selection.

Experience: Research and production activities with forage crops in sub-Saharan Africa is very desirable.

General

Both professional positions will be based in Ethiopia but will require extensive travel within ILCA's mandate area. To facilitate travel and training, appointees will be expected to be bilingual or to undertake training in the second language (English or French).

STAFF QUALIFICATIONS FOR REGIONAL FACILITATORS

The three regional facilitators will act as catalysts. By utilizing their experience and local resources, they will help promote the necessary seed system activities at in-country and regional levels. It should be recognized that a considerable degree of mobility will be required and that support services will be offered by ASDO as and when required. Access to the other WASU will enable further backstopping in the more specialized fields of vegetative reproduction and herbage and forage seed production. (They should be prepared to work closely with IARCs outreach programs operating in this area as well as with bilateral and multilateral donors assistance, and national seed programs and staff.)

The two facilitators posted by WASU to eastern and central Africa will divide their work into two principal areas. In response to suggestions made to the Study Team, the marketing and management component of local seed systems will be examined. Lack of market research, as reflected by the variable seed demand both within and between countries, will receive priority attention. This will be complemented by work on the various promotional aspects ranging from promoting testing to packaging and pricing. Business management will receive equal attention to ensure that the corporate and individual effectiveness of seed system personnel is improved. It is proposed that this post be located in Ethiopia. To assist countries with seed components at varying levels of competence, the second facilitator will be based in Zimbabwe and play a trouble-shooting and training role in all seed system components. The regional facilitator in central Africa will be in direct contact with WASU/IITA to help establish, on a regional and in-country basis, seed systems to distribute vegetative material received from IITA. Liaison between IITA and the region will be established through the IITA outreach system at the facilitator's duty station.

Facilitators for Eastern and Southern Africa

Facilitator for Seed Production and Training

Qualification: Preferably a postgraduate degree in agriculture or a related subject.

Experience: Extensive experience with various African seed systems. A capability to advise on any component of such systems. Experience in the design, construction, and execution of in-country and regional training courses will be advantageous.

Location: Probably Ethiopia.

Facilitator for Marketing and Management

Qualification: Similar to the corresponding position at Bouake.

Location: Probably Zimbabwe.

General Requirements

1. Candidates should have experience in more than one agroclimatic zone in the sub-Saharan region of Africa or in similar semiarid areas.
2. Preference will be given to those able to speak or willing to learn French, Kiswahili, and(or) Portuguese.
3. A willingness to travel for 6 months or more per year, primarily in eastern Africa.
4. The RFs will report to the coordinator of WASU but they will also establish and maintain positive links with EASU units activities they will promote.

Facilitator for Western and Central Africa

Qualification: A graduate or postgraduate degree in plant science or agricultural botany. Qualifications in seed technology would be very advantageous. French speaking.

Experience: Several years of experience in vegetative propagation with crops other than potatoes is desired. The task will be to establish "seed" systems to ensure distribution of and a continuing supply of materials for vegetative propagation.

Location: Probably at an IITA outreach station in the humid tropics such as in Zaire.

General Requirements

1. Candidates should have experience in the sub-Saharan regions of Africa or in similar subhumid or humid regions.
2. Preference will be given to those able to speak or willing to learn English in addition to French requirement.
3. The position will entail travel for 6 months or more per year, primarily in the subhumid and humid regions of western and west central Africa.
4. The incumbent will be responsible to WASU and IITA.

VIII. PROPOSED IMPLEMENTATION PLANS FOR SEED UNITS IN AFRICA

INTRODUCTION

The terms of reference for the study call for the Study Team to present a plan or plans for implementation of the proposals made for Africa seed units. (See Appendix 1.) Those plans follow.

PROPOSED IMPLEMENTATION PLAN WASU

Ivorian Discussions

At the earliest practical time, the Ivorians should receive unofficially a copy of the Study Team Report so that Ivorian reactions can be obtained. Perhaps Dr. Brian Gray of the World Bank could pass a copy to N'DRI Brou Benoit in Abidjan.

Sequential Conceptial Implementation Plan

1986

April	Preliminary funding in hand. MOA with Ivory Coast signed.
September	Director engaged.

1987

January	Director takes up position.
January-March	Preparation by Director and Mississippi State University of plans for headquarters infrastructure: Office laboratory classroom building Dormitory-food service.

Conditioning and storage facilities (as detailed in Section VI).

(Mississippi State University has an ongoing USAID contract to provide design, construction, and supervision-of-installation services without fee to approved seed unit development projects.)

March	Seed production and conditioning technologist joins staff.
May	Plans for Seed Farm Units completed.
June	Two Regional Facilitators for eastern and southern Africa join staff.
August	Contract let for Seed Farm Units and construction starts.
September	Contract let for headquarters unit and construction starts.
October	Workshop on the importance of on-farm trials to seed programs.
November	A training course: Planning Seed Unit Facilities and for Quality Assurance.

1988

January	A workshop at IITA.
March	A training course: Seed Farm Planning.
April	Quality assurance technologist joins staff.
May	First crop plantings at seed farms.
June	A training course: management and marketing.
June	The Regional Facilitator for vegetative propagation joins staff.
August	Seed Farm Units complete and operational.
September	Headquarters facilities complete and operational.
November	A workshop in eastern or southern Africa.

1989

January	The management/marketing specialist joins staff.
April	The pathologist joins staff.
January-December	Three or four training courses utilizing the new facilities at the headquarters and seed units.

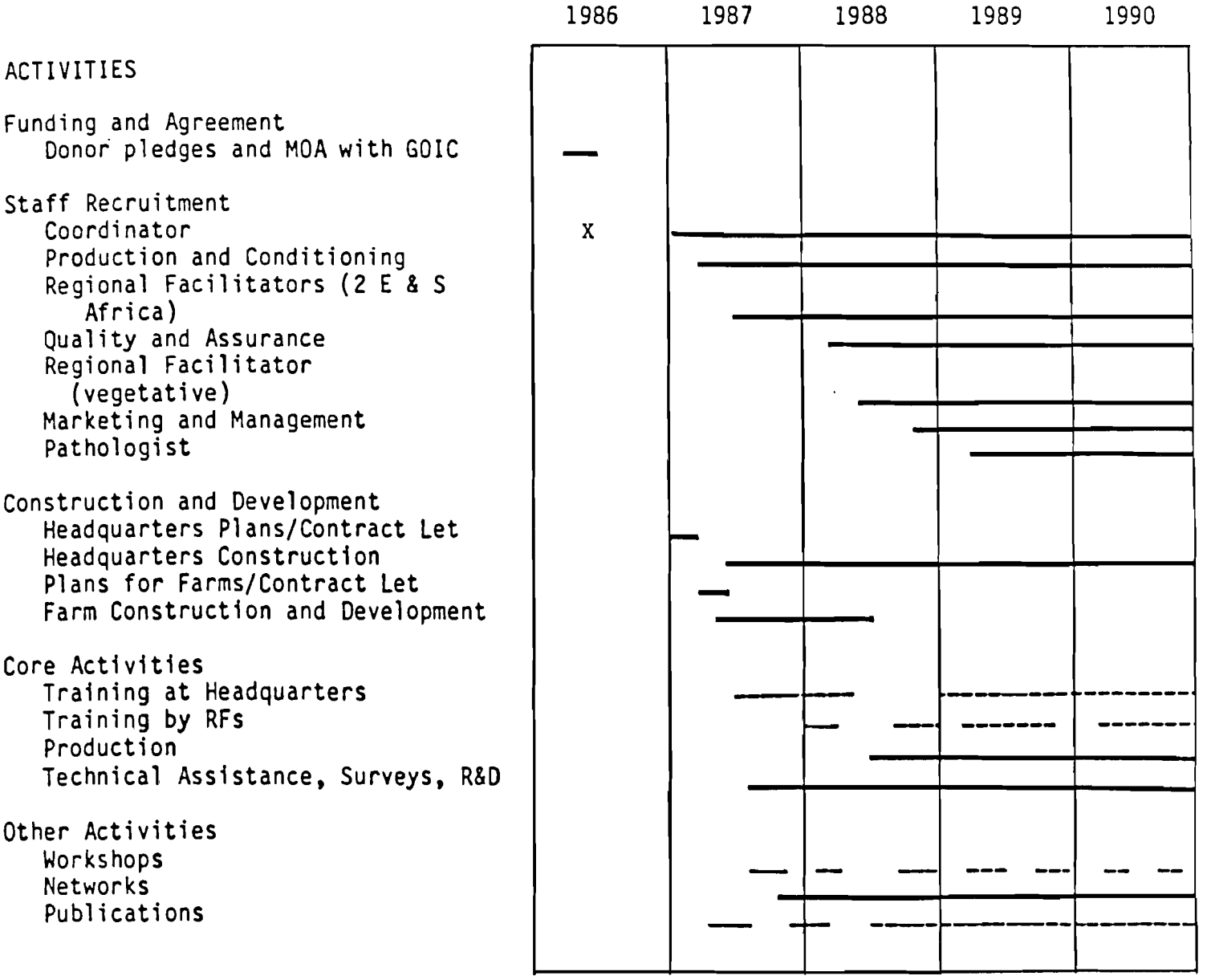
1990	The IITA/WASU fully operational and engaged in training courses and workshops as well as in the provision of technical assistance and applied research. Information services also to be commenced.

See also figure 2, a conceptual bar chart of the sequence of activities of WASU during the initial 5-year period of activities.

PROPOSED IMPLEMENTATION PLAN FOR EASU

The proposal for the establishment of a Herbage Seed Unit (ILCA, 1984) includes detailed implementation plans. Tables 9 and 10, which are copied without change from the ILCA document, provide breakdowns of proposed training activities and staff recruitments during the initial 5 years of operation of the unit. The Study Team has no suggestions for changes in those plans at this time but repeats the opinion that there is likely to be need for flexibility in the early years of such a program.

Figure 2. Bar chart of WASU conceptual development.



KEY:
X = appointment made

Table 9. Training Plan for the Herbage Seed Unit over 5 years.

Training Type	Year 1	2	3	4	5	Total People
Individual Training (emphasis on research)						
- postgraduates (man-years)	2	3	5	5	5	20
- postdoctorals (man-years)	1	1	1	1	1	5
Group Training (emphasis on production)						
AT ILCA						
Medium length courses (20 participants each) a/	1	1	1	1	1	80
- Short courses (20 participants each) a/				1	1	40
- Workshops (leadership and management personnel). (20 participants each) a/			1	1		40
Within countries b/						
- Short courses (20 participants each) a/			1	1		40
				Total		225

a) 10 participants will be supported by project funds.
b) To be held in East Africa (English) and West Africa (French).

Table 10. Incremental staffing for the Herbage Seed Unit.

	Year				
Position	1	2	3	4	5
Unit Head	1	1	1	1	1
Ph.D. researcher	1	1	1	1	1
Graduate technical assistants	1	2	2	2	2
Consultants	.25	.5	.5	.25	.25
Secretary	1	1	1	1	1
Field staff	1	2	2	2	2

IX. BUDGET ESTIMATES FOR THE SEED UNIT PROPOSALS

BUDGET ESTIMATED FOR WASU

Although details regarding the facilities, personnel, and implementation proposals for WASU at Bouake and IITA, Ibadan, as well as for the Regional Facilitators are outlined in Section V, VI, and VII of this report, cost estimates have not been made because of the major uncertainties referred to in the foregoing and also due to the great reduction in time for the team to work on report preparation. No reference is made to the possible needs of the Sahelian Crop Center.

Fortunately, the IITA proposal to establish a seed unit provides very helpful cost estimates made in mid-1985, which are probably quite comparable to costs which would apply in Ivory Coast for similar project components and activities. Table 11, copied for the IITA document, shows the staffing pattern in man-years. The column "Five Year Total Cost" has been added by the authors of this report. Table 12, the IITA budget summary for this initial five years, has been reproduced without change in this report. Further details regarding the IITA budget estimates are provided in Appendix 5.

It is clearly difficult to arrive at budget estimates for WASU with the major uncertainties which apply. However, some guesses seem desirable.

- It is proposed that WASU have eight principal staff members compared to the five listed in the IITA proposal. Table 12 personnel costs at IITA would total $4,293,000 for five years.

  On that basis, WASU personnel costs might be in the $5 million to $6 million range for the first five years.

- In table 10, the nonpersonnel costs of the IITA proposal total $5,247,000 for five years.

If there were to be no sharing or complementarity of resources and facilities between WASU and the Ivorian seed services, nonpersonnel costs for WASU might be on the order of $15 million for the first five years.

However, if there were to be extensive sharing and complementarity of resources and facilities between WASU and Ivorian seed services, the nonpersonnel costs for the first five years of WASU might be in the $5 million to $10 million range.

BUDGET ESTIMATES FOR EASU

Tables 6, 7, and 8 of Section V have been copied from the ICLA herbage seed unit proposal (see pages 99-102). Those tables include detailed information regarding cost estimates for capital equipment and construction. Table 13, which follows, is copied from the ILCA proposal and provides the projected 5-year budget for the herbage seed unit. A comparison of the ILCA data of table 13 and the IITA data of table 12 gives an impression that the estimates for personnel costs are higher in the IITA proposal. It would be difficult to attempt comparisons of other items in the two proposals without intimate knowledge of local conditions and operations.

The study team has no basis for suggesting revisions in the EASU estimates of ILCA, the total of which for the initial 5-year period is $3,701,000.

Table 11. Staffing pattern for seed unit at IITA.
(in man-years)

Staff Position	YEAR 1	2	3	4	5	Five year total cost
Principal Staff						
Unit Head	1	1	1	1	1	$541,000
Training Officer		1	1	1	1	390,000
Seed Production/Processing Spec.	1	1	2	2	2	780,000
Junior Scientist		1	1	1	1	210,000
Consultant and Visiting Scientists	1	1	1	1	1	480,000
Secretary (PG V)	1	2	2	2	2	82,000
Junior Staff						
PG VI	1	2	2	2	2	154,000
PG III	1	2	2	2	2	61,000
PG II	2	3	3	3	3	71,000
PG I	1	2	2	2	2	36,000
						$2,896,300

* This column transferred to here by Study Team for another table in the IITA proposal.

Table 12. Budget summary for seed unit at IITA.

I.	Donor's Contribution		$6,772,700
	a. Project Personnel	$2,806,300	
	b. Training	1,142,500	
	c. Supplies	165,000	
	d. Services	32,000	
	e. Travel	374,600	
	f. Capital Equipment	411,900	
	g. Capital Construction	727,100	
	h. Vehicles	80,000	
	i. Overhead	1,033,200	
II.	IITA's Contribution		1,768,000
	a. Personnel	487,000	
	b. Capital	560,000	
	c. Support Services	721,000	
	TOTAL FOR PROPOSED SEED TECHNOLOGY UNIT		$8,450,700

Table 13. Projected 5-year budget for Herbage Seed Unit.

Items	Year 1	2	3	4	5	Total
Operating costs						
Project personnel:						
Unit head	85	90	90	95	95	445
Ph.D. researcher	--	40	40	45	45	170
Graduate technical assistants	8	16	16	18	18	76
Secretary	8	8	8	8	8	40
Field staff (contract)	4	8	8	10	10	40
Casual labor	10	10	10	12	12	54
Consultants	25	50	50	30	30	185
Subtotal	140	222	222	218	218	1020
Training:						
Postdoctorals	--	40	40	45	45	170
Postgraduates	30	45	75	80	85	315
Participants in						
-8 week courses at ILCA	--	40	45	50	55	190
-4 week courses at ILCA	--	--	23	--	28	51
-4 week courses away	--	15	--	17	--	32
Workshops	--	40	--	60	--	100
Subtotal	30	180	183	252	213	858
Supplies and services:						
Local travel and allowances	20	25	25	30	30	130
Field supplies (fertilizer, seeds, power, fuel, repairs and maintenance, etc.)	50	60	60	70	70	310

Table 13 (cont.).

Office supplies, (printing, photocopy, etc., for training and newsletter)	15	20	25	25	30	115
International travel for Unit staff (mainly within Africa) in support of training and outreach	5	15	20	20	25	85
Subtotal	90	120	130	145	155	640
Total operating costs	260	522	535	615	586	2518
Contingency (10%)	26	52	53	62	59	252
Total operating	286	574	588	677	645	2770
Capital costs						
Equipment (Appendix I Part II)	258	--	--	--	--	258
Capital works (Appendix II)	175					175
Total capital	433					433
Obligatory CGIAR overhead charge of 18% on operating costs	51	103	106	122	166	498
Total project costs	770	677	694	799	761	3701

X. OUTLINE OF WORKSHOP TO CONSIDER PROPOSALS FOR AFRICAN SEED UNITS

INTRODUCTION

The terms of reference for the African seed unit study call for the study team to prepare detailed suggestions regarding a workshop, and a draft program for a workshop to be held as a follow-up to the study report. (See Appendix 1).

Proposals regarding the workshop follow.

PROPOSED WORKSHOP PROGRAM

Location: Hotel Ivoire, Abidjan, Ivory Coast
Time: March 1986 or earlier (to ensure participation of J. E. Douglas)
Organized by: IITA
List of Invitees: Prepared by Winrock International and IITA

Program

Day 1

8:30	Registration
9:00	Opening, CGIAR or Winrock International
9:15	HYVs need effective seed systems (J. E. Douglas of CIAT)
10:00	Coffee
10:20	Study Team Report (R. G. Griffiths)
11:20	Donor evaluation and concern as to current status and progress of African seed systems (World Bank)
12:00	Announcements

14:00- 17:30

Six invited country presentations of 30 minutes each from among Chad, Ivory Coast, Kenya, Malawi, Niger, Nigeria, Senegal, Tanzania, Uganda, Zimbabwe

Evening CIAT audio-visual: Successful seed programs

Day 2

8:30 The Proposed WASU/EASU Network and organization (R. G. Griffiths)

9:30 Distribution of lists of working group members and their topics[2]

Training Course Needs

Initial multiplication of new varieties

Technical assistance for seed systems

Seed promotion and networks

Locations for the African seed units

Resources needed for the African seed units

10:00 Coffee

10:30 Depart for Yamousoukro and Bouake[3]

16:00 and(or)

20:00 Sessions of the six working groups

Day 3

Return to Abidjan by noon

14:00 -17:30

Working groups continue

20:00 Preparation of working group reports

Day 4

8:30 - 12:00

Presentations and discussions of the six working group reports -- 30 minutes each

14:00 Slide shows by IITA and ILCA and(or) CIAT audio-visual tutorials

15:00 Coffee

15:30 Presentation and discussion of the conceptual synthesis of the working group reports

16:30 - 22:00
Working groups review the conceptual synthesis

Day 5

8:30 Final synthesis and discussion

10:00 Coffee

10:30 Proposed implementation schedule

11:00 Prospective support by donors: report by a donor representative following a meeting of donors present at the workshop

11:30 Closing of workshop

14:00 Committee meetings and planning session(s)

FOOTNOTES TO PLAN

Invitees

The question of which countries should be invited to send one or two representatives to the workshop is a difficult one. Moreover, funding of the representatives of some countries may be necessary to ensure their participation in the workshop.

1. Participants from African Countries

It is proposed that African country invitees be grouped as follows:

A. Countries invited to send one sponsored participant.

1. Specific countries which clearly should be represented.

Ethiopia	Senegal
Ivory Coast	Zaire
Kenya	Zimbabwe
Nigeria	

2. Pairs of countries, in rank order, one of which would be invited to send a representative. In the event the first invited country in any pair does not accept the invitation, the other country in that pair would then be invited to send a representative.

   a. Cameroon - Chad
   b. Angola - Mozambique
   c. Botswana - Sudan
   d. Niger - Rwanda
   e. Ghana - Tanzania
   f. Mali - Uganda
   g. Malawi - Zambia

B. Countries invited to send a representative at their own expense.

   1. Countries in group A.1 could be invited to have one unsponsored representative attend without funding support from the workshop.

   2. The second country in the pairs of countries in A.2 could be invited to have one unsponsored representative attend without funding support from the workshop.

C. There should be a deadline for acceptances of the foregoing categories of invitations to persons from African countries.

In the event acceptances from A and B of the foregoing do not result in an adequate number of representatives from African countries (including the private sector seed companies) then some additional invitations might be issued. However, in order to keep the number of participants at a reasonable number, there might be a limit of perhaps 25 or 30 for participants from countries of sub-Saharan Africa.

2. Participants from International and Donor Agencies.

It is proposed that there be three groups of invitations to agencies in this category.

A. The following IARCs:

CIAT	IITA
ICRISAT	ILCA
CIMMYT	WARDA

B. The following international agencies:

ADB	UNDP
CDC	Winrock International
FAO	World Bank
IFAD	
FIS (Federacion Int.'l De Semences)	

C. Donors to the CGIAR not represented in the foregoing lists.

It is suggested that the total number of participants be limited to not more than 60.

Working Groups

Topics for working groups would be distributed as part of the program material sent to invitees.

When registering, participants would be asked to complete a form indicating their 1st, 2nd, and 3rd choice preferences as to the working group they would prefer to join. At 9:30 of Day 2, the lists of working groups would be distributed together with the names of the chair~~men~~ and rapporteurs for each group. Groups or subgroupos may need to be based on language capabilities.

Field Trip

Details of the field trip will need to be worked out with the Ivorians. Some possible features include:

- bag lunches to be eaten enroute
- use of mini-buses (one per working group)
- Ivorian commentators for enroute explanations and descriptions
- visit sites for Ivory Coast proposed national seed unit, and for Pioneer Seed Co., operations
- visit IDESA

Cost Estimates for Workshop

The study team was asked to prepare a budget proposal for the workshop. In that request it was suggested that a minimal workshop might have a budget somewhat as follows:

Table 14. Conceptual Costs for Minimal Workshop

Travel for 10 at average cost of $800	$ 8,000.00
Per diem for 10 at $50 x 4 days	2,000.00
Other direct costs:	
Workshop supplies	500.00
Communications and miscellaneous	500.00
Staff for coordination and support	2,500.00
Total	$13,500.00

The IITA seed unit proposal (IITA 1985) includes a budget proposal for a 5-year workshop entitled "Development of the African Seed Sector: Current Status and Projected Needs." Table 15 is copied from the IITA proposal.

The proposed IITA workshop is one day longer and the suggested number of sponsored participants is three times the number in table 10.

The study team was not instructed regarding a likely number of workshop participants to be sponsored but the team is of the opinion that 10 is too small a number. Having regard for the important roles that WASU and EASU should have in Africa during the next couple of decades, there might be 20 to 30 sponsored participants. On the basis of the data in table 15, a workshop of five days with 20 to 30 sponsored participants would probably cost $40 to $60 thousand.

Table 15. Estimated budget for workshop in IITA Seed Unit proposal.

Accommodation for 30 participants . . .	US $ 6,000
Food for 30 participants . . .	4,400
Allowance for participants . . .	1,100
Cocktail party . . .	1,800
Barbeque dinner . . .	2,600
Temporary personnel . . .	1,200
Travel for participants . . .	24,000
In-country transportation . . .	1,900
Office supplies . . .	1,000
Telex and postage . . .	3,500
Publication of proceedings . . .	5,000
Consultancy services . . .	7,500
Refreshments . . .	500
	$ 60,500

IITA will provide conference center and interpreter/translator services.

Of an estimated 75 participants, 30 will be supported by IITA; 30 will be supported by outside sources; and 15 will be supported by their organization.

REFERENCES

Brumby, P. J. 1985. ILCA, its objectives, structure and future. International Livestock Centre for Africa. Addis Ababa, Ethiopia. (Draft manuscript.)

CGIAR. 1985. Centre Directors Discuss Africa. News from Consultative Group on International Agriculture Research 5 (1) March 1985.

CGIAR. 1985. Women and agricultural technology. News from Consultative Group on International Agricultural Research 5 (2) June 1985.

Cossins, N. J. 1985. The productivity and potential of pastural systems. ILCA Bulletin No. 21 (pages 10-15). Addis Ababa, Ethiopia.

Douglas, J. E. 1980. Successful seed programs: a planning and management guide. Westview Press, Boulder, Colorado.

FAO. 1985a. Economic cooperation among developing countries in the multiplication, supply and expanded use of quality seeds of improved crop varieties. Paper No. ESP: ECDC/85/4. FAO Secretariat, March. Food and Agriculture Organization, Rome, Italy.

FAO. 1985b. Information note on the Seed Improvement and Development Program (SIDP). AGP/SIDP/85/15. Seed Service, Plant Production and Protection Division. FAO, Rome, Italy. (14 pages.)

FAO. 1984. Fertilizer and plant nutrition guide. Fertilizer and Plant Nutrition Bulletin 9. FAO, Rome, Italy.

ILCA. 1984. An application for special project funding for establishment and operations of a herbage seed production, training, outreach and research unit. International Livestock Centre for Africa. Addis Ababa, Ethiopia. (July)

Institut Du Sahel/USAID. 1984. Executive summary from the assessment of agricultural research resources in the Sahel. Regional analysis and strategy. USAID, Document and Information Handling Facility, Chevy Chase, MD 20815.

Jutzi, S. C. 1985. Herbage seed production in sub-Saharan Africa, its integration in national pasture research and seed industry development and prospects for regional supporting activities. ILCA, P.O. Box 5689, Addis Ababa, Ethiopia. (27-page manuscript.)

Kirkby, R. A. (Editor). 1984. Crop improvement in Eastern and Southern Africa. IDRC Public. No. 218e. IDRC, Box 8500, Ottawa, Canada.

Vaughan, C. E. and Cortes, J. E. 1985. Project proposal for a seed technology unit at IITA. Seed Technology Laboratory, Mississippi State University. (June).

Von Amster and Van Gastel. 1985. Seed Program for ACP countries -- Present situation and future prospects (June).

Von Massow, V. H. 1985. Dairy imports into sub-Saharan Africa and their policy implications. ILCA Bulletin No. 21. (pages 16-27.) Addis Ababa, Ethiopia.

APPENDIX 1

TERMS OF REFERENCE FOR AFRICAN SEED TEAM

The following outline, with minor verbal supplementation, constituted the terms of references for the Study Team.

TOPICS TO BE ADDRESSED BY AFRICAN SEED STUDY TEAM

I. Background and Rationale for Study
   - A. Need for production and use of proposed seed to accelerate agricultural development
   - B. Previous seed development work in Africa (UNDP, AID, World Bank, FAO)
   - C. CGIAR interest
   - D. Experiences and success of CIAT Seed Unit

II. Current Status of Seed Production and Use Situation in Africa
   - A. Status of variety development in national programs and with the international center system
     1. National - public sector
        - private sector
     2. International centers
   - B. National seed development plans
     1. Government policies
     2. Role of public and private sector
     3. Personnel development
     4. Financial support
   - C. Breeder and basic seed supplies
     1. Quantities
     2. Availability to public and private sector

D. Commercial-certified seed production, drying, conditioning, storage, and marketing capabilities
   1. Public sector development
   2. Private sector development
E. Quality control systems
   1. Legislation
   2. Seed certification
   3. Seed testing facilities
   4. Internal with seed enterprises
F. Extension and education systems to support variety introduction and seed use
   1. Current rate of adoption
   2. Special attention to women's role in seed selection
G. Quality of farmer's own seed
   1. Information available
   2. Studies underway
H. Major constraints to development such as:
   1. Lack of clear policies
   2. Limitation of adapted and accepted varieties or hybrids
   3. Poor seed quality
   4. Weak extension and marketing programs
   5. Restricted or limited private seed enterprise development
   6. Limited numbers of properly trained people
   7. Economic capacity to purchase seed

III. Proposals on How to Improve the Seed Situation
A. Major needs to be met:
   1. Subregional requirements
   2. Crop emphasis
   3. Trained personnel
   4. Seed supplies of good quality seed
   5. Seed technology research
   6. Improvement of farmer's own seed supplies

7. Differences in stage of development of national seed programs
8. Language differences
9. Improved government policies
10. Private sector development
11. Stock seed reserves

B. Methods for meeting needs:
1. National seed projects
2. Seed specialists with research projects and international agencies on country basis
3. Special center(s) to concentrate technical collaboration and communications effort and to support national program development

IV. Regional and(or) Subregional Unit/Units to Support Seed Development
A. Objectives
B. Crop priorities
C. Relationship with CGIAR activities
D. Links with ongoing and future national seed projects
E. Relationship with donor and technical assistance agencies
F. Links with the CIAT Seed Unit

V. Proposed Activities of Regional and(or) Subregional Unit(s)
A. Training
B. Seed production
C. Technical cooperation
D. Research
E. Communication
F. Support to the identification and development of seed projects

VI. Consideration and Recommendations on Location(s)

- A. Accessibility
- B. Facilities for training, production, and research
- C. Complementarity of research scientists
- D. Local seed enterprises
- E. Potential cooperating university for seed technology and production degree program
- F. Language needs
- G. Plant quarantine and governmental restrictions on nonexperimental seed shipments
- H. Potential for long-term political stability

VII. Facilities Required at Recommended Location(s)

- A. Training
- B. Seed production, conditioning and storage
- C. Laboratory
- D. Office

VIII. Staff Needs

- A. Kind and numbers
  1. Principal staff
  2. Junior staff
  3. Consultants and visiting scientists
  4. National program and staff fellowship appointments

IX. Phasing of Program Development During the Next 10 Years

- A. Initial phase
- B. First 5 years
- C. Second 5 years

X. Estimated Budget

- A. Facilities and equipment
- B. Staff
- C. Program activities

XI. Conclusions and Summary Recommendations

APPENDIX 2

A FEASIBILITY STUDY RELATING TO SADCC REQUEST FOR DONOR SUPPORT FOR A SEED PRODUCTIVITY AND SUPPLY REQUEST

When the Seed Unit Study Team was in Nairobi, it received from the representative of a donor agency a copy of a request addressed to 11 donor agencies seeking funding for the above study. The request was dated 28 May 1985 and had been prepared by the Zimbabwe Ministry of Agriculture at the request of the SADCC Agriculture Ministers. The requested study and proposed project are additional SADCC Regional Food Security Projects.

The following quotation taken from the request for funding of the proposed study constitutes a clear expression of the perceived needs and the justification for the request of the SADCC countries for assistance intended to lead to improved seed systems.

Objectives of the Study

The average yield per hectare for many of the staple food crops grown in the SADCC countries are much lower than the current technological knowledge permits, particularly among small scale farmers who are the dominant group of food producers in the region. Modern agricultural practice requires the use of appropriate high quality seed if good crop yields are to be achieved. Although certain varieties of appropriate high quality food crop seed has been developed by the agricultural researchers of the region, it appears to be insufficiently used by SADCC farmers. It will be a major objective of this study, therefore, to identify whatever production and supply problems constrain its availability. The other major objective of the study will be to make recommendations for reasonable measures which if adopted by SADCC countries would, in the short-term, alleviate the seed production and availability

problem. The study will also be expected to recommend measures which, if implemented, are likely to provide a longer term solution to the problem.

The Nature and Content of the Study

The study will identify the more important food crops produced in the major agroecological zones of each SADCC member country. Particular attention will be drawn to the similarity of agroecological conditions in the different countries. This will be done to permit the study to identify food crop seed produced in some of the SADCC countries that could be usefully used elsewhere in the region.

The study will examine current demand and estimated need for high quality certified seed of the identified food crops. Projections of demand and need to the year 2000 will also be made, by commodity, for each SADCC country.

The current production capacity of each SADCC country to meet the needs of its farmers for high quality certified food crop seed will be examined. This part of the work will also consider the ability of seed producing countries to supply the needs of their SADCC seed importing partners. The prospect to the year 2000 will also be examined when this aspect of the problem is being dealt with.

The study will endeavor to identify the major factors currently constraining both the production and supply of suitably high quality certified seed within the various SADCC countries and throughout the region as a whole. Reasonable and practical short-term measures which could alleviate the present difficulties will be proposed. Recommended action of a more permanent nature which, if undertaken, appears likely to solve seed production and supply difficulties within SADCC, will be put forward. Especially important in a study of this nature will be proposals for regional action.

APPENDIX 3

SELECTED QUOTATIONS FROM A PAPER BY JUTZI (1985)

The following quotations are selected from a paper by J. C. Jutzi of ILCA 1985 entitled "Herbage seed production in sub-Saharan Africa, its integration in natural pasture research and seed industry development and prospects for regional supporting activities."

- Kenya and Zimbabwe are exceptions with a somewhat longer tradition in this field. These two countries are also the only ones with a herbage seed industry strong enough to offer sizable herbage seed quantities for export markets.

- Agricultural subsistence economies are unlikely to develop strong and continuous commercial demands for herbage seed. It is thus only the comparatively limited farming sector with surplus livestock produce and accessible commercial outlets for it which can develop genuine demand for herbage seed.

- African governments tend to prefer integration of domestic seed production into the state-controlled sector rather than to favor the build-up of private seed enterprises. Kenya is again the exception to this rule.

- New crop species and cultivars commercially introduced through seed schemes are likely to bring about changes in quantity and(or) quality of the crop residues produced and will thus influence the performance of livestock.

- The livestock sectors in national economies therefore have a genuine interest in the integration of feed value criteria into the breeding and selection processes with food grain crops. The

differences in feed values of crop residues even within a given crop species (e.g., sorghum) are considerable and warrant more attention by plant breeders.

- Research reports on herbage seed production from sub-Saharan Africa are scarce and generally do not reflect coordinated efforts to backup commercial production. Kenya and Zimbabwe are the exceptions to the rule.

- A national seed industry is composed of several equally important components which range from cultivar improvement and evaluation by agricultural research institutions oversee quality control measures carried out by governmental seed certification offices to seed production and distribution done by public and(or) private initiative and channels.

- A seed review carried out by FAO, in 1979/80 showed that in most countries agricultural research institutes are operational. But, in spite of appreciable improvements in the implementation of national seed production efforts in the recent past, only a few developing countries have sufficient installations for the production, quality control, and distribution of improved seeds.

Inserted Comments by Seed Unit Study Team

Seed systems in Africa are clearly very inadequately developed. That situation has resulted in a generally low utilization of HYVs. That in turn has been a major factor in the failure of most of Africa to achieve yield increases during the past two decades.

- The FAO Seed Review (1979/80) reviewed the seed situation in 84 countries, viz. 25 in Africa, 24 in Asia, 9 in Central America, 10 in South America, 11 in Europe, and 3 in Oceania.

- Table 1 groups the countries according to their reports on the food and pasture seed situation into three categories, those with advanced levels of development of the seed industry, those which reported fragmentary or pilot scale operations and those where no substantial activities have been undertaken.

- Africa ranks last for the three basic seed industry components and for the two crop groups reviewed. There are, however, appreciable differences between African countries in terms of their efforts and achievements in the sector. Kenya and Zimbabwe have undoubtedly had the greatest progress in the development of sizable commercial supplies of improved seed of both food and pasture crops. Their cases are presented in more detail below. Malawi, Zambia, Ethiopia, Nigeria, Ivory Coast, and Madagascar are countries with a more recent onset of their activities. Many countries on the continent did not undertake substantial efforts to set up domestic seed industry until the beginning of the 1970s.

- Oggema (1983), reporting on the Kenyan seed industry, lists five elements necessary for a reliable seed production:

  1. An assured source of basic seed materials.
  2. Existence of seed production companies.
  3. Existence of regulatory services.
  4. Registered seed growers.
  5. Demand for the seed after production.

- Kenya has a network of agricultural research stations which continuously provide basic seed of tested cultivars to seed production channels. The main stations are the Njoro National Plant Breeding Station, the Thika National Agricultural Research Station, and the Katumani Dryland Research Station. Commercial seed production in Kenya is left to the private sector. There are more than a dozen seed companies, the major ones are the Kenya Seed Company,

Njoro Seed Company, East African Seed Company, Simpsons and Whitelaw, and Kerchoff. Most of these companies do not have farms of their own for seed production but contract with farmers to whom they provide the initial seed material for multiplication under supervision. The companies also often provide required inputs to facilitate application of appropriate technology.

- It is estimated that the national seed industry covers about 40% of the country's seed requirements (the rest being land races) in Kenya.

APPENDIX 4

CRITERIA AND EVALUATION FOR LOCATION OF SEED UNITS

This appendix consists of two parts. Before the Seed Unit Study Team began specific evaluations of site locations for WASU, a list of the criteria to be considered was prepared. Part I of this appendix consists of that list. Those criteria and related considerations were employed in making the specific comparisons of IITA Ibadan and Ivory Coast as the headquarters site for WASU. Those comparisons make up Part II of this appendix.

PART I: CRITERIA FOR SEED UNIT LOCATION

Criteria which the team employed in part to evaluate possible headquarters locations for WASU are listed in alphabetical order, unranked.

1. Agroecological characteristics:

   - a range of conditions available to enable growing of the major crops of the region
   - research stations and land available for seed unit use at or near them in major climatic zones

2. Amenities for Seed Unit Staff and for trainees:

   - health services and recreation facilities
   - isolation, social and schooling factors

3. Communications:

   - air services (nearness and frequencies)
   - cable services
   - roads and accessibility to major research stations
   - postal service quality (internal and external)
   - telephone service (local, regional, and international)
   - telex service

4. Country's agricultural technology status:

   - enthusiasm to have Seed Unit and supporting resources for it
   - extension service (number and performance record)
   - research establishments, personnel, and facilities
   - variety release record and recency
   - variety testing program, current status

- education facilities (agricultural university faculty and colleges)
- suitability, quality, and availability of local staff

5. Currency: controls and external convertability

6. Infrastructure at proposed headquarters for Seed Unit:

   - conditioning facilities exist, or usable buildings available, or suitable site available
   - housing available, or suitable land offered
   - housing facilities available or suitable land offered, air conditioning practical?
   - relative construction costs for infrastructure and housing, also operating costs
   - storage, amount and quality of land available
   - training facilities exist (classrooms, dormitories, etc.) or suitable land available, food service, field plots, recreational facilities
   - availability of labor for harvesting and conditioning
   - adequate utilities (power and water) and reliability

7. International Status for Seed Unit:

   - Rights, privileges and allowances to be accorded Seed Unit and its international staff.
   - Freedom of entry and departure for trainees and short-term consultants.

8. International Agriculture Center(s) activities in the region:

   - locations and accessibility
   - seed-related research activities of them

9. Simultaneous interpretation facilities:

- permanent installation available
- convenience of installation

10. Seed multiplication facilities available to Seed Unit:

- number of available locations, amounts of land
- seasonal, rainfed only (?)
- irrigated and all year (?)

11. Status and record of phytosanitary regulations:

- quality of standards and realism of application
- external acceptance of exports
- imports/exports record (volumes and destinations or sources)

12. Status of the seed system:

- a seed certification system exists, quality and effectiveness
- quality controls related to conditioning (standards, facilities, and throughput per year)
- seed multiplication system (seed sources, who multiplies, volumes, quality, inspection system, export record, etc., for breeder seed, basic seed, certified one, and certified two)
- contract production (extent and supervision)
- seed distribution system (characteristics of agencies and effectiveness)
- private sector role in seed system (history, present status, prospects)
- seed legislation (acts, status, effects)
- status and history of multilocational (on-farm) comparisons or tests, are there data from them (?)
- quality of storage (where produced of conditioned, on farms)

- seed distribution system (free; subsidized; commercial; purchases by ordinary farmers; road, rail, sea and air freight facilities and costs)

13. Other seed system considerations:

A. Evaluation and release
   - responsibilities, agroecological testing, site location -- on-farm research substation, educational establishment -- evaluation of agronomic performance, distinctiveness, uniformity, and stability
   - authority for release, throughput

B. Multiplication
   - responsibilities, locations, quantity and quality of land and seed
   - zoned production with(without) extra inputs
   - state or private sector contracted work

C. Conditioning
   - facilities (including specialized storage) and quantities

D. Marketing and Distribution
   - promotion
   - consumer characteristics
   - channels and methods of communication
   - export/import potential
   - price considerations

E. Quality Control
   - field inspection and laboratory location and facilities
   - degree of in-house quality control
   - legislative enforcement -- market orientation (phyto-santiary controls, plant breeders' rights)

F. Government Program Policy

- seed program encouragement and enforcement
- sector participation -- private, state, overseas

PART II. COMPARISON OF LOCATIONS FOR WASU

INTRODUCTION

Although IITA had prepared a proposal for the establishment of a seed unit at IITA/Ibadan, the study team recommends that the West African Seed Unit (WASU) be located in Ivory Coast.

The proposal that WASU be a semi-autonomous unit attached to IITA, but with the unit itself located in Ivory Coast, is based on a variety of considerations with respect to the comparative merits of having WASU in Ivory Coast or at IITA Ibadan. These factors are discussed in the following paragraphs.

CONSIDERATIONS FAVORABLE TO BASING WASU IN IVORY COAST

- Ivory Coast has a range of agroecological conditions enabling production of the seven principal grains of western Africa (cowpea, groundnut, maize, millet, rice, sorghum, and soybean) within the country. These crops can be grown at the proposed headquarters for WASU or in other nearby climatic zones in Ivory Coast which are suitable for the crops concerned and easily accessible from the proposed base.

  The recommended base location in Ivory Coast has a climate suitable for growing most of the crops concerned and seeds of the seven crops can be stored there without the necessity for costly dehumidifying and cooling facilities to enable storage of seed without loss of viability or other types of deterioration pending the planting of them the following season.

  It will be less costly to store grain from the multiplication of new varieties at the Ivory Coast location proposed than to store similar amounts of the same seeds at IITA Ibadan where climatic

conditions are so much less favorable for seed production and storage. The hot humid environment at Ibadan during seed maturation increases the risk of field deterioration of the seed before harvest. Experience at IITA has found that heated force air drying must be used 24 hours a day during grain harvest there.

If seeds of the crops adapted to the semiarid or subhumid regions were to be grown in Nigeria (say in the Zaria area), the costs of travel and accommodation for both workers and students, would be higher than would be the case under comparable conditions in Ivory Coast. At such sites, similar infrastructure and equipment would be needed whether in Nigeria or Ivory Coast -- but based on present prices, those costs would be higher in Nigeria.

- An active program to upgrade the seed system in Ivory Coast is underway and is expected to receive financial support from the Commonwealth Development Corporation (CDC) to assist project proposal preparation for a National Seed Unit to be located at Yamousourkro or Bouake. That seems to imply some CDC funding for the project (subject to necessary agreements).

- Ivorian officials, at an informal meeting convened by the World Bank 22 August 1985, expressed high interest in having WASU located in Ivory Coast. They foresaw a cooperative and complementary association between the soon-to-be Ivorian National Seed Unit and WASU. Subject to satisfactory discussions, WASU and the National Seed Unit would probably have adjacent physical locations with advantageous sharing or complementarity for both the administrative and training units. The sharing of infrastructure, equipment, machinery, services, and so forth and the availability of additional land at a 5,000 ha seed farm within a half-days drive would be other advantages.

- Costs and quality of construction, labor and living are generally very favorable in Ivory Coast compared to most other countries of the region.

- Ivory Coast has excellent communications, (air, cables, postal, roads, telephone, and telex) which may be the best in western Africa.

- The GOIC philosophy actively encourages private enterprise and de facto reductions in government involvement in state-operated enterprises are in course now.

- Pioneer Seed Company, one of the largest companies, after extensive investigations in western Africa has decided to inititate its sub-Saharan activities in Ivory Coast. That decision was much affected by the favorable attitudes towards business, the high quality infrastructure and communications, the assistance and cooperation of GOIC which enable Pioneer to obtain a substantial area of land excellently suited for the company's seed multiplication needs, the regional basing of most agribusiness in Abidjan (not the case in Lagos), and the relative ease of doing business in Ivory Coast.

- Ivory Coast has hard currency, the CFA being convertible to French francs. Citibank and several other international banks operate freely in Ivory Coast. Seed exports will benefit from the covertability of the currency.

- The World Bank expects to provide substantial funding for agricultural projects in the Ivory Coast in the near future.

- There is a very strong desire on the part of francophone countries of western Africa to see the establishment of a seed unit where the normal working language will be French. The ICRISAT sub-centers for millet (in Niger) and for sorghum (also to be in the franco-

phone Sahel) will also have French as the normal working language which would therefore facilitate interactions with WASU if it were in Ivory Coast.

- Regulations and procedures for imports to and exports from Ivory Coast are less hampering than those of most other countries of the region. Moreover, based on 1985 conditions, seed exports from Ivory Coast would be more competitive in the market place than would similar exports from Nigeria.

- If WASU is located in Ivory Coast, the working language will be French and that will be advantageous for the large francophone population of western Africa. At IITA, what will usually be available to francophones will be simultaneous interpretation, something which is not practical for the types of hands-on and in-the-field training strongly recommended by the study team.

  When desired or needed, training courses in the English language can be held at IITA.

- Ivory Coast is a recognized leader in western Africa. It is often cited as a development success and can play an even greater regional role. To date, Ivory Coast has been rather by-passed by the IARC network primarily because of the language problem. Location of WASU in Ivory Coast will establish a basis for increased interactions with the IARC system thereby benefitting the region generally.

CONSIDERATIONS UNFAVORABLE TO BASING WASU IN IVORY COAST

- At present, there are few, if any, staff members of any of the IARCs stationed in Ivory Coast. Indeed, the IARCs, including IITA, have had rather minimal interactions with Ivory Coast.

- Initially, it may be difficult to recruit professional personnel with suitable technical qualifications in seed technology and who also have full competence in French.

CONSIDERATIONS FAVORABLE TO BASING WASU AT IITA, IBADAN

- IITA is a mature IARC and some of the infrastructure needs of the WASU and many of the support services to be required already exist at IITA, Ibadan. Infrastructure and equipment needed specifically for the seed unit would need to be obtained as would be the case if the WASU were to be in Ivory Coast.

- Effective administration and financial systems are already in place at IITA.

- The institute has an International Cooperation and Training Program with support staff, facilities, and experience which would be of great assistance to seed unit personnel undertaking to organize and execute activities such as those proposed for WASU. Training is deemed to be the most important initial activity of WASU and IITA Ibadan is excellently qualified to assist the seed unit to organize and conduct training courses at IITA Ibadan.

- Many students seeking graduate degrees have done thesis research under the supervision or co-supervision of IITA staff members. It may take some time for universities to become familiar with WASU and to accredit staff members as advisors or supervisors of graduate students if the seed unit is at Bouake.

- IITA is a well established and widely known institute that would give WASU important immediate credibility if it were located at Ibadan. If the seed unit were located in Ivory Coast as a semi-autonomous unit attached to IITA, its initial credibility might be lower.

- Excellent facilities and equipment for simultaneous interpretation exist at IITA and the institute has some experience in conducting training courses in French. Additionally, if desirable and practical, some training courses could be conducted at Cotonou in Benin where IITA has recently established some facilities for such purposes in that French milieu.

- IITA has a substantial number of staff posted to outreach stations and through them as well as through its training programs the institute is beginning to establish working relationships with some African universities. Such interactions will tend to support and improve course programs and research activities of universities and might enable WASU, if located at Ibadan, to interest some university to initiate research, courses, or programs related to seed technology.

- IITA is already engaged in multiplication of cassava, cocoyams, sweet potatoes, and yams by vegetative methods of propagation. The seed unit study team is recommending that the IITA applied research, resources for, and activity in that area be increased. One of the donors supporting the seed unit study has indicated an interest in such propagations being an area of interest for any seed unit that may be proposed.

CONSIDERATIONS UNFAVORABLE TO BASING WASU AT IITA IBADAN

- The range of agroecological conditions easily accesible from IITA Ibadan does not enable the production of the seven principal grain crops of West Africa with the same ease and convenience as would apply if WASU were based in Ivory Coast. Seed farms suitable for multiplication of groundnuts, millet, and sorghum already exist in Ivory Coast. Seed multiplication and in-the-field training courses for those crops will be easier and less costly if WASU is located

in Ivory Coast than will be the case if it is in Nigeria. Thus the Ivory Coast location would be able to better serve the interest of the vast semiarid areas of Africa where the crops listed are so important.

- The multiplication, conditioning, storage, and distribution to other countries of breeder and pre-basic seed for new varieties whether developed by CIMMYT, IITA, ICRISAT, WARDA, national programs, universities or other agencies can be done more easily and at lower cost it WASU is located in Ivory Coast rather than at IITA Ibadan.

- Costs of construction, equipment, labor, living, and transportation in Nigeria are generally higher than in Ivory Coast.

- Communications of all kinds are very difficult and slow in Nigeria compared to Ivory Coast. Lagos airport has a very poor reputation among persons who have been through it.

- Costs, regulations, and controls make importation and exportations more costly, slow, and difficult in Nigeria than in Ivory Coast. Seed exports from Nigeria are very costly and difficult.

- Pioneer Seed decided that Ivory Coast has more favorable conditions than Nigeria for the initiation of the company's activities in western Africa.

- Nigerian currency is not easily convertible and currency controls are hampering.

- IITA Ibadan has an anglophone milieu where francophones will persistently be at some disadvantages.

- To date, IITA Ibadan has not been engaged in seed multiplication for other than its mandate crops -- cowpeas, maize, rice, and soybeans.

APPENDIX 5

Proposed Building Areas at Costs - Seed Technology at IITA

Preliminary Estimate May, 1985

Construction Item	Cost (U.S. $)	
IITA DIRECT COSTS		
Basic Construction*		
850 m^2 $600/$m^2$	510,000	
Grading and fill		
850m^2 $5/$m^2$	4,300	
Warehouse Insulation		
550m^2 $5/$m^2$	3,000	
Silo foundations		
4 $1500/each	6,000	
Roads and parking		
300m^2 $40/$m^2$	12,000	
Service lines	24,000	
		559,300
INFLATION (10%/year)		55,900
TECHNICAL CONSULTING (15%)		83,900
CONTINGENCIES (5%)		28,000
TOTAL COSTS		727,100

* Includes the following areas:

Processing area	250m^2
Laboratory and offices and controlled atmosphere storage	400m^2
Open storage area	200m^2
	850m^2

TABLE 3. BUDGET-SPECIAL PROJECT: SEED TECHNOLOGY UNIT

Part covered by donor contribution

		YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
A. PROJECT PERSONNEL							
1. Principal Staff							
a. Coordinator		100,000	100,000	110,000	110,000	121,000	541,000
b. Seed Producing Specialist				100,000	100,000	100,000	300,000
c. Seed Processing Specialst		90,000	90,000	100,000	100,000	100,000	480,000
d. Training Officer			90,000	100,000	100,000	100,000	390,000
e. Junior Scientist			50,000	50,000	55,000	55,000	210,000
2. Junior Staff							
a. PG VI	(1)	15,000	(2) 30,000	(2) 33,000	(2) 36,300	(2) 40,000	154,300
b. PG III	(1)	6,000	(2) 12,000	(2) 13,200	(2) 14,500	(2) 15,900	61,600
c. PG II	(2)	9,000	(3) 13,500	(3) 14,800	(3) 16,200	(3) 17,800	71,300
d. PG I	(1)	3,500	(2) 7,000	(2) 7,700	(2) 8,500	(2) 9,300	36,000
3. Secretaries							
a. PG V	(1)	8,000	(2) 16,000	(3) 17,600	(2) 19,300	(2) 21,200	82,100
4. Consultants and Visiting Scientists	(1)	90,000	(1) 90,000	(1) 100,000	(1) 100,000	(1) 100,000	480,000
Subtotal		321,500	498,500	646,300	659,800	680,200	2,806,300

TABLE 3 (continued)

		YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5	TOTAL
B. TRAINING											
1. Postgraduate Interns	(2)	28,600	(2)	28,600	(2)	31,400	(2)	31,400	(2)	34,500	154,500
2. Research Fellows and Scholars	(1)	15,700	(2)	31,400	(3)	51,600	(3)	51,600	(3)	56,800	207,100
3. 4-Week Course (1/year)	(20)	59,000	(20)	59,000	(20)	64,900	(20)	64,900	(20)	71,400	319,200
4. 4-Week Course (2/year)			(40)	96,000	(40)	96,000	(40)	105,600	(40)	105,600	403,200
5. Workshop (1/year)	(30)	10,800	(30)	10,800	(30)	11,900	(30)	11,900	(30)	13,100	58,500
Subtotal		114,100		225,800		255,800		265,400		281,400	1,142,500
C. SUPPLIES											
1. Laboratory and Plant supplies		5,000		5,500		6,000		6,500		7,000	30,000
2. Office Equipment and supplies		41,600		33,500		1,500		1,500		2,000	80,100
3. Library and Documentation		3,000		3,500		4,000		4,500		5,000	20,000
4. Training Materials		6,000		6,500		7,000		7,500		8,000	35,000
Subtotal		55,600		49,000		18,500		20,000		22,000	165,000
D. SERVICES											
1. Specialists		2,000		2,500		3,000		3,500		4,000	15,000
2. Newsletter Publications				4,000		4,000		4,500		4,500	17,000
Subtotal		2,000		6,500		7,000		8,000		8,500	32,000
E. TRAVEL											
1. Specialists		28,800		43,200		57,600		57,600		57,600	244,800
2. Workshops		24,000		24,000		26,400		26,400		29,000	129,800
Subtotal		52,800		67,200		84,000		84,000		86,600	374,600

TABLE 3 (continued)

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
F. CAPITAL EQUIPMENT						
(See Appendix 1, Part 2)	411,900					411,900
G. CAPITAL CONSTRUCTIONS						
(see Appendix II)	727,100					727,100
H. VEHICLES (4)	40,000	20,000	20,000			80,000
I. OVERHEAD (18%)	310,500	156,100	185,700	186,700	194,200	1,033,200
TOTAL	2,035,500	1,023,100	1,217,300	1,223,900	1,272,900	6,772,700

TABLE 4. Part covered by IITA contribution

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
A. PERSONNEL						
1. Lecturers (time contribution) 0.3 Man/years	45,000	45,000	49,500	49,500	54,500	243,500
2. Training Officers	45,000	45,000	49,500	49,500	54,500	243,500
B. CAPITAL						
1. Equipment contributed to Seed Unit	279,200					279,200
2. Building Contribution to Seed Unit	280,800					280,800
C. SUPPORT SERVICES						
1. Message design	20,000	20,000	22,000	22,000	24,200	108,200
2. Print shop	20,000	20,000	22,000	22,000	24,200	108,200
3. Genetic Resources Unit	40,000	40,000	40,000	44,000	48,400	216,400
4. Farm Services	25,000	25,000	40,000	40,000	50,000	180,000
5. Library and Administration	20,000	20,000	22,000	22,000	24,200	108,200
TOTAL	775,000	215,000	249,000	249,000	280,000	1,768,000

PART I: EQUIPMENT AVAILABLE

Item	No.	Replacement Value US $
A. Seed Drying, Conditioning and Storage		
1. Claas combine	1	42,000
2. Picker with husking unit	1	17,000
3. Soybean and cowpea threasher	6	55,000
4. Picker with husking and shelling Unit	1	26,000
5. Cowpea harvester	1	16,000
6. Perforated metal drying room floors	6	5,000
7. Fan and heater unit	1	13,000
8. Complete maize conditioning unit with cob conveyors, sheller, treater, bagger/weigher system and conveying equipment	1	60,000
9. Air-screen cleaner (M-2B)	1	2,400
10. Air-screen cleaner	1	11,000
11. 4-wheel grain trailers	3	9,000
12. Fumigation sheets	3	2,000
13. Air-conditioner (18,000 BTU)	1	1,000

B. Laboratory (Genetic Resources Unit)

1. Cabinet germinator	1	12,500
2. Moisture meter	1	1,800
3. Oven	1	5,500
Total for equipment		279,200

PART II: EQUIPMENT REQUIRED

Item	No.	Approximate Cost US $ (FOB Supplier)
A. Seed Drying, Conditioning and Storage		
1. Ear Corn dryer	4x2	Local construction
2. Sack dryer	1	Local construction
3. Fan and heating unit	1	7,000
4. Round bin driers	4	12,000
5. Fan and heating unit (bin)	4	10,000
6. Trough belt conveyor for ear corn	2	8,000
7. Corn sheller	1	6,000
8. Vibro-pit	1	5,000
9. Air-screen cleaner	1	20,000
10. Spiral separator	1	800
11. Indent cylinder separator	1	3,800
12. Cylinder for separator	6	4,200
13. Width and thickness graders	1	4,500
14. Cylinders for grader	8	3,200
15. Gravity Table	1	8,000
16. Liquid treater	1	4,000
17. Bagger-weigher	1	1,700
18. Trough belt conveyor	2	9,000
19. Internal discharge elevator	1	16,000

20. Belt bucket elevator	4	16,000
21. Vibrating conveyor	1	7,000
22. Bin-discharge auger	1	2,500
23. Bean ladder	6	3,600
24. Working bin over air-screen cleaner	1	3,500
25. Working bins	4	10,000
26. Dust collector for seed cleaner	1	3,000
27. Dust collector (general purpose)	1	2,000
28. Fan for dust collector	1	2,500
29. Bag scale (platform type)	1	800
30. Platform bag truck (4 wheel)	2	1,200
31. Air-conditioners for seed storage	14	14,000
32. Dehumidifiers	2	8,000
33. Vacuum cleaner	2	1,000
34. Portable hand blowers	2	700
35. Sump pump	1	300
36. Fork lift	1	15,000
37. Aluminum ladder	1	300
38. Complete tool set	1	1,500
39. Insulation for seed storage	550 m2	3,900
Subtotal		228,000

B. <u>Laboratory</u>

1. Gravity Table	1	4,000
2. Spiral Separator	1	300
3. Aspirator	1	4,000

4. Indent Cylinder Tester	1	4,500
5. Disc Separator Tester	1	800
6. Precision Grader Tester	1	4,000
7. Velvet-roll separator	1	200
8. Lab-size treater	1	3,000
9. Moisture testers	3	2,500
10. Analytic balance (4 dec. places)	1	3,000
11. Torsion balance	1	700
12. Shadograph scale	1	1,200
13. Dial-o-gram balance	8	1,500
14. Oven	1	500
15. Purity workboard	10	1,400
16. Boerner divider	1	800
17. Gamet divider	1	2,200
18. Weight per bushel tester	1	500
19. Seed blower	1	1,000
20. Hand testing screens (complete set)	1	1,200
21. Forceps	50	300
22. Seed magnifiers	10	400
23. Hand tally	8	100
24. Stereomicroscope	3	1,500
25. Seed counter	1	800
26. Germinator	1	3,000
27. Germination paper and blotters (100 sheets)	6	800
28. Seed driers	6	1,000
29. Counting boards	4	600

30. Sampling pans	10	100
31. Filter masks (100/box)	10	300
32. Air-conditioner for walk-in germinator	1	400
	Sub-total for laboratory equipment	46,600
	Partial total for equipment	274,600
	Shipping, insurance, tax cost (figured at 50% of equipment cost)	137,300
	TOTAL COST OF EQUIPMENT	411,900

APPENDIX 6

EXPANDED DESCRIPTIONS OF PROPOSED ACTIVITIES OF SEED UNITS

In order to present more fully the concepts of the activities to be undertaken by the seed units, especially the activities of WASU, the following material supplements the abbreviated descriptions contained in Section V.

Unit Activities

Training. Training is necessary to ensure understanding, improve competence, and adoption of new technology. Seed training courses have been held for considerable time through bilateral or multilateral assistance. Such courses have covered short-term in-service off and on the job training at regional, national, and internatinal levels and do not offer qualifications. Various universities and international research centers also offer graduate and(or) post graduate courses with aspects of seed production -- a few offer seed specialist post-graduate courses. More specific training can be attained through various seed associations.

Nonacademic courses have given cause for concern in that content has been of a general nature, except when specific to quality control and processing. Little emphasis appears to have been given to marketing and management. Trainees have varied in qualification, experience, age, status, and even language ability, with the result that courses have not been tailored to suit the trainees. Consequently, the team feels that training must receive priority in terms of unit and regional facilitators activities. Furthermore, it is the team opinion that assistance can and should be given to state and private sector seed activities in the formulation of manpower development programs thereby providing continuing and realistic training common to their own experiences.

The team is therefore of the opinion that training opportunities should be made available along the following lines:

For individuals:

1. Nonsponsored

   a. post doctorate, post graduate, undergraduate, or non-graduate courses of variable duration and structure at unit or regional location

2. Sponsored

   a. post graduate (M.S. or Ph.D) in conjunction with recognized national or overseas university
   b. graduate qualification thesis contribution in penultimate vocation or final year

For groups:

Courses with fees and courses with sponsored participant; for general or specific courses at unit, regional, or in-country courses. To improve standards within the industry a certificate of writ based on a series of in-course tests can be awarded. The possibility for short-term interchange or work study tours should be explored.

Production

The lack of reliable supplies and quality seed at all multiplication stages considerably reduces the expansion of a national seed program and decelerates the speed at which the farmers have access to new improved crop seed. When this occurs at the initial stages (i.e., breeder and basic seed production), the problem of quality may be compounded in succeeding generations.

The initial multiplication may concern in-country activities when facilities exist involving national or international material. Where facilities are not available or resources (including climate) are unfavorable, it may be necessary to consider multiplication elsewhere -- outside the national program or outside the country, depending on the crops availability. In either case (national/regional production), the quality of the end product must be ensured. To this end it may be necessary to produce the seed on customers behalf, particularly in the case of cultivars from the IARCs.

The quantities envisaged would be restricted to small amounts, perhaps of 100 kg to 500 kg. The greater the number of species and cultivars, the more difficulty both national and regional programs will encounter in maintaining quality of the individual varieties. Production may have to be on a regional basis adaptability so that it occurs in suitable agroecological environments. Moreover, in some cases, the quantities of seed needed are beyond the production capability of existing seed units.

Loss of seed through physical shortages or quality contamination may require the creation of a seed reserve to overcome shortages in the initial stages until national programs become more competent.

A shortage of seed at the post breeders stage may reduce the effectiveness of new variety promotion as seed is needed for tests and demonstration by government and by NGOs and extension services. Arrangements may have to be considered for packaging quantities of seed suitable for distribution by extension programs for tests and evaluation by individual smallholders on their own farms.

During recent years, some countries have suffered from lack of seeds of any quality, class or kind as a result of drought or other devastations. Some events have sometimes affected seed farmers who normally save seed for their own use, as well a seed provided to farmers by the national programs of some countries. Lack of regional seed reserves,

compounded by inadequate seed-demand forecasting, cause additional complications. Affected countries may lack funds to purchase their seed needs from external sources. Seed units, with donor funding, may be called upon to help meet seed needs under such emergency conditions.

Technical Cooperation

Various countries require support in several technical aspects. Such support should be complimentary to existing activities and based on regional/national requirements. The support should be available to NGOs (profit making or otherwise) and government agencies. The NGOs could be charged for the services rendered depending on the assistance needed and the nature of technical help provided.

Frequently, applied research of a practical nature is necessary to prescribe standards for certification and improve seed technology in general. However, the facilities and skills needed may be limited, thereby restricting national seed program activities. It may, therefore, be necessary to initiate, support, or gap-fill applied research activities. Where facilities and practices are available and proven, it may only require coordination of results and activities between neighboring countries on a regional basis as temporary but immediate solutions. Member states may not be aware of problems and seed unit personnel may be able to create awareness.

The promotion of improved, quality seed at the farmer level may be impeded by lack of on-farm testing or demonstrations. This may be due to lack of seed or other inputs, or to the inability to design and implement such activities within either the national seed program and(or) the extension services. Assistance could therefore be offered in this field of activity including evaluation and coordination of such testing on a regional basis. Such a program would develop important data regarding suitable cultivars for importation as substitute varieties when national seed supplies are in short supply. A catalogue

of available varieties and their characteristics could be drawn up, together with data regarding their suitabilities for various agro-ecological environments.

Occasionally baseline data are unavailable on a national or regional basis. Assistance to the design of programs to obtain such data could be offered with a view to assisting in project formulation for national governments or eventually for submission to donors. Such information could be collated at the center and used as a reference for training, case study material, and so forth, with the agreement of the governments concerned. Countries may request evaluation of on-going programs.

Various components of national seed programs may require additional funding to facilitate continuing expansion without undue delay. Seed programs are complex interrelated activities which are effective only when all work to maximum efficiency. Any weakness can adversely affect the rate of progress. Consequently, it may periodically be necessary to assist countries in identifying sources of funds.

National seed programs will have seed demands covering many species of food crops. Supply of basic and pre-basic seed, where limited locally, may be supplied by the international research centers themselves or through the national seed centers or other national agencies. Considerable liaison may therefore be required between such agencies and the seed unit requirements may be to supply seed or information and scientific advice pertaining to the crops specific to the different problems.

Where intercountry seed distribution is involved, it may be necessary to advise regarding procedures related to phytosanitary and ISTA certificates.

Facilities at the seed unit would be available for examination and demonstration to assist countries contemplating equipment purchases for seed testing and conditioning, including packaging and storage. The seed units could also serve as referee in terms of standards to be used

in certification and conditioning. Representative samples could be sent for verification through check plot growing, laboratory analysis, and cleaning.

Promotion

The need for, but more importantly the use of, the seed industry must be promoted. A seed unit would become a reference point for interested parties to obtain or impart information. National and private program along with government extension services could turn to the units for advice or could be galvanized into action by the distribution of advice, seeds, and so forth.

Lists of publications available from national, regional, or international sources would be compiled. Bibliographies and notes on regional/national activities could be circulated as required.

Workshops and seminars become vital focal points in concentrating the attention of participants on key problems. Participant reactions and resolutions can considerably assist understanding of the needs for national seed programs affecting both those attending and those in positions of authority in their respective countries. Such activities could be highly mobile being held at different venues or even touring in a given region.

At times of seed shortages, imports and exports are required. The procedures and methods of identification to ensure seeds of only well adapted cultivars are important to seed importers and the seed units would be able to provide useful information and criteria for selection of imports.

Collaborative seed work between international and national centers of research could be strengthened through seed unit programs for training, production, and technical cooperation. National seed industries could be assisted by the creation of seed associations which would help foster

trade, training, and so forth, on a regional basis. The seed units could be considered as a secretariat to support such developments.

The overall development of national and regional seed industries would involve promotion of both the private and public sector.

Seed programs inevitably take time to have an impact on the producer sector, especially if new improved materials are involved. The situation at present does not allow for such delays and alternative materials may have to be used in order to obtain approved cultivars of regional origin, perhaps from indigenous farmers' own seed. The seed unit could locate and assist coordination of large scale importation of seed. It could also assist in training local farmers to improve their efficiency and methods of selection, storage, and use of seed. Home-sowed seed is a major feature of the seed industry, and despite fears of "competition to new seed" it will require considerable attention. Existing seed programs could, for example, improve physical and physiological quality standards with availability in general.

At the same time, joint activities with extension programs to promote recommended husbandry practices could be implemented and might not require expensive agrochemical inputs.

Such services by seed units would be available to both private and public sector seed enterprises. The seed companies could be charged a consultancy or service fee depending on their stage of development while the farmers could be charged for materials such as seed only.

APPENDIX 7

COMMENTS AND SUGGESTIONS FROM CENTER DIRECTORS, DONORS, AND OTHERS

CIAT -- by Johnson Douglas

After a more careful reading of the report, I still feel the team prepared a quite useful report that fully justifies the proposed follow up workshop and steps to initiate the needed seed units. Chapters II and III are good and provide many valuable points that help develop a sound case for getting on with the job to be done.

The team's case for the location of the ASU seems logical, although the Ivory Coast location, as would any location away from an international center, will create some problems of establishment and needed logistic support. The amount of administrative and related support to that location available from IITA or other agencies in the area would need careful study. I am very much aware of how much assistance CIAT provides us, but that was rather easy because we were on the campus.

The AFSU seems to be a reasonable solution to the forage seed development needs. Having just talked with Vartan Guiragossian about East Africa's sorghum program, my guess is that it will be difficult for the AFSU to remain totally on forage. Already it is possible to see a sorghum seed specialist attached to that unit by ICRISAT -- that might not be all bad if money is available to do it.

The surprise in the report is the apparent limited interest identified by the team on South and East Africa. It is probably our fault since we guided them only to the more developed programs of Kenya and Zimbabwe. Being sent under separate cover are two tables that are going into an ICRISAT report on East Africa. You will notice the limited availability of seed technologists and the need for sorghum seed training as identified by those countries. My understanding of needs in most of the East

African countries in which CIAT's bean program is working leads to the same kind of conclusion -- much needs to be done and a "limited human resource base exists." The regional facilitators may be a way to start the program, but they will not be able to achieve all that is expected of them.

For them to be very effective it will be essential that they are located where they can work with and interact with the outreach staffs of CIMMYT, ICRISAT, and CIAT in that region. If they can, through this process, develop a "team" approach to the seed problems that exist in the region, they will have a much greater chance of impact.

It will be extremely important to follow-up on the results of the SADCC request for a feasibility study on seed as outlined in Appendix 2. The results of that study, if completed, could be placed along with the team's report as supplemental information.

This report seems weak in showing the linkages and role played by the other international centers in the region. The thrust and needs of the CIMMYT, ICRISAT, and CIAT activities in Africa do not come through clearly. The crop orientation of the ASU does show that the unit is not an IITA unit alone, but it would have been nice to have the report show how the ASU would relate to the specialists and programs of the other centers.

In Chapter IV, page 7, the first paragraph could end with a clear statement of what crops the units would relate to instead of the last sentence that is there. Another point in the same paragraph needs attention. Another part of the report identifies several needs and yet this paragraph concentrates on two major needs. I have no problems with these two points; but instead of making the private enterprise point seem to be 50% of the effort, it would probably be more acceptable to African governments to include that point along with 4 or 5 other needs to be met.

We are struggling with what a semi-autonomous unit really would mean at CIAT. The points listed on page 8 of Chapter IV are good, but it is doubtful that achieving these points make the unit semi-autonomous. Perhaps leaving this point vague is better at this stage, but I was looking for a solution to our own concerns and failed to find it. Perhaps the idea of a "Coordinating Seed Council or Board" for everything on the diagram on page 7 with clear responsibilities would help keep all of these activities linked together and focused more clearly on specific objectives. Such a step would not necessarily make the units semi-autonomous. At any rate, donors and others may be concerned about this term and we need to be prepared with what purposes are to be achieved by this approach and why having the unit or units semi-autonomous is important, if it is.

On page 10 of the same chapter the paragraph on seed multiplication needs attention. The team undoubtedly had in mind that the primary effort in seed multiplication will be placed on helping the national seed programs develop strong basic seed and commercial seed multiplication systems. However, the paragraph does not say that and the statement leaves the impression that the units are going to take on the whole of Africa with a seed multiplication program. I think their idea was that this multiplication effort would supplement the national program activities and be used to assist national programs to get their programs underway. A rewrite of that paragraph is suggested.

On page 16 of that same chapter on line 4, reference is made to "full" membership in ISTA. ISTA's membership includes accredited governmental authorities, stations, and individuals. The laboratory could perhaps be an accredited station authority to issue ISTA certificates. It is doubtful that the laboratory should seek "full" membership.

As discussed in Washington, it would be useful before the workshop to at least informally determine the Government of the Ivory Coasts's reaction to consider a unit attached to them but in the Ivory Coast.

Regarding the workshop, it would be useful to prepare objectives to be achieved through the workshop. Under separate cover, I sent a sheet that outlines some objectives that could be achieved but the organizing committee probably should agree on such points.

Also sent a copy of our schedule for training and conferences at and away from CIAT as well as a copy of our 1985 report. The schedule is a bit full. In addition to what is there, I plan to attend the ISTA Congress in Australia, do some other official stops in conjunction with that trip and vacation a bit from July 2 to August 10. We are also planning a study of the future nature of the CIAT Seed Unit through the period from September 25 to November 28. As you consider dates for the workshop, please keep me informed because 1986 is becoming rather congested.

Suggested Objectives for Workshop

1. To provide an opportunity for agricultural and seed activity leaders in Africa, international center representatives and donors to review and react to the study and proposals on "Improved Seed Systems for Africa."

2. To further clarify and identify seed development needs and measures to meet them in Africa.

3. To develop proposed actions to be taken as a follow up to the study by the concerned groups or institutions.

ICRISAT -- by Les Swindale

The report on "Improved Seed Systems for Africa" is comprehensive and generally well done. It is certainly a timely report on a subject which urgently needs attention, especially in West Africa. Such a program should not only have an important function, but it should be able to effectively advise countries on the most appropriate methods of seed

production, certification, evaluation, storage, marketing, and utilization.

In our opinion, the proposed site at Boake, Ivory Coast, is excellent for the reasons given, but it will not meet needs of sorghum, millet, and groundnut. The report, of course, lays emphasis on rice, maize, cowpea, soybean, etc.

The report has suggested setting up an African seed unit at Bouake, Ivory Coast, attached to IITA along with other units at ILCA for forages plus three regional facilitators attached to the African seed unit are suggested for advising on the programs in Easter, Southern, and Central Africa. The report is silent about the sub-Sahelian region, specifically about sorghum, millet, and groudnut. We doubt that the needs for quality seeds of millet, sorghum, and groundnut can be met by the unit at Ivory Coast.

The projected capacity of the unit is to produce about 100 tons of the seed. Obviously, this will be inadequate to the requirements of all the countries of Africa. No doubt there is a need for creating facilities for training and monitoring quality seed in Africa, but unless seed production is stimulated in the countries concerned and long-term commitments are made the objective of the plan may not be fulfilled.

We recognize that this is only a starting point and expansion can take place in the later phases. However, recognizing the need for quality seed, especially sorghum, millet, and groundnut which are dominant crops in the sub-Sahelian region, it is essential that a sub-center in close proximity to ICRISAT Sahelian Center should also be considered.

IITA -- by Larry Stifel

We cannot add to the questions we raised at the Washington meeting concerning:

1. The relevance of CIAT model to West Africa.
2. The recommended location.
3. The reasons for a semi-autonomous unit.
4. The availability of funding.

We hope these issues will be addressed in the final report. Because of strategic planning study under way at IITA during 1986, we are not prepared to comment on the consultant's recommendation regarding IITA.

IILCA -- by Peter Brumby

The key task is to get some funding behind seed production proposals, especially as our proposal was fully endorsed by Bentley team based on CIAT experience. We have reservations about separating food crop and herbage seed units because of incremental costs, especially as IITA should continue with vegetative propogation techniques and because major function of unit must be training with need to cover spectrum of production needs. Budget costs of proposed African unit seems very high at US $12 to 20 million, about five times CIAT unit cost. Regional facilitators likely to be overly stressed by mobility suggested leading to rapid turnover and inadequate experience. If two separate units are established, some form of formal linkage between them and regional facilitators required. Description of current status of African Seed Systems is most valuable.

International Rice Research Institute -- by D. J. Greenland, Deputy Director General

We received your cable on February 17, 1986, regarding our comments on the Winrock study, "Improved Seed Systems for Africa." Dr. Swaminathan and several of our staff members have read it. They have commented that it would be a good idea to hold a workshop in which all those interested would participate, and we will be pleased to be included in such a workshop.

We believe that a strong seed unit should be developed at IITA to provide a similar help to that which CIAT is providing in Latin America. To be effective, the seed unit will need to do considerable work in developing training programs for different countries to set up and establish organized seed programs of their own. One of the difficulties at the present time in Africa is that even with a centralized strong seed production organization, many of the national programs do not have the structures which would enable them to demonstrate the superiority of the seed and make it available widely within their own countries. Thus, a major training component is obviously very important.

In other areas the report might be strengthened. Most important, perhaps, is the need to address the quarantine question in some detail. The present quarantine regulations in Africa coordinated through different quarantine officers set up by the Organization of African Unity are very active, and any seed center set up to move seed between countries needs to be carefully coordinated with those quarantine services.

Regarding rice seed, we see that there is a need to discuss existing seed production in rather more detail than is given at present. Rice seed has been produced and distributed to other francophone countries from the Ivory Coast for several years, and data on this organization are available in IRAT records. It might also have been worthwhile to include some information about seed distribution to other countries form Egypt. In the recent past, seed has been sent from Egypt to several African countries and because of the now well-established seed production and distribution facilities in Egypt and the climatic and other conditions which enable high quality seed to be produced there, they could well serve the needs at least of the Sahelian countries which produce rice under somewhat similar conditions to those of the Egyptian delta region.

SDC -- by Paul Egger

We do not have particular comments on the recommendations of the report, only three minor points:

1. In the introduction, the steps which led to this study might be properly mentioned.
   a. ILCA's proposal for a herbage seed unit
   b. SDC's interest to see a coordinated effort in the seed improvement in Africa before taking a bilateral decision

2. The justification for the location of the ASU in Ivory Coast might not be sufficient to go ahead with implementation.

3. In order to strengthen relations between the ASU and the African Forage Seed Unit, it might be appropriate to combine the East African Regional Facilitator of the ASU with the forage seed unit.

International Fund for Agricultural Development -- by Abbas Kesseba, Senior Technical Advisor

As expected, following our earlier discussion on the report in Washington, D.C., IFAD deems the report to be inadequate and that it cannot be used as a basis for further follow up either through a workshop or in investment decisions. It would be appreciated if Winrock would not publish the report at this stage in any form without prior consultation with IFAD.

The issue of improved seed systems for Africa is very important; in IFAD's view the mission report and the proposal contained therein have failed to address this issue adequately.

The question of improved seed "availability" from different sources and "demand" by farmers (Item 1 in the TOR) remains very much unanswered. No definite answer could be expected on this issue, but a trend or

indication of this should be established as a basis for proceeding with seed programs. Regional seed centers, regardless of whatever merits they might have, would not address this issue. The solution must be on a case by case basis for different countries. The report does not deal with this focal issue.

A study based on 2- to 4-day visits to a few countries (8) could hardly reflect a reliable and "average" situation in Sub-Saharan Africa (39 countries). Given the time constraints, the generalized and sometimes speculative nature of the consultants' assessments and conclusions are somewhat understandable.

The mission should have spent more time in the field in order to be able to provide us with a more indepth analysis and a wider-coveraged study. For example, the report should have provided an account of the reasons for success or failure of seed production schemes or the state of the art in Africa.

The report does not address the basic framework and the need for the development of seed programs at national level where these do not exist or are at a rudimentary stage (most of the countries in the region fall into this category). Seed programs are basically nationally oriented and should be tailored to the specific needs of a given country. Before this is done, a regional approach would not work except for training purposes.

While the establishment of the proposed seed centers would undoubtedly contribute to the improvement of the seed situation in the region in the long-term, the expected impacts should be placed in right context in order not to raise undue expectations. The report gives the impression that the seed centers seem to be the solution to seed problems in the region. It should be noted that the services provided by CIAT in Latin America (the model for the consultants' proposal) are primarily on staff training and limited dissemination of germplam and breeder seed.

Proposed Seed Centers

The report proposes the establishment of two seed centers: one for basic food crops (ASU) and the other for forage seed (AFSU). With regard to the former (ASU), the objectives are well defined, but the proposed arrangements raise a number of questions:

1. The location is proposed to be in the Ivory Coast with a significant portion of the activities to be undertaken at IITA, Nigeria (page 13 of the report). Further, IITA is to have the overall administrative responsibility for the ASU (page 6). These arrangements do not seem to be practical and workable for obvious reasons. Although the criteria for the selection of location are sound, there is no reason for the proposed seed center not to be an autonomous unit in the Ivory Coast with a close link to IITA on research matters. Ideally, it would have been better to combine both activities in the same location (as in the case with CIAT and ILCA).

2. A detailed organization and management structure should be worked out for the proposed centers. The report only given indicative professional staff requirements (5), which is considered low.

3. As has been pointed out by the consultants, the cost estimates for the establishment and operation of the centers need to be closely reviewed and finalized. In this connection, cost breakdown should clearly specify investment requirements as well as recurrent costs. An analysis should also be carried out for the cash flow of the centers over a reasonable period.

4. A review mechanism should be established for the performance and(or) modifications of the centers, as may be needed in the future.

5. Cost estimates as presented are those worked out by the IARCs. The mission failed to appraise these proposals or elaborate on the rationale and conceptual aspects of the proposed seed centers, which leave much to be desired.

6. The relationship between the proposed centers and the private sector is not clear. Will these centers operate on a self-financing basis? Will they produce seeds for sale to national programs? What would the linkage be between national seed industries and the regional centers?

It is clear that the mission failed to address the TOR's 1 through 6 adequately. There is hardly any reference in the report to items 2, 3, or 4.

Therefore, we in IFAD wonder whether it was the time factor, the resource availability, or the composition of the mission that was a limiting factor for a more adequate response to the TOR.

I would appreciate knowing, in your view, what the best available option is for ensuring that we receive an appropriate report with sound proposals for future follow up. Given the time factor, I assume you would like to discuss these comments with Winrock and react to them in due course, giving particular attention to the comments raised above and to those of other financiers.

I would appreciate receiving your proposals for how to go past this bottleneck to ensure that appropriate follow up, based on a joint endeavor, can be initiated.

FAO -- by N. Murthi Canishetty

Excellent paper and we have nothing to add.

IBPGR -- by Trevor Williams

IBPGR will not make comments on your paper in view of our staff not practically involved. However, look forward to seeing final draft.

CIP -- by K. Brown, Acting Director General

Drs. Sawyer and Valle-Riestra currently in East Africa, returning March 3. Will bring this telex to their attention upon arrival.

Swedish University of Agricultural Sciences -- by Lennart Kahre

In general, I consider that the study is well made and the proposals sound.

The main thing I would like to underline is the long-term nature of a seed program. It seems necessary to plan support for at least some 10 to 15 years to the countries concerned. It takes time to build up the basis for crop improvement, to train sufficient manpower at all levels, and to establish facilities and skill for production, processing, storage, distribution, and marketing, as well as quality control.

It seems that the units in West Africa and Ethiopia (ILCA) are well justified and balanced. The regional facilitators are also of reference and possibilities to work, also with the long-term aspects on the seed programs in these regions and possible coordination of different inputs.

These are my views, very briefly. I would be glad to assist in the further development of the planned activities.

CIMMYT -- by CIMMYT Maize Program Staff

The report is comprehensive in defining the need for improved seeds in Africa and stressing the importance of training.

We concur with the report finding of greater need in West Africa, but CIMMYT, like the team, also recognizes a need in eastern and southern Africa which needs attention in short term.

The CIAT Seed Unit was used as a point of departure for study and the unit has made a significant contribution along with IARC's operating regions program in Latin America, and last, but certainly not least, the increasing awareness in some national programs who have exercised responsibility to implement seed programs.

Based on experience of CIAT, it would be useful to explore what thrusts would receive more attention in any proposed project in Africa. We believe that the African proposal would benefit from more emphasis on training vis-a-vis seed production as opposed to seed technology. This training could be organized at a central regional location to serve needs of various countries and follow-up supplementary training in-situ at country level. We would recommend taht the unit only produce basic and foundation seed only as part of training exercise and not to meet national program needs. Responsibility for producing basic and foundation seed should clearly remain with breeders and they should be encouraged to exercise responsibility fully. Assigning some of this responsibility to the training unit would divide and confuse the line of responsibility. For similar reasons we would recommend that IARC's operations in Africa could not be responsible for production of basic seed for the region (e.g., recommendation that IITA produce basic seed for region) because this would not be in the interest of national programs, and in any event we doubt feasibility/advisability of one unit producing all basic seed requirements for region. We concur with the team's recommendation to locate seed unit for West Africa at IITA where adequate logistics and training support are available.

Clarification on specific points of information:

1. Both IITA and CIMMYT have respective and joint responsibilities for development of maize germplasm for Africa.

2. Cultivar evaluation in maize regional trials are being conducted systematically by SAFGRAD, IRAT, and IITA.

3. First paragraph, chapter III, page 2, "Results from on-farm trials on maize in Ghana as well as Ivory Coast show clearly that improved maize varieties are available which give better yields than locals under subsistence farming conditions even under low input conditions."