PD-AAQ 993
Isn: 39114

FACULTY OF AGRICULTURE

SUBPROJECT IDENTIFICATION DOCUMENT
(SPID)

TITLE XII

AGRICULTURAL DEVELOPMENT SUPPORT PROGRAM

PROJECT 279-0052

YEMEN ARAB REPUBLIC

MAY 19, 1983

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

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

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: Yemen Arab Republic

3. PROJECT NUMBER: 279-0052

4. BUREAU/OFFICE: USAID/Yemen — 03

5. PROJECT TITLE (maximum 40 characters): Agriculture Development Support

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM DD YY

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 84 B. Quarter 2 C. Final FY 89

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

A. FUNDING SOURCE	FIRST FY 84 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(2,000)	(—)	(21,000)	(76,130)	(—)	(76,130)
(Loan)	(—)	(—)	(—)	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country		12,400	12,400		31,803	31,803
Other Donor(s)	24,600	—	24,600	24,600	—	24,600
TOTALS	26,600	12,400	58,000	100,730	31,803	132,533

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) FN	000	601	—	34,498	—	23,000	—	76,130	—
(2)									
(3)									
(4)									
TOTALS				34,498	—	23,000	—	76,130	—

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 070 019

11. SECONDARY PURPOSE CODE

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

A. Code	BR	BL	PART	EQTY			
B. Amount	25	25	25	25			

13. PROJECT PURPOSE (maximum 480 characters)

The purpose of the Title XII Program, is to improve the capacity of of the YAR Government and Yemeni Agricultural producers to develop and sustain an agricultural sector which effectively and efficiently uses Yemeni natural resources, is integrated into the economy, and is supportive of a broad-based and equitable social and economic development.

14. SCHEDULED EVALUATIONS

Interim MM 09 YY 83 MM 09 YY 85 Final MM 09 YY 89

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

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment.)

17. APPROVED BY

Signature

Title

Date Signed MM DD YY

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

AID 1330-4 (8-79)

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT IDENTIFICATION DOCUMENT FACESHEET (PID)

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Revision No. ____

DOCUMENT CODE: 1

2. COUNTRY/ENTITY

3. PROJECT NUMBER: 279-0052

4. BUREAU/OFFICE — A. Symbol: ____ B. Code: 03

5. PROJECT TITLE (maximum 40 characters): Agicultural Development Support Program Faculty of Agriculture Subproject

6. ESTIMATED FY OF AUTHORIZATION/OBLIGATION/COMPLETION

A. Initial FY: 84

B. Final FY: 93

C. PACD: 94

7. ESTIMATED COSTS ($000 OR EQUIVALENT, $1 =)

FUNDING SOURCE		LIFE OF PROJECT
A. AID	23,000	23,000
B. Other U.S. 1.		
B. Other U.S. 2.		
C. Host Country	31,800	31,800
D. Other Donor(s)	24,600	24,600
TOTAL		79,400

8. PROPOSED BUDGET AID FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	C. PRIMARY TECH. CODE 2. Loan	D. 1ST FY 84 1. Grant	D. 1ST FY 84 2. Loan	E. LIFE OF PROJECT 1. Grant	E. LIFE OF PROJECT 2. Loan
(1) FN	000	601		2,000		23,000	
(2)							
(3)							
(4)							
TOTALS				2,000	—	23,000	—

9. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 070, 019

10. SECONDARY PURPOSE CODE

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

A. Code	BR	BL	PART	EQTY			
B. Amount	25	25	25	25			

12. PROJECT PURPOSE (maximum 480 characters)

To support the establishment within the University of Sanaa, Yemen's first Faculty of Agriculture, which will be responsive to the YAR's agricultural needs, is supportive of private and public sector development, and has appropriate linkages to the agricultural sector's production and institutional structure.

13. RESOURCES REQUIRED FOR PROJECT DEVELOPMENT

Staff: (1) An expert familiar with AID's authorization documents and proceedures.
(2) Education Administrator/curriculum specialist/agronomist (team leader).
(3) Agricultural Economist/Manpower Development Analyst.
(4) Social Anthropologist.

Funds (5) Animal Production/Protection Specialist.

Cost is 45 person days X 5 X $375 or $84,375. Funds will come from the CORE Subproject support under contract NE-C-1698 with onsortium for International Developmer

14. ORIGINATING OFFICE CLEARANCE — Signature: ____ Title: Mission Director — Date Signed: MM 05 DD 18 YY 83

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

16. PROJECT DOCUMENT ACTION TAKEN — S = Suspended, A = Approved, D = Disapproved, CA = Conditionally Approved, DD = Decision Deferred

17. COMMENTS

18. ACTION APPROVED BY — Signature: ____ Title: ____

19. ACTION REFERENCE

20. ACTION DATE — MM DD YY

AID 1550-2 (8-79)

FACULTY OF AGRICULTURE SUBPROJECT
OF THE
AGRICULTURAL DEVELOPMENT SUPPORT PROGRAM
PROJECT 279-0052
YEMEN ARAB REPUBLIC

Yemem has an inadequate supply of technical-trained agriculture personnel to develop the country's agriculture potential. Agriculture is Yemen's largest sector and the majority of the population are rural inhabitants. The AID Agriculture Sector Assessment (December 1982) concluded that the first strategic priority for USAID agriculture assistance in Yemen should be B.S.-level education. This subproject will assist Yemen to develop the capability to trian agriculture personnel to the Bachelor level at their own Faculty of Agriculture. The purpose is "to support the establishment within the University of Sanaa, Yemen's first Faculty of Agriculture which will be responsive to the YAR's agricultural development needs, is supportive of private and public sector development, and has appropriate linkages to the agricultural sector's production and institutional structure."

AID funding for a ten-year period will be used to train 15 Yemenis to the Ph.D. level in the United States to become the faculty; establish the instructional farm on the FOA campus which will be an integral part of the curriculum; provide three professors to fill positions until Yemenis staff complete their Ph.D. training; provide training and advisory assistance for the Yemeni dean, librarian, and instructional farm manager; purchase limited laboratory equipment; design the classroom/office buildings; and supervise construction of the same.

YARG is providing the land, Yemeni staff and salaries, and operating costs. YARG is seeking a loan from another Arab country to pay for construction of the classroom/office buildings.

Illustrative Life of Subproject Obligations (FY 84-93)
($000)

Component	AID Contribution Grant	YARG	Other Donor Parallel Financing	Estimated Total
Land		12,400		12,400
Technical Assistance (Personnel)	6,283	7,689		13,972
Training	2,948			2,948
Instructional Farm	1,947			1,947
Classroom/Office Buildings Design & Construction Supervision	1,700			1,700
Construction			23,375	23,375
Commodity Support	1,392			1,392
Other Direct Costs	1,881	2,688		4,569
Contingency and Inflation	6,721	9,026	1,169	16,916
TOTALS	22,872	31,803	24,544	79,219

PID Facesheet.....i
Project Data Sheet.....ii
Table of Contents.....iii
Acronyms.....v
SPID Design Team.....vii
List of Tables.....ix
List of Figures.....xi

I. SUMMARY.....
A. Overview.....1
B. Key Points for Consideration by PRC and NEAC.....4

II. PROGRAM FACTORS.....
A. Conformance to YARG Development Strategy.....6
B. Relationship to CDSS.....6
C. Relationship to Agriculture Sector Assessment.....7
D. Relationship to Agriculture Development Support Program..7
E. Other Donor Involvement in Agriculture Education.....9

III. PROJECT DESCRIPTION
A. Statement of the Problem.....11
B. Alternative Approaches.....12
C. Summary Project Description.....12
1. Project Goal and Purpose/End-of-Project Status.....16
2. Expected Outputs.....19

IV. FACTORS AFFECTING PROJECT SELECTION AND DEVELOPMENT.....
A. Institutional Settting.....21
B. Labor Force Need Analysis.....24
C. Social and Institutional Considerations.....26
D. Economic Considerations.....29
E. Estimated Costs and Method of Financing.....31
F. Physical Contingency and Price Escalation.....34
G. Proposed Grantee and Implementing Agency.....34
H. Environmental Threshold Recommendations.....35
I. Design and Policy Issues.....35
J. AID Implementation Strategy.....42
K. Project Design Strategy.....45

TABLE OF CONTENTS
CONTINUED

V. ANNEXES

A. Logical Framework

B. Initial Environmental Examination

C. YARG Request for Assistance

D. Presidential Decree Establishing the Faculty of Agriculture

E. Scope of Work for SPP Team and SPP Outline

F. Preliminary Manpower Analysis

G. Preliminary Financial Plan

H. Preliminary Social and Economic Analysis

I. Preliminary Technical Analysis

J. Demonstration Farm Analysis

K. Request for Project Mobilization Fund

L. Cables

M. References

N. Prefeasibility Report (to be added)

O. Scope of Work Atchitect/Engineer Services (to be added)

ACRONYMS

ABS	Annual Budget Submission
ADSP	Agriculture Development Support Program
A and E	Architectural and Engineering
AID	Agency for International Development
AIYS	American Institute for Yemeni Studies
ARDA	Agricultural Research and Development Authority
CARS	Central Agricultural Research Station (Taiz)
CDSS	Country Development Strategy Statement
CID	Consortium for International Development
CID/Yemen	Consortium for International Development Yemen Office
CP	Condition Precedent (to Disbursement)
CPO	Central Planning Organization
CYDA	Confederation of the Yemeni Development Association
DLRC	Documentation Learning Resource Center
EOPS	End-of-Project Status
EPA	Environmental Protection Agency
FAPU	Faculty of Agriculture Planning Unit
FAO	Food and Agriculture Organization of the United Nations
FOA	Faculty of Agriculture
FFYP	First Five Year Plan (1976-81)
FSR	Farming Systems Research
FY	Fiscal Year
GDP	Gross Domestic Product

IBRD	International Bank for Reconstruction and Development
IEE	Initial Environmental Examination
LDA	Local Development Authority
LGU	Land Grant University
LIC	Lesser Income Countries
MAF	Ministry of Agriculture and Fisheries
MOA	Ministry of Agriculture (old designation which has been replaced by MAF)
MOE	Ministry of Education
NES	National Extension Service
NE/TECH/AGR	Near East Bureau, Office of Technical Support, Agricultural Development Division
NWSA	National Water and Sewage Authority
OSU	Oregon State University
RRC	Regional Research Center
SFYP	Second Five Year Plan (1981-85)
SOW	Scope of Work
SPID	Subproject Identification Document
SPP	Subproject Paper
SURDP	Southern Uplands Rural Development Project
TDA	Tihama Development Authority
TFYP	Third Five Year Plan
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
YAR	Yemen Arab Republic
YARG	Yemen Arab Republic Government
YR	Yemeni Rials(s): YR 1.00 = $ 0.22 YR 4.57 = $ 1.00

SUBPROJECT IDENTIFICATION DOCUMENT

DESIGN TEAM

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SUBPROJECT IDENTIFICATION DOCUMENT

DESIGN TEAM

(Continuation)

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Ali Alkhidr Kambel, Sorghum and Millet Expert

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MINISTRY OF EDUCATION

Mohammed Al-Harazi, Director of Agricultural Education

LIST OF TABLES

1. Alternative Approaches That Do Not Involve Establishing a Faculty of Agriculture in the YAR

2. Alternative Approaches That Involve Establishing a Faculty of Agriculture in the YAR

3. Broad Elements of the Development of the Faculty of Agriculture

4. Summary Financial Plan, FOA Components

5. Summary Financial Plan for FOA Subproject

6. Proposed Phasing Plan for FOA Subproject

F-1 Growth in Schools and Enrollment in the YAR Education System, 1962/63 to 1979/80

F-2 Agricultural Technical Manpower Employed at MAF as of 6/30/82 at the B.S. or Higher Level of Training

F-3 MAF-Estimated B.S. Level Agricultural Manpower that Would be Required for Major Agricultural Projects in Pipeline as of October 1, 1981

F-4 MAF Project for FY 83 [Including Donor Agencies Recognizing that the YARG Contributes to all Projects]

F-5 Requirements for Graduate and Post Graduate Training in Agriculture, Veterinary Science, Fishery and Irrigation during the Second Five Year Plan (1981 - 1986)

F-6 Yemeni Students Sent Abroad for University Training in Agricultural Fields from 1974 - 1980, MAF Projections of Expected Returns of Such Students, and Actual Returns to MAF through June 1982

F-7 Projected Supply of B.S. Degree General Agriculture Students Entering YAR Agricultural Public Sector From FOA - University of Sanaa and Overseas Sources

F-8 Agricultural Technical Manpower Employed by MAF at the Technical [Secondary] Level as of 6/30/82

F-9 A Preliminary Comparison of Curriculum Requirements at Agriculture and Science Secondary Schools Expressed in Years of Training by Subject

F-10 Estimated MAF Manpower Needs at the Technical Secondary Level Required for Major Agricultural Projects in Pipeline as of October 1, 1981

G-1 Summary Financial Plan

G-2 Summary of Detailed Work Sheets for AID Dollar Budget

G-3 Detailed Work Sheets of AID Dollar Budget

G-4 Summary of Detailed Work Sheets AID Local Currency Budget

C-5 Detailed Work Sheets for AID Local Currency Budget

G-6 Summary of Detailed Work Sheets for YARG Budget and Donor Parallel Financing

G-7 Detailed Work Sheets for YARG Local Currency Budget

H-1 Comparison of Educational Incentives at Secondary and University Levels

H-2 Comparison Salary Levels for various Occupations

H-3 Projected Actual and Projected Present Value of AID, YARG, and Other Donor Costs for Establishing and Operating a Faculty of Agriculture for 20 years

H-4 Projected Actual and Projected Present Value of Costs for Training Abroad to the B.S. Level

H-5 Calculation of Adjustment to Number of B.S. Completed by the End of the Planning Horizon

H-6 Calculation of B.S. Graduates Available to YAR and the MAF by Training Alternative

H-7 Cost Per B.S. Trained by Various Training Alternatives and Available to YAR and the MAF

I-1 Proposed Phasing of FOA Participant Training

I-2 Staffing Plan for Proposed FOA

I-3 Proposed Curriculum and Practicum

J-1 Percentage of the Economically Active Yemeni Population Engaged in Various Occupations (1975)

J-2 Agriculture vs. Total Industrial Output for YAR (1979/80)

J-3 Education Status for the Yemeni Population 10 Years and Older (1975)

J-4 Estimated Number of University Trained Manpower for Agriculture Compared to Estimated Need for the Four Year Period 1979-1980

J-5 Distribution of Pre-University Students in 1979/80

J-6 Students and Faculty at the University of Sana'a During 1979/80

J-7 Students on Grants in Arab and Friendly Countries During 1979/80

J-8 Precipitation in Four Areas of YAR

J-9 Precipitation for Sana'a from 1963-1981

J-10 Temperature for Sana'a

J-11 Land Use in the YAR

J-12 Type of Agricultural Land

J-13 Production of the Main Crops in YAR and in the Province of Sana'a for 1979/80

J-14 Major Plan Commodities Consumed in YAR

J-15 Suggested Allocation of Land to Various Uses as a Function of the Size of the Water Supply

LIST OF FIGURES

Page -22 Figure 1 Administrative and Operational Linkages Associated with the proposed FOA

I-1 Proposed Organization for Faculty of Agriculture (1993)

I-2 Proposed Organization for Faculty of Agriculture (1999)

I-3 Proposed Organization for Faculty of Agriculture (2010)

J-1 Map of Demonstration Farm

J-2 Off-Campus Well Location

J-3 Farm Office and Crops Laboratory Building

J-4 Farm Livestock Center

J-5 Open Corral Area-Livestock Center

J-6 Poultry Building

J-7 Feed Center and Pump House

J-8 Farm Shop and Equipment Storage

I. SUMMARY

A. Overview

1. Recommendation

a. Authorization to proceed with preparation of a Project Paper for a Faculty of Agriculture (FOA) Subproject which will grant $23 million to the YAR for technical assistance, training, instructional farm development, architect and engineer services to design the faculty buildings and supervise construction and limited commodities under the Title XII Agriculture Development Support Program.

b. Approval for pre-subproject expenditures of up to $664,000 from the Core Subproject for farm site preparation - surveying, land leveling, grading, road construction, perimeter fencing, water distribution system, and farm building design. A detailed subproject mobilization budget and justification is presented in Annex K - Request for Project Mobilization Fund.

c. That as soon as the A and E Prefeasibility Report is completed, it be amended to this SPID as the final annex.

d. That all aspects of U.S. assistance for the FOA be included in one project paper.

e. That initial design activities for the classroom and office buildings continue with preparation of the program of requirements, site inventory, and schematic design prior to, or concurrent with, the design of the Project Paper.

2. Duration - Ten Years (FY 84 through FY 93)

3. Purpose

To support the establishment within the University of Sanaa, Yemen's first Faculty of Agriculture which will be responsive to the YAR's agricultural development needs, is supportive of private and public sector development, and has appropriate linkages to the agricultural sector's production and institutional structure.

4. Project Components

a. Twenty-two person years of technical assistance to establish and operate the FOA and its instructional farm.

b. Nine person years of professors to fill faculty positions until Yemeni professors complete their PhD training in the U.S.

c. Campus backstop support - Two people part time, a director and secretary, for ten years.

d. Six person years of short-term technical assistance.

e. Training fifteen Yemenis to the PhD level in the U.S. who will become the FOA faculty.

f. Six months specialized internship training for FOA dean, farm manager and librarian.

g. Buildings and equipment for the instructional farm.

h. Limited laboratory and teaching equipment.

i. Library resources.

j. A and E services to design the faculty classroom/office buildings.

k. A and E services to supervise construction of classroom/office buildings.

5. Justification

a. Agriculture is the largest sector of the Yemen Arab Republic's economy. Traditional agriculture practices prevail and the growth of the agriculture sector has been less than one percent per year. Lack of a trained Yemeni labor force in agriculture and the resulting low labor productivity is a major constraint for the agricultural sector.

b. The Agriculture Sector Assessment concluded that the highest priority USAID program in agriculture should be assistance to education emphasizing first B.S. level, and then secondary school level agricultural education.

c. The public and mixed sector demand for an agriculture labor force trained to the bachelor degree level is 1,540 persons through 1991 according to the YARG manpower study used to prepare the Second Five Year Plan (SFYP). Even though YARG's analysis of the private sector labor force requirement is not complete, it is estimated that the private sector demand in agriculture will equal the public sector demand. The most efficient manner of meeting this long-range demand for B.S.-trained agriculturalists is to develop an indigenous Faculty of Agriculture at the University of Sanaa with Yemeni professors.

d. The United States Government through AID is probably the world's leader in establishment of agriculture colleges and universities in developing countries. The Consortium for International Development (CID), the contractor for the Agriculture Development Support Program in Yemen, is composed of eleven U.S. Land Grant Universities and clearly has a comparative advantage in the development of a Faculty of Agriculture at the University of Sanaa.

e. Agriculture production will be increased when there are strong Yemen agriculture research, extension, and education/training institutions which are linked in a coordinated, supportive arrangement. Such coordination and mutual support depends on the existence of the three institutions in Yemen. One leg of this supporting arrangement is

missing as long as the education at the post-secondary level is being done outside Yemen in scattered countries and institutions. A Faculty of Agriculture in Yemen will provide the higher education side of the triangle but will also assist in the coordination with the other two elements through short-term and in-service training and through some research by faculty members.

6. Background

a. Yemen has attempted to meet some of its needs for trained agriculture personnel through foreign technicians either employed directly by YARG or provided through donor assistance. The next step in the development of Yemen's agriculture institutions is the training of Yemeni technicians who can replace the foreign personnel and fill the even greater number of vital positions that have never been staffed. Ever larger numbers of Yemenis go abroad each year for bachelor training in agriculture. There are disadvantages in the present system in terms of overall costs, loss of foreign exchange, relevance of training, and return and retention of personnel. It is a natural and appropriate evolution to move towards development of an in-country agriculture B.S. degree training facility.

b. The Yemen Government believes that a Faculty of Agriculture at the University of Sanaa should be developed to fill the gap of trained personnel in agriculture. However, only in the past two years have they initiated comprehensive studies which would provide guidance about the appropriate type of facility and how the faculty should be organized. The YARG has asked USAID to assist them in the process of planning and implementing a Faculty of Agriculture and USAID has indicated a willingness to participate.

c. YARG issued Republican Decree No. 51 establishing the Faculty of Agriculture on July 26, 1982. It is important for the development of Yemen's agriculture potential that the Faculty of Agriculture begin operation as soon as possible. Delays will increase the cost of construction, increase the cost of training Yemeni abroad, and will decrease the rate of development in the agriculture sector.

7. USAID Assistance Strategy

a. The USAID would like to assist Yemen with the development of the Faculty of Agriculture because of its high priority with YARG, because it is a type of project that USAID has done in other countries with considerable success and because it is particularly suited to the capabilities of the Land Grant Universities in the Consortium for International Development (CID) which implements the Agriculture Development Support Program (ADSP) in the collaborative mode with USAID and the YARG. Without a Faculty of Agriculture or with a Faculty of Agriculture developed with technical assistance from another donor, the effect of the long-term U.S. agriculture assistance will be reduced significantly.

b. U.S. assistance for the development of a Faculty of Agriculture will not include funding for construction of the faculty buildings. The YARG understands that assurance of availability of funding for construction is needed before the U.S. Government will commit funds for this long-term technical assistance project. YARG provided official letters (Annex C) stating that funding was available from Iraq. Due to the conflict between Iraq and Iran, that funding from Iraq is not available now. YARG is seeking a funding commitment from another donor or donors. Several donors have indicated a strong interest in funding the Faculty of Agriculture construction.

c. Concurrently with this FOA SPID, USAID is preparing an A and E Prefeasibility Study for the construction of FOA classroom/office buildings to provide YARG the necessary information that they need to obtain other donor funding. A draft of the prefeasibility study has been completed and distributed to the YARG for comments prior to completing the final report.

d. This FOA SPID and the draft prefeasibility were prepared by different contractors. The major difference between the two documents is the FOA opening date. This SPID describes a series of activities that will lead to a Faculty of Agriculture which plans for full operation in September 1986 while the draft prefeasibility study indicates construction will be completed by September 1987. The Mission does not have sufficient information to choose between the two alternate time schedules, but prefers to maintain the September 1986 opening date outlined in this SPID. This should ensure that the staff is trained before the buildings are completed which is preferable to the reverse.

B. Key Points for Consideration by PRC and NEAC

1. Preparation for Instructional Farm

The instructional farm will be an integral part of the FAO curriculum providing practical laboratory and educational exercises. It is important that this farm be ready for use by the first class of FOA students which may be as early as September 1986. A $664,000 mobilization budget is needed so that farm development can begin immediately to insure it will be in full operation by September 1985. This will allow a year to establish the livestock and cropping systems before the students enter. AID mobilization funding for the farm does not imply commitment to the long-term development of the farm or the overall FOA. The instructional farm will benefit agriculture development efforts in Yemen through its demonstrations, farmer visits, etc. Even without an FOA or without an AID supported FOA subproject, the farm could be used by YARG, USAID and CID as a central part of the Agriculture Development Support Program.

2. Parallel Financing

It is YARG's and USAID's objective to obtain parallel financing from another donor for construction of the FOA classroom/office buildings. The parallel financing will probably come from another Middle East country. This FOA project presents an opportunity for co-financing with Arab donors for a major technical assistance effort.

3. Detailed SPID

Even though this SPID is lengthy and detailed, Mission cautions that it should not be viewed as a project paper and that it does not answer all possible questions about a Faculty of Agriculture in the YAR. The SPID does address the issues raised by the NE Bureau in the May 29, 1982, memo prepared by Richard Cobb, NE/TECH/AD, and Peter Sellars, NE/DP.

II. PROGRAM FACTORS

A. Conformance to YARG Development Strategy

During the implementation of the YARG's First Five Year Plan (FFYP) from 76/77 through 80/81, the agricultural sector's average annual growth rate was less than one percent. The stagnation was due to several factors: lack of trained manpower, lack of irrigation, emigration of farm labor, product marketing, storage and distribution problems and insufficient public support to the sector. During this period, due largely to absorptive capacity constraints caused by the lack of trained human resources, only 38 percent of the investment projects planned for the agriculture sector were carried out. In the education sector, significant expansion of education opportunity occurred with a total of all pre-university enrollments rising from 276,000 in 1976 to 453,000 in 1981; university enrollment increased from 2,300 to 4,200.

Given the regional comparative advantages Yemen has for rain-fed and irrigated agriculture, and the diversified employment opportunities available in Yemen and outside of Yemen in the last eight years, it is clear to YARG planners that increased productivity of labor in agriculture is requisite for economic growth. Transfer of technology, improved human resource base and responsive public institutions of research, extension, and credit receive high priority in the YARG's 1982 through 1986 plan for agricultural development. The Central Planning Organization, University of Sanaa, Ministry of Agriculture and Fisheries, and Ministry of Education have agreed that creation of a university Faculty of Agriculture, using a generalized U.S. land-grant model, is the best means to transfer technology, train technicians and strengthen research and extension. Establishment of the Faculty of Agriculture during the 1982 through 1986 plan is one of the YARG's highest priorities. The Minister of Development, Minister of Agriculture and Fisheries, and the Prime Minister have strongly emphasized this priority in their discussions with USAID and other donors, notably the Saudi Fund and Abu Dhabi Fund.

B. Relationship to CDSS

AID strategy in the YAR since 1978 has concentrated primarily on expanding the YAR's human capital and on institution-building and technology transfer. The primary sectoral emphasis for these themes are agriculture and education. An extreme shortage of mid-upper level Yemeni technicians, managers, and researchers has retarded project/program implementation, hampered achievement of project goals, and, consequently, led to extension of project time frames and cost overruns. The YARG and other donors are equally aware of this manpower shortage. Development in Yemen has suffered from a neglect of investment in institutional and human capital. Institution building in Yemen requires both in-country primary and secondary education as well as technical and scientific education to produce the men and women who will be the catalysts, planners, and managers for the development process.

AID assistance to establish a Faculty of Agriculture at the University of Sanaa is a major element in both human resources and institutional development in Yemen. It complements other A.I.D. projects which assist primary and secondary education, institution building in the MAF, horticultural and poultry activities, and rural development projects. It also complements other donor projects which seek to expand the University of Sanaa during the Second Five Year Plan through creation of Faculties of Engineering and Medicine and improving existing Faculties of Education and Science.

C. Relationship to the Agricultural Sector Assessment

The Agriculture Sector Assessment (December 1982) recommended four strategy components for the AID agriculture assistance program in the YAR. Listed in order of priority, they are:

1. Assistance to education emphasizing first B.S. level and then secondary school level agricultural education.

2. Assistance to expanding the institutional capability of the MAF to provide services to private farmers.

3. Assistance to increase the capability of the MAF to undertake improvements which would increase the effective utilization of water supplies for irrigation.

4. Assistance to promote private sector development.

Education is of the highest priority because the major impediment to successfully carry out development activities is the lack of an effectively functioning work force in the public and private sectors. The top priority must be assigned to B.S.-level education for those who will provide education and training services to others in the agriculture sector. Agricultural education at the B.S.-level produces graduates who cannot only educate and train others, but also provide the necessary administrative and management skills needed for the successful operation of schools or training institutions such as an extension service. It is these graduates who are needed to staff the scientific, technical, and administrative upper levels in public and private institutions and organizations, including the MAF. B.S.-level personnel are also desperately needed to direct and implement development projects and provide suitable candidates for advanced degrees.

D. Relationship to the Agricultural Development Support Program 279-052

A key objective of USAID/Yemen's development assistance program in the YAR is institutional development through human resource education and training. In the agriculture sector, this objective is being achieved by implementation of the Agricultural Development Support Program (ADSP) under a long-term Title XII arrangement with the Consortium for International Development (CID). ADSP is a sector-wide program conducted in a collaborative mode which identifies, designs, and implements several

subprojects in priority areas. The goal of the ADSP is to increase income and improve the quality of life of rural inhabitants; the purpose is to improve the capacity of the YAR Government and Yemen's agriculture producers to develop and sustain an agricultural sector which effectively and efficiently uses Yemeni natural resources, is integrated into the economy and is supportive of a broad-based and equitable social and economic development. The thrust of the program and all of its subprojects is to support the establishment in the YARG of a strong institutional base that will facilitate accelerated agricultural development.

Several ADSP suprojects are currently being implemented:

- Core
- Horticulture Improvement and Training (HITS)
- Poultry Extension and Training (PETS)
- Ibb Secondary Agricultural Institute (ISAI)

The Core Subproject is responsible for providing technical assistance and training to the central administration of the Ministry of Agriculture and Fisheries (MAF) in planning, policy analysis, design, implementation and evaluation of national agricultural development efforts. Core is also responsible for coordinating with the YARG in the development of additional subprojects and providing broad administrative and logistical support for their implementation.

The Horticulture Improvement and Training and the Poultry Extension and Training Subprojects are expected to provide the MAF with an institutional capacity to support increasing fruit and poultry production and protection services for rural producers through education and training.

The Ibb Secondary Agricultural Institute Subproject supports the education and training of mid-level agricultural technicians who will enter into public or private sector services, or who are eligible for university training in the agricultural sciences. This cadre will form an essential element that will contribute to agricultural development efforts in the YAR.

The proposed Faculty of Agriculture (FOA) Subproject will contribute directly to a major, end-of-program, status of element of the ADSP.

> An agricultural education system identifying small farmer and rural population needs and capabilities, and providing responsive education and training...in technology, economics, and administrative skills.

The FOA Subproject will support and complement the MAF's program and other subprojects in the ADSP by:

- Producing graduates who will serve as managers and counterparts in MAF and donor-sponsored projects and as candidates for participant training programs for graduate level study;

- Producing candidates for M.S. level training who will serve in a teacher or training capacity (multiplier effect) in agricultural, technical and vocational schools and in MAF/donor-sponsored development projects;

- Providing opportunities for in-country refresher training for agricultural personnel;

- Strengthening research on priority agricultural and rural development issues, including those being addressed by ADSP subprojects;

- Supporting those agencies that are active in developing and extending technology to private producers and cooperatives, including technology being developed in ADSP subprojects;

- Supporting growing needs for well-trained technical manpower in the private sector; and,

- Demonstrating to local farmers improved cultural practices on the instructional farm which will support activities of other AID, MAF, and other donor projects.

E. Other Donor Involvement in the Agricultural Education Subsector

The current status of agricultural education and training in the YAR is well documented in the recent AID Agriculture Sector Assessment:

> "There are few opportunities to receive any education in agricultural subjects in the YAR. No agriculture is taught in the primary or regular secondary schools; nor is there an agricultural college at the university. There are only three technical agricultural schools within the YAR school system: The Ibb Secondary Agricultural School, the Surdud Secondary Agricultural School, and the Sanaa Livestock Secondary School."[1/]

The Ibb Secondary Agricultural School is a three-year school with a functional capacity of 60 students per year and an actual enrollment of 52 students in its first (1982) graduating class. It is in its fourth year of operation with AID assistance. The school offers secondary level technical training for agricultural extension agents and technicians. Graduates can also pursue university agricultural studies.

The Surdud Secondary Agricultural School, modeled after the Ibb School, enrolled its first students in 1982 with IBRD financing. Like the Ibb School, Surdud offers three-year secondary technical training for agricultural extension agents and technicians. It has a functional capacity of about 50 students per year.

The Sanaa Livestock Secondary School, also financed by IBRD, initiated operations in 1982. It too has a functional capacity of about 50 students per year for a total of 150 students. The program emphasizes

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1/ AID Agriculture Sector Assessment of the YAR, p. 92, December 1982.

animal production and health courses. Graduates will serve as animal husbandry/veterinary technicians. Initial enrollment in all three schools has been below capacity.

In addition to long-term formal education, short-term training of one year or less is provided under various donor projects in extension, plant and animal production and protection, animal health, and agricultural modernization. They include the AID-funded subprojects in the ADSP, the Southern Uplands Rural Development Project (SURDP), and the Tihama Development Authority (TDA) Project. These last two projects have trained between 250 and 280 agricultural extension agents since 1974. British sponsored projects have provided extension training in animal health and mechanics, producing about 180 trained Yemenis in the past seven years. The British Agricultural Mechanics Training Project provided two to four week courses for extension agents and rural mechanics. Generally, these donor projects provide training courses but do not leave in place a permanent Yemeni capacity for skilled or semi-professional training.

A. Statement of the Problem

The problem which the proposed Faculty of Agriculture Subproject will address is an acute shortage of educated Yemeni professional and administrative manpower to staff the agricultural institutions requisite for national agricultural development. The need for appropriately trained indigenous manpower is apparent, as documented by YARG and donor studies.2/ The draft Second Five Year Plan of the YARG states:

> "Among the most crucial problems which hindered the implementation of the nation's Three Year Plan, then its First Five Year Plan, was the critical scarcity of technical and specialized skills, and the acute shortage of administrative and professional capabilities. This has caused dependencies on foreign skills . . . for the implementation of development projects and has resulted in [cost overruns] and in underutilization of capacities. . . . A priority is reducing the country's reliance on non-Yemeni personnel."3/

A recent World Bank report echoes this concern:

> "Inadequate supply of technical level cadre has actually been the most serious bottleneck to the implementation of the (development program) and stands to be even more serious in the Second Five Year Plan."4/

The recent AID Agriculture Sector Assessment verifys the impact of the shortage of universtiy-trained Administrators and professionals, and proposes that top priority be assigned to B.S. level education.

The problem is illustrated by the demand in donor projects for educated Yemeni counterparts to serve in line positions and as candidates for graduate education. Competition among donors for scarce Yemeni talent is high. For example, the recently proposed World Bank Agricultural Research and Development Authority Project has a requirement for 44 senior scientists at technical and administrative levels, 49 junior scientists and 121 technical and administrative staff. While the World Bank is to provide graduate education for senior scientists, no baccalaureate or technical school education is planned.5/ This situation is representative of the real dimensions of a very difficult problem.

The YARG believes that external training of Yemeni students and importation of expatriate technicians is but a temporary solution, and, as such, is insufficient and undesirable to continue. In the long-term the YARG believes that establishment of a Faculty of Agriculture at the University of Sana'a is the appropriate solution to one aspect of its manpower dilemma. YARG has, therefore, requested AID and other donor support in this endeavor. The AID Agriculture Sector Assessment strongly encourages this decision by the YARG, and proposes that:

2/ See Annex L for listing of reports.
3/ Draft, Second Five Year Plan, Chapter 3, p. 27, YARG, March 1982.
4/ IBRD, Yemen Arab Republic Agricultural Sector Analysis, Nov. 1981; see also IBRD, "Manpower Development in the YAR," March 1981, p. 84.
5/ AID Agricultural Sector Assessment, p. 303.

priority need for continuing agricultural education at the university level in Yemen that merits USAID attention." 6/

B. Alternative Approaches

Alternative approaches to addressing the problem of shortage of baccaureate degree manpower have been examined by officials of the Central Planning Organization, MAF, Ministry of Education, and the University of Sana'a, as well as a number of outside donor agencies. After examining these alternatives, YARG reached the conclusion that appropriately trained manpower can be provided most appropriately by establishing an indigenous FOA within the University of Sana'a.

The alternatives evaluated in reaching this conclusion fall into two general categories. They are: (1) Approaches that involve establishing a FOA in the YAR and (2) approaches that do not. A qualitative specification of these alternatives which lists corresponding advantages and disadvantages is presented in Tables 1 and 2. A more detailed economic analysis of B.S. level training is presented in Section IV.D.

C. Summary Project Description

This project will support the establishment within the University of Sana'a of a Faculty of Agriculture to train Yemeni students in agricultural sciences at the baccalaureate level.7/ Table 3 summarizes broad elements of the overall development of the FOA. It is proposed that AID support to the FOA be provided in two activities: (1) Technical assistance, training, instructional farm and laboratory development, provision of library reference materials; and (2) Architectural design services for the FOA classroom, library, laboratory, and office buillidngs and engineering supervision of the construction program. The building construction will be funded by other donors.

Proposed AID support described in this SPID will include:

-U.S. technical assistance for curriculum development and for key faculty and staff positions while Yemeni counterparts complete training programs (45 person-years);

-U.S., third-country, and in-country training of key faculty and staff in long and short-term programs and on-the-job training (46 student-years);

-Development of an instructional farm on the FOA campus, including facilities, farm equipment, and supplies;

-Establishment of an instructional/research greenhouse and several agricultural sciences laboratories, including scientific equipment, materials, and supplies;

-Reference materials for an FOA library; and

-Engineering supervision of the construction phase of the instructional farm facilities.

6/ Ibid, p. 304.

7/ For the foreseeable future the proposed Faculty of Agriculture will be limited to baccalaureate level education only.

TABLE 1

ALTERNATIVE APPROACHES THAT DO NOT INVOLVE ESTABLISHING A FACULTY OF AGRICULTURE IN THE YAR

Alternative	Advantages	Disadvantages
1. Concentrate resources on secondary and/or technical/vocational training only.	1. An opportunity to strengthen existing institutions. 2. Meets some of the short-range training needs of the YAR. 3. More direct access to target beneficiary.	1. Will develop no in-country capacity to generate new knowledge. 2. Training will not be at the required higher levels. 3. The technology gap continues.
2. Continued and expanded importation of expatriate expertise.	1. Immediate solution to problem. 2. No fixed capital requirements. 3. Access to broad technology resource pool.	1. Lack of continuity. 2. Limited relevance of imported knowledge to Yemeni conditions. 3. External influence on Yemeni cultural system. 4. More Expensive
3. Continued and expanded training overseas.	1. Access to broad educational pool. 2. Minimizes intellectual inbreeding. 3. No fixed capital requirements.	1. Very costly. 2. Limited relevancy of training to Yemeni conditions. 3. High attrition rates.
4. Student training overseas with practicum in the YAR.	1. More practical and relevant. 2. Limited fixed capital requirements. 3. Access to broad technology resource pool.	1. Perceived as too costly. 2. High attrition rates. 3. Difficulty in arranging faculty supervision and input during practicum experience.

TABLE 2

ALTERNATIVE APPROACHES THAT INVOLVE
ESTABLISHING A FACULTY OF AGRICULTURE IN THE YAR

Alternative	Advantages	Disadvantages
1. Faculty of Agriculture at the University of Sana'a staffed primarily with expatriates.	1. Potential access to better talent. 2. Minimizes potential for inbreeding/ "deadwood." 3. Immediate solution.	1. Not consistent with attempts to Yemenize YAR institutions. 2. Not self-sustaining. 3. More expensive Education of expatriates not directly relevant to Yemeni conditions.
2. College of Agriculture in Sana'a independent of University of Sana'a and with an instructional farm.	1. Closer proximity to target beneficiary. 2. Encourages development of a more applied focus. 3. Deconcentration of institutions from Sana'a.	1. Lack of access to needed land resources. 2. Discourages close linkages with other University of Sana'a faculty, particularly Science. 3. No economies of size.
3. Faculty of Agriculture without an instructional farm on or near campus or without access to practical production experience.	1. Saves cost of establishing farm.	1. No practical experience. 2. Weak or nonexistent linkages to the production sector. 3. Limited relevance of training.
4. Faculty of Agriculture without an instructional farm on the main campus (use other farms).	1. Would encourage linkages to local farmers for practicum training. 2. Would result in wider diversity of practicum experience. 3. Lower initial cost.	1. Difficult in gaining access to local practicum sites. 2. Travel time would discourage use of practicum training. 3. Training would consequently focus on theory, with little practical application.

Alternative	Advantages	Disadvantages
5. Substitute the Ibb School program with a Faculty of Agriculture.	1. Would encourage linkages to local farmers for practicum training. 2. Potential for wider diversity of practicum experience. 3. Lower initial cost.	1. Difficulty in gaining access to local practicum sites. 2. Detracts from the needed role of Ibb School secondary training 3. Faculty and students would be isolated from other campus faculties and resources. 4. Discourages effective linkages to the MAF.
6. Modify Ibb School to include baccalaureate program with a Faculty of Agriculture.	1. High probability of strong practical emphasis in curriculum. 2, Faculty would be located in close proximity to targeted beneficiary. 3. Faculty would be located close to major research station.	1. Inadequate land and resources at Ibb for both baccalaureate and secondary programs. 2. Faculty and students would be isolated from other campus facilities and resources. 3. Discourages effective linkages to the MAF.
7. Faculty of Agriculture limited to offering an Associate of Arts (2-year) degree or non-degree education.	1. Entrance standards likely lower, would provide wider access to targeted beneficiaries. 2. Lower cost.	1. Lower benefits with respect to goal and purpose. 2. No mechanism for replacement of faculty. 3. Faculty would not have same professional status as colleagues in other faculties at the university.
8. Faculty of Agriculture at University of Sanaa with Yemeni staff and an instructional farm on the main campus.	1. Agriculture education linked with other facilities in Sanaa University. 2. Practical instruction integrated into cirriculum. 3. Yemeni institution with relevance to Yemeni conditions. 4. Encourages effective links with MAF 5. Self-containing	1. Substantial initial capital costs. 2. Concentration of institutions in Sanaa 3. Geographically not a principle agriculture region.

Proposed AID support described in draft Prefeasibility Report will include:

U.S. Architect/Engineer services to prepare

-Program of requirements

-Site inventory

-Schematic design

-Design development

-Contract documents

-Bid analysis

U.S. Architect/Engineer services to

-Supervise construction

1. Project Goal and Purpose/End-of-Project Status

The FOA is being proposed as a subproject of the ADSP (279-052). The broad goal of the ADSP is "to increase rural incomes in the YAR through agricultural development." Each subproject contributes to the realization of this goal by supporting a more specific subgoal. The subgoal of the FOA Subproject is:

> "To increase the supply of appropriately trained manpower to plan, manage, implement, and evaluate development activities in the private and public agricultural sector of the YAR."

Achieving the purpose of the FOA subproject is expected to have a significant impact on the above mentioned subgoal. The purpose of the FOA Subproject is:

> "To support the establishment within the University of Sana'a, Yemen's first Faculty of Agriculture which will be responsive to the YAR's agricultural development needs, is supportive of private and public sector development, and has appropriate linkages to the agricultural sector's production and institutional structure."

This purpose statement reflects the objectives of the FOA as jointly defined by the University of Sana'a, the MAF, and the MOE, and recommended by three donor agency studies.

The proposed subproject is expected to continue for 10 years, beginning in FY 1984. There are five major end-of-project status elements which should exist by FY 1993, the end of AID's proposed contribution to the FOA. These are:

> a. A functional, indigenous Faculty of Agriculture, within the University of Sana'a, engaged in teaching and applied research and assisting MAF extension activities;

TABLE 3

BROAD ELEMENTS OF THE DEVELOPMENT OF THE FACULTY OF AGRICULTURE 1/

AID PROJECT		PARALLEL FINANCING OF OTHER DONORS	YARG
Institutional Development (Technical Assistance/Training)	Faculty Design and Supervision of Construction		
1. Pre-Authorization Mobilization Activities in Training and Farm Development (including site preparation, fencing, roads, etc.)	1. Preliminary FOA Building Design (including classrooms, Library, Labs, Offices) a. Prefeasibility Study b. Program of Requirements c. Site Inventory d. Schematic Design		1. Pre-Project Planing Activities 2. Land for FOA and Farm
2. U.S. Technical Assistance 3. Participant Training 4. Instructional Farm Development and Building Construction 5. Instructional Greenhouse and Laboratory Development 6. Library Reference Materials	2. Final Design of FOA Buildings 3. Engineering Supervision of Construction Phase	1. Construction of All FOA Buildings, except the Instructional Farm Buildings 2. Furnishings for Above	3. Local Faculty and Staff 4. Operating Expenses (including Utilities, local transportation, Maintenance, Repair, etc.) 5. Equipment Replacement

shed line separates mobilization and implementation phases.

baccalaureate level and assuming responsible technical and management positions in the private and public agricultural sector;

c. Continuing collaboration between the Faculty of Agriculture, the MAF, the MOE, private agencies, and agricultural producers on:

(1) Research and research priorities;

(2) Extension;

(3) Curriculum development for two-year and baccalaureate level programs;

(4) Agricultural and technical secondary school training;

(5) Other formal agricultural training programs (workshops, seminars, etc.); and

(6) In-service training.

d. An operational instructional farm that is integrated into the curriculum and research functions of the Faculty of Agriculture; and

e. A productive and ongoing sister university relationship between the Faculty of Agriculture and one or more U.S. land-grant university faculties of agriculture.

This subproject is clearly institution building by design, and has as a by-product of this focus the graduation of students educated in agricultural sciences. The primary concern is to institutionalize within the YAR a capacity to produce trained agricultural manpower at the B.S. level. Graduates constitute the major, but not the sole, raison d'etre for the FOA.

The SPID design team has identified several significant factors which affect the achievement of the project purpose and end-of-project status. These are:

a. The policies of the University of Sana'a will continue to permit and support the development of the Faculty of Agriculture, including the support function provided by the Faculty of Science;

b. Adequate facilities not funded by AID will be constructed in a timely manner;

c. The FOA will be successful in recruiting and graduating eligible students in satisfactory numbers;

d. Private agencies and the YARG, particularly the MAF and MOE, continue to support an indigenous FOA;

e. The incentive structure will attract and retain qualified Yemeni professors for the FOA;

f. YARG development and operational budgets for the FOA will be adequate, and funds will be released in a timely manner;

g. University/FOA facility and equipment maintenance and replacement policies will be implemented during and after the project;

h. Agriculture will continue to be a priority growth area for Yemen;

i. Curricula of YAR private and public secondary schools are adequate to prepare students for higher education. Agricultural technical secondary schools are flexible in modifying their curricula, as appropriate, to produce eligible candidates for entry into the FOA;

j. Coordination mechanisms can be established to link operationally the teaching functions of the proposed Faculty of Agriculture, the proposed Agriculture Research Development Authority (ARDA) of the MAF, and the Agriculture Extension component of the MAF and other donors.

k. FOA curriculum will provide theoretical and practical training relevant for commercial agriculture as well as traditional small farms.

l. Traditional and small farmers will be adequately represented through the student population of the Faculty of Agriculture;

m. U.S. land-grant universities will continue to expand the sister university relationships with the Yemen Faculty of Agriculture.

The above factors, except for k. and m., are largely outside the direct sphere of influence of subproject management. During the development of the Subproject Paper (SPP), each of these factors will need to be assessed as to validity and probable impact on the subproject.

2. Expected Outputs

To achieve the purpose of the FOA Subproject, eleven major outputs have been identified.

a. An appropriate and flexible administrative/organizational structure which can accommodate the projected growth in the FOA;

b. Trained Yemeni faculty members who are capable of instructing in agricultural sciences at the B.S. level, conducting research on priority Yemeni rural development issues, and assisting other institutions in agricultural extension activities;

c. A curriculum that is responsive to the agricultural training needs of the YAR including small traditional farmers, women, commercial farmers, and the institutions/agencies that provide agriculture support services;

d. Appropriate linkages with other key institutions of the agricultural sector;

e. An agricultural sciences library on the University of Sana'a campus;

f. Six agricultural science laboratories, one each in:

(1) Plant physiology,
(2) Animal physiology,
(3) Agricultural mechanization,
(4) Soil science,
(5) Foods and nutrition,
(6) Agricultural production processing;

g. An instructional farm on the University of Sana'a campus, which is integrated into the curriculum of the Faculty of Agriculture;

h. An instructional greenhouse on the University of Sana'a campus which is integrated into the curriculum of the FOA.

i. Graduates at the B.S. level;

j. Programs for in-service and refresher training for MAF personnel; and

k. A sister university relationship between the Yemeni Faculty of Agriculture and one or more U.S. land-grant university faculties of agriculture.

The SPID design team has identified several major assumptions for output achievement to be verified and analyzed during SPP development.

a. Qualified Yemenis are available for Ph.D. training will meet English language requirements, will complete training as scheduled, and will return to specified faculty positions;

b. Facility construction will not have appreciable negative environmental impacts;

c. Adequate water will continue to be available to support operation of FOA facilities, including the instructional farm;

d. Only minimal remedial education will be required of prospective Faculty of Agriculture students.

IV. FACTORS AFFECTING PROJECT SELECTION AND DEVELOPMENT

A. Institutional Setting

The Yemen Arab Republic cast off its isolationist cloak in 1962 with a civil war which continued into the early 1970's. Even today, all of the country does not come under the direct influence of the central government. There is no tradition of a central government able to provide effective public services. However, increasingly, the villages are looking to the government for access to public goods in return for taxes.8/ The YAR has undergone profound and fundamental political, economic, and social changes which established the foundations of a modern state during the 1970's. Key economic factors have been the massive outflow of labor to neighboring oil countries, remittances which have triggered significant private investment back into the predominantly agrarian economy, increased demand for food and consumer goods, massive inflows of donor aid, weak absorptive capacity, and limited central government planning activities. 9/, 10/

Labor outmigration has placed severe stress upon maintaining agricultural production even though 90 percent of the YAR population is rural. Shortage of skilled manpower is an overriding constraint to development as skilled manpower is drawn from a labor pool with very limited education and no modern agricultural training.11/

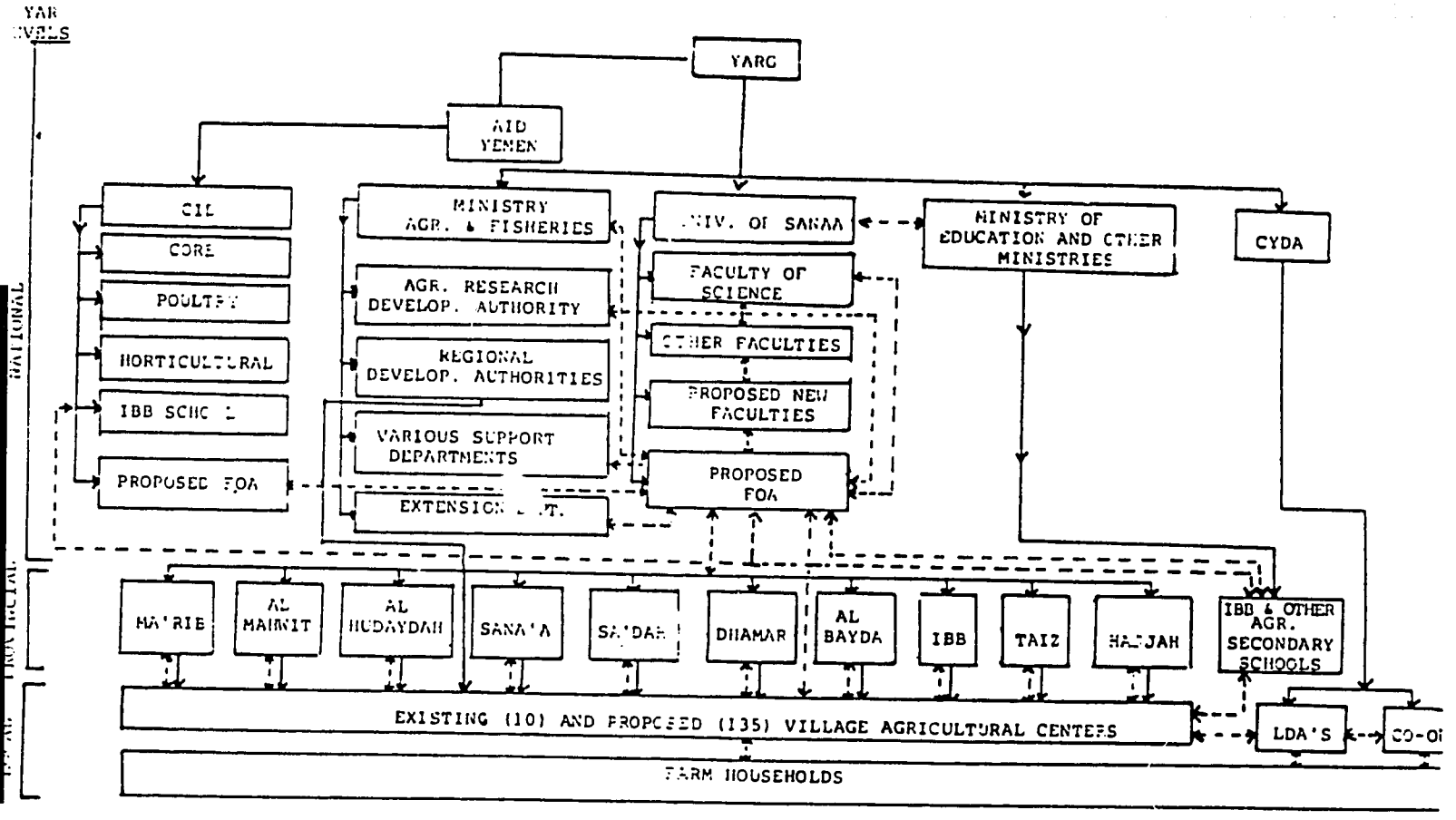
8/ Cohen, John M. and David B. Lewis, "Rural Development in the Yemen Arab Republic: Strategy Issues in a Capital Surplus, Labor Short Economy," Development Discussion Paper No. 52, Harvard Institute for Interntional Development. February 1979, p.9.

9/Obtained from three World Bank sources:
(1) Manpower Development in the Yemen Arab Republic, Report No. -3181a, YAR, March 27, 1981.
(2) "Third Education Project, Yemen Arab Republic," Report No. 2246-YAR April 27, 1979.
(3) "Yemen Arab Republic, Development of a Traditional Society," World Bank Country Study, January 1979.

10/A detailed treatise of Yemeni imigration is provided in Jon C. Swanson's book, Emigration and Economic Development: The Case of the Yemen Arab Republic, Westview Replica Edition, 1979.

11/Refer to footnote #11 re. World Bank, Manpower Development in Yemen Arab Republic.

FIGURE 1. ADMINISTRATIVE AND OPERATIONAL LINKAGES ASSOCIATED WITH PROPOSED FACULTY OF AGRICULTURE



The foundations of the country's physical and social infrastructure were laid by the YARG's First Three Year Development Program in 1973-76 and the First Five Year Plan (FFYP) in 1976-81. Both plans placed primary emphasis upon (1) building institutions for agricultural and rural development and (2) building a public school system which provides free country-wide primary and secondary education. Heavy reliance upon non-Yemeni teachers and instructional materials have been required to implement these programs.

No agricultural institutions existed prior to 1970. The Ministry of Agricultural and Fisheries (MAF) was organized in 1970. Agricultural research independent of MAF was initiated in 1973 with the establishment of a Central Agricultural Research Service (CARS) in Taiz in the Southern Uplands region with UNDP/FAO support. Research continued to expand with an increasing number of commodity-oriented bilateral assistance projects. All research projects to date have been conducted independently with little regard to overall coordination. The National Extension Service (NES) was added to MAF during the FFYP. It has operated almost entirely on a regional basis. The extention agents in regional and central MAF offices are funded by the MAF. Agents working out of regional development offices are funded by outside donors.

Plans have been developed, but not yet approved, to reorganize the MAF research activities as outlined by a World Bank loan proposal. The plan calls for all agricultural research in YARG to be supervised and coordinated by an Agricultural Research and Development Authority (ARDA), with establishment of ARDA Headquarters and Central Highland Regional Research Center (RRC) in the Dhamar area, the Tropical Lowland RRC in Surdud, and the Southern Uplands RRC at the CARS site in Taiz.

The ARDA plan, if implemented, is expected to provide national coordination for all agricultural research and provide research sites for each of YAR's three major ecological zones.

There are limited opportunities to receive training in agricultural subjects in the YAR. No agriculture is taught in the primary schools nor the regular secondary schools. There are only three secondary agricultural technical schools in the YAR. Each provides three years formal technical training beyond the ninth grade, culminating in a technical school diploma (see Section II.D. above). All secondary schools are administered by the Ministry of Education (MOE). The agricultural secondary schools are to supply all technical level manpower needs of the country, primarily for NES (see Annex F for details). Short-term in-service agricultural technical training is being provided by various donor sponsored projects, including CARS, the British Veterinary Services Project, the British Agricultural Engineering Project, and ADSP horticulture and poultry subprojects.

There is one university in the YAR, the University of Sana'a, and it contains four faculties: Law, Education, Science, and Commerce. Faculties of Medicine, Engineering, Veterinary Medicine, and Agriculture are planned. Priority needs for the FOA are to train agricultural technicians and B.S. graduates to: (1) Staff the MOE and MAF in technical, professional, and administrative roles, (2) Staff some 56 on-going donor supported agricultural and rural development projects, (3) Provide

personnel for the emerging agri-business sector, (4) Collaborate in the development and staffing of a national agricultural extension service, and (5) Provide technical expertise for numerous local development authorities and a growing credit/banking system.

At this point in time, no firm coordination mechanisms have been established to link operationally the teaching functions of the proposed Faculty of Agriculture, the proposed ARDA of the MAF, and the proposed agricultural extension component of the MAF. Such linkages are fundamental to the successful operation of a system which requires integration of research, teaching, and extension functions to serve an agricultural public which consists of farmers as the ultimate clientele group. The university is to play an important educational and coordinative role vis-a-vis the U.S. land-grant model in providing the technical training and research skills for modernizing the agricultural sector and to provide potential for improved agricultural production. Figure 1 illustrates the preliminary proposal for effecting FOA linkages with other agricultural institutions.

B. Labor Force Need Analysis 12/

The MAF had fewer than 500 trained agricultural technicians assigned to five governorates in 1974. No extension existed at that time. By mid-1982, MAF had grown to approximately 750 technical personnel in ten governorates, 187 having B.S. degree level training or higher, and the remainder of over 550 employed as secondary level technicians in an expanding extension service (Tables F-2 and F-8, Annex F).

1. Public and Mixed Sector Demand for Agricultural Manpower Trained to the Bachelor Level

Needs for trained agricultural manpower at the university level (B.S. degree) have been projected through 1991 as follows:

Need	Approximate Numbers
To replace expatriates currently in MAF (as of 6/30/82)	90
To complete FFYP needs	250
To meet SFYP projections for 1982-1986	600
To meet TFYP projections for 1987-1991	600
Total	1,540

The rate of projected demand (need) is assumed to be constant for each FYP resulting in a constant total demand of 600 in each five year planning period.

12/The following section is a summary of Annex F. Reference is made to several tables in Annex F which are not replicated herein. The reader is encouraged to read the more complete analysis in Annex F.

2. Labor Force Strategy

Based upon the above analysis for agriculture and similar analyses in other fields, the YARG has identified education and labor force development as a high priority for its second Five Year Plan period. As part of the process to develop the SFYP, the YARG completed a fairly comprehensive labor force study which concentrates on public and parastatal labor force needs. The YARG has begun a survey of private sector labor force needs. USAID provided technical assistance for the first YARG labor force study through Project 279-0040. USAID plans to continue to assist YARG to update and elaborate on their labor force study and strategy through technical assistance and training under the proposed Development Training II Project (279-0080).

The available labor force survey and the estimated labor force requirements in the private agriculture and agriculture business sector, clearly indicate the need for specialized and advanced training in agriculture. Increasing the productivity of labor in agriculture is a necessity for development of Yemen's economy. The YARG has therefore placed high priority on the development of indigenous agriculture training institutions three agriculture high schools already operating, and this proposed Faculty of Agriculture established by Republican Decree No. 51, July 26, 1982.

3. Supply of Undergraduate Trained Agricultural Manpower

All post-secondary school level agricultural training of Yemenisto date has been from training abroad, primarily from Arabic speaking universities of the Middle East. During the eight year period from 1974 through 1980, 655 students were sent abroad for B.S. level training in agriculture. Of that number, a total of 53 have returned to employment with MAF (Table F-6). It appears that the approximate time to obtain a B.S. degree overseas is about five to six years. With such an apparent return time lag, the actual return rate to MAF is about 15 percent (sum of first four years' number of students sent out (376) - number returned (53).

4. Bachelor Level Supply Projection from Overseas and FOA Sources

The projected supply of B.S. level Yemeni agriculturalists from both overseas and FOA sources is presented in Annex F., Table F-7. Assumptions are presented as footnotes at the bottom of Table F-7. Column 3 shows a total of 447 B.S. level agriculturalists returning to MAF from overseas in response to the FFYP, SFYP, and TFYP. No projection is made beyond TFYP. The projected supply of B.S. level agriculturalists to MAF from FOA through 1999 is 648, and a total of 1,095 through 1999 from both overseas and FOA sources. Projections beyond 1999 can be made easily as they reflect a constant 72 graduates from FOA and 30 from overseas--if an additional 600 students are sent abroad for the Fourth Five Year Plan.

The projected need of 1,540 B.S. level trained agriculturalists would be met from bo' overseas and FOA sources, assuming the sending of another 600 student overseas for the Fourth Five Year Plan, by 2003 and by 2005 with graduat. coming only from FOA.

It is concluded from this analysis that:

a. Both FOA and overseas training are necessary to meet manpower projections through the Fourth Five Year Plan.

overseas training complements (by providing 40 percent of B.S. students) the FOA output which is not adequate by itself; therefore, continued overseas training is recommended.

5. Manpower Analysis for Secondary Level Technical Training

A manpower analysis of the secondary level agricultural technical component similar to that presented in this SPID for B.S. level agriculturalist training will be conducted in the SPP.

C. Social and Institutional Considerations 13/

1. Overview of YAR Agriculture

The dominant social and institutional conditions which are influencing Yemen's agricultural sector may be summarized as:

a. An historically efficient and complex subsistence agriculture sector based upon labor abundance, scare land, and scarce water resources. Drought tolerant sorghum/millet crops combined with livestock as a source of fuel, animal protein and power have provided the basic production components with irrigation limited to less than 15 percent of the land area.

b. Low and declining overall agricultural production within which 90 percent of the population depends directly or indirectly for livelihood.

c. A significant shift, since 1972, to relative labor scarcity and high wage rates generated by migration to Arabian oil fields; such a condition may have stabilized due in part to a softened oil market and increased labor competition from Asia.

d. Extensive use of remittances at village level for road and school construction, which has exposed heretofore isolated mountainous regions to the outside world.

e. Limited investment opportunities to increase production in agriculture resulting in an increase in consumption investment and a consequent reduction in capital investment in the rural areas.

13/The following section is a summary of Annex H. Reference is made to a number of topics which are treated at length in the appendix. The reader is encouraged to examine thoroughly the more complete text in Annex H.

f. Regionalized agricultural research capacity centering in Southern Highlands with limited central authority. Little agricultural research focusing upon the typical rainfed sorghum/millet crop and livestock conditions of Central and Northern Highlands.

g. Small and fragmented privately-owned plots dominate land holdings due to steep, mountainous, terraced terrain, Islamic inheritance laws, and farmer strategy to hedge against variable micro-conditions.

h. Men have been responsible largely for field work with animals, construction (buildings, terracing, roads, etc.), and product marketing; children are responsible for herding; women are responsible for livestock feeding, water and fuel gathering, food preparation, and other household activities.

2. Emphasis Upon Education

A concentrated thrust by YARG, which is supported by local villages, is to provide free education to all through at least the sixth grade. Extreme scarcity of skilled teachers has forced Yemen to use a large number of expatriates at all educational levels. Such foreigners are being replaced as soon as possible with trained Yemenis to provide greater opportunity for "Yemenization" and less influence of others upon the socio-cultural value system of Yemen. Training of Yemenis abroad has not provided the types of technical skills required to match the needs of Yemen agriculture.

3. Beneficiaries of FOA

Primary beneficiaries associated with the development of a Faculty of Agriculture at the University of Sana'a are expected to be the agricultural students trained at the B.S. level who will staff positions in the public and private sectors. Secondary beneficiaries will be the public and private agricultural institutions which employ the graduates in technical and administrative positions. The public institutions include the research and extension components of MAF, the regional development authorities and the MOE, which needs agricultural teachers to serve its secondary level technical training responsibilities. The private agri-business sectors include credit banks and agricultural input and product processing and marketing firms. Indirect, but ultimate, beneficiaries will be villages, families, and individuals--both as agricultural producers and as product consumers. They are expected to benefit over time through institutional capacity building of agricultural instruction, research, and extension components in the public sector to develop and extend improved technology. This, in turn, is expected to increase food production, increase rural incomes, and reduce the real cost of food to Yemeni consumers through improved production efficiency.

Direct access to public officials, including those of the university, and widespread use of TV and radio are expected to serve as important media to the rural communities in expressing needs and response by the agricultural institutionsin providing new technology and accompanying information.

While education of women is not emphasized by Yemeni culture, official government policy encourages their involvement. The FOA curriculum has human nutrition, animal husbandry, and food preparation and processing components designed to involve women. Additionally, the FOA will be involved in research to assess changing agricultural production and household patterns and their impact upon various members of a household.

4. Linkages

Development of both administrative and operational linkages between FOA and other public and private institutions is fundamental to achieving an institutional system which (1) permits needs of individual farmers and villages to be projected upward through the system to be addressed by researchers and teachers and (2) permits information and technology from teachers and researchers to flow back down through the system for testing, evaluation, and modification and utilization at the village and farm level.

The development of administrative linkages between research, teaching, and extension components continues to evolve in YARG. Teaching and some research functions are expected to be the responsibility of FOA. Specific research and extension responsibilities of MAF are unclear, but are expected to be clarified with the proposed reorganization of MAF sometime in 1983. Research, teaching, and extension components in YARG have emerged largely as separate administrative units, a development common to most LDC 's, as contrasted to the LGU system in the U.S. which embraces all functions within a single institution (LGU - Land Grant University).

The administrative linkages to FOA which will be explored more fully in the SPP include the following:

University of Sana'a:

- Faculty of Science
- Faculty of Education
- Faculty of Commerce
- Proposed Faculties:
  - Faculty of Veterinary Medicine
  - Faculty of Medicine
  - Faculty of Engineering

Ministry of Agriculture and Fisheries:

- ARDA
- Regional Development Authorities
- NES

Ministry of Education:

- Agricultural Technical Institutes
- Secondary (Science Option) Schools
- Other entities providing short-course and work-shop training

Confederation of Yemeni Development Associations:

- LDA's
- Cooperatives

Donor Assistance:

- USAID/Yemen
- World Bank & Others

Others:

- Long-Term LGU Linkages
- Yemeni Farmers
- Women

Administrative linkages are important in the establishment of priorities for research, teaching, and extension and allocations of funds among the operating units. To see that operational projects are carried out in accordance with such goals and policy mandates, however, requires that each operational unit has a component within its annual work plan that is common to all units. Farming systems research and development (FSR) is suggested as a common component for further consideration in the PP. An FSR component is already under consideration by the World Bank with its Phase III project to develop ARDA.

D. Economic Considerations 14/

1. The Macro Economic Environment of Yemen

The main economic and political realities of YAR are summarized as:

a. An economic system highly dependent upon exogenous variables of:

(1) The international oil market via migrant remittances; and

(2) External donor assistance.

b. A highly negative balance of payments condition;

c. A weak tax revenue system dependent upon import taxes;

d. Limited influence of the central government in much of the country;

14/The reader is encouraged to read Annex H which provides a detailed presentation of the issues summarized in this section as well as a detailed account of the calculations used in the least cost analysis.

e. Use of donor assistance to extend the sphere of government influence; and

f. Extremely limited data base and government records for analysis purposes.

2. Alternatives to FOA: A Least-Cost Analysis

Several alternatives are available for increasing the number of Yemenis with training in agriculture at the B.S. level. The predominant alternatives are as follows:

1. Train Yemenis to the B.S. level in the U.S.;

2. Train Yemenis to the B.S. level in an Arab country;

3. Establish a Faculty of Agriculture at the University of Sana'a and train Yemenis to the B.S. level in that faculty.

A cost effective analysis of the three alternatives shows that the present values of the "cost to AID per B.S. trained and available to the YAR" and the "cost to AID per B.S. trained and available to the MAF" are both significantly lower for the FOA alternative than for any of the other alternatives considered. "Cost to AID, YARG, and other donors per B.S. trained" is also lower for the FOA alternative than for any of the other two alternatives, although the differences are not as large as they are when costs to AID alone are being considered. Specific results are as follows:

Cost Criteria 15/	Cost Per B.S. Trained Using Different Training Alternatives	
1. Cost to AID per B.S. Trained and Available to YAR	FOA	:$ 6,860
	In Arab country	: 33,671
	In U.S.	: 104,064
2. Cost to AID, YARG, and Other Donors per B.S. Trained and Available to YAR	FOA	:$ 30,235
	In Arab country	: 33,671
	In U.S.	: 104,064
3. Cost to AID per B.S. Trained and Returning to MAF	FOA	:$ 8,574
	In Arab country	: 50,521
	In U.S.	: 277,743
4. Cost to AID, YARG, and Other Donors per B.S. Trained and Returning to MAF	FOA	:$ 37,789
	In Arab country	: 50,521
	In U.S.	: 277,743

15/ Present value of cost.

The advantage of the FOA alternative would be even greater if the government subsidies of the other Middle East universities was included in the analysis.

Because the above results are clearly in favor of further pursuing the potential of establishing a FOA, a sensitivity analysis of the robustness of the results to various assumptions on which the analysis was based was not performed. Such a sensitivity analysis should be performed for certain critical assumptions as part of the SPP.

3. Recurrent Cost Considerations

YARG's capacity to fully staff and operate the FOA on a continuous basis will be addressed in the SPP. This is of considerable importance in light of plans to develop and staff Faculties of Engineering and Medicine, in addition to the FOA. Such analysis will address user fees and their possible effect upon student enrollment. The impact of recent economic events and trends include the recent earthquake, slowing of remittances, and softening of the oil market in the Arab oil producing states.

E. Estimated Costs and Method of Financing

The estimated total cost of the proposed FOA Subproject is about $80 million dollars. Of this amount, it is recommended that AID provide a $21 million grant to fund mobilization activities for the FOA instructional farm, technical assistance, participant training, commodity support, instructional farm development, and other direct costs. Approximately $4.7 million (22 percent) of the AID funds will be for direct purchase of Yemeni Rials to cover specified local cost items. It is recommended that upon approval of the SPID, approximately $664,000 of the total AID contribution be provided through the Core Subproject to fund specific mobilization activities for the instructional farm development (building design, surveying, leveling, grading, road construction, perimeter fencing, water distribution system, and necessary technical supervision). See Annex K for details.

Besides the $21 million dollar AID grant for technical assistance, it is also recommended that AID provide a grant of approximately $2.0 million dollars to fund Architect and Engineer services to design the Faculty classroom and office buildings and supervise construction. The detailed budget and scope of work for the A and E services are contained in a Prefeasibility Study which is still in draft.

The YARG contribution will approximate $19.4 million dollars in Yemeni rials equivalent for land, salaries, operating costs, etc., but excluding university overhead costs of administration, student room and board, etc.

The balance of the funding will be parallel financing in the form of a loan for construction of the FOA classroom, lab, office, and library facilities from another donor, probably a Middle Eastern country. The parallel financing could be as much as $24.5 million dollars. The YARG is expected to provide funds for any construction not supported by a parallel financing loan.

Tables 4 and 5 summarize the proposed financial plan for the FOA Subproject. Preliminary budget details are provided in Annex G.

TABLE 4

SUMMARY FINANCIAL PLAN

FOA COMPONENTS

($000)

(Technical Assistance and Farm Development) 2/

CATEGORY	AID Dollar	AID Local Currency	YARG ($ Equivalent)	OTHER DONOR Parallel Financing	ESTIMATED TOTAL
Land	-	-	12,400	-	12,400
Personnel	3,560	-	7,317	-	10,877
Allowances	1,106	-	-	-	1,106
Travel and Transportation	1,324	293	372	-	1,989
Commodity Support	1,164	228	-	-	1,392
Participant Training	2,814	134	-	-	2,948
Development of Instructional Farm, including farm buildings	462	1,485 1/	-	-	1,947
Facility Construction	-	-	-	23,375	23,375
Other Direct Costs	536	1,345	2,688		4,569
SUBTOTAL	10,966	3,485	22,777	23,375	60,603
Contingency @ 5%	548	174	519	1,169	2,410
Inflation, compounded @ 10%	4,681	1,018	8,507	-	14,206
TOTAL (Rounded)	16,195 2/	4,677	31,803	24,544	$ 77,219 2/

1/ Approximately 75 percent is for local construction costs.

2/ The Architect/Engineer services are not included in these totals. They will cost an additional 1.8 to 2.0 mill dollars according to the draft prefeasibility study.

Table 5 Summary Financial Plan for Faculty of Agriculture Subproject 1/ 2/

($000)

SOURCE/CATEGORY	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	
I. AID Budget												
A. AID Dollar Budget	222	1,864	1,206	1,489	1,409	1,421	1,115	818	582	488	351	1
1. Contingency, 5%	11	93	60	74	70	71	56	41	29	24	18	
2. Inflation, 10% (Compounded)	-0-	-0-	127	328	490	692	715	663	580	586	500	
Subtotal	233	1,957 2/	1,393	1,891	1,969	2,184	1,886	1,522	1,191	1,098	869	1
B. AID Local Currency	550	982	309	331	296	321	243	127	117	93	117	
1. Contingency, 5%	28	49	15	17	15	16	12	6	6	5	6	
2. Inflation, 10% (Compounded)	-0-	-0-	32	73	103	156	156	103	116	112	166	
Subtotal	578	1,031	356	421	413	493	411	236	239	210	289	
TOTAL AID BUDGET	811	2,988 2/	1,750	2,313	2,383	2,677	2,297	1,758	1,430	1,308	1,157	3
II. YARG Budget	-0-	12,400	655	765	789	1,031	1,165	1,307	1,429	1,566	1,689	22
A. Contingency, 5%	-0-		33	38	39	52	58	65	71	77	86	
B. Inflation, 10% (Compounded)	-0-	-0-	69	169	274	502	747	1,059	1,424	1,856	2,408	8
Total YARG Budget	-0-	12,400	757	973	1,103	1,584	1,970	2,431	2,924	3,479	4,181	31,
III. Other Donor Parallel Financing	-	23,375	-	-	-	-	-	-	-	-	-	23,
A. Contingency	-	1,169	-	-	-	-	-	-	-	-	-	1,
Subtotal	-	24,544	-	-	-	-	-	-	-	-	-	24,
GRAND TOTAL (AID, YARG, Parallel Financing)	811	39,932	2,507	3,286	3,485	1,584	1,970	2,431	2,924	3,479	4,181	$77,

1/ Marginal differences due to rounding.

2/ Does not include Architect/Engineer services for faculty design and construction supervision. Draft Prefeasibi Study indicates that the A and E services will add between 1.8 and 2.0 million dollars to the total costs, mostl in Year One and Year Two.

Subproject Contingency and Price Escalation

According to the guidance provided by NE/DP in STATE 015268 of January 18, 1983, the local inflation rate has recently dropped from 30 percent to approximately 12 percent and is projected to drop to 10 percent by 1986 (the third project year and second year of inflation). The same cable quotes an IBRD report which suggests that average annual international price increases will be 7.5 percent in 1984 and drop to 6.0 percent by 1986.

The budgets in this SPID include a physical contingency of five percent for each year of the project. An inflation rate of ten percent (compounded) was used for both the foreign exchange and local currency budgets. Inflation was factored on the physical contingency. The first project year which should be FY 84, was used as the base year for compounding the ten percent inflation. Ten percent inflation was applied at the end of the second project year - FY 85, and ten percent compounded was applied at the end of each succeeding year for both the dollar and local currency expenses. The mobilization activities contain a five percent physical contingency. The mobilization expenditures may occur partly in FY 83, but mostly in FY 84, which is the Project Year 1. 1983 base year prices were used for the mobilization expenses and no inflation was estimated.

The IBRD used a ten percent inflation rate compounded for both local and foreign costs in the recent (1982) appraised report for their Agriculture Research and Development Project for Yemen. Mission used the ten percent inflation rate on dollar costs because it was felt a liberal budget estimate at the PID stage was preferable to a conservative estimate. The principle dollar cost item is salaries and benefits of personnel from the CID member universities. Their salary increases are tied to the respective state economy and decisions of the state legislatures. AID contract office has allowed the contractor, CID, to grant annual pay raises consistent with the individual university policy, which in some cases, has exceeded ten percent per year. Since the annual salary increase for long-term personnel is not known because it is not known in advance which universities will supply the personnel, a ten percent inflation rate was used across the board. Applying those international price escalation percentages as contained in STATE 015205 to the AID dollar budget in this PID (with the first project year as the base year and the inflation compounded at the end of each succeeding year) results in a $2,668,222 total inflation for the dollar budget. This is more than 40 percent less than the total AID dollar budget inflation of $4,680,572 shown in this PID.

The PP design team will examine the contingency and inflation factors for various components of the project and justify the factors they choose. It is likely that the physical contingency will be increased to ten percent for the instructional farm building costs and that the inflation rate for the long-term personnel salaries may drop below ten percent.

G. Proposed Grantee and Implementing Agency

The proposed Faculty of Agriculture Subproject is one of several activities being developed and implemented under the ADSP. The grantee is the Yemen Arab Republic Government, represented by its Central Planning Office (CPO) in negotiations with donors. Implementing agencies for current projects are the MAF and the MOE. The implementing agency for the FOA Project will be the University of Sana'a.

[illegible] of his position, the Minister of Education serves as chairman of the University's Board of Regents. Budget resources provided by AID and other donors for the FOA will be provided via CPO and the Ministry of Finance to the University of Sana'a, earmarked for the FOA.

While the University of Sana'a will be the primary implementing agency, it will establish appropriate linkages with the MAF and MOE regarding faculty participation in, and support of, agricultural training, research, and extension and regarding the sources of potential FOA students. Coordination with the MAF will largely be via membership of the Dean of the FOA on the proposed Board of Directors of the Agricultural Research and Development Authority (ARDA). ARDA is proposed to be established with World Bank loan support to coordinate all agricultural research in the YAR

FOA faculty members will serve on several ARDA subcommittees concerned with specific research activities.

There also will be coordination between the FOA, MAF, and MOE regarding identifying and sponsoring Yemeni candidates for graduate education in foreign universities.

Coordination with the MOE to obtain students for the Faculty of Agriculture will be largely through the Department of Agricultural Education. This department is concerned with agricultural education at the secondary level.

H. Environmental Threshold Recommendation

Annex B presents the Initial Environmental Examination (IEE) for the FOA Subproject, and recommends approval of a Negative Determination. This recommendation is based on a conclusion that the FOA Subproject will engage in instructional "research activities which may have a limited effect on the physical and natural environment, but will not have a significant effect as a result of limited scope, carefully controlled nature, and effective monitoring," as defined in Section 216.C (1) (iii) of the Environmental Procedures. Since the FOA buildings, to be designed by AID and constructed with funding from one or more other donors, are an integral part of YARG's overall FOA Project, the environmental effects of the construction of those facilities have also been considered in the IEE. It has been determined that no long-term or irreversible effects are anticipated from such construction activities.

I. Design and Policy Issues

There are several key issues which are of a policy or design nature that will be addressed by the Subproject Paper team. These issues should be discussed during AID/W's review of the SPID to provide clarification and direction for the SPP design team.

1. Funding for Construction

The YARG did have a committment of funds for construction from Iraq, but due to the Iran-Iraq war, those funds are not available now. Several other Middle East countries have expressed an interest in funding faculty construction. USAID is preparing a Prefeasibility Study for Faculty construction which the YARG will use as a proposal to present to potential

Prefeasibility Study should be completed by July and donor funding for construction secured by the time the USAID technical assistance project is authorized. YARG does not anticipate great difficulty in obtaining funding because of the interest and high priority that potential donors place on establishment and expansion of university education, particularly in agriculture.

This project presents an ideal opportunity to use U.S. technical assistance to leverage Arab donor funding for construction in a parallel financing arrangement. This approach has been explored by the Assistant Administrator for the Near East with the Saudi Fund. In addition, the Mission Director has had contact with representatives of Saudi Fund and the Abu Dhabi Fund who expressed preliminary interest. USAID involvement in the planning and provision of technical assistance is an encouragement to other donors to fund construction. U.S. participation in project development should continue in a visible, active manner so that the parallel financing can be secured. It is important that the initiative not be dropped which will happen if each side waits for prior committment from the other. A "chicken and egg" syndrome could develop which might slow down the project, but more likely, would kill it.

USAID proposes that project paper design and mobilization activities continue and that assurance of funding for construction be included as a condition precedent.

2. Relationships and Coordination

The University of Sanaa is a relatively new institution which orginally was part of the Ministry of Education. The Minister of Education serves as Chairman of the University of Sanaa Board of Regents. The degree of independence of the university and its relationship to government ministries is not firmly established. The institutional roles and relationships are evolving and sometimes there is conflict. This potential problem will be explored as the project paper is designed. Appropriate steps will be recommended and taken, if necessary, to ensure that possible conflict does not impede implementation and accomplishment of the project purpose, recognizing that guarantees cannot be made until implementation begins and relationships established.

3. Utilization of Faculty of Science Facilities

The University of Sanaa intends to enroll its first class of agriculture students in the September 1985 class, using the facilities of the Faculty of Science for the first year. The second year will be in the new Faculty of Agriculture which is scheduled to open in September 1986. The Prefeasibility Study suggests that the Faculty of Agriculture will not be completed until September 1987. The feasibility of using the Faculty of Science facilities for one or more years for the agriculture students beginning in 1985 will be assessed. Alternative arrangements and dates for starting classes will be presented to allow for variations in the construction schedule.

The general agreement within the YARG on the above points supports the opinion of the SPID team that the FOA is to be an institution which clearly addresses the problems of Yemen's rural majority as perceived by the Yemenis themselves.

4. Project Phasing and Packaging

YARG has requested that USAID provide technical assistance, training, and architect/engineer services, including construction supervision. USAID/Yemen proposes that:

a. Justification at the PID level for the technical assistance activities, and A and E services, be developed as separate documents, but that both aspects of USAID assistance be included in a single project paper.

b. AID assistance to the FOA be provided via two activities: (1) the current PID proposal for a 10-year project providing technical assistance, training, instructional farm development and construction, commodity support, lab development, and (2) a pending Prefeasibility Study proposal for funding architectural design for a faculty building (classrooms, labs, offices, and library) that will be constructed with other donor assistance and engineering supervision of the construction phase.

c. The FOA development be expedited by the approval of funds for critical farm site preparation activities prior to the authorization of a subproject paper.

d. Preliminary A and E activities (Program of Requirements, Site Inventory, Schematic Design) for the faculty buildings proceed as soon as the Prefeasibility Study is approved (see cables in Annex).

e. The current proposal be implemented (without phasing of AID's committment) over a 10-year life-of-project, but funded on an incremental basis.

No phasing of AID assistance is recommended because USAID/Yemen believes that, to achieve its objectives, the FOA will need a sustained committment of donor support during its formative years. One of the major shortcomings of institutional development projects has been the relatively short-time horizon that donor agencies have in supporting what constitutes a long-term problem. In recognition of this, the Administrator of AID had recently authorized the approval of projects with up to a 10-year life. In view of this action and the rather complex implementation schedule for the FOA Subproject, USAID/Yemen recommends that the project not be phased. To insure that the project's design remains relevant to the needs of the FOA over the 10-year life of project, there will be a series of internal and external evaluations (see Section IV. J. 2). The second of three external evaluations will occur in year six, and will assess the need for substantive design modifications.

5. Relating Assistance to Higher Education to the Rural Majority

The SPID team has had several discussions with various elements of the YARG regarding how they view the FOA supporting YARG's rural development objectives and how the average rural residents potentially will benefit. Within YARG, there appears to be general agreement that:

a. The curriculum of the FOA focus on applied agriculture.

b. The faculty members actively participate and liaise with MAF research and extension programs which are seeking solutions to current farmer problems (see Section G of Annex H);

c. The students experience not just one, but a series of practicums which provide critical hands-on experience and orientation towards servicing farm problems (see Annex I, Preliminary Technical Analysis); and

d. There be direct access by farmers to MAF and FOA operations, including limited farmer demonstrations on the FOA instructional farm.

6. Subsidized Education

In general, education in the YAR is provided at essentially no cost to students. This includes university education at home and abroad. For critical disciplines in which significantly more trained manpower is needed, the YARG has a policy of providing students subsistence allowances to encourage study in these disciplines. These include secondary level training in agriculture and science, and secondary and university level training in teach education. In accordance with YARG and University of Sanaa policy, the FOA will not require any user costs or student fees for study in agricultural sciences. Until there is a comprehensive overhaul of the entire system, subsidies will probably continue. It is unlikely that the system will be changed just for the Faculty of Agriculture. The SPP design team will investigate the likelihood of any alterations in this YARG policy in the future, based on the projected growth in the number of students and graduates over time and on the projected increases in the costs of education.

7. English Language Competency

The FOA proposes to conduct training in both Arabic and English. This is due to the wide availability of scientific teaching materials in English. The FOA will have to decide if English language competency will be required of students prior to acceptance, or whether English language training will be an integral part of the curriculum, or whether to adopt a combination of the two choices. The former alternative could have a negative impact on the number of qualified students available to study agriculture. The latter alternative will have definite implications for the structure of the curriculum and the length of the B.S. degree program. These issues will be decided upon during SPP development. Their implications will be duly addressed in the SPP analyses (see Annex I).

8. Involvement of Women as Participants and Beneficiaries

As a significant proportion of the rural, farming population, women will be among the ultimate beneficiaries of the FOA. It is expected, for example, that women will benefit from the focus on animal husbandry, food preparation and processing, and nutrition in the FOA curriculum and laboratory structure. Also, possible community outreach including video or television media outreach, or extension programs sponsored or supported by the FOA, will address this issue.

A related issue is how women will participate as direct beneficiaries, i.e., FOA faculty, other employees, or students. Women do constitute a small portion (20 percent in 1982) of the students at the University of Sana'a. Women make up 50 percent of the 1981 and 1982 classes entering the Faculty of Science. University officials state that the total number of women students is growing, albeit not at an appreciable rate. The number of females entering secondary school is growing, and, therefore, it is expected that more women will complete secondary school and continue their education at the university level. Women will not be excluded from becoming students in the FOA.

This issue is discussed in more detail in Section IV. C and in Annex H. Further analysis and recommendations will be considered by the SPP team.

9. Institutional Linkages

To be effective in its mission, the FOA must establish viable and effective working linkages with the institutional structure of the agricultural sector. This includes, foremost, the MAF research and extension entities, the MOE agricultural secondary schools, local development authorities, cooperatives, and the private sector institutions. The SPID team has identified several key linkages, including participation of the dean of the FOA on the Board of Directors of the ARDA, the proposed institution for coordinating agricultural research in the YAR. FOA members will participate on commodity specific research subcommittees of ARDA. Also, FOA students will have practicums which will provide hands-on experience and exposure to agricultural research and extension. Further, area farmers will benefit from limited demonstration opportunities that will be programmed on the instructional farm. Other linkages will be explored (see Section IV.A).

10. Quantity and Quality of Secondary School Graduates Entering the Faculty of Agriculture

It is both an issue and an assumption that there will be a sufficient number of well-qualified secondary school graduates who choose to enter the Faculty of Agriculture so that enrollment will reach 600 by the year 1992. The combination of two factors lead to the conclusion that the quantity of students will be sufficient; first, external B.S. training scholarships are not likely to increase, and second, the recent doubling of enrollment in the elementary schools will move up through the system and put pressure on space at the University of Sanaa. The quality of students may be a more difficult issue. This will depend on the attractiveness of agriculture and agriculture-related occupations in Yemen in comparison to alternatives available to the secondary school graduates. Some of the more than 100 students per year who

presently enter B.S. agriculture programs in other countries can be expected to enter the Faculty of Agriculture at the University of Sanaa when it opens. Other factors which will influence enrollment include the FOA entrance requirements, adequacy of the secondary school curriculum, the one-year military service requirement, and level of stipends and subsidies. Only secondary school agriculture and science track graduates will be admitted to the FOA under present University of Sanaa regulations. Relaxing this requirement would increase the pool from which potential students might be drawn. The PP design team will examine the probability that the quantity and quality of students who choose to enter the FOA will be adequate. Appropriate recommendations will be made if it appears that the quantity and/or quality of FOA students might be significantly improved by actions which that YARG or USAID could undertake or influence.

11. YARG Retention of B.S. Graduates From FOA

YARG is able to retain and employ a higher percent of those Yemenis who study agriculture in Middle East universities than those who study in the United States. It is assumed that an even higher percent will be retained from those who study in the Universtiy of Sanaa FOA. Employment of FOA graduates by YAR public sector institutions could be an issue if the demand and salaries offed by Yemen's private sector and neighboring countries' public and private sectors is significantly greater than that of YARG. Employment of FOA graduates in neighboring countries will slow the development of Yemen's institutions but probably will increase Yemen's income from remittances.

Recently there have been substantial numbers of Yemenis return from long-term foreign employment to their rural villages in Yemen. While no study exists of this phenomonon, general knowledge of local conditions leads to the conclusion that social and cultural identity reasons may be as important as economic considerations. This is the case with Yemenis who have returned to become professors at the University of Sanaa.

The ability of the MAF to employ FOA graduates to work in areas outside Sanaa and the other major cities may be a problem. This will be more of an issue for the YARG and MAF than for the University of Sanaa.

The PP design team will examine the various aspects of the issue of retention of FOA graduates and include monitoring procedures as part of the project evaluation.

12. USAID Budget Priorities

USAID's number one priority for at least the past five years has been participant training. This has been evident in project priority rankings and zero-base budgeting presentations in ABSs and CDSSs. This priority was further substantiated by the recent Agricultural Sector Assessment in which the number one priority for the agriculture sector was the improvement of Yemeni human resources through increased B.S. level training. A substantial portion of USAID's aggregate training budget has been devoted to training in agricultural sciences. Therefore, even without an inter-project comparison to specify exactly where this subproject would fall out in a budget-cutting exercise extending from FY83 through FY93, it

is clear that since this subproject promises a substitution impact in the number one priority of participant training, it has, and will continue to have, a very high ranking in USAID/Yemen's planning and budgeting priorities. That ranking is supported further by the attractive possibility of co-financing this well-documented YARG priority with both Arab and other western donors. USAID would likely seek to continue funding for this subproject even if the annual program levels requested for FY84 and FY85 were cut significantly.

13. Classroom/Laboratory Teaching Assistants

University of Sanaa officials have raised a question about the lack of laboratory assistants in this project. They feel that laboratory/teaching assistants will be needed and that this technical assistance project should include training for teaching assistants. Additional research and analysis will be required before this item can be added to the project. The PP design team will evaluate the need for teaching assistants, and if required the number needed by area of specialization. The analysis may include such things as a review of the potential pool of persons who could become teaching assistants, possibility of the instructional farm technicians also serving as teaching assistants, training required, and hiring non-Yemeni. A small addition to the budget may be needed to train teaching assistants.

14. Need for Separate FOA Library

The FOA Planning Unit recommends the establishment of a FOA library rather than (a) integrate agricultural reference materials into the university library system, or (b) develop a system whereby the FOA and MAF share reference materials and facilities that would be provided in the proposed AID-funded Documentation Learning Resource Center (DLRC) for the MAF. This proposal for a separate FOA library is consistent with the experience of other University of Sanaa faculties, and has, interalia, resulted from the limited facilities of the central university library.

The FOA library will be designed similar to those on most universtiy campuses in the U.S. Its major clientele will be the students and the Faculties of Agriculture, Science and Commerce. The students and faculty will use the library for the preparation of term papers, research papers, extension information and general classroom/laboratory use. The FOA Library will be a teaching/academic research facility containing reference material, journals, books and relevent periodicals for students.

The DLRC at the MAF will be used primarily by MAF and other YARG ministry personnel, foreign technicians, and design teams. The documents that are to be housed in the DLRC will be government documents, records, project feasibility studies, research reports, etc., and few, if any, general agriculture texts and reference books. The DLRC will have the capacity to generate large amounts of government statistics that will be used by YARG to develop policies in agricultural planning, marketing, crop development, census, etc. Additionally, the DLRC will have the capacity to duplicate large volumes of material that will be used by constituents of the agriculture sector.

Clearly, the FOA library differs from the DLRC in location, clientel, and purpose. The FOA liabrary will operate as a lending library mainly for student use. The DLRC will be repository for single copies of

reports and reference documents (not books) which can be read and desired portions copied. The DLRC will not loan materials. Combining the two facilities, either physical or administrative, would weaken both entities. Since they are key units whose functions are critical to the development of their respective institutions and economics of scale are limited at best. The Mission does not recommend attempting to service both functions with one facility.

It is planned that one library advisor will assist in the establishment of the FOA library. This FOA library advisor will coordinate efforts with the DLRC to share information and materials that will enhance the quality of both facilities.

Until appropriate Yemeni staff are trained and in place, the DLRC proposes to have two technical assistance positions for long-term personnel and the FOA library will have one position. The DLRC advisor will supervise establishment of the DLRC building and its information retrival systems and search the country for reports to put into the DLRC. The DLRC reference specialist will perform the tasks of a librarian in the DLRC facility and train a Yemeni counterpart to do the same. The FOA library advisor will establish with a Yemeni counterpart the FOA library and its systems for purchase, cataloging, storing, and lending books to students.

The SPP design team will analyze the possible areas of overlap between the personnel and the two facilities and make recommendations for coordination.

J. AID Implementation Strategy

The proposed FOA Subproject will be implemented as an activity under the ADSP and the Title XII arrangement with CID. An amendment will be negotiated to the overall Title XII contract between AID and CID for CID to provide technical assistance, commodity procurement, participant training, farm development, and overall project administration (including adequate campus backstopping). CID will sub-contract to obtain local services for farm development activities.

CID will coordinate closely with AID and other donor assistance being provided to the FOA, i.e., proposed AID assistance to fund A and E design and supervision for faculty (non-farm) building, and proposed other donor aid to the construction of faculty buildings. USAID/Yemen has been, and will continue to be, involved in discussions and investigations of other donor assistance to the FOA.

USAID/Yemen will provide general monitoring of the subproject by its Agricultural Development Office, which has broad responsibility for ADSP activities, and by the Mission Engineer. In-country CID activities will be coordinated through the CID/Sana'a Office and the Core Subproject. CID will select a lead university to provide leadership in all aspects of the subproject. CID has tentatively identified Oregon State University as lead university.

CID has established a procedure whereby lead universities are selected for individual CID/Yemen Program Subprojects. Briefly, this procedure is that, when a new subproject is proposed for submission to AID, CID requests applications from all interested CID institutions which wish to serve as lead university to backstop the proposed subproject. When applications are received by CID and reviewed by the CID Executive Office and Board of Trustees as to qualifications/capabilities of the universities, the most appropriate university is selected and nominated to AID as lead university for the subproject.

It is generally expected that OSU will continue as the lead university during the implementation phase. A decision will be made on this issue during contract negotiations. OSU has identified a candidate on-campus Project Director to coordinate project management with the CID/Executive Office.

1. Project Mobilization

USAID/Yemen and the YARG have identified several critical project mobilization activities which should proceed prior to project authorization if the general implementation targets are to be met. These activities are specified in Annex K and relate to the development of the instructional farm and training of faculty members. AID/W has already approved $138,000 in the Core Subproject for training of prospective faculty members for the FOA Subproject. Annex K presents a request for $664,000 for pre-authorization activities related to the development of the instructional farm. Justification for proceeding with these activities in advance of project authorization is also included in Annex K. If approved with the SPID, USAID/Yemen and CID will proceed immediately with these activities. It is proposed that funding of these activities be provided initially from the Core Subproject budget, which will be reimbursed from first year funds upon authorization of the FOA Subproject. Project mobilization activities related to the instructional farm will be subcontracted to local contractors, and will be coordinated by the Core Subproject agricultural engineer and TDY assistance from OSU, the CID lead university.

Water will be piped about two kilometers to instructional farm from a well to be drilled on the site of the new Faculty of Medicine. The amount of water available at the farm site will determine the cropping pattern and amount of livestock that can be accommodated.

Following is a list of activities that will have to be accomplished before the FOA instructional farm can begin operations in September 1985.

Design/ Mobilization Phase	First participant initiates training in U.S.
	PID approved with authority for mobilization activities
	Farm site surveyed
	Farm layout completed
	Contractor selected
	Temporary fence installed
	Subcontracts signed

	Land levelled/graded On-farm roads completed Permanent fence installed Building designs completed Project authorization Grant Agreement signed
Construction Phase	CPs to disbursement met Initiate bidding for construction of farm buildings Construction contract signed Construction initiated U.S. equipment/commodities ordered Utilities completed; construction completed Access road completed; farm staffing completed; local equipment/supplies ordered All equipment and supplies ordered/installed
Establishment Phase	Begin farm operations
Implementation Phase	Farm used for student instruction

2. Project Implementation

Table 6 presents a preliminary phasing diagram for the FOA Subproject. This will be refined and completed during the development of the SPP.

3. Project Evaluation

Given the extended life of project (ten years), USAID/Yemen recommends that the project be subjected to a series of evaluations to more clearly assist its progress and to insure that the design remains relevant to the needs of FOA. The contractor, CID, in collaboration with USAID and YARG, will undertake an internal assessment of the project in Years two, five, and eight. Aid will schedule more comprehensive external evaluations of the project in Years three, six, and nine. The external evaluation in Year six will constitute the mid-term evaluation, and will be the most comprehensive. The team for the external evaluation will consist of external consultants plus AID/W representatives. The budget includes funding for 30 work days TDY service for each external evaluation; $47,250 for 90 days over the project life.

The evaluations will review the effectiveness of the FOA Subproject activities to date and the status of accomplishment of its goal, purpose, and outputs. Each external evaluation will be done as part of the evaluation of the total Agriculture Development Support Program (Project 279-0052) and all of its subprojects. The external evaluations will review the effectiveness of the FOA subproject, as well as its relationship to the other subprojects and its contribution toward achievement of the Agriculture Development Support Program's goal, purpose, and outputs.

Results of the evaluations will be used to modify annual work-plans, project outputs, etc., as necessary. Each long-term technical expert will, in close consultation with the subproject team leader, chief of party, and YARG counterparts, develop an appropriate data collection strategy whereby key progress indicators may be monitored. During the Joint Annual Field Review, there will be a review of the selection of key indicators for each element of the FOA subproject.

Initial indicators for the first internal and external evaluation should include, but are not necessarily limited to, the following:

a. Status of construction of faculty buildings and instructional farm

b. Analysis of enrollment by sex, background, home location, high school, etc.

c. Analysis of Yemeni faculty in training and employed

d. Relevance of curriculum, instructional farm, and student work experience program to the small, traditional farmer and to rural women

e. Development of relationships between the MOE, MAF, and FOA, and between the teaching, research, and extention.

K. Project Design Strategy

Design of the proposed FOA Subproject is the responsibility of CID. CID proposes to field a Subproject Paper (SPP) team in the summer of 1983 for up to five weeks. The SPP will be completed and submitted to AID/W for review/approval by end of FY 1983 for FY 1984 authorization and initial funding.

The draft scope of work (SOW) for the SPP team is included as Annex E. This SOW will be finalized following AID/W review/approval of the SPID, and will reflect any additional analysis requirement resulting from those reviews. The design team will be funded by ADSP/Core funds in accordance with the objectives of the Core Subproject. The proposed team composition follows:

1. Education Administrator/Curriculum-Specialist/Agronomist (Team Leader)

2. Agricultural Economist/Manpower Development Analyst

3. Social Anthropologist

4. Agricultural Mechanization/Civil Engineer

5. Animal Production/Protection Specialist

6. Project Design Officer

TABLE 6

PROPOSED PHASING PLAN FOR FOA SUBPROJECT
(Calendar Years)

Subproject Activities	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1. Subproject Design and Implementation	Mobilization Phase			Subproject Approval	In/E 4/	Ex/E 4/		In/E	Ex/E	In/E		Ex/E	Subproje Terminat
								Implementation Phase					
a. Study tour and preliminary SPID													
b. SPID Design Team													
c. SPP Design Team													
2. Participant Training													
a. Proposed FOA Training			3/	3 scholarships/year for 5 years in 6 areas of specialization at U.S. LGU's									
b. Administrative Intern													
c. Library Resource Intern					6-Month Internships								
d. Farm Manager Intern													
3. Instructional Farm 1/		Design Phase	Construction, Purchasing Phase		Establishment Phase			Implementation Phase					
4. Faculty Buildings, Supplies and Equipment 2/			Design Phase	Construction Purchasing Phase				Implementation Phase					
				Design		Construction		Implementation 5/					
5. Curriculum Design and Implementation				Design Phase					Implementation Phase				

1/ USAID will finance site preparation, well drilling, pump and delivery pipe, building design and construction, equipment and supplies. will provide well, site, obtain right-of-way access for water delivery, and well hookup.

2/ USAID will finance equipment, materials, supplies, and construction observation services. Architectural design will be funded by AID via a separate project. YARG and other donors will finance construction of FOA buildings and commodities (desks, chairs, lab and greenhouse benches, shelves, etc.).

3/ Five scholarships previously authorized for project mobilization for 1983 calendar year under Core Subproject.

5/ Schedule for Faculty Buildings as presented in the Prefeasibility Study. Assumes approval of the Prefeasibility Study in July 1983.

PROJECT TITLE: Faculty of Agriculture Subproject
Agricultural Development Support Program

ANNEX A

LOGICAL FRAMEWORK

NARRATIVE SUMMARY	OBJECTIVELY VERIFICABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
GOAL To increase rural incomes in the YAR through agricultural development. **SUB-GOAL** To increase the supply of appropriately trained manpower to plan, manage, implement and evaluate development activities in the private and public agriculture sector of the YAR.	**MEASURES OF ACHIEVEMENT** **GOAL** Increased agricultural production. Improved agricultural trade balances. Increased farm income. **SUB-GOAL** Increase in number of trained Yemeni working in agriculture and rural development and a corresponding decrease in expatriates in key positions.	**MEANS OF VERIFICATION** **GOAL** YARG statistics. Socio-economic analyses. **SUB-GOAL** 1. YARG employment data. 2. MOE records. 3. MAF records on expatriate involvement in rural development.	**ASSUMPTIONS** **GOAL** Agriculture will remain an important economic activity in rural Yemen. **SUB-GOAL** 1. Incentive structure sufficient to attract Yemeni personnel to employment in the agriculture sector and to retain trained Yemeni personnel in YAR. 2. There will continue to be a demand for trained Yemeni personnel in the agriculture sector.
PURPOSE To support the establishment within the University of Sana'a, Yemen's first Faculty of Agriculture that is responsive to private and public sector development, and has appropriate linkage to the agriculture sector's production and institutional structure.	**END OF PROJECT STATUS** 1. An operational indigenous Faculty of Agriculture within the University of Sana'a engaged in teaching and research, and assisting MAF extension activities. 2. 120 students per year being trained and graduated, and assuming responsible positions in the private and public sectors. 3. Ongoing collaboration between the Faculty of Agriculture, the MAF, the MOE, private agencies and agricultural producers on: a) research and research priorities b) extension c) curriculum development d) in-service training 4. A productive and ongoing sister university relationship between the Faculty of Agriculture and a U.S. Land-Grant University Faculty of Agriculture. 5. An operational instructional farm that is integrated into the curriculum of the Faculty of Agriculture and is providing students opportunities for relevant, practical experiences.	**MEANS OF VERIFICATION** 1. Project evaluation reports. 2. University/Faculty of Agriculture records. 3. Follow-up surveys of graduates. 4. Site inspections. 5. Lists from U.S. Land-Grant Universities of seminars, special courses and TDYs to support sister university relationships with the Yemeni FOA.	**ASSUMPTIONS** 1. University of Sana'a policies will continue to permit and support the development of a Faculty of Agriculture. 2. Adequate facilities not funded by AID will be funded and constructed in a timely manner. 3. Faculty of Agriculture will be successful in recruiting and graduating students in projected numbers. 4. Private agencies and the YARG, particularly MAF and MOE, will continue to be supportive of an indigenous Faculty of Agriculture. 5. Incentive structure for faculty will attract and retain qualified personnel for the FOA. 6. YARG development and operational budgets will be adequate and funds released in timely manner. 7. Curricula of private and public secondary schools are adequate in preparing students for higher education. Agriculture technical secondary schools are flexible in modifying curriculum, as appropriate, to produce eligible candidates for entry into the Faculty of Agriculture. 8. University/FOA facility and equipment maintenance and replacement policies will be implemented during and after project. 9. Agriculture will continue to be a priority growth area in the YAR. 10. U.S. Land-Grant universities will continue to expand the sister university relationships with the Yemeni Faculty of Agriculture. 11. Traditional and small farmers will be adequately represented through the student population of the Faculty of Agriculture.

LOGICAL FRAMEWORK

NARRATIVE SUMMARY	OBJECTIVELY VERIFICABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
OUTPUTS 1. An appropriate and flexible administrative/organizational structure which can accommodate projected growth in the Faculty of Agriculture and changes in the country's agricultural sector. 2. Trained Yemeni faculty capable of instructing at the B.S. level, conducting research on priority Yemeni rural development issues, and assisting other institutions in extension. 3. A flexible curriculum that is responsive to the training needs of the YAR. 4. An agricultural sciences library. 5. Agricultural sciences laboratories. 6. An instructional greenhouse. 7. An instructional farm on the university campus. 8. Graduates at the B.S. level. 9. Programs for in-service and refresher training. 10. Appropriate linkages for collaborating with other key institutions of the agriculture sector. 11. Sister university relationship developed with a U.S. Land-Grant University Faculty of Agriculture	**MAGNITUDE OF OUTPUTS** 1. One administrative/organizational structure. 2. Yemeni Faculty trained in following fields: 4 in livestock (and poultry) production and protection 3 in crop production and protection 1 in agricultural economics 3 in soils, hydrology and agricultural engineering 2 in agricultural education/extension 2 in food science technology 3. One curriculum 4. One library 5. Six laboratories: - one animal physiology lab - one plant physiology lab - one agriculture mechanization lab - one soil science lab - one agricultural product processing lab - one food and nutrition lab 6. One greenhouse 7. 120 B.S. graduates per year 8. Two In-service training courses per year	**MEANS OF VERIFICATION** 1. Project evaluation reports. 2. Project training and other records. 3. Site inspections. 4. University records. 5. Lists from U.S. Land-Grant Universities of seminars, special courses and TDYs to support sister university relationships with the Yemeni FOA.	**ASSUMPTIONS** 1. Quality participants are available for training, will meet English language requirements, will complete training as scheduled, and will return to specific faculty positions. 2. Adequate facilities will be funded and constructed in timely manner. 3. Facility construction will not have appreciable negative environmental impacts. 4. Adequate water will continue to be available to support operation of facilities, including instructional farm. 5. Only minimal remedial education will be required of prospective Faculty of Agriculture students. 6. U.S. Land-Grant universities will develop and nurture the sister university relationships with the Yemeni Faculty of Agriculture.

48

LOGICAL FRAMEWORK

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
INPUTS 1. AID grant of $21 million over 10 year period (FY84-93). 2. YARC contribution of TR 44 million over same period. 3. Implementation contract with CID.	**QUANTIFIABLE INDICATORS** (See preliminary budget) (See preliminary budget)	**MEANS OF VERIFICATION** 1. AID Project Agreement(s). 2. YARC budget and records of budget allocations. 3. University records. 4. CID contract.	**ASSUMPTIONS** 1. AID grant to support architectural and engineering services for the design and supervision of facility construction will be approved and released in timely manner. 2. Other donor funding of facility construction will be approved and released in timely manner. 3. AID, YARC and other donor commitment to supporting project remains strong throughout life-of-project. 4. Land for the Faculty of Agriculture and instructional farm will remain available. 5. The campus of the Faculty of Agriculture and particularly the instructional farm will not be negatively affected by urban encroachment.

A-3

49

ANNEX B

INITIAL ENVIRONMENTAL EXAMINATION

OR

CATEGORICAL EXCLUSION

Project Country: Yemen Arab Republic

Project Title: Faculty of Agriculture Subproject

Funding: FY (s) _____ $ _____

IEE Prepared by: James G. Cassanos, USAID/Jordan (PSC Engineer)

Environmental Action Recommended:

Positive Determination _____

Negative Determination _____ X _____

Categorical Exclusion:

This activity meets the criteria for Categorical Exclusion in accordance with Section 216.2 (C) and is excluded from further review because:

Concurrence:

Bureau Environmental Officer _____

APPROVED _____

DISAPPROVED _____

DATE _____

Clearance: GC/NE _____

Date _____

ANNEX B

Faculty of Agriculture
University of Sana'a
Initial Environmental Examination

I. SUBPROJECT DESCRIPTION

The purpose of the subproject is to establish within the University of Sana'a a Faculty of Agriculture (FOA) that is responsive to the agricultural needs of the Yemen Arab Republic, is supportive of private and public sector agricultural development, and has appropriate linkages with the agricultural sector's institutional structure.

The establishment of an FOA on the existing campus of the University of Sana'a in Sana'a will be supported by AID and other donors. AID funding will support the following activities:

A. U.S. graduate training of Yemeni faculty members that will be capable of providing instruction at the bachelor of science level, conducting research on priority rural development issues, and supporting other institutions in strengthening their agricultural extension services.

B. A contract with the Consortium for International Development (CID) for the services of counterpart faculty who will provide administrative and teaching assistance to the FOA until Yemeni faculty are trained and ready to assume these responsibilities.

C. An instructional farm that will provide opportunities for research, teaching, and extension demonstration in agronomy, horticulture, animal science, and the associated sciences of plant protection, soil science, and agricultural engineering.

D. Construction observation services of an architectural and engineering firm for FOA classroom, offices, laboratory and library facilities. Actual construction will be funded by other donors.

II. PROJECT SETTING

The FOA will be located on the University of Sana'a campus on land that has already been acquired. The campus, now on the edge of Sana'a, will soon be surrounded by the expanding city. The total area of the campus, approximately 170 hectares, should, however, be adequate for the needs of the university well into the next century. It is expected that about 21 hectares (50 acres) will be needed for the instructional farm and a much smaller area for the faculty buildings. The factors involved in evaluating the decision of the YARG and the university to locate the agricultural faculty and the associated instructional farm on the univer-

51

sity campus in Sana'a are discussed at length by Vomocil et al. 1/ They considered the constraints of water availability, soil quality, topography, climate and parcel size, and concluded that the proposed location is preferable to any alternative sites that might be considered.

The major constraint to the development of an FOA at the campus site is water availability. There is a well on the campus with the capacity of about 1.5 liters per second. The study team recommended drilling a well on the instructional farm, but since it is unlikely that sufficient water will be found on the campus, the team, early in 1982, discussed with knowledgeable YARG officials the possibility of obtaining additional water in the vicinity of the university. As a result, a potential well site north of the campus was identified. The National Water and Sewerage Authority (NWSA) has tentatively agreed to permit the university to drill a well there and the Ministry of Public Works has agreed to the laying of a pipeline to convey about 12 liters of water per second to the campus along the rights-of-way of the outer Ring Road and the Wadi Dahr Road. It now appears that it may be possible to drill for water close to the university. It has also been suggested that, because of low yields from the aquifers near the campus, the university should consider paying NWSA what it would cost the university to develop its own facilities. NWSA, in turn, could drill a well in one of its more productive well fields, pump the water into its present transmission and distribution system, and permit the university to draw a fixed amount of water from the 600 mm pipeline on the road adjoining the university property. If an equitable arrangement can be worked out, this may be the most feasible solution to the problem of water availability. The various possibilities will be further explored during the subproject paper design stage. In any event, it is likely that sufficient water will be available for the development of the instructional farm. If the predictions about the depletion of groundwater in the Sana'a basin prove accurate, wells drilled privately by the university could be dry by the end of the century. If the university can work out an arrangement to use the public water supply similar to that described above, then the university would share the shortages with domestic users and could adjust its research and farm instructional programs accordingly.

III. ENVIRONMENTAL CONCERNS

A. Water Conservation

The plan for the instructional farm emphasizes the opportunities that will be available for faculty and students to work and experiment with various methods of tillage and irrigation to study their effects on water conservation.

1/ Vomocil, James A., Leroy Daugherty and John Leffel, "A Demonstration Farm Study for the University of Sana'a Faculty of Agriculture." Consortium for International Development, Sana'a (1982).

58

It is hoped that by teaching, demonstration, and extension, the FOA can (directly and indirectly) show farmers how to improve agricultural yields with much less water than they are now using. Such demonstrations are particularly relevant in the Sana'a water basis, where wasteful irrigation and cropping practices are important contributors to the rapid depletion of the groundwater resource.

B. Waste Management

It is expected that the university will be connected to the Sana'a sewerage system within 5 years during Phase II of the Sana'a sewerage project that is being financed by the World Bank and other donors. Until such time, domestic and laboratory wastes must be treated on the site in cesspools or septic tanks. For several years at least, the faculty and students of the FOA will occupy housing and dormitories already constructed on the campus for general university use and will not require additional separate wastewater disposal facilities. Because there will not be much activity at the FOA until 1986, on-site disposal of domestic and laboratory waste should be adequate until the university is connected to the public sewerage system.

Animal wastes should not present a significant problem since they can be composted with other agricultural wastes and used as a soil conditioner and organic fertilizer.

C. Pesticides and Herbicides

The demonstration and controlled use of insecticides, fungicides, and herbicides at the farm and the associated training of students should have positive effects on the use of these materials in Yemen. No pesticides banned by the Environmental Protection Agency (EPA) will be used on the instructional farm or recommended for use outside the farm. When EPA-approved pesticides are used on the farm, they will be used in accordance with EPA and USDA guidelines for the purpose of demonstrating proper management and for training students in their effective and safe use.

D. Construction Activities

The principal construction activities at the FOA will include the construction of the main faculty buildings and eight one-story buildings on the instructional farm. People at the university and those using the Wadi Dahr Road will experience temporary disturbances such as increased noise levels, dust, particulate matter, exhaust fumes, and traffic congestion. There is no vegetation or wildlife on the site. If it were decided to drill wells off the campus, there would be some temporary increase in noise level at the well sites, which are remote from human habitation. The transmission lines would follow highway right-of-way, and would be buried. The effect of such construction on the local ecology is expected to be minimal and short-term. Similar short-term effects would be expected if it were decided to arrange with NWSA to drill a well and to deliver water to the instructional farm.

The land on which the instructional farm will be built is not now being cultivated. Existing terraces will be restored to the extent

feasible, the rest of the land will be leveled, plots and the on-farm water distribution system will be installed. Trees to serve as windbreaks will be planted along the perimeter of the farm. Gravel roads will also be built. Since the land is not being used now, there will be no adverse environmental effects from building the instruction farm. In fact, the green area of the farm will be an aesthetic improvement in an otherwise barren environment.

IV. CONCLUSIONS

The activities of this subproject and the related activities at the FOA to be financed by one or more other donors involve classes of actions that are categorically excluded (except to extent that such programs include activities such as construction of facilities) and for which Initial Environmental Examinations are generally not required.

The instructional farm meets the criteria of a research activity "which may have an effect on the physical and natural environment but will not have a significant effect as a result of limited scope, carefully controlled nature, and effective monitoring," as defined in Section 216.2(c)(1)(iii) of the Environmental Procedures.

Similarly, YARG's overall FOA project meets the criteria of an education, technical assistance, and training program, except to the extent that it includes activities directly affecting the environment (such as the construction of facilities) as defined in Section 216 2(C)(2)(i) of the Environmental Procedures. As indicated above, no long-term or irreversible effects are anticipated from such construction activities.

V. RECOMMENDATION

Negative determination.

YARG REQUEST FOR ASSISTANCE

DIR/DD
ASH
[illegible]
CONT
EXO
HR
PROG
RD
CHRON
KF

CPO
Dept. of Technical Cooperation and Conference
Assistance Section

Ref: 411
Date: 1/26/1982

Subject: Contribution on Faculty of Agriculture Project

To:
The Director
USAID/Sanaa

This is to inform you that we have received Sanaa University's note No. 1531 dated 1/19/1982 regarding your contribution in the Faculty of Agriculture Project of Sanaa University and their request for a meeting to discuss the type and scope of assistance which USAID could provide in this vital project. In the previous meetings you have expressed your interest to contribute in this project specially in the following fields:

1. To provide participant training in Agriculture (Masters/ PHDs), 5 scholarships per year during the next five years.

2. Funding of technical studies related to Engineering Designs and specifications, inorder to submit these studies to the Iraqi fund for International Development.

3. To reclaim the land located inside the university campus of Wadi Dhahr Road to be a nucleus for the Faculty of Agriculture Farm.

We would also like to inform you that the government has obtained necessary funds for the Faculty Buildings. The project is given a higher priority in the plan.

Please take note and initiate necessary action and advise.

Thank you for your cooperation.

Fatehy Salem Ali
Deputy CPO

cc: Sanaa University

بسم الله الرحمن الرحيم

YEMEN ARAB REPUBLIC

PRIME MINISTER'S OFFICE

CENTRAL PLANNING ORGANISATION

P. O. Box : 175 - SANA'A
Teleg. : CENPLAN
Phone : 2992-3
73506-10

الجمهورية العربية اليمنية
رئاسة مجلس الوزراء
الجهاز المركزي للتخطيط

صندوق بريد : ١٧٥ - صنعاء
تلغرافيا : سنبلان
تلفون : ٢٩٩٢٠٣
٧٣٥٠٦٠١٠

DATE DUE 12/27	ACTION	INFO
DIR/DD	✓	
AGR		✓
CD		
CONT		
EXO		
HR		
PROG		✓
RD		
CHRON		✓
RF		✓

Dept : Minister's Office
Our Ref : 5429
Date : 9 December 1982
Subject

إدارة :
رقم الصادر :
التاريخ :
الموضوع

Dear Mr. Ward,

In a recent meeting with you, we discussed the status of project development for the Faculty of Agriculture, Sana'a University.

This letter is to confirm to the Agency for International Development that donor financing has been negotiated from other donors in an estimated amount of US$20 millions (excluding the cost of land) for the construction and basic equipping of buildings and facilities for the new Faculty of Agriculture. The Y.A.R. Government contribution for the construction and equipping of the Faculty of Agriculture will be about Yemeni Rials 45 millions (excluding the financing from other donors).

Is it possible for AID to finance the detailed engineering and architect services originally requested in our January 26, 1982 letter No. 411. This is required so that donor commitment needed for financing construction and construction supervision services can be firmed up. We appreciate AID's favorable consideration of Yemen's request for assistance in the design and construction of an experimental farm for the Faculty of Agriculture, as well as training for faculty members and administrators, and technical assistance.

Sincerely yours,

Fuad Kaid Mohammed,
Minister of Development Chairman,
Central Planning Organization

Mr. Ward,
Director,
USAID Mission,
Sana'a

56

ANNEX D

PRESIDENTAL DECREE

ESTABLISHING THE FOA

Typed exactly as received from Abdulkader M. Uqba

Y.A.R.

President of the Republic and the Cabinet

Legal Office

REPUBLICAN DECREE NO. 51

YEAR 1982

FOR THE ESTABLISHMENT OF

AGRICULTURE FACULTY -

SANAA UNIVERSITY

AFTER THE DECREE INTRODUCTION AND CONSTITUTIONAL REFERENCES.

Item (1) - the establishment of the Agriculture Faculty and to to be included with Sanaa University faculties and valid under the rules of the law no. 89 for year 1977 "The Law of Establishing Sanaa University".

Item (2) - This decree is legal from its effective date and to be published in the Government Official Magazine.

Issued at the Republican Palace
Date of Issue 26th July 1982

Signed by

Ali Abdulla Saleh	Abdulkarem Al Irani	Ahmed Mohamed Abdul Malik Alasbahi
Y.A.R. President and Commander in Chief	Prime Minister	Minister of Education

الجمهورية ومجلس الوزراء

قـــرار جمهـــوري رقم (٥١) لسنة ١٩٨٢م

بانشاء كلية للزراعة بجامعـــة صنعـــاء

بعد الاطلاع على الدستور الدائم ،

وعلى الاعلان الدستوري الصادر بتاريخ ٦/٢/١٩٧٨م بتشكيل مجلس الشعب التأسيسي

المعدل بالاعلان الدستوري الصادر بتاريخ ١٧/٤/١٩٧٨م ،

وعلى الاعلان الدستوري الصادر بتاريخ ٢٢/٤/١٩٧٨م بالعمل بقرار مجلس الشعب

التأسيسي بتحديد شكل رئاسة الدولة واختصاصاتها وعزلها ،

وعلى الاعلان الدستوري الصادر بتاريخ ٨/٥/١٩٧٩م بتعديل بعض احكام الاعلانات

الدستورية السابقة الخاصة بمجلس الشعب وتوسيع اختصاصاته ،

وعلى قرار مجلس القيادة بالقانون رقم (١٣٦) لسنة ١٩٧٦م باعادة تنظيم وزارة التربية

والتعليم وتعديلاته ،

وعلى قرار مجلس القيادة بالقانون رقم (٨٩) لسنة ١٩٧٧م باصدار قانون جامعة صنعاء ،

وبعد أخذ رأي مجلس الجامعة وبناء على عرض وزير التربية والتعليم ،

وبعد موافقة مجلس الـــــــوزراء ،

قـــــرر

تنشأ كلية للزراعة وتكون ضمن كليات جامعة صنعاء وتسري عليها احكام القانون رقم ٨٩

لسنة ١٩٧٧م باصدار قانون جامعة صنعاء .

يعمل بهذا القرار من تاريخ صدوره ، وينشر في الجريدة الرسمية .

صدر بالقصر الجمهوري بصنعـــــــــــاء

بتاريخ ٦ / شوال / ١٤٠٢هـ

الموافق ٢٦ / يوليو / ١٩٨٢م

د. عبد الملك الاصبحي — وزير التربية والتعليم

د / عبد الكريم علي الارياني — رئيس مجلس الوزراء

العقيد / علي عبد الله صالح — رئيس الجمهوريـــة

القائد العام للقوات المسلحة

ANNEX E

SCOPE OF WORK FOR SUBPROJECT PAPER TEAM 1/

TEAM LEADER

A Team Leader will be provided by CID/OSU to work with the SPP team throughout the design effort. The Team Leader will:

A. Plan and develop a work schedule for completion of the SPP in the given time frame in collaboration with CID/Yemen and AID/Yemen administrative and staff personnel;

B. Assume overall responsibility for assembling all recommendations and estimates, as well as designs, sketches, and plans into an appropriate SPP;

C. Provide leadership to stateside technical assistance team in the preparation of a developmental plan for the Instructional Farm. The plan will provide the technical layout of the farm and will be the basis for negotiations with a local Yemen contractor relative to the proposed subproject mobilization activities (See Annex K);

D. Develop a detailed implementation schedule for all components of the subproject;

E. Verify and expand on the proposed subproject budget estimates;

F. Assist, as necessary, in presenting the project to AID.

AGRICULTURAL EDUCATION ADMINISTRATOR

The Agricultural Education Administrator will:

A. Work closely with University of Sana'a and MAF officials to verify appropriateness of the proposed organizational structure of the FOA;

B. Expand on specific relationships that need to be developed between the FOA and other University of Sana'a Faculties, as well as outside agencies in the public and private agricultural sector; design specific activities that the FOA can engage in to initiate linkage development; and

C. Verify faculty positions, training schedules, and staffing plan in light of candidate availability and other donor contribution. Verify attrition rates with help of team manpower specialist.

1/ CID will carefully consider opportunities for combining various functions. See Section IV.K. of SPID.

AGRONOMIST

The Agronomist will:

A. Verify the appropriateness of the proposed FOA curriculum in the area of field crops, horticulture, and soil science; develop a mechanism for integrating the resources of the Instructional Farm, greenhouse, and laboratories into the curriculum; and

B. Target specific crop production and soil management activities and/or research on the Instructional Farm for the FOA.

CURRICULUM SPECIALIST

The Curriculum Specialist will:

A. With Yemeni counterparts plan, a detailed 4-year curriculum leading to a baccalaureate degree in agricultural science; carefully assess its relevance to YAR needs; determine its appropriateness in terms of the University of Sana'a calendar and holidays and determine its feasibility in terms of the course-load capability of prospective students;

B. Determine faculty workloads in view of (A), and project short and long-range staffing needs to implement the curriculum;

C. Evaluate the need for teaching/laboratory assistants;

D. Develop a detailed course list and a brief description of each course; indicate the likely allocation of each course into time spent in lecture, laboratory, and practicums;

E. Assess the future (beyond the end of project) training needs of the YAR agricultural sector, e.g., fisheries, and design a plan for long-range staffing of new aspects of curriculum development.

F. In consultation with University of Sana'a officials, develop entrance and exit standards for performance in the programs of the FOA; consider such things as English language competencies, beneficiary group, and relationship to standards of other University Faculties;

G. Verify the appropriateness of the degree(s) to be offered initially by the FOA, and suggest a time frame for eventual phasing, if appropriate, to greater specialization; and

H. Develop an appropriate list of relevant texts associated with the FOA curriculum.

I. Assess the relationship of the FOA curriculum to the Agriculture secondary school curriculum in terms of consistency and remedial needs.

J. Assess the agriculture technical school curriculum with the science option secondary school curriculum for consistency and remedial needs.

A. Review the instructional farm proposal/plan and its relationship to the construction, expected student body, size of the faculty, and curriculum development. Coordinate the involvement of other team members in this review.

B. Verify and expand on the mobilization, implementation, and operation phases of the Instructional Farm as follows:

1. Mobilization

   a. Verify the appropriateness of A and E design of the Instructional Farm buildings.

   b. Verify and/or expand on the Instructional Farm Plan and site preparation recommendations.

2. Implementation

   a. Develop a detailed implementation schedule for the construction of the Instructional Farm.

   b. Verify and/or expand on the special equipment needed for operation of the Instructional Farm, confirming cost estimates.

   c. Assess the adequacy and reliability of the water delivery system to the Instructional Farm and the plan for on-farm water delivery.

3. Operation

   a. Target specific agricultural engineering research and teaching activities that can be carried on by the FOA using the facilities of the Instructional Farm.

   b. Through an operational narrative, develop a mechanism for integrating the engineering activities of the Instructional Farm with the curricular and extra-curricular offerings of the FOA.

C. Review the recommendations of the A and E contractor relative to the construction and design of the Faculty of Agriculture building. Verify specific recommendations for construction observation services and scope of work as proposed therein.

D. Review the agricultural engineering components of the FOA curriculum. Assess its appropriateness in terms of:

1. Content;

2. Relevance to perceived YAR needs;

3. Facilities, resources, and equipment necessary for implementation.

61

AGRICULTURAL ECONOMIST/MANPOWER SPECIALIST

The Agricultural Economist/Manpower Specialist will:

A. Evaluate the new administrative structure for the MAF/ARDA which is to be approved in 1983 on the following issues:

1. Role of FOA;

2. Administrative linkages;

3. Economic incentives for participating groups;

4. Coordinative role for research, teaching, and extension components.

5. Role of donor assistance projects and their linkages to research, teaching, and extension components;

6. Operational linkages between FOA, MAF/ARDA, MOE, NES, etc.;

7. Extent to which regional research will include dominant sorghum/millet cropping areas; and

8. Extent to which plans and funding materialize to establish and staff proposed provincial and village agricultural extension offices.

B. Develop FOA recurrent cost analysis which focuses upon (a) impact of earthquake upon budget allocations, (b) impact of development of other fáculties, (c) impact of YARG debt and balance of payments issues, (d) impact of apparent blunted emigrant remittances upon YARG budgets, and (e) cost of FOA practicums.

C. Develop analysis of salary structure including an assessment of the nature and extent of salary supplements and committee assignment payments and their economic affect on employment choices between civil service public institutions and semi-autonomous public institutions.

D. Complete qualitative and quantitative analysis of selected variations for FOA development in Yemen.

E. Review labor force analyses and reconfirm the conclusions and assumptions in the PP about labor force supply and demand as it relates to the FOA.

62

ECONOMIC ANTHROPOLOGIST
(Social Scientist)

The Social Scientist will:

1. Prepare social soundness analysis (SSA) for the Project Paper, following the general guidelines set up in AID Handbook 3. Basically, the SSA should discuss the following:

   a. What specific socio-economic problem is this project addressing?

   b. How specifically will this project address the problem described in (a)?

   c. Who will benefit from the project? Although the immediate beneficiaries will obviously be the students, the SSA should demonstrate that the ultimate beneficiaries will be the majority of rural farmers. (By "demonstrate", the writer should explain how the project will affect the rural population). Both groups of beneficiaries should be discussed. In the discussion of students, the analysis should investigate ways to ensure that good students are attracted to the FOA at the university. This will include a brief discussion of how the university assigns entering students to various faculties. This section should also include a frank assessment of possibilities of recruiting women to the FOA. This portion should cover employment opportunities for FOA graduates, retention problems which might be caused by insufficient salaries and possible solutions.

2. In order to demonstrate that the FOA is ultimately directed at farmers, the social scientist should describe the "land grant model" and how it will be applied in Yemen. This includes making an analysis of possible social or cultural constraints in Yemen which may require changes in the model to make it fully applicable to the Yemeni context. Special attention should be paid in this section to ways in which the land grant model channels information to its agricultural audience and its methods for responding to their needs. Specific attention should be paid to the "target groups" of the HITS and PETS projects to show how linkages will occur between these projects.

3. Some attention should be focused on the instructional farm. This should be described by the social scientist so that it is clear that a range of technologies are being tested at the farm including experiments with energy saving technologies where appropriate, as well as innovations which are within the reach of the average small farmer.

4. The social scientist should discuss the spread effect of this project showing how research and findings from FOA will be disseminated to the rural population. This section should investigate ways in which the media can be used and explore the feasibility of developing radio and television programs aimed at male and female audiences, and at the illiterate.

5. The probable impact of this project on women should be discussed. At least two beneficiary groups should be disaggregrated: female university students and women involved in agriculture.

   Under the first category, the social scientist should discuss the number of women at the university and the faculties in which they are enrolled. From this, he/she should explore the possibilities of the FOA attracting women students. In addition, the courses to be offered in home economics

should be described and mechanisms to assure (1) that female students in other faculties are aware of these courses and (2) that they are encouraged to enroll in these. Finally, the PP should demonstrate how these courses will benefit the female students enrolled and what the "spread effect" will be.

In a larger sense, the PP should discuss how the land grant model (in its Yemeni version) will reach rural women. If special TV programs will be developed, they should be mentioned in this section. Will the instructional farm experiment with agricultural tasks performed by women (small scale poultry, vegetable gardens). How will lessons learned be communicated to women?

Will the agriculture engineering curriculum include application of technology practical for small farmer and technology related to women's concerns (i.e., fuel - efficient stoves, etc.)?

Specifically describe how the courses for women in the college of agriculture will impact on agriculture production and will improve the quality of rural life.

PROJECT DESIGN OFFICER

A Project Design and Evaluation Officer will be provided by the CID Executive Office to work with the SPP team during the last 2 to 3 weeks of the design effort. The Design and Evaluation Officer will:

A. Confirm the validity of the Logical Framework contained in the SPID based on the additional technical, social, economic, financial, and implementation analyses prepared by other team members. He will modify the Logical Framework as appropriate;

B. Be responsible for orchestrating the preparation of the SPP text and annexes;

C. Recommend appropriate conditions of effectiveness of the AID grant;

D. Define and summarize the critical policy, design, and implementation issues which should be discussed and resolved prior to AID authorization of the project;

E. Develop an evaluation plan, including illustrative evaluation criteria and team requirements;

F. Edit the SPP text and annexes for consistency of style and content; and

G. Assist, as necessary, in presenting the project to AID.

DRAFT

FACULTY OF AGRICULTURE

SUBPROJECT PAPER OUTLINE

Project Development Team
Acronyms
List of Tables
List of Figures
Map of YAR

I. SUMMARY
- A. Overview
  - 1. Recommendation
    - a. Authorization
    - b. Approval of Waivers
  - 2. Duration
  - 3. Purpose
  - 4. Justification
  - 5. Method of Implementation
  - 6. Life-of-Project Cost
  - 7. Exchange Rate
  - 8. Environmental Recommendation
- B. SPID and Other Design Issues

II. BACKGROUND AND SETTING
- A. Background
- B. Trained Manpower as a Constraint to Development
- C. Relationship to Development Strategy
  - 1. YARG
  - 2. AID/CID

III. DETAILED PROJECT DESCRIPTION
- A. Purpose and Summary Components
- B. Faculty of Agriculture Development
  - 1. Technical Assistance
  - 2. Participant Training
  - 3. Laboratory Development
  - 4. Library Development
  - 5. Engineering Observation
- C. Instructional Farm
  - 1. Technical Assistance and Training
  - 2. Construction and Farm Establishment
- D. Other AID and Donor Assistance
  - 1. AID
  - 2. Other Donor

IV. PROJECT ANALYSES
- A. Technical Analysis
  - 1. Manpower Projections
    - a. Demand
      - (1) Demand for Skilled and Trained Agricultural Manpower
      - (2) Demand for Baccalaureate Level Agricultural Manpower

65

b. Supply
(1) Supply of Skilled and Trained Agricultural Manpower
(2) Supply of Baccalaureate Level Agricultural Manpower
c. Conclusions
2. The Project
a. Faculty Development
(1) Technical Support
(2) Training Requirements
(3) Laboratory Development
(4) Technical Reference Materials
(5) Commodity Support
b. Instructional Farm
(1) Pre-Authorization Activities
(2) Technical Support
(3) Training Requirements
(4) Facility Construction
(5) Water Delivery
(6) Integration Into Curriculum
(7) Demonstration and Community Outreach Programs
(8) Faculty Research Activities
c. Curriculum and Practicum Experiences
d. Evolution of Organizational and Administration Structure
(1) Administration Linkages with Public and Private Sector
(2) Operational Linkages with Public and Private Sector
3. Construction of Instructional Facilities
4. Conclusions
B. Social Soundness Analysis
1. Socio-Cultural Setting
a. Background
b. Education in Yemeni Society
(1) General Education
(2) University Level Education
2. Beneficiaries
a. Faculty and Students
b. Agricultural Sector Institutions
c. Farmers and Farmer Groups
d. Women
(1) Direct Beneficiaries
(2) Indirect Beneficiaries
3. Source of Students
a. Secondary Schools
b. Agricultural Technical/Secondary Schools
c. User Fees vs Student Incentive Pay
d. Military Service Requirement
4. Employment of Faculty of Agriculture Graduates
a. Public Sector
b. Private Sector
c. Graduate Study
5. Institutional Linkages
6. Community and Media Outreach
7. Conclusions

C. Economic and Budgetary Analyses
   1. Least-Cost Analysis
      a. Internal vs External Training
      b. Alternatives for Internal Training
      c. Conclusions
   2. Budgetary Analysis
      a. YARG Development and Recurring Budget
      b. Budgetary Allocations to Higher Education
      c. University of Sana'a Budgetary Analysis
      d. Faculty of Agriculture Budgetary Analysis
         (1) Development Costs
         (2) Recurring Costs
         (3) Conclusions
D. Summary Financial Plan
   1. Total Project Costs
   2. AID Contribution
      a. Institutionalization Project
      b. Architectural/Engineering Design and Supervision
   3. YARG Contribution
   4. Other Donor Contribution
E. Institutional Analysis
   1. University of Sana'a
   2. Faculty of Agriculture

IV. IMPLEMENTATION ARRANGEMENTS
A. Implementation Strategy
   1. USAID/Yemen
   2. CID
B. Summary Implementation Schedule
C. Evaluation Plan
   1. Internal CID Assessments
   2. External AID Evaluations
   3. Evaluation Criteria
D. Covenants and Conditions

ANNEXES

A. SPID Approval Message
B. Approved Initial Environmental Examination
C. YARG Request for Assistance
D. Technical Analysis
E. Economic Analysis
F. Social Soundness Analysis
G. Manpower Assessment
H. Detailed Financial Plan
I. Detailed Implementation Schedule

67

OUTLINE FOR ANNEX F

Preliminary Manpower Assessment

I. Overview of Education and Training System

II. Training for the Agricultural Sector

A. Agricultural Manpower Training in Higher Education

1. Projected Needs at B.S. Level
2. Projected Supply at B.S. Level
3. Manpower Assessment

B. Agricultural Manpower Training at Technical (Secondary) Level

1. Projected Needs for Secondary Level Technical Training
2. Projected Supply and Manpower Analysis for Secondary Level Technical Training

ANNEX F

PRELIMINARY MANPOWER ASSESSMENT 1/

I. Overview of Education and Training System

YAR is desparately short of manpower, at all technical and management skill levels, to implement its ambitious modernization plans. Almost no institutional capacity for education and training existed at any level prior to 1970. At the time of the revolution in 1962, only 919 primary schools existed in the entire country, with enrollment of 61,000 students, as shown in Table F-1. Only eight preparatory and secondary schools enrolled about 2,000 students. No improvement in this situation occurred until after 1970 with termination of civil war activity.

In the decade of the 1970's, through the initial YARG Three-Year Plan (1973-76) and the First Five-Year Plan (1976-81), the YARG placed major emphasis upon establishment of an educational system to develop human resources. The system utilzes a year structure of 6-3-3-4 respectively for primary, preparatory, secondary, and university levels. Most primary and preparatory structures have been built by local development authorities (LDAs). The number of such schools increased to over 2,700 by 1979/80. The number of secondary schools (teacher training, technical commercial, and agricultural) increased from 3 in 1962 to 27 in 1979-80. They have been financed largely by YARG and donor assistance. Ibb, the first agricultural technical school for training agricultural extension agents, opened in 1979. The University of Sana'a, YAR's only university, opened in 1970 with 64 students in the Faculties of Arts (literature), Law and Religion, and Sciences, and with a staff of 14 professors. The Faculties of Commerce and Education were added in 1973/74. Student enrollment increased to more than 4,200 by 1981. Plans exist to add Faculties of Medicine, Engineering, and Agriculture.

Enormous educational progress has been made. By 1980, 36 percent of the primary school age population and 4 percent of the secondary school population were enrolled. The total number of students enrolled increased from 127,000 to 485,000 in 1979/80, a nearly four-fold increase. The literary rate has increased to above 20 percent. Females make up less than 15 percent of enrollment at all levels. Attrition rate of students appears high at all levels. Ministry of Education statistics indicate that about 15 percent of the students entering Grade 1 complete Grade 9, and about one-half of the students completing each level proceed to the next level of schooling. The quality of schooling is relatively low, reflecting the shortage of buildings, furniture, equipment, teaching materials, and teachers.

Teacher shortage is the most critical education problem at all levels. While teacher numbers exceed 8,400, the number of Yemeni teachers has been dropping continuously since 1975. Yemeni teachers are being replaced by expatriates, largely from Egypt and Sudan to permit further training of Yemeni teachers. The proportion of expatriates in the preparatory and secondary levels averages about 90 percent.

TABLE F-1

GROWTH IN SCHOOLS AND ENROLLMENT IN THE YAR EDUCATION SYSTEM, 1962/63 to 1979/80

Level	Number of Schools			Number of Teachers			Number Enrolled (Thousands)		
	1962/63	1971/72	1979/80	1962/63	1971/72	1979/80	1962/63	1971/72	1979/80
Primary	919	1,115	2,513	-	5,825 1/	6,727	61	119	453
Preparatory	5	47	200	-	599 1/	1,061	1	6	20
Secondary	3	6	27	-	233 1/	480	-	1	8
University	-	1	1	-	14	153	-	1	4
TOTAL	927	1,169	2,741	-	5,611	8,421	62	127	485

1/ N/A for 1971/72; 1974/75 figures used

Source: Ministry of Education and University of Sanaa

Non-formal education and training also exists. The MOE has primary responsibility for such activity. In addition to the technical secondary schools, MOE has initiated about 100 literary centers which reached over 2,200 adults in 40 villages since 1979. Such adult classes provide training courses in electricity, carpentry, sheetmetal and welding, construction, automotive, general mechanics, agriculture, health care, home economics, nutrition, sewing, and weaving. Also provided are country-wide literary classes which are intended to provide Grade 4 literary and arithmetic skills. Enrollment levels in the literary classes exceeded 10,400 in 1979/80. Health centers provided by the Ministry of Health enrolled 90,000 persons in 1979/70 in their health classes. Eight community development centers provided training for development in embroidery, sewing and home economics.

II. Training for the Agricultural Sector

The MAF was a skeleton organization of less than 500 technical people in just five governates in 1974 with no extension service. 2/ By mid-1982, MAF had grown to approximately 750 technical personnel operating in ten governates, and with a growing extension service component of nearly 600.

TABLE F-2

AGRICULTURAL TECHNICAL MANPOWER EMPLOYED AT MAF AS OF 6/30/82 AT THE B.S. OR HIGHER LEVEL OF TRAINING

Discipline	Number
Agriculture	143
Veterinary	5
Fishery	3
Engineering	6
Other	25
TOTAL	187

Source: Ministry of Agriculture and Fisheries

A. Agricultural Manpower Training in Higher Education

1. Projected Needs at B.S. Level - The FFYP (1976-1981) called for about 600-650 B.S. level personnel to be sent overseas for B.S. level training in general agriculture. 3/ Table F-3 indicates that by October 1, 1981, there was a need for 249 B.S.-level trained agriculture personnel to implement on-going agriculture projects.

71

TABLE F-3

MAF - ESTIMATED B.S. LEVEL AGRICULTURAL MANPOWER THAT WOULD BE REQUIRED FOR MAJOR AGRICULTURAL PROJECTS IN PIPELINE AS OF OCTOBER 1, 1981

Subject Matter	Manpower Requirements
For Water Resource Development	
Civil Irrigation Engineers	43
Mechanical Engineers	4
Surveyors	22
Geologists	1
Subtotal	70
For General Agricultural and Veterinary Sciences (B.S. Degree Level)	
General Agriculture	63
Agronomy	12
Horticulture	15
Entomologist	6
Plant Protection	6
Soils	5
Farm Machinery	6
Livestock Production	40
Veterinary	26
Agri. Extenson	36
Agri. Information	5
Agric. Economics and Marketing	7
Agri. Statistics	3
Fisheries	17
Forestry	2
Total	249

Source: Ministry of Agriculture, October 1981.

72

TABLE F-4

MAF PROJECTS FOR FY 83

(Including donor agencies recognizing that the YARG contributes to all projects)

		Donor
1.	Seed Multiplication/Improvement	FAO/EEC
2.	Coffee Seed Development	YARG
3.	Potato Improvment	Dutch
4.	Hort Seedling and Honey Production	YARG
5.	Plant Protection	German, USAID/CID
6.	Desert Locust Control - Tihama	FAO
7.	Agricultural Development - Batana	YARG, PRC
8.	Agricultural Research and Forestry - Dhamar	British
9.	Agricultural Engineer - Taiz and Tihama	British
10.	Reduction of Harvest Losses - Southern Uplands,	UNDP
11.	Soil Conservation and Forestry Development	German
12.	Agriculture Research - Middle and Southern Uplands, Tihama	WB/IFAD, Italy
13.	Land Classification Survey - all regions	UNDP perhaps
14.	Agriculture Extension and Information - all regions	YARG
15.	Poultry Production - Al Rawdah	Dutch
16.	Poultry Training and Production - Al Hasaba	USAID/CID
17.	Veterinary Services	British
18.	Animal Husbandry	YARG
19.	Fodder Improvement	UNDP
20.	Zoological Garden - Sana'a	Not Implemented
21.	Wadi Al Jawf Development	German
22.	Small Diversion Dams - all regions	YARG
23.	Terrace and Dyke Maintenance	YARG
24.	Agriculture Meteriological Stations - all regions	YARG
25.	Ground Water Studies	YARG
26.	Institutional Support - Irrigation Department	Arab Fund
27.	Institutional Support - Irrigation Department	Arab Fund
28.	Wadi Bana (Ibb) Development	YARG
29.	Water Resource Survey - all regions	YARG
30.	Applications of Modern Irrigation Techniques	UNDP
31.	Utilization of Sewage Water for Irrigation	Not Implemented
32.	Sana'a Water Basin Study	USSR
33.	Institutional Support for MAF	WB - contract expired 12/31/82

13

34.	Improvement of Agriculture Planning and Statistics	USAID/CID
35.	Rural Development - not Eastern regions	YARG
36.	Agriculture Marketing - Sana'a	YARG
37.	Rural Development - Southern Uplands	WB, IFAD, Abu Dhabi, Swiss
38.	Rural Development - Rawdah area	Dutch
39.	Rural Development - Al Baun	German
40.	Rural Development - Khawlan	Islamic Bank
41.	Rural Development - Hajjah	Islamic Bank
42.	Rural Development - Mahwit	YARG
43.	Rural Development - Sadah	Feasibility Study Italy
44.	Rural Development - Anis	Feasibility Study AOAD
45.	Wadi Zabid Development - Tihama	YARG
46.	Wadi Rima Development - Tihama	WB, Kuwait Fund
47.	Wadi Mawr - Tihama	WB, Kuwait Fund, German, EEC, IFAD
48.	Seed Improvement and Extension - Tihama	Dutch, UNDP
49.	Surdud Pilot Farm - Tihama	YARG
50.	Agriculture Research - Tihama	Not Implemented
51.	Wadi Siham Development - Tihama	YARG
52.	Northern Wadis Study - Tihama	Not Implemented
53.	Fisheries Development - Hodeidah	WB, Denmark
54.	Institutional Support to Fisheries Coop-Hodeidah	YARG
55.	Fish and Shrimp Aquaculture - Khawka	Not Implemented
56.	Fishing net factory - Hodeidah	YARG

TABLE F-5

REQUIREMENTS FOR GRADUATE AND POST GRADUATE TRAINING IN AGRIC., VETERINARY SC., FISHERY AND IRRIGATION DURING THE SECOND FIVE YEAR PLAN (1981-1986)

Specialization	Ph.D.	Ms.C.	Bs.C
Agric. Research	9	25	80
General Agriculture	-	-	150
Agric. Planning	1	2	10
Agric. Economics	-	2	10
Agric. Statistics	-	2	20
Agric. Extension	-	7	50
Crop Production & Seed Propagation	-	4	10
Vegetables, Fruits & Coffee	-	4	10
Forestry	-	1	20
Agric. Engineering	-	2	10
Plant Protection	-	2	40
Land & Soil Survey	-	2	10
Animal Production	-	9	30
Veterinary Science	-	5	20
Fishery	-	2	15
Marine Science	-	2	15
Fishery Landing Terminals	-	-	15
Cooling Engineering	-	-	10
Mechanical Engineering	-	-	10
Civil Engineering - Irrigation	-	-	60
TOTAL	10	71	595

Source: Ministry of Agriculture and Fisheries, January 1983.

75

2. Projected Supply at B.S. Level - All university level training (B.S., M.S. and Ph.D.) of Yemeni in agriculture, to date, has come from training abroad and sponsored by donor assistance. The bulk of much training is for B.S.-degree training in Arabic-speaking universities of the Middle East, primarily Saudi Arabia Egypt and Syria. Only 10 percent have gone to other Middle Eastern countries, 7 percent to Eastern European countries and 3 percent to the U.S.

a. From Overseas Sources - The number of students sent abroad for B.S. degree level training in agricultural and fisheries related programs from 1974 through 1980 as shown in Table F-6. Of the 748 sent out, 655 were for training in general agriculture. The projection for returnees also is presented in Table F-6. It included no provisions for normal attrition, delayed returns, employment elsewhere in Arab bloc countries and employment in Yemen's private sector. The number of Yemenis returning to Yemen and the MAF with B.S. degree in hand, as of June 1982, was 53. Thus in four years, the MAF staff with B.S. degrees has grown fro about 134 to 187 through overseas training. It appears that the approximate time to obtain a B.S. degree overseas is about 5-6 years. With such an apparent return time lag, the actual return rate to MAF is about 15 percent (sum of first four years' number of students sent out (376) - number returned (53). The 1982 return may be indicative of a higher average return rate in the future, perhaps 20-25%, due in part to reduced job opportunities in Arab countries with softening of the international oil market.

No data is available on the number of Yemenis actually being sent abroad for B.S. level training in agriculture to meet the needs of the SFYP. It is assumed that approximately 600 will be sent out. Further, it is assumed that another 600 will be sent out for the Third Five Year Plan.

b. From Proposed FOA - Manpower supply projections from the proposed FOA can be made only by making several assumptions. The extent to which such assumptions materialize will unfold over time. Assumptions concerning FOA contribution to B.S. level manpower needs are as follows:

1) The first FOA class is admitted at the University of Sana'a in 1985;

2) The average time to complete the four year program is five years; 4/

3) The dropout rate for a class is 20 percent;

4) The number of students admitted to FOA in the first five years of operation follows a growth curve which lies between that experienced by the Faculties of Science and Commerce during their initial growth years. The assumed FOA admissions are:

Year 1:	30
Year 2:	60
Year 3:	90
Year 4:	120
Year 5 (and thereafter):	150

76

TABLE F-6

YEMENI STUDENTS SENT ABROAD FOR UNIVERSITY TRAINING IN AGRICULTURAL FIELDS FROM 1974 THROUGH 1980, MAF PROJECTIONS OF EXPECTED RETURNS OF SUCH STUDENTS, AND ACTUAL RETURNS TO MAF THROUGH JUNE 1982

YEAR	NO. STUDENTS SENT ABROAD					EXPECTED STUDENT RETURN				ACTUAL RETU EMPLOYMENT BY
	4 YR. AGRI	5 YR VET	4 YR FISH.	5YR AG ENG	TOTAL	AGRIC.	VET	IRRIG. ENG.	TOTAL	
1974	41	-	5	2	48					
1975	86	1	2	2	91					
1976	172	-	10	-	182*					
1977	77	18		2	97					
1978	85	2		2	89					
1979	131	34		3	168	7			7	5
1980	63	10			73	108			108	5
1981						73			73	13
1982						130		2	132	30
1983						115	17	2	134	
1984						109	16		125	
1985						23	7	3	33	
1986						90	15		105	
TOTAL	655	65	17	11	748	655	55	7	717	53

Source: Ministry of Agriculture and Fisheries, June 30, 1982.

5) The percentage of FOA graduates entering the public sector is 60 percent, with the remainder employed by the private sector, admitted for further graduate training, or employed outside Yemen.

In reality, we do not know the extent of the agricultural private sector and its absorptive capacity for B.S. trained agriculturalists. It is perceived by the SPID team that some market potential exists presently for such technology as two-wheeled tractors, pesticides, new seed varieities and water conserving irrigation equipment. The extent to which such a market exists and is exploited by the private sector will determine the need for B.S.-trained agriculturalists. Other demands are long-term in nature and will be delayed until some time after FOA, NES, ARDA, etc. are fully operational and generating appropriate technology.

3. Manpower Assessment - A summary of the demand for B.S. level Yemeni agriculturalists referred to in earlier sections is as follows:

As of 6/30/82:	Number Needed
Replacement of expatriates currently in MAF	90
To complete FFYP (1981)	250
To meet SFYP projections (1982-1986)	600
To meet Third FYP projections (1986-1991)	600
	1540

The total projected demand through the end of the Third Five Year Plan for B.S. level Yemeni agriculturalists approaches 1540 personnel.

The projected supply of B.S. level Yemeni agriculturalists over time from both overseas and FOA sources is presented in Table F-7. The assumptions are presented as footnotes at the bottom of the table. Columns 1, 2, and 3 show the manpower supply from overseas sources.

Column 3 shows a total of 177 B.S. graduates returning to MAF through 1987 from the pool sent overseas under the FFYP. By 1991, the number of MAF increases to 297 as a consequence of the SFYP pool sent out. The final group sent out under the Third Year Plan return by 1996 and increase the total from overseas sources to 447. By 1996, an additional 280 B.S. level graduates from overseas are expected to be in the private sector.

Combining overseas returnees with graduation from FOA and entry into MAF provides a total of 1095 (648 from FOA and 447 from overseas) through 1999 (column 8). This falls 445 short of estimated needs through the Third Five Year Plan. The need would be met by 2005 with generation of B.S. graduates from FOA only or by 2003 with FOA and sending students overseas as part of a Fourth Five Year Plan.

The major manpower leakages in the analysis are from two sources. One is a low return rate from overseas back into the MAF due primarily to losses into the Yemen private sector and Arab bloc countries. The other is loss of B.S. graduates from FOA to the Yemen private sector. Limited manpower and relative weakness of YARG makes control of overseas leakages

Table F-7

PROJECTED SUPPLY OF B.S. DEGREE GENERAL AGRICULTURE STUDENTS ENTERING YAR AGRICULTURAL PUBLIC SECTOR FROM FOA/UNIVERSITY OF SANA'A AND OVERSEAS SOURCES

YEAR	TOTAL RETURNED ANNUALLY FROM OVERSEAS (1)	TRAINED OVERSEAS AND EMPLOYED BY MAF		FACULTY OF AGRICULTURE STUDENTS				COMBINED TOTAL OF FOA AND OVERSEAS (8)
		ANNUALLY (2)	TOTAL (3)	ADMITTED (4) 1/	GRADUATED (5) 2/	EMPLOYED ANNUALLY BY MAF (6) 3/	EMPLOYED BY MAF (7)	
1979	4/	5 5/	5					5
1980		5 5/	10					10
1981		13 5/	23					23
1982		30 5/	53					53
1983	38 6/	23 6/	78					78
1984		23	101					101
1985		23	124	30				124
1986		23	147	60				147
1987	50 7/	30 7/	177	90				177
1988		30	207	120				207
1989		30	237	150	24	14	14	251
1990		30	267		48	29	43	310
1991		30	297		72	43	86	383
1992	50 8/	30 8/	327		96	58	144	471
1993		30	357		120	72	216	573
1994		30	387				288	675
1995		30	417				360	777
1996		30	447				432	879
1997	9/	9/					504	951
1998							576	1023
1999							646	1095

1/ Number of students entering FOA assumed to follow a growth curve which lies between that experienced by the Faculty of Science and the Faculty of Commerce.

2/ Assumes a five year time period to graduate and a 20 percent attrition rate.

3/ It is assumed some 60 percent of FOA graduates will be employed by the public sector (MAF). The remainder will be employed by the private sector, admitted for further graduate training, or employed outside Yemen.

4/ Unknown

5/ Actual return and employment by MAF from Table F-5.

6/ The overseas return rate to MAF for B.S. degree training in agriculture is expected to be 25 percent with a five year training lag (See Annex F for detail). Of the 655 sent abroad (Table F-6), 164 are expected to return to MAF over the seven year period from 1979 through 1986, or an average of 23 per year. This is expected to be 60 percent of those returning. The remaining 15 (38-23) are assumed to enter the private sector.

7/ Assumed an additional 600 B.S. level candidates will be sent for overseas training in accordance with SFYP projects (Table F-5). With a five year lag and assumed 25 percent returning rate a total of 150 will return to MAF, or 30 per year beginning 1987. Again there is assumed to be 60 percent of those returning. The remaining 20 (50-30) are assumed to enter the private sector.

8/ [illegible]

9/ No Projections made beyond Third Five Year Plan.

unenforcable. Development of an FOA on the other hand, allows greater control potential by YARG upon those who may be allowed to obtain employment outside Yemen. Control within Yemen between the public and private sector is not desired.

B. Agricultural Manpower Training at Technical (Secondary) Level

By mid-1982, the MAF had a staff of trained agricultural technicians at the secondary school level which numbered over 550 as shown in Table F-8.

TABLE F-8

AGRICULTURAL TECHNICAL MANPOWER EMPLOYED BY MAF AT THE TECHNICAL (SECONDARY) LEVEI AS OF 6/30/82

Specialty	Number
Agricultural Technician	380
Veterinary Technician	86
Irrigation Technician	34
Commercial Secondary School and Others	66
Total	566

Source: Ministry of Agriculture and Fisheries

While all or nearly all of these personnel are believed to be Yemeni, a significant number, perhaps 50 percent, have less than three years of secondary school technical training.

Agricultural technical training for extension agents was initiated as part of the Three-Year Plan in 1974 in which a number of extension centers were established. These were located in Hodiedah (9 center), Wadi Zabid (10 centers), Ibb (11 centers), and Taiz (6 centers) and were supported from donor projects. The extension centers provided an 11-month training course originally requiring nine grades of ormal school for entrance. This has since been modified to allow down to six grade training for admission as the program is terminal. The training concentrated on extension activities that were expected to increase the productivity of subsistence farmers and generate marketable surpluses. The trainees received a stipend of 750 YR/month plus food, lodging, bocks and round trip transportation. Trainees who completed the course were expected to stay with MAF for a period of five years or repay the stipend in proportion to time rendered. By summer 1982, some 250-280 students had been trained of which 193 continue to serve in the field. The 11-month training programs were expected to terminate in 1982 and be replaced by the agricultural technical schools. The proposed 1983 MAF/ARDA reorganization will determine the fate of the training programs.

All long-term (3 years) agricultural extension agent training is to be provided through MOE and its three agricultural technical secondary

40

schools at Ibb, Surdud and Sana'a. The Ibb school started in 1979 and graduated its first class of 52 students in the summer of 1982. Surdud started in September 1981. Construction of the Sana'a livestock school is nearing completion. It opened in the fall of 1982 to provide specialized veterinary technical training.

The Ibb school had a design capacity of 270 students or 90 per year for a three-year course of study, but the functional capacity is only about 50 to 60 students per year. The other two schools have a lesser design capacity (about 180) each. Detailed information and experience is available only with the Ibb school and Surdud school.

Student enrollment at Ibb currently is 43, 32 and 36 for first, second and third-year students, respectively, for a total of 111 students. Maximum class capacity is 60 students. Entrance requirements are that each student must have passed the standard 9th grade exam and show such credentials. A stipend is provided to qualified students who are accepted. It includes 300 YR/month (150 YR each from MOE and MAF), food, lodging, books, and 150 YR/year for clothes, and one round trip between home and Ibb. The secondary teacher schools pay an incentive of 500 YR/month or more plus room and board.

There is stipend competition with the secondary teacher schools, an issue of concern expressed by Ibb students through a 1982 survey. Additionally, some regular secondary schools, offering both the arts and science options do offer stipends as well. The sources of students for the proposed Faculty of Agriculture at the University of Sana'a are expected to be the three agricultural technical schools and the science option of the regular secondary school. To date, 80 percent of students enrolled at Ibb have farm backgrounds.

The Ibb school is certified as an approved school for students receiving scholarships for B.S. degree training in Egypt. The curriculum emphasizes about 40 percent general science and 60 percent agricultural sciences. A preliminary comparison of the standard science curriculum in secondary schools with curriculum at Ibb is shown in Table F-9.

A PRELIMINARY COMPARISON OF CURRICULUM REQUIREMENTS

AT AGRICULTURE AND SCIENCE SECONDARY SCHOOLS

Expressed in Years of Training by Subject

Courses	Agriculture Ibb Secondary Ag. Institute	Science Secondary
Math	2	2
Islamic Religion	3	3
Arabic Language	3	3
English	3	3 (technical)
Chemistry		
Physics	3	1
Botany		
Applied Technical Agriculture	2	-

The apparent trade-off for Ibb students going on for university training is that they will be better trained on technical subjects, especially those relating to agriculture, but be weaker in math than the urban student. University performance of Ibb School graduates will need to be monitored continuously and compared with that from secondary schools.

Student attrition at Ibb had been low: 15 percent in Year 1, 5 percent in Year 2, and none in Year 3. A strong attitude prevails, even for the poor students to go on for university training. The six best students in the first two classes are provided scholarships for university training overseas.

Students' parents are highly supportive of further education, with greatest encouragement in the most prestigeous faculities of medicine and engineering. The perceived need for agricultural training, job opportunities upon graduation in the agricultural sector, and salary levels are issues of concern both by students and parents. Students prefer Arab bloc university training because it is in Arabic rather than English or another foreign language. Most students have been sent to Egypt because it has provided more openings for Yemen students and its entrance requirements are somewhat less than those found in other Arab universities.

Ibb students have come almost entirely from the Ibb, Taiz and Hodeidah provinces, relfecting a strong regional influence. A number of YAR students from northern provinces were selected for enrollment early on in the project. All were sent home with the reason expressed being inadquate reading and writing skills.

92

It is estimated that about 30 students of the 150 annual enrollment capacity of FOA will come from the agricultural technical schools. The remaining 120 are projected to come from the science option/secondary schools.

1. Projected Needs for Secondary Level Technical Training

Employment opportunities for agricultural technical school graduates appear vast. The projected manpower needs for technical level support as of October 1, 1981 is 773 as shown in Table F-10. The projection for agricultural extension agents specifically is 160, and for veterinary assistants is 190.

TABLE F-10

ESTIMATED MAF MANPOWER NEEDS AT THE TECHNICAL SECONDARY LEVEL REQUIRED FOR MAJOR AGRICULTURAL PROJECTS IN PIPELINE AS OF OCTOBER 1, 1981

Technical Specialty	Number
Water Resource Projects	
Surveyors	64
Mechanics	1
Geology	4
General Agriculture	1
Draftsmen	100
Extension Agents	11
Horticulturists	160
Farm Machinery	30
Veterinary Assistants	16
Crop Protection	190
Statistical Clerks	50
Fisheries	10
Forestry	91
	45
Total	773

Source: Ministry of Agriculture and Fisheries

An additional 163 are specialized non-agricultural technicians for fisheries, forestry, survey, geology and drafting. The remaining 260 are for agricultural technicians in crop protection, farm machinery, horticulture, water resources and general agricultural positions on donor assisted projects. The projected needs for SFYP, obtained from the CPO/SFYP summary sheets is as follows:

Laboratory Technicians	-	260
Veterinary Assistants	-	7
Agricultural Technicians	-	664
Livestock Technicians	-	120
Total		1051

Thus, through 1986, the projected need for agricultural technicians trained at the secondary level exceed 1800 personnel (773 + 1051 = 1824). For planning purposes, it is assumed that the Third Five Year Plan will project an additional need for 1,000 agricultural technicians for the 1987 - 1991 period.

2. Projected Supply and Manpower Analysis for Secondary Level Technical Training - A manpower analysis of the secondary level training is being reviewed as part of the documentation for an extension of the Ibb Secondary Institute Subproject.

44

FOOTNOTES

1/ The data presented in this section, while largely from Ministry of Education, University of Sana'a and YARG 1975 Census sources, have been compiled and presented in narrative form from several other references. They include:

(1) "Agricultural Extension Services in Yemen: Assessment of Several Programs and Recommendations for Improvement", Thomas B. Stevenson Consultant - CID, July 16, 1982.

(2) "Agricultural Sector Assessment", AID/Yemen, 1982.

(3) "Agricultural Sector Study", World Bank (IBRD), November 17, 1981.

(4) "Manpower Development in the Yemen Arab Republic", World Bank Report No. 3181a-YAR, March 27, 1981.

(5) "Staff Appraisal Report, Third Education Project, Yemen Arab Republic", Report No. 2746-YAR, April 27, 1979.

(6) "Yemen Arab Republic, Report of a Traditional Economy", World Bank Country Study, January 1979.

2/ Gable, Richard W., "Government and Administration in the Yemen Arab Republic" (Paper prepared for Office of Rural and Administrative Development, USAID), University of California, Davis, January 1979.

3/ While the precise number specified in the FFYP is not known, that 655 students wwere sent abroad, as shown in Table F-6, is suggestive of the estimate given. Some 50 donor-sponsored projects, as shown in Table F-4 are expected to absorb the unfilled positions as soon as expatriates and returning Yemeni from overseas B.S. level training are available to be posted.

The number of trained university level agriculturalists needed as specified by the SFYP (1982-1986) is presented in Table F-5. That projection is for 676 trained agriculturalists; 595 at the B.S. level; 71, M.S.; and 10 Ph.D. Thus through 1986, the projected need for B.S. level agriculturalists in Yemen is about 845.

For planning purposes, it is assumed that the Third Five Year Plan will specify an additional 600 B.S. level trained agriculturalists needed for the 1987-1991 period.

4/ University of Sana'a dropout rates historically have been low primarily because higher education is free. The major problem has been a proliferation of part time students and extended periods, perhaps 5 to 7 years, before graduation. The primary factor for such occurrence has been an examination policy which required examinations to be taken once a year on all courses and to repeat the entire process is one or more examination components are failed. The University recently changed its policy to the U.S. system whereby examinations are taken each quarter or semester on each subject and only those courses retaken in which the student failed the

examination. Further, a minimum of 12 hours will now be required each quarter as a means to reduce part time students.

46

A N N E X G

PRELIMINARY FINANCIAL PLAN

I. Summary Financial Plan for Faculty of Agriculture Subproject (Table G-1)

II. AID Dollar Budget, Faculty of Agriculture

   A. Summary of Detailed Worksheets (Table G-2)

   B. Detailed Worksheets of AID Dollar Budget (Table G-3)

III. AID Local Currency Budget, Faculty of Agriculture

   A. Summary of Detailed Worksheets (Table G-4)

   B. Detailed Worksheets for AID Local Currency Budget (Table G-5)

IV. YARG Budget, Faculty of Agriculture

   A. Summary of Detailed Worksheets (Table G-6)

   B. Detailed Worksheets for YARG Budget (Table G-7)

A N N E X C

Table G-1 Summary Financial Plan for Faculty of Agriculture Subproject
(Dollars)

SOURCE/CATEGORY	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
I. AID Budget												
A. AID Dollar Budget	222,400	1,864,000	1,206,300	1,489,200	1,409,300	1,420,600	1,115,200	818,400	582,200	487,900	350,500	10,966,000
1. Contingency, 5%	11,120	93,200	60,315	74,460	70,465	71,030	55,760	40,920	29,110	24,395	17,525	548,300
2. Inflation, 10% (Compounded)	-0-	-0-	126,662	328,369	489,802	692,265	714,871	663,051	579,950	585,861	499,741	4,680,572
Subtotal	233,520	1,957,200	1,393,277	1,892,029	1,969,567	2,183,895	1,885,831	1,522,371	1,191,260	1,098,156	867,766	16,194,872
B. AID Local Currency Budget	550,000	981,800	308,600	331,400	295,500	320,900	243,200	126,800	116,700	93,100	116,700	3,484,700
1. Contingency, 5%	27,500	49,090	15,430	16,570	14,775	16,045	12,160	6,340	5,835	4,655	5,835	174,235
2. Inflation, 10% (Compounded)	-0-	-0-	32,403	73,073	102,701	156,376	155,897	102,731	116,249	111,793	166,390	1,017,613
Subtotal	577,500	1,030,8[illegible]	1/ 356,433	421,043	412,976	492,321	411,257	235,871	238,784	209,548	288,925	4,676,548
TOTAL AID BUDGET	811,020	2,988,090	1,749,710	2,313,072	2,382,543	2,677,216	2,297,088	1,758,242	1,430,044	1,307,704	1,156,691	20,871,420
II. YARG Budget /Donor Parallel	-0-	23,375,000	2/ 655,300	765,500	789,200	1,030,700	1,165,200	1,306,900	1,429,200	1,545,900	1,688,600	33,751,500
A. Contingency, 5% Financing	-0-	1,168,750	2/ 32,765	38,275	39,460	51,535	58,260	65,345	71,460	77,295	84,430	1,687,575
B. Inflation, 10% (Compounded)	-0-	-0-	68,807	168,793	274,286	502,265	746,922	1,058,824	1,423,676	1,856,286	2,407,597	8,507,456
Total YARG Budget	-0-	24,543,750	2/ 756,872	972,568	1,102,946	1,584,500	1,970,382	2,431,069	2,924,336	3,479,481	4,180,627	43,946,531
GRAND TOTAL (AID & YARG)	811,020	27,531,840	2,506,582	3,285,640	3,485,489	4,261,716	4,267,470	4,189,311	4,354,380	4,787,185	5,337,318	64,817,951

1/ AID financing of Architect/Engineer services for faculty design and construction supervision will add about 2.0 million dollars in Year 1 and/or Year 2.

2/ Some or all of the 24.5 million dollars for Faculty construction including contingency will be parallel financing from donors other than AID and the YARG. Funding will likely come from a Middle East country.

3/ In addition the YARG has provided 25 hectares of land for the Faculty of Agriculture and instructional farm which is valued at 56.75 million rials = 12.4 million dollars.

4/ Total including land, other donor parallel financing and A and E services increased from 64.8 to 79.2 million dollars

Table G-2 Summary of Detailed Worksheets for AID Dollar Budget - FOA

(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
I. Salaries and Wages	55,500	1/ 159,000	283,400	376,900	333,800	381,300	294,200	181,900	129,500	138,000	129,500	2,463,000
II. Indirect Costs	20,700	75,800	126,500	166,800	145,900	157,600	126,200	88,600	61,200	66,200	62,000	1,097,500
III. Allowances	-0-	45,300	159,500	212,300	184,400	187,400	134,200	74,900	33,500	33,500	41,000	1,106,000
IV. Travel and Transportation	8,200	311,100	141,800	149,300	121,500	119,800	113,900	103,100	94,900	91,900	68,500	1,324,000
V. Expendable Equipment & Materials	-0-	12,500	23,500	31,500	29,500	27,500	23,500	21,500	18,500	16,500	13,500	218,000
VI. Non-Expendable Equip. & Materials	-0-	15,000	168,000	157,000	125,000	124,000	92,000	91,000	79,000	59,000	36,000	946,000
VII. Participant Training	138,000	274,800	303,600	386,400	469,200	414,000	331,200	248,400	165,600	82,800	-0-	2,814,000
VIII. Instructional Farm	-0-	461,500	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	461,500
IX. Other Direct Costs	-0-	509,000	-0-	9,000	-0-	9,000	-0-	9,000	-0-	-0-	-0-	536,000
Subtotal	222,400	1,864,000	1,206,300	1,489,200	1,409,300	1,420,600	1,115,200	818,400	582,200	487,900	350,500	10,966,000
Contingency, (5%)	11,120	93,200	60,315	74,460	70,465	71,030	55,760	40,920	29,110	24,395	17,525	548,300
Subtotal	233,520	1,957,200	1,266,615	1,563,660	1,479,765	1,491,630	1,170,960	859,320	611,310	512,295	368,025	11,514,300
Inflation, (10%, Compounded)	-0-	-0-	126,662	328,369	489,802	692,265	714,871	663,051	579,950	585,861	499,741	4,680,572
TOTAL AID DOLLAR BUDGET	233,520	1,957,200	1,393,277	1,892,029	1,969,567	2,183,895	1,885,831	1,522,371	1,191,260	1,098,156	867,766	16,194,872

1/ Totals from detailed worksheets, Table G-3, rounded upward to nearest hundred.

Table G-3 Detailed Worksheets of AID Dollar Budget, FOA

(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
I. Salaries and Wages												
A. On-Campus												
1. Home Office												
-Proj. Director, 0.75-0.25 FTE	16,875	36,000	31,680	24,000	24,000	24,000	15,840	15,840	12,000	12,000	12,000	224,23
-Secretary, 0.50-0.33 FTE	-0-	6,500	6,500	6,500	6,500	6,500	4,290	4,290	4,290	4,290	4,200	53,95
2. TDY												
-Proj. Dir., 60-90 days @ $220	-0-	19,800	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	138,60
-Proj. Consultants, 30 days @ $220	26,400	6,600	6,600	6,600	6,600	6,600	6,600	6,600	6,600	6,600	6,600	92,40
-Grad. Stud. Super, 45-90 days @ $220	-0-	9,900	9,900	9,900	9,900	9,900	19,800	19,800	19,800	19,800	19,800	148,50
-Proj. Eval., 30 days @ $220	-0-	-0-	-0-	6,600	-0-	-0-	6,600	-0-	-0-	6,600	-0-	19,80
Total On-Campus Salaries & Wages	43,275	78,800	67,880	66,800	60,200	60,200	66,330	59,730	55,890	62,490	55,890	677,48
B. Off-Campus												
-Proj. Manager, 1.0 FTE	-0-	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	450,000
-Co-Dean, 1.0 FTE	-0-	-0-	48,000	48,000	48,000	48,000	48,000	-0-	-0-	-0-	-0-	240,000
-Co-Mngr., Farm, 1.0 FTE	-0-	-0-	33,000	33,000	33,000	33,000	33,000	-0-	-0-	-0-	-0-	165,000
-Co-Librarian, 1.0 FTE	-0-	-0-	27,000	27,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	54,000
-Expt. Fac., TCN, 1.0-3.0 FTE	-0-	-0-	-0-	74,000	74,000	111,000	37,000	37,000	-0-	-0-	-0-	333,000
Total Off-Campus Salaries & Wages	-0-	45,000	153,000	227,000	200,000	237,000	163,000	82,000	45,000	45,000	45,000	1,242,000
C. Fringe Benefits												
-On-Campus (Academic), 28.2%	12,204	20,389	17,281	17,005	15,143	15,143	17,495	15,634	14,551	16,412	14,551	175,808
-On-Campus (Classified), 31.5%	-0-	2,048	2,048	2,048	2,048	2,048	1,351	1,351	1,351	1,351	1,351	16,995
-Off-Campus (Academic), 28.2%	-0-	12,690	43,146	64,014	56,400	66,834	45,966	23,124	12,690	12,690	12,690	350,244
Total Fringe Benefits	12,204	35,127	62,475	83,067	73,591	84,025	64,812	40,109	28,592	30,453	28,592	543,047
TOTAL SALARIES & WAGES	55,479	158,927	283,355	376,867	333,791	381,225	294,142	181,839	129,482	137,943	129,482	2,462,532
II. Indirect Costs												
A. On Campus, 30%	19,089	52,684	55,810	66,368	61,775	60,785	55,403	52,640	39,133	43,816	39,853	547,356
B. Off-Campus, 19.5%	-0-	17,480	61,274	88,039	73,252	85,099	61,403	29,327	17,480	17,480	17,480	468,316
C. CID G & A, 8.0%	1,527	5,613	9,367	12,353	10,802	11,671	9,345	6,557	4,529	4,904	4,587	81,255
TOTAL INDIRECT COSTS	20,616	75,777	126,451	166,760	145,829	157,555	126,153	88,524	61,142	66,200	61,920	1,096,927

90

Table G-3 (Continued) Page 2; Detailed Worksheets of AID Dollar Budget, FOA

(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
III. Allowances												
A. Post Differential, 25%	-0-	11,250	38,250	56,750	50,000	59,250	40,750	20,500	11,250	11,250	11,250	310,500
B. COLA, 6%	-0-	2,700	9,180	13,620	12,000	14,220	9,780	4,920	2,700	2,700	2,700	74,520
C. Sunday Pay, 5%	-0-	2,250	7,650	11,350	10,000	11,850	8,150	4,100	2,250	2,250	2,250	62,100
D. Educ. Allowance, $15750/fam.	-0-	15,750	63,000	78,750	47,250	47,250	47,250	15,750	15,750	15,750	15,750	362,250
E. Move In/Move Out, $11800/fam. In	-0-	(1-In) ( )	(3-In) ( )	(3-In) (1-Out)	(3-In) (3-Out)	(2-In) (3-Out)	( ) (3-Out)	(1-In) (2-Out)	---	---	( ) (1-Out)	---
$7400/fam. Out	-0-	11,800	35,400	42,800	57,600	45,800	22,200	26,600	-0-	-0-	7,400	249,600
F. Storage	-0-	1,500	6,000	9,000	7,500	9,000	6,000	3,000	1,500	1,500	1,500	46,500
TOTAL ALLOWANCES	-0-	45,250	159,480	212,270	184,350	187,370	134,130	74,870	33,450	33,450	40,850	1,105,470
IV. Travel and Transportation												
A. Per Diem												
1. Domestic												
-Proj. Director, 30 days @ $75	-0-	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	22,500
Total Domestic Per Diem	-0-	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	22,500
2. International												
-Proj. Dir., 30-90 days @ $105	3,150	9,450	6,300	6,300	6,300	6,300	6,300	6,300	6,300	6,300	6,300	69,300
-Proj. Consult., 30 days @ $105	-0-	3,150	3,150	3,150	3,150	3,150	3,150	3,150	3,150	3,150	3,150	31,500
-Grad. Stud. Super., 45-90 days @ $105	-0-	4,725	4,725	4,725	4,725	4,725	9,450	9,450	9,450	9,450	9,450	70,875
-Proj. Eval., 30 days @ $105	-0-	-0-	-0-	3,150	-0-	-0-	3,150	-0-	-0-	3,150	-0-	9,450
Total International Per Diem	3,150	17,325	14,175	17,325	14,175	14,175	22,050	18,900	18,900	22,050	18,900	181,125
Total Per Diem	3,150	19,575	16,425	19,575	16,425	16,425	24,300	21,150	21,150	24,300	21,150	203,625
B. Travel												
1. Domestic												
-Proj. Dir., 4/yr @ $500	-0-	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	20,000
-Proj. Consult., 1/yr @ $500	-0-	500	500	500	500	500	500	500	500	500	500	5,000
-Proj. Eval., 2/yr @ $500	-0-	-0-	-0-	1,000	-0-	-0-	1,000	-0-	-0-	1,000	-0-	3,000
Total Domestic Travel	-0-	2,500	2,500	3,500	2,500	2,500	3,500	2,500	2,500	3,500	2,500	28,000

Table G-3 (Continued) Page 3; Detailed Worksheets of AID Dollar Budget, FOA

(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
2. International												
-Proj. Dir., 2-3/yr @ $2500	5,000	7,500	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	57,500
-Proj. Consult., 1/yr @ $2500	-0-	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	25,000
-Grad. Stud. Super., 3/yr @ $2500	-0-	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	75,000
-Proj. Eval., 2/yr @ $2500	-0-	-0-	-0-	5,000	-0-	-0-	5,000	-0-	-0-	5,000	-0-	15,000
Total International Travel	5,000	17,500	15,000	20,000	15,000	15,000	20,000	15,000	15,000	20,000	15,000	172,500
Total Travel	5,000	20,000	17,500	23,500	17,500	17,500	23,500	17,500	17,500	23,500	17,500	200,500
C. Transportation												
-Commodities, 55%	-0-	268,125	104,500	102,850	84,150	82,500	62,700	61,050	52,800	40,700	26,400	885,775
-Air Freight, 15 shipments @ $225	-0-	3,375	3,375	3,375	3,375	3,375	3,375	3,375	3,375	3,375	3,375	33,750
Total Transportation	-0-	271,500	107,875	106,225	87,525	85,875	66,075	64,425	56,175	44,075	29,775	919,525
TOTAL TRAVEL AND TRANSPORTATION	8,150	311,075	141,800	149,300	121,450	119,800	113,875	103,075	94,825	91,875	68,425	1,323,650
V. Expendable Equipment & Materials												
A. On-Campus												
-Staff Office - Supp. & Mat.	-0-	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	10,000
-Staff Orientation - Supp. & Mat.	-0-	500	500	500	500	500	500	500	500	500	500	5,000
Total On-Campus Exp. Equip. & Mat.	-0-	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	15,000
B. Off-Campus												
-Vehicle & Equip. Spare Parts	-0-	-0-	-0-	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	32,000
-Office Supplies	-0-	8,000	15,000	20,000	18,000	16,000	14,000	12,000	10,000	8,000	6,000	127,000
-Teaching Materials	-0-	1,000	2,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	11,000
-Miscellaneous	-0-	2,000	5,000	5,000	5,000	5,000	3,000	3,000	2,000	2,000	1,000	33,000
Total Off-Campus Exp. Equip. & Mat.	-0-	11,000	22,000	30,000	28,000	26,000	22,000	20,000	17,000	15,000	12,000	203,000
TOTAL EXPENDABLE EQUIP. & MATERIALS	-0-	12,500	23,500	31,500	29,500	27,500	23,500	21,500	18,500	16,500	13,500	218,000
VI. Non-Expendable Equip. & Materials												
A. On-Campus	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
B. Off-Campus												
-Teaching Materials	-0-	4,000	8,000	7,000	7,000	6,000	6,000	5,000	5,000	5,000	4,000	57,000
-Library Resources	-0-	5,000	50,000	50,000	40,000	40,000	30,000	30,000	30,000	20,000	10,000	305,000
-Teaching Equipment	-0-	4,000	50,000	50,000	40,000	40,000	30,000	30,000	30,000	20,000	10,000	304,000
-Office Equipment	-0-	-0-	50,000	40,000	30,000	30,000	20,000	20,000	10,000	10,000	10,000	220,000
-Misc. Equipment	-0-	2,000	10,000	10,000	8,000	8,000	6,000	6,000	4,000	4,000	2,000	60,000
TOTAL NON-EXP. EQUIPMENT & MAT.	-0-	15,000	168,000	157,000	125,000	124,000	92,000	91,000	79,000	59,000	36,000	946,000

92

Table G-3 (Continued) Page 4; Detailed Worksheets of AID Dollar Budget, FOA

(Dollars)

	BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
VII.	Participant Training												
	A. Degree Training												
	-Grad. Scholarships, 5-17 @ $27,600	138,000	220,800	303,600	386,400	469,200	414,000	331,200	248,400	165,600	82,800	-0-	2,760,000
	Total Degree Training	138,000	220,800	303,600	386,400	469,200	414,000	331,200	248,400	165,600	82,800	-0-	2,760,000
	B. Non-Degree Training												
	-Admin. Intern., 3 x 6 mos @ $3,000/mo.	-0-	54,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	54,000
	TOTAL PARTICIPANT TRAINING	138,000	274,800	303,600	386,400	469,200	414,000	331,200	248,400	165,600	82,800	-0-	2,814,000
VIII.	Instructional Farm												
	-Irrigation Equipment	-0-	93,900	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	93,900
	-Crop Science Equipment	-0-	84,400	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	84,400
	-Livestock Equipment	-0-	93,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	93,000
	-Poultry Equipment	-0-	3,400	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	3,400
	-Farm Shop Equipment	-0-	35,300	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	35,300
	-Gen. Farm Machinery/Equipment	-0-	151,500	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	151,500
	TOTAL INSTRUCTIONAL FARM	-0-	461,500	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	461,500
IX.	Other Direct Costs												
	-Arabic Language Training	-0-	9,000	-0-	9,000	-0-	9,000	-0-	9,000	-0-	-0-	-0-	36,000
	-Engr. Constr. Supervision, Fac. Bldg.	-0-	500,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	500,000
	TOTAL OTHER DIRECT COSTS	-0-	509,000	-0-	9,000	-0-	9,000	-0-	9,000	-0-	-0-	-0-	536,000
	TOTAL AID DOLLAR BUDGET												

Budget of Architect/Engineer Services

Following is a budget estimate of the cost of Architect/Engineer services per phase, based on the Scope of Work and on a schedule as recommended in the Prefeasibility Report which is still in draft.

Program of Requirements		
A/E fee	$ 35,000.	
2 man-round trips to Sana'a	6,000.	
16 days per diem	2,000.	
		$ 43,000.
Site Inventory		
A/E fee	$ 17,000.	
2 man-round trips to Sana'a	6,000.	
16 days per diem	2,000.	
		$ 25,000.
Schematic Design		
A/E fee	$220,000	
5 man-round trips to Sana'a	15,000.	
25 days per diem	3,000.	
Reproduction, printing	1,000.	
Model	3,000.	
		$ 242,000.
Design Development		
A/E fee	$300,000.	
5 man-round trips to Sana'a	15,000.	
25 days per diem	3,000.	
Reproduction, printing	2,000.	
Rendering	3,000.	
		$ 323,000

94

Table G-3 (continued) Page 6; Detailed worksheets of AID Dollar Budget, FAO
(Dollars)

Contract Documents		
A/E fee	)0,000.	
5 man-round trips to Sana'a	15,000.	
25 days per diem	3,000.	
Reproduction, printing	2,000.	
		$ 630,000.
Bid Analysis		
A/E fee	$ 76,000.	
1 man round trip to Sana'a	3,000.	
7 days per diem	1,000.	
		$ 80,000.
Construction Phase		
A/E fee	$335,000.	
24 man-round trips to Sana'a	60,000.	
192 days per diem	24,000.	
Telephone/Telex	25,000.	
		$ 444,000.
TOTAL A/E COST		$ 1,787,000.
12% Contingency		213,000.
TOTAL		$ 2,000,000.

The costs for the performance of a topographical survey and a geotechnical investigation are not included in the above amount.

Table G-4 Summary of Detailed Worksheets for AID Local Currency Budget, FOA
(Dollars)

	BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
I.	Salaries and Wages	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
II.	Operations	-0-	29,800	1/ 119,000	178,500	148,800	178,500	119,000	59,500	29,800	29,800	29,800	922,500
III.	Travel and Per Diem	-0-	4,400	16,400	19,700	21,500	58,200	41,000	31,100	32,700	31,100	36,700	292,800
IV.	Training	-0-	-0-	22,000	4,000	24,000	4,000	24,000	4,000	24,000	4,000	24,000	136,000
V.	Expendable Equip. & Materials	-0-	-0-	19,000	17,000	15,000	14,000	13,000	11,000	10,000	8,000	6,000	113,000
VI.	Non-Expendable Equip. & Materials	-0-	-0-	20,000	20,000	14,000	14,000	14,000	9,000	8,000	8,000	8,000	115,000
VII.	Instructional Farm	550,000	935,400	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1,485,400
VIII.	Other Direct Costs	-0-	12,200	112,200	92,200	72,200	52,200	32,200	12,200	12,200	12,200	12,200	422,000
	Subtotal	550,000	981,800	308,600	331,400	295,500	320,900	243,200	126,800	116,700	93,100	116,700	3,484,700
	Contingency (5%)	27,500	49,090	15,430	16,570	14,775	16,045	12,160	6,340	5,835	4,655	5,835	174,235
	Subtotal	577,500	1,030,890	324,030	347,970	310,275	336,945	255,360	133,140	122,535	97,755	122,535	3,658,935
	Inflation (10% Compounded)	-0-	-0-	32,403	73,073	102,701	156,376	155,897	102,731	116,249	111,793	166,390	1,017,613
TOTAL AID LOCAL CURRENCY		577,500	1,030,890	356,433	421,043	412,976	493,321	411,257	235,871	238,784	209,548	288,925	4,676,548

1/ Totals from detailed worksheets, Table G-5, rounded upward to nearest hundred.

Table G-5 Detailed Worksheets for AID Local Currency Budget, FOA

(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
I. Salaries & Wages	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
II. Operations												
A. Housing												
-Rent, $22,500/yr/family	-0-	22,500	90,000	135,000	112,500	135,000	90,000	45,000	22,500	22,500	22,500	697,500
-Utilities, $2500/yr/family	-0-	2,500	10,000	15,000	12,500	15,000	10,000	5,000	2,500	2,500	2,500	77,500
-Maintenance, $3500/yr/family	-0-	3,500	14,000	21,000	17,500	21,000	14,000	7,000	3,500	3,500	3,500	108,500
-Retro Fitting, $1250/yr/family	-0-	1,250	5,000	7,500	6,250	7,500	5,000	2,500	1,250	1,250	1,250	38,750
Total Operations	-0-	29,750	119,000	178,500	148,750	178,500	119,000	59,500	29,750	29,750	29,750	922,250
III. Travel and Per Diem												
A. Travel												
1. Domestic, @ $50/trip												
-Co-Dean (12)	-0-	-0-	600	600	600	600	600	-0-	-0-	-0-	-0-	3,000
-Co-Farm Manager (6)	-0-	-0-	300	300	300	300	300	-0-	-0-	-0-	-0-	1,500
-Co-Librarian (2)	-0-	-0-	100	100	-0-	-0-	-0-	-0-	-0-	-0-	-0-	200
-Proj. Manager (12)	-0-	600	600	600	600	600	600	600	600	600	600	6,000
Total Domestic Travel	-0-	600	1,600	1,600	1,500	1,500	1,500	600	600	600	600	10,700
2. International												
1/ -Dean (U.S. @ $2500/r.t.)	-0-	-0-	-0-	-0-	2,500	-0-	-0-	-0-	-0-	-0-	2,500	5,000
2/ -Grad. Stds. (U.S.)	-0-	-0-	-0-	-0-	-0-	12,500	7,500	7,500	7,500	7,500	7,500	50,000
-Local Grad. Advisor (U.S.)	-0-	-0-	-0-	-0-	-0-	12,500	7,500	7,500	7,500	7,500	7,500	50,000
Total International Travel	-0-	-0-	-0-	-0-	2,500	25,000	15,000	15,000	15,000	15,000	17,500	105,000
Total Travel	-0-	600	1,600	1,600	4,000	26,500	16,500	15,600	15,600	15,600	18,100	115,700
B. Per Diem												
1. Domestic, $105/day												
-Proj. Manager (36)	-0-	3,780	3,780	3,780	3,780	3,780	3,780	3,780	3,780	3,780	3,780	37,800
-Co-Dean (36)	-0-	-0-	3,780	3,780	3,780	3,780	3,780	-0-	-0-	-0-	-0-	18,900
-Co-Farm Mngr. (18)	-0-	-0-	1,890	1,890	1,890	1,890	1,890	-0-	-0-	-0-	-0-	9,450
-Co-Librarian (6)	-0-	-0-	630	630	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1,260
Total Domestic Per Diem	-0-	3,780	10,080	10,080	9,450	9,450	9,450	3,780	3,780	3,780	3,780	67,410

1/ Graduate students return to U.S. LCU to defend thesis, take final exams.
2/ Local CID/AID/FOA Graduate Committee Member travels to U.S. LCU to participate on student's thesis defense, examination.

Table G-5 (Continued) Page 2: Detailed Worksheets for AID Local Currency Budget, FOA

(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
2. International, $96/day												
-Dean (15 days)	-0-	-0-	-0-	-0-	-0-	1,440	-0-	-0-	-0-	-0-	1,440	2,880
-Grad. Students (10 days)	-0-	-0-	-0-	-0-	-0-	7,200	4,320	4,320	4,320	4,320	4,320	28,800
-Local Grad. Advisor (10 days)	-0-	-0-	-0-	-0-	-0-	7,200	4,320	4,320	4,320	4,320	4,320	28,800
Total International Per Diem	-0-	-0-	-0-	-0-	-0-	15,840	8,640	8,640	8,640	8,640	10,080	60,480
Total Per Diem	-0-	3,780	10,080	10,080	9,450	25,290	18,090	12,420	12,420	12,420	13,860	127,890
C. R & R Travel	-0-	-0-	1,670	5,010	5,010	3,340	3,340	-0-	1,670	-0-	1,670	21,710
D. Medical Evacuations	-0-	-0-	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	27,000
Total Travel and Per Diem	-0-	4,380	16,350	19,690	21,460	58,130	40,930	31,020	32,690	31,020	36,630	292,300
IV. Training												
A. English Language	-0-	-0-	20,000	-0-	20,000	-0-	20,000	-0-	20,000	-0-	20,000	100,000
B. In Service Training/Planning	-0-	-0-	2,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	34,000
Total Training	-0-	-0-	22,000	4,000	24,000	4,000	24,000	4,000	24,000	4,000	24,000	134,000
V. Expendable Equip. & Materials												
A. Office												
-Supplies	-0-	-0-	6,000	5,000	5,000	4,000	4,000	3,000	3,000	2,000	1,000	33,000
-Equipment	-0-	-0-	8,000	7,000	6,000	6,000	5,000	5,000	4,000	4,000	3,000	48,000
B. Instructional Farm	-0-	-0-	4,000	4,000	3,000	3,000	3,000	2,000	2,000	1,000	1,000	23,000
C. Training	-0-	-0-	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	9,000
Total Expendable Equip. & Materials	-0-	-0-	19,000	17,000	15,000	14,000	13,000	11,000	10,000	8,000	6,000	113,000
VI. Non-Expendable Equip. & Materials												
A. Equipment	-0-	-0-	15,000	15,000	10,000	10,000	10,000	5,000	5,000	5,000	5,000	80,000
B. Materials	-0-	-0-	5,000	5,000	4,000	4,000	4,000	4,000	3,000	3,000	3,000	35,000
Total Non-Expendable Equip. & Mat.	-0-	-0-	20,000	20,000	14,000	14,000	14,000	9,000	8,000	8,000	8,000	115,000

Tabel G-5 (Continued) Page 3; Detailed Worksheets for AID Local Currency Budget, FOA

(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
VII. Instructional Farm												
A. A & E Design	40,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	40,000
B. Est. Costs (Roads, grading, leveling)	265,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	265,000
C. Perimeter fencing	105,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	105,000
D. On-Farm Water Distribution	140,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	140,000
E. Water System to Farm	-0-	553,900	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	553,900
F. Crop Science Field Lab/Equip.	-0-	179,300	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	179,300
G. Livestock Field Lab/Equip.	-0-	139,500	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	139,500
H. Poultry Field Lab/Equip.	-0-	27,400	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	27,400
I. Farm Shop	-0-	35,300	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	35,300
Total Instructional Farm	550,000	935,400	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1,485,400
VIII. Other Direct Costs												
A. Instructional Farm Recurring Costs	-0-	-0-	100,000	80,000	60,000	40,000	20,000	-0-	-0-	-0-	-0-	300,000
B. Local Core Support	-0-	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	12,200	122,000
Total Other Direct Costs	-0-	12,200	112,200	92,200	72,200	52,200	32,200	12,200	12,200	12,200	12,200	422,000

Table C-6 Summary of Detailed Worksheets for YARG Budget and Donor Parallel Financing, FOA
(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
I. Salaries and Wages	-0-	-0-	484,000	491,500	491,500	694,500	805,500	916,500	1,027,500	1,138,500	1,267,500	7,317,000
II. Operations	-0-	-0-	154,000	252,000	278,000	304,000	320,000	341,000	347,000	343,000	349,000	2,688,000
III. Travel and Per Diem	-0-	-0-	17,300	1/ 22,000	19,700	32,200	39,700	49,400	54,700	64,400	72,100	371,500
Subtotal	-0-	-0-	655,300	765,500	789,200	1,030,700	1,165,200	1,306,900	1,429,200	1,545,900	1,688,600	10,376,500 2/
Contingency (5%)	-0-	-0-	32,765	38,275	39,460	51,535	58,260	65,345	71,460	77,295	84,430	518,825
Subtotal	-0-	-0-	688,065	803,775	828,660	1,082,235	1,223,460	1,372,245	1,500,660	1,623,195	1,773,030	10,895,325
Inflation (10% Compounded)	-0-	-0-	68,807	168,793	274,286	502,265	746,922	1,058,824	1,423,676	1,856,286	2,407,597	8,507,456
TOTAL YARG LOCAL BUDGET	-0-	-0-	756,872	972,568	1,102,946	1,584,500	1,970,382	2,431,069	2,924,336	3,479,481	4,180,627	19,402,781 2/
Donor parallel Financing of Facilities Development		23,375,000										23,375,000
Contingency (5%)		1,168,750										1,168,750
Total Parallel Financing		24,543,750	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	24,543,750

1/ Totals from detailed worksheets, Table C-7, rounded upward to nearest hundred.

2/ In addition the YARG has provided 25 hectares of land for the FOA and its instructional farm which is valued at 12.4 million dollars.

Table G-7 Detailed Worksheets for YARC Local Currency Budget, FOA

(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
I. Salaries and Wages												
A. Faculty Building												
-Dean, FOA, 1.0 FTE	-0-	-0-	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	432,000
-Faculty Members, 5-20 @ $37000	-0-	-0-	-0-	-0-	-0-	185,000	296,000	407,000	518,000	629,000	740,000	2,775,000
-Librarian, 1.0 FTE	-0-	-0-	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	243,000
-Adm. Asst., Fiscal, 1.0 FTE	-0-	-0-	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	207,000
-Adm. Asst., Personnel, 1.0 FTE	-0-	-0-	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	207,000
-Purchasing Agent, 1.0 FTE	-0-	-0-	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	126,000
-Budget/Financial Analyst, 1.0 FTE	-0-	-0-	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	180,000
-Sec./Typist, 3.0 FTE @ $17000	-0-	-0-	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	459,000
-Translator, 1.0 FTE	-0-	-0-	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	198,000
-Janitor, 2.0 FTE @ $6500	-0-	-0-	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000	117,000
-Bldg. Maintenance Person, 1.0 FTE	-0-	-0-	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	180,000
-Groundskeeper, 1.0 FTE	-0-	-0-	-0-	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	60,000
Total Fac. Bldg. Salaries & Wages	-0-	-0-	261,000	268,500	268,500	453,500	564,500	675,500	786,500	897,500	1,008,500	5,184,000
B. Instructional Farm												
-Manager, 1.0 FTE	-0-	-0-	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	297,000
-Senior Mechanic, 1.0 FTE	-0-	-0-	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	144,000
-Maint. Man, Buildings, 1.0 FTE	-0-	-0-	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	180,000
-Maint. Man, Grounds, 1.0 FTE	-0-	-0-	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	157,500
-Drivers, 4.0 FTE @ $11500	-0-	-0-	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000	414,000
-Janitor, 1.0 FTE	-0-	-0-	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	6,500	58,500
-Guards, 2.0 FTE @ $6000	-0-	-0-	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	108,000
Total Instr. Farm Salaries & Wages	-0-	-0-	151,000	151,000	151,000	151,000	151,000	151,000	151,000	151,000	151,000	1,359,000
C. Technicians												
-Animal Technician, 1.0 FTE	-0-	-0-	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	162,000
-Field Crop Tech., 1.0 FTE	-0-	-0-	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	162,000
-Horticulture Tech., 1.0 FTE	-0-	-0-	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	162,000
-Poultry Technician, 1.0 FTE	-0-	-0-	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	162,000
-Food Science Tech., 1.0 FTE	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	18,000	18,000
-Agric. Media Tech., 1.0 FTE	-0-	-0-	-0-	-0-	-0-	18,000	18,000	18,000	18,000	18,000	18,000	108,000
Total Technicians Salaries & Wages	-0-	-0-	72,000	72,000	72,000	90,000	90,000	90,000	90,000	90,000	108,000	774,000
TOTAL SALARIES AND WAGES	-0-	-0-	484,000	491,500	491,500	694,500	805,500	916,500	1,027,500	1,138,500	1,267,500	7,317,000

101

Table G-7 (Continued) Page 2; Detailed Worksheets for YARC Local Currency Budget, FOA

(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
II. Operations												
A. Faculty Buildings												
-Utilities	-0-	-0-	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	450,000
-Communications	-0-	-0-	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	360,000
-Maintenance & Repair	-0-	-0-	-0-	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	160,000
-Printing	-0-	-0-	15,000	25,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	250,000
Total Faculty Buildings Operations	-0-	-0-	105,000	135,000	140,000	140,000	140,000	140,000	140,000	140,000	140,000	1,220,000
B. Vehicles and Tractors												
-Gasoline & Petroleum Products	-0-	-0-	40,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	560,000
-Insurance & Licenses	-0-	-0-	4,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	52,000
-Spare Parts & Tires	-0-	-0-	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	54,000
-Outside Services	-0-	-0-	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	9,000
Total Vehicles & Tractors Operations	-0-	-0-	47,000	75,000	76,000	77,000	78,000	79,000	80,000	81,000	82,000	675,000
C. Instr. Farm & Motorpool												
-Road & Yard Maintenance	-0-	-0-	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	180,000
-Building & Shop Renovation	-0-	-0-	-0-	-0-	-0-	5,000	-0-	-0-	5,000	-0-	5,000	15,000
-Exterior Lighting	-0-	-0-	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	18,000
-Recurring Costs	-0-	-0-	-0-	20,000	40,000	60,000	80,000	100,000	100,000	100,000	100,000	600,000
Total Instr. Farm & Motorpool Oper.	-0-	-0-	22,000	42,000	62,000	87,000	102,000	122,000	127,000	122,000	127,000	813,000
TOTAL OPERATIONS COSTS	-0-	-0-	154,000	252,000	278,000	304,000	320,000	341,000	347,000	343,000	349,000	2,688,000
III. Travel and Per Diem												
A. Travel												
1. Domestic, @ $50/r.t.												
-Dean (12)	-0-	-0-	600	600	600	600	600	600	600	600	600	5,400
-Farm Manager (6)	-0-	-0-	300	300	300	300	300	300	300	300	300	2,700
-Librarian (2)	-0-	-0-	100	100	100	100	100	100	100	100	100	900
-Faculty Members, (12/yr/FM)	-0-	-0-	-0-	2,400	2,400	3,000	4,800	6,600	8,400	10,200	12,000	49,800
-Technicians (6 x 4-6)	-0-	-0-	2,400	2,400	2,400	3,000	3,000	3,000	3,000	3,000	3,600	25,800
Total Domestic Travel	-0-	-0-	3,400	5,800	5,800	7,000	8,800	10,600	12,400	14,200	16,600	84,600
2. International, (Arab Bloc @ $1200/r.t.)	-0-	-0-	-0-	1,200	-0-	-0-	-0-	1,200	-0-	1,200	-0-	3,600
Total Travel	-0-	-0-	3,400	7,000	5,800	7,000	8,800	11,800	12,400	15,400	16,600	88,200

Table G-7 (Continued) Page 3; Detailed Worksheets for YARG Local Currency Budget, FOA

(Dollars)

BUDGET ITEM	PROJECT MOBILIZATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
B. Per Diem												
1. Domestic, $105/day												
-Dean (30)	-0-	-0-	3,780	3,780	3,780	3,780	3,780	3,780	3,780	3,780	3,780	34,020
-Farm Manager (18)	-0-	-0-	1,890	1,890	1,890	1,890	1,890	1,890	1,890	1,890	1,890	17,010
-Librarian (6)	-0-	-0-	630	630	630	630	630	630	630	630	630	5,670
-Faculty Members (18 x 5-20)	-0-	-0-	-0-	-0-	-0-	9,450	15,120	20,790	26,460	32,130	37,800	141,750
-Technicians (18 x 4-6)	-0-	-0-	7,560	7,560	7,560	9,450	9,450	9,450	9,450	9,450	11,340	81,270
Total Domestic Per Diem	-0-	-0-	13,860	13,860	13,860	25,200	30,870	36,540	42,210	47,880	55,440	279,720
2. International, $105/day												
-Dean (10)	-0-	-0-	-0-	1,050	-0-	-0-	-0-	1,050	-0-	1,050	-0-	3,150
Total Per Diem	-0-	-0-	13,860	14,910	13,860	25,200	30,870	37,590	42,210	48,930	55,440	282,870
TOTAL TRAVEL AND PER DIEM	-0-	-0-	17,260	21,910	19,660	32,200	39,670	49,390	54,610	64,330	72,040	371,070
Facilities Development												
A. Land for Faculty Bldg. and Instr. Farm (25 h.a. @ $55000)	-0-	1,375,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1,375,000
B. Faculty Building (estimate)	-0-	22,000,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	22,000,000
TOTAL FACILITIES DEVELOPMENT	-0-	23,375,000	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	23,375,000

103

OUTLINE FOR ANNEX H

Preliminary Social and Economic Analysis

A. The Agricultural Sector of Yemen

1. Geography
2. Population
3. Historical Setting and Recent Trends

B. Socio-Cultural Context of Project

C. Beneficiaries

D. FOA Student Considerations

1. Criteria for Admittance
2. Other Issues

E. Employment Incentives for FOA Graduates

F. FOA Operational Linkages to Other Public Institutions

G. Alternatives to FOA: A Cost Effectiveness Analysis

1. The Issue
2. Cost Effectivenss Criteria
3. Assumptions
4. Analysis
5. Sensitivity Analysis of Critical Assumptions

Annex H

PRELIMINARY SOCIAL AND ECONOMIC ANALYSIS

A. The Agricultural Sector of Yemen 1/

1. Geography

Yemen is divided into three major geographical zones. First, the Tihama is the humid, semi-desert plain bordering the Red Sea. The Tihama is intersected by seven deep drainages (wadis) originating in the highlands and extending to the sea. These wadis run seasonally. Intensive cultivation of cereals, sugar cane, and tropical fruits is carried out in the foothill wadis. The second zone bordering the eastern extremity of the YAR is the arid, sandy desert region of the interior Arabian peninsula. Population is sparse and limited mostly to nomadic tribes. Between these two regions is the third, the highland region, with 90 percent of the country's population. The highlands consist of steep mountains, plateaus and sharply eroded wadis. Much of the arable land is extensively terraced and cropped. The people live in fortified rock houses, and villages are perched high on mountain ridges. Annual rain fall in the Tihama varies from 100 to 300 mm in the highlands, and from 1200 mm in the south to 200 mm in the north, and essentially zero in the arid eastern interior. Agriculture of the country is largely dryland farming. Less than 15 percent of the total cropped area receives some form of irrigation, largely temporary diversion from seasonal monsoons and tubewells.

2. Population

The 1975 census is the only census ever taken in Yemen. Projections based upon this census place the 1982 population near 8 million. About 85 to 90 percent is resident, with the remainder being migrant labor working in other Arab countries, primarily Saudi Arabia. Net annual population growth is estimated at 2.6 to 2.9 percent. Life expectancy is 42 years but is rising rapidly with improved access to isolated villages, education through mass media and improved health facilities. Ninety percent of the population lives in rural areas, usually in small villages of under 500. The estimated number of household is 1,097,6785 with average size of 7.3 persons and one person per household temporarily absent abroad. Households generally consist of the extended family (parents, children, and their families, cousins, aunts and uncles) under patriarchal control.

3. Historical Setting and Recent Trends

The nature of agricultural production has changed little in Yemen for more than a thousand years prior to the overthrow of the Iman in 1962. Climate in the highlands is amenable to year-round production but availability of water limits this choice to only 5 to 10 percent of the farmers. Crop production in most of Yemen has consisted primarily of grain crops, mostly sorghum and millet, for subsistence where water is available. Coffee and cotton were grown on a commercial scale in the Tihama area where water existed for irrigation, but recent labor shortages have seen a decline in both. Livestock, principally cattle, goats, sheep, donkeys,

camels, and poultry, have been an integral part of traditional farming. Livestock have been used for meat, dairy products, transport, power for crop cultivation, and dung for fuel. Most production was for family consumption with limited amount for barter or sale for staples. The traditional system was very labor intensive for all activities, including household chores of fuel and water gathering, cooking, crop production, livestock herding, terrace building and community activities such as road and school construction.

Terrace building was the principal method to preserve and conserve the most scarce productive resources, land and water. Drought resistant sorghum and millet were the principal subsistence crops. Cows, kept in confinement, utilized crop residues for forage and provided milk and cheese for food, and dung for fuel. Goats and sheep utilized any available land for grazing and provided meat. Camels, donkeys and cows provided transportation and power for field cultivation and plowing, threshing and well lifts.

Ravaged by the 1962 civil war and a seven-year drought from 1967 through 1973, the country experienced a decline in agricultural production of one-fourth to one-half. Migration to the oil rich Arab countries commenced in the early 1970s and continues to this day. In one decade Yemen was transformed from a labor abundant to a labor scarce economy.

As remittances began to flow back to Yemen from the oil fields, new influences began to change the traditional economic system. Land prices increased rapidly. Availability of water increased marginally as new wells were dug. Water prices increased. Purchase of consumer goods, including food imports, increased. The price of preferred Yemeni food goods, especially fresh chickens and locally grown crops, increased significantly. Large investments in secondary road construction, wells with motorized pumps, trucks for transport, tractors for hire, and home construction have occurred. Since 1970 unskilled labor wage rates have increased from YR 5 per day to YR 60 - 90 per day. Skilled labor wages have increased from YR 30 to YR 300-400/day in 1982.

Other changes have resulted fromthe switch to a labor scarce and relatively capital abundant market economy. Much of the irrigated cropland above 1500 meters has shifted to qat production, a plant whose leaves are mildly narcotic, in response to consumer demand which is 20-30 percent of family income is used for such consumptive purpose. Qat leaves are chewed in daily social gatherings, primarily of men each afternoon.

While little is known about the effects of qat, it is generally recognized as a stimulant. Livestock numbers, particularly sheep, goats, donkeys, and camels, have declined for several reasons. Motorized vehicles have replaced donkeys and camels for transportation, except in the most isolated regions. Increases in locally constructed schools have led to more farm children attending schools rather than herding family sheep and goat flocks. Strong growth in commercial chicken production has also occurred. The average number of livestock per household, exclusive of chickens, typically ranges from 5 to 9 head.

106

A long-standing cooperative ethic , based upon Islamic law and tribal customs, persists for community harvests, building construction and repair of damaged structures. This has extended to local road building and school construction in recent years.

Land holdings are highly fragmented due to tradition, i.e., Islamic inheritance laws and geography and terracing on steep terrain. Fragmentation also is used by Yemeni farmers as a hedge against variable microclimates and moisture conditions. The average number of parcels per rural household ranges from 2.7 in the coastal Province of Hodeidah to 6.8 in the Central Highland Province of Dhamar. The size of family holdings varies widely. More than 90 percent of all family or household holdings are less than five hectares. Some two-thirds of all family holdings are less than one hectare. While very small holdings dominate the Yemeni scene in total numbers by total area, land distribution is skewed toward larger holdings, especially in Dhamar, Hodeidah, Hajjah, and Taiz provinces. Holdings of greater than five hectares comprise slightly over 50 percent of all the land area for the six provinces included in the 1981 agricultural census (Dhamar, Hodeidah, Hajjah, Mahweet, Taiz, and Ibb). In those six provinces, totally owned holdings comprise over 60 percent of all holdings. Only 12 percent are totally share-cropped, a more common practice in Mahweet and Ibb provinces.

Field crops, primarily sorghum and millet, account for 73 percent of total land use, on the average. Permanent crops such as alfalfa, fruit trees account for five percent, temporary fallow, eight percent; abandoned land, 12 percent of total land use and two percent in other uses, according to the census. Some 84 percent of the holdings are totally dependent solely upon rainfall. Another eight percent depend totally upon some form of irrigation (springs, pumps, spate). Vegetable and fruit production are common on such irrigated land. The remaining eight percent employ a mix of rainfed and supplemental irrigation.

Family labor continues to be the dominant labor source, comprising about 55 percent of total labor. Temporary hired labor and traded labor among farmers comprise the remainder.

Some 85 percent of the holdings use draft animals for field . Nearly 30 percent hire tractors on a custom basis to handle heavy plo. Some of the steepest terrace lands will not accommodate existing mechanized traction as evidenced by 14 percent of the holdings using only manual tools. About three-fourths of the holdings in Taiz and Ibb use commercial fertilizer in small amounts. Fewer than 20 percent of holdings in Dhamar and Hodeidah provinces use commercial fertilizers. Only about five percent of holdings in the six provinces use pesticides. Farmers are well aware of disease, insects, and fungus problems. Agricultural chemicals have not yet been tested nor yet available to any great extent.

107

Shortage of labor has led to abandonment of marginal agricultural lands, neglect of terraces, some erosion, and adjustment of some terraces to accommodate mechanization.

The fisheries industry, while very small, is thriving because of strong consumer demand and increased catches in recent years. Only 3,000 to 4,000 fishermen in 40 communities comprise the industry.

Forestry is essentially a non-existent economic enterprise. The country has been essentially denuded of trees, so much so that fuel for cooking is sold at a premium. Women spend a significant amount of time collecting limbs from thorny shrubs and scrub trees.

The dominant socio-economic conditions currently influencing Yemen's agricultural sector are summarized as follows:

a. Low and declining overall agricultural production;

b. Relative labor scarcity and high wage rates, due to immigration to Arab oil fields, a phenomenon whose growth appears to have peaked;

c. High local investments in roads and schools which has opened heretofore isolated areas;

d. High capital cost for infrastructure development because of mountainous terrain;

e. A bustling private sector with demand for consumer goods and strong preference for Yemen produced food products in spite of higher domestic food prices;

f. An unspecified, but real, economic impact from rapid expansion of qat chews as a recent social phenomena; and

g. Limited investment opportunities in agricultural crops or technology, other than qat, which will increase agricultural production and family income.

B. Socio-Cultural Context of Project

The primary project purpose is to develop the institutional capacity within the YARG to train Yemeni agriculturists at the baccalaureate level. This is to be accomplished through the establishment of a Faculty of Agriculture within the University of Sana'a. The faculty is to be engaged in training and research activities which will increase the pool of trained manpower for the public and private sectors to modernize traditional agriculture in Yemen and thereby increase production.

To date, trained manpower needs for agricultural training, research, and extension activities have been filled through use of trained technicians from other Arabic speaking countries, and through training of Yemeni students abroad. While these approaches meet immediate technical needs, both are deficient.

A country's educational system, besides being a training ground for its future manpower, is also the basis for the perpetuation and modification of its own cultural and social value system. With a significant portion of Yemeni teachers at all levels, including the university level, being foreigners, such objectives may not be met. Yemenization of the education system is an important goal to reduce dependency upon other countries and to focus upon problems, problem prioritization, and approaches to problem solutions which embody a Yemeni perspective. Yemeni trained abroad do not get a Yemeni agriculture focus, nor are they necessarily provided with the types of technical skills which are matched to the needs of Yemen agriculture. The training of Yemeni through the FOA is intended to address such deficiencies.

Economic conditions of labor scarcity and increased capital availability through remittances at the farm level have generated considerable testing and some adoption of modern agricultural technology by farmers. Custom use of tractors is increasing, and is replacing oxen drawn plowing. Improved seed varieties and fruit rootstock, disease and insect control measures, broiler production, more intensive irrigated alfalfa production for livestock, and frost control on qat are examples of new technologies being attempted. Some technology is being discarded because of inappropriateness for technical and economic reasons. No marked technological breakthroughs have occurred yet with the traditional sorghum/millet crops, as evidenced by continued decline in Yemen's subsistence agricultural production.

The FOA Subproject is to generate skilled manpower who are trained with an applied focus. This applied focus is intended to place primary emphasis upon the immediate needs of increasing agricultural production in Yemen. It is important to recognize that a primary performance criteria for FOA operations is on improving production in the agricultural sector. Past experience in the Middle East2/ points to a number of issues for (1) higher agricultural education, (2) subcollegiate agricultural education, and (3) agricultural extension which should be considered. A summary of the recommendations from past experience is presented here to serve as a partial check-list for the SPP team.

Conclusions and Recommendations for Higher Agricultural Education in the Middle East:

1. Higher agricultural education should always be enriched with practical field experience during the course of study.

2. A basic knowledge of human nutrition should be required of agricultural college graduates. (The knowledge may be provided by a required course.)

3. Agricultural college students should be trained in community service and development.

4. Agricultural colleges should organize refresher courses, short courses, and round table discussions to be offered on a continuing basis.

5. Agricultural colleges should involve their alumni in evaluating, at regular intervals, the type of training they have received and the training currently being offered.

109

6. The professional staff of agricultural colleges should be in constant touch with local people and familiar with current rural and agricultural problems in order to improve their teaching and research methods and to guarantee their relevancy.

7. Agriculture college students should be given experience in identifying problems and learning where to find answers (such as effective use of libraries and utilizing research results). Case studies may be used to advantage.

8. Agricultural colleges should place more emphasis on recruiting students from agricultural-rural areas.

9. Professors in the different colleges of the Middle East, after acquiring experience in the area, should write textbooks in their specialities, adapted to local conditions.

10. Professors should attend international congresses and conferences in their field of specialization, and institutions should attempt to seek all possible sources of funding for travel.

11. Additional emphasis in the curriculum of agricultural colleges should be given to communicative skills, human sciences, pedagogy, and international development (such as the world economic order).

12. Agricultural colleges should coordinate their programs with the needs of the employers of the graduates of the colleges.

13. There should be an ongoing exchange of ideas and much greater communication among all agricultural colleges of the Middle East and Arab World.

Conclusions and Recommendations for Sub-Collegiate Agricultural Education in the Middle East:

1. The teaching of agriculture and nutrition in rural areas should be instituted at both the primary and secondary school levels. (This should be accomplished through formal instructional means as well as indirectly through farm youth organizations.)

2. The mass media should be utilized to provide learning for all, including those who are illiterate.

3. Fully equipped farms or production training units ranging from small to large, and involving various levels of investment and technology, should be established in intermediate institutions to enable students to learn the required skills.

4. The objectives of each level of education should be agreed upon and publicized.

Conclusions and Recommendations for Agricultural Extension in the Middle East:

1. Greater integration and coordination between various development programs in rural areas are high priority needs.

2. Extension and research personnel should communicate and enter into dialogue so that research findings can easily and promptly be disseminated and applied.

3. Extension must be viewed by national agricultural and rural development leaders as a two-way process so that researchers are made aware of the needs of farmers without delay.

4. Extension should be an important function of university programs, including training.

5. In view of the reportedly slow growth of agriculture in response to extension work over a long period, agricultural universities should do research on factors responsible for this state of affairs.

6. Extension programs should be responsive to the recognized needs and aspirations of farmers and rural people. (This can best be done by getting farmers and villagers involved in both planning and implementation.)

C. Beneficiaries

The primary beneficiaries of the FOA Subproject are expected to be the agricultural students trained at the B.S. level who enter the private and public sectors directly or who go on for advanced degrees. Salaries, prestige, personal satisfaction, and upward economic mobility are viewed as the principal economic and esthetic benefits.

The FOA is expected to assist the MOE in identifying the best FOA graduates for further study overseas. Upon return, some M.S. trained candidates are expected to be posted with the MOE as teachers for the agricultural secondary schools and fill proposed specialist positions with the NES in the provincial agricultural offices.

The secondary beneficiaries of the FOA Subproject are expected to be the people served by agricultural institutions. The FOA will provide trained Yemeni manpower to fill technical and administrative positions for both public and private institutions with greatest intended emphasis upon public institutions. The public institutions include the research and extension components of MAF, the semi-autonomous regional development authorities, and other public institutions such as the MOE which may require agricultural graduates to serve their program. The MOE is expected to benefit indirectly from the availability of trained Yemeni to staff the three agricultural secondary schools which they administer. The small but expanding agri-business sector of Yemen, including credit banks, agricultural input supply firms, and agricultural product processing and marketing firms also will be secondary beneficiaries. The extent to which the public versus private sectors will benefit from the FOA is not known at

this time. The growth of each sector and the relative salary relationships between them will be contributing factors. Detail on number of expected beneficiaries is provided in Annex F (Preliminary Manpower Analysis).

The tertiary beneficiaries of the FOA Subproject are expected to be local villages through the improved technical training at the agricultural institutes, the hiring of graduates of such institutes by the NES, and proposed posting to the provincial and local levels. The local extension centers are expected to test, evaluate, and modify for local conditions the research work conducted at the regional experiment stations. Several aspects of technology development, including water and public grazing land, likely will involve public (common property) issues for group improvement. Training of local paraprofessionals through technical classes and their employment by local groups (LDAs) may provide a means to enhance sensitivity of training and research to maintain focus upon local needs. Availability of television and radio media, even in isolated villages, improves accessibility of villages and farmers to new technology. Farm families are expected to be the ultimate, but indirect, beneficiaries through institutional capacity building which has the capacity to develop and extend technology of relevance to Yemen agricultural needs. Yemen has an egalitarian tradition based on tribal law. This tradition allows any man direct access to leaders to present a grievance or request a favor. Such an egalitarian ethic is expected to provide direct access to government officials. This tradition is expected to serve not only as an important direct linkage to the FOA, but also as a means by which FOA can link into all of the governorates.

A potential training bias, favoring non-farm village and urban students at the expense of those students with a farm background, is possible. This issue needs to be monitored carefully during the project. Current indications from the Ibb Secondary Agricultural School are that 80 percent of the students have farm backgrounds. Just how well those students will fare academically in competition with urban students entering FOA through the secondary school science curriculum is not known. It is expected that up to 80 percent (120 out of 150) of the FOA students will come from the regular (science option) secondary schools. However, because many villages are small, a large number of regular secondary school students are expected to have some familiarity with agriculture and are expected to be reflected in the FOA student population.

Of much greater concern is the dearth of productive investment opportunities in rural Yemen.3/ This poses a challenge for the FOA, MAF, and NES as the mandate of these institutions is to provide applied technical knowledge of near-term application. The extent to which such issues are near-term in nature and can be solved satisfactorily will have a significant impact upon the credibility of the FOA and MAF. A number of issues very likely will require long-run solutions. This is acceptable if some near-term solutions are forthcoming.4/

The official policy of YARG encourages women to attend school. However, many traditional families do not support this policy. Consequently, preparatory and secondary schooling for women are available where separate classrooms are provided (almost entirely in cities) with enrollment levels not exceeding 20 percent. While overall literacy exceeds 20 percent, that

for women, is very low, perhaps 2 to 3 percent. Traditional Yemeni still believe that schooling is for boys, and that girls are to marry at an early age and raise children, instead of attending school. The University of Sana'a and primary levels of education are coeducational. As of 1979-80, only 11 percent of the children entering primary schools were girls.

The traditional division of labor in Yemeni rural society and extensive male labor migration place many women farmers in key production roles. It is important for FOA course offerings to reflect this need. The FOA program will encourage female enrollment and participation by offering human nutrition, food preparation and processing, livestock production, and management classes. These subjects are expected to be of great interest to women who train to be extension agents. There are 23 Home Demonstration Agents in SURDP now. Further initiatives by the YARG to encourage female involvement through the MAF and NES are expected to be slow. Observable changes in agricultural production, cropping patterns, and family household patterns require close analysis, as they may affect women and children differently than men. Inaccessibility of women to the market and lack of opportunity to accumulate capital for investment appear to be extremely important economic issues as Yemeni agriculture becomes more market-oriented.5/

D. FOA Student Considerations

1. Criteria for Admittance

The following criteria for admittance to the FOA have been established tentatively:

a. Graduation from any of the agricultural technical schools or secondary (science option) schools with national exam score - 60 percent,
Pass - 50 percent,
Faculty of Arts - 56 percent,
Faculty of Science - 60 percent,
Faculty of Law - 62 percent,
Faculty of Commerce - 66 percent;

b. Military draft requirements met;

c. Degree of English language competency necessary.

2. Other Issues

At this point a number of unresolved issues remain. It is not clear how equivalent or comparable the secondary (science option) school curriculum is with that provided through the agricultural secondary schools. It appears that the agricultural secondary schools have traded math courses for applied agricultural courses. Thus, remedial training in math may be required for some students. This may also be the issue in English language training for some. A comparison of national scores would be helpful.

One year military service is required of all able-bodied men. The one exception is for all men who are in teacher training who may substitute the military requirement with one year teaching in primary or secondary

schools in rural areas. Adoption of this option may need to be explored for agricultural students if incentives are not adequate to attract sufficient rural based students to the FOA.

In addition to free housing and meals for students attending secondary schools and the University of Sana'a, scholarships and other incentives are provided. A comparison of such educational incentives is shown in Table H-1.

A number of issues will need to be evaluated with reference to the 4-year FOA curriculum. They include (1) the influence of the Ramadan religious holiday (about one month each year) upon both the summer practicum and the semester courses, (2) the requirement of a 12 credit hour course minimum/quarter and its effectiveness in reducing the number of part-time students, (3) the possibility for provision of a 2-year associate degree, and its impact upon FOA instructional capability and agricultural secondary schools, and (4) the impact which a recently implemented quarterly examination process will have upon the problem of delayed graduation.

E. Employment Incentives for FOA Graduates

A preliminary comparison is made among alternative employment opportunities for FOA graduates in Table H-2. At the B.S. level, the salaries are comparable between the FOA, MAF, and MOE, ranging from 3,000 to 3,500 YR/month for initial employment. How this compares with salaries in the private sector is not known, but needs evaluation by the SPP team. At higher degree levels (M.S., Ph.D.), salaries at the University of Sana'a are substantially higher than either those of the MAF or MOE. This is due in part to the fact that the University is semi-autonomous and, apparently, is not constrained by civil service salary requirements as are the MAF and MOE. Salary supplements through consultancies and committee assignments also are available to university faculty.

F. FOA Operational Linkages to Other Public Institutions to Facilitate Technology Development and Adoption

Training of agricultural manpower by the FOA does not by itself insure improved economic well-being in the agricultural sector. The nature and type of training, how it is utilized to conduct agricultural research, the nature of that research, and extending of technical knowledge to the farmers, each is an important factor. The training by the FOA is expected to be a blend of classroom and field experience on the university training farm and summer practicum. Some applied research by professors and students also is expected to provide technical and economic comparison between traditional and modern technology. As currently planned, B.S. training and very limited research capacity will fall within the responsibility of the FOA. Primary research responsibilities, while as yet unsettled, appear to be vested with the proposed Agricultural Research and Development Authority (ARDA) of the MAF. Primary extension responsibilities will be vested with the NES through satellite rural development projects and agricultural extension centers. While formal linkages appear to have been established between the three units at general directorate levels, the operational linkages are not yet defined. Further, central

TABLE II-1

COMPARISON OF EDUCATIONAL INCENTIVES AT SECONDARY AND UNVERSITY LEVELS, YAR

Benefit	Secondary Level			University - B.S. Level	
	Teacher Training	Agr. Tech. Schools	Secondary (science option)	Overseas in Arab Bloc Countries[1/]	FOA (Tentative)
Housing		free		5,000 - 6,000 YR/Yr.	free
Meals	free	free	free	6,300 - 6,800 YR/Yr.	free
Scholarship	500 YR/Mo.	300 YR/Mo.	(variable)[2/]	-	800 - 1,000 YR/Mo.
Clothes and Misc.	-	150 YR/Yr.		1,800 - 2,400 YR/Yr.	
Transportation	-	Round trip to school		Round trip to school	
Books	-	-		700 - 1,200 YR/Yr.	
Medical Insurance	-	-		320 YR/Yr.	
Fees (tuition)	-	-		14,000 - 18,000 YR/Yr.	
Who Qualifies?	Everyone Admitted	Everyone Admitted	Everyone Admitted	Best Students	Best Students

Sources: World Bank, Agricultural Sector Report, 1981; AID/Yemen Training Office; Ibb School Personnel; University of Sana'a Personnel.

1/ Round trip air fare within the Arab bloc countries paid by YARG. Remainder of other costs totalling approximately U.S. $7,000 - $8,000 per year are paid by donor assistance.

2/ Detailed information to be provided in the SPP.

TABLE H-2

COMPARISON OF SALARY LEVELS FOR VARIOUS OCCUPATIONS IN YAR, 1983

University of Sana'a[1/]	
Full Professor (PhD)	11,000 YR/mo.
Housing	3,000
Assoc. Professor (PhD)	10,000
Housing	3,000
Asst. Professor (PhD)	8,000
Instructor (M.S.)	5,000
Asst. Instructor (B.S.)	3,000
Ministry of Agr. & Fisheries	
Base Salary	2,100 YR/mo.
With B.S.	+ 1,000
With M.S.	+ 1,300
With PhD	+ 1,500
Salary Increase every three years	+ 300
Ministry of Education[1/]	
With B.S.	3,500 YR/mo.
With M.S.	4,000
With PhD	5,000
National Extension Service[2/]	
With Agr. technical Secondary Certificate	1,800 YR/mo.
Bonus for Living in Village	+ 500
Day Laborers in Sana'a	60 - 90 YR/day

1/ Paid on 12 month basis with two months vacation. Consulting policy is liberal by U.S. standards. Additional remuneration is provided for committee assignments and meetings.

2/ Information limited to Rada Integrated Rural Development Authority. Salary topping-off may occur with semi-autonomous RDAs which are not limited by civil service regulations.

Source: University of Sana'a, FOA Advisory Committee, MAF, MOE and Ibb School personnel.

authority of agricultural extension is weak and will continue to be so until given higher priority. To enhance the likelihood that the separate research, teaching, and extension units coordinate their efforts, use of joint appointments between the FOA, NES, and ARDA should be evaluated. Additionally, operational methodology which embodies a common component to each unit should be developed within the plan of work for each unit.

A suggestion herein recommended is a component called "farming systems research and development" (FSR) is for serious consideration. The FSR approach contains the following characteristics:

1. A mechanism to measure the technical and economic characteristics of technologies currently used by farmers which the introduced technologies are expected to replace. This step establishes comparative (opportunity cost) benchmarks which introduced technology must surpass to have potential for adoption.

2. A mechanism to establish agricultural research priorities which embrace farmer, researcher, and teacher input into the decision process.

3. A mechanism to screen introduced technologies by technical and economic criteria at experimental and farmer field sites to:

   a. Eliminate technologies which hold little economic promise for adoption;

   b. Modify promising technologies through farmers and researcher changes to enhance potential for adoption in farmer field trials; and

   c. To clarify importance of interactions between multiple inputs and their economic impact on an individual versus package of practices basis.

4. A mechanism to measure level of actual economic gain or premium required to induce farmers to shift from the current practices to an introduced technology or package of technologies and the factors influencing such premium.

5. A mechanism to measure broader village and community acceptability of introduced technology on economic and social grounds.

The methodological approach of FSR outlined above requires direct involvement of farmer, local communities, agricultural research units, extension, and training. Each of the steps outlined should be shared jointly by two or more units. The training functions of the FOA, while applicable in each of the steps, should be given major leadership emphasis in steps 1, 2, and 5. The FOA could play a supporting and monitoring role in steps 3 and 4 which should be the primary responsibility of ARDA units.

which includes support for ARDA, is planning to include FSR units in its research programs with initial technical expertise to be provided by the International Development Research Center. The long-range plan for CID/Core macro-planning assistance to the MAF, also includes an FSR component.

G. Alternatives to FOA: A Cost Effectiveness Analysis

1. The Issue

Manpower assessment for Yemen (see Annex F) has shown that there is a critical shortage of Yemenis trained at the B.S. level. This is particularly true for the agricultural sector. This shortage seriously impairs the effectiveness of development efforts in this sector.

Several alternatives are available for increasing the number of Yemenis with training in agriculture at the B.S. level. The predominant alternatives are as follows:

a. Train Yemenis to the B.S. level in the U.S.

b. Train Yemenis to the B.S. level in an Arab country.

c. Establish a Faculty of Agriculture at the University of Sana'a and train Yemenis to the B.S. level in that faculty.

Economic factors are of considerable importance when determining which alternatives should be pursued to alleviate the trained manpower shortage in the agricultural sector of Yemen. A cost effectiveness analysis of the alternatives identified above was performed. The cost per B.S. graduate trained and available is lower for the FOA alternative than for the other alternatives considered. This advantage of the FOA alternative would be even greater if the university subsidies by other Middle East countries were added to the average annual student cost in other Arab countries of $8000 used in this analysis. Yemen should not rely on subsidized education from other Middle East countries. These countries could decide to remove the subsidy and thereby raise the cost of university education for all students, or just for the foreign students. A sensitivity analysis of the removal of the subsidies from the cost of education in other Middle East countries will be done as part of the Project Paper design.

2. Cost Effectiveness Criteria

The following cost effectiveness criteria were considered:

a. Cost6/ (in $) to AID per B.S. graduate trained and available to YAR;

b. Cost6/ (in $) to AID, YARG, and other donor per B.S. graduate trained and available to YAR;

c. Cost6/ (in $) to AID per B.S. graduate returning to the MAF;

d. Cost6/ (in $) to AID, YARG, and other donors per B.S. graduate returning to the MAF.

3. Assumptions

The most likely scenario includes:

a. Annual rate of inflation: 10 percent
b. Discount factor: 12 percent
c. Practically relevant planing horizon: 20 years
d. Rate of retainment of B.S. by YAR when:

1) B.S. from U.S.: 80 percent
2) B.S. from Arab country: 90 percent
3) B.S. from FOA: 100 percent

e. Rate of retainment of B.S. by MAF when:

1) B.S. from U.S.: 30 percent
2) B.S. from Arab country: 60 percent
3) B.S. from FOA: 80 percent

f. Number of B.S. degrees granted by FOA during planning horizon:

Year	Number of B.S. degrees granted by FOA 7/
1	0
2	0
3	0
4	0
5	26
6	48
7	72
8	96
9-20	120
Total (20 yrs) 7/, 8/	1,682

g. Cost of training per student per year:

1) When studying in U.S.: $ 22,000
2) When studying in Arab country: $ 8,000

h. Drop-out rate of B.S. students:

1) When studying abroad: 10 percent
2) When studying at the University of Sana'a: 20 percent

4. Analysis

a. Procedure

The three alternatives considered for increasing the number of Yemenis trained in agriculture at the B.S. level involve greatly different timing and levels of expenditures. More specifically, the establishment of an FOA involves significant investments prior to the beginning of any teaching activities with relatively lower costs in subsequent years, whereas the alternatives of training Yemenis abroad calls for relatively

higher expenditures in later years in order to generate an equivalent number and timing of B.S. degrees. In order to make these differently timed expenditures comparable, all expenditures are discounted to their present values, i.e., their comparable value in year one of the (20 year) planning horizon.

The actual costs for the first ten years of the FOA alternatives are obtained from Table G-1. It is assumed that there will be no AID participation after year 10; hence, costs to AID for this alternative are zero beyond year ten. Costs to YARG are assumed to be level beginning with year ten, except for an annual increase of ten percent due to inflation. These costs are then discounted to their present (year one) value to arrive at the present value of total costs of establishing and operating an FOA for 20 years. The present value of costs to AID is $13.35 million, to YARG and other donors $45.49 million. Present value of total costs is $58.84 million (see Table H-3).

To calculate the present value of costs associated with training Yemeni abroad, it was assumed that the cost of training one student for one year is $22,000 (U.S.) and $8,000 (Arab country), respectively, in year one. An inflationary increase of ten percent per year was used to arrive at the relevant rates for subsequent years. These annual rates per student per year were then multiplied by that number of students which will need to be in training to produce the same number of B.S. degrees that would be produced by an FOA (see "Assumptions" above for drop-out rates) to arrive at the total cost of producing that number of B.S. degrees that are projected to be produced by an FOA, if established. Discounting these total costs to their present (year one) values shows that the present value of the total cost of producing B.S. degrees equivalent in number and training to those produced by an FOA is $58.7 million for the "Arab country" alternative and $166.1 million for the "U.S." alternative (see Table H-4).

The cost effectiveness criteria are computed by dividing the respective present values of total costs (for the various training alternatives) by the number of students available to the YAR and the MAF, respectively, from the various alternatives. Although all alternatives produce the same number of B.S. graduates throughout the planning horizon, they yield significantly different number of trained (at the B.S. level) Yemenis to YAR and the MAF because of different retention rates associated with the various alternatives (see "Assumptions"). Also, there will be a different number of first, second, etc., year students "in the pipeline" at the end of the planning horizon (because of different drop-out rates; see "Assumptions"). Computations to adjust for these differences have been made prior to computing the cost effectiveness criteria (see Tables H-5 and H-6).

b. Results

The results of the analysis show that, with the assumptions used, the (present value of the) "Cost to AID per B.S. graduate trained and available to the YAR" and the "Costs to AID per B.S. graduate trained and available to the MAF" are both significantly lower for the FOA alternative than for any of the other alternatives considered (Table H-7). "Cost to

100

Table H-3
Projected Actual and Projected Present Value of
AID, YARG, and Other Donor Costs
for Establishing and Operating a Faculty of Agriculture for 20 Years

Year	Project Budgets 1/				
	Actual 2/		Present Value		
	AID	YARG and Other Donors	AID	YARG and Other Donors	Total Present Valu
0	811	---	908	---	908
1	2,988	24,544	2,988	24,544	27,532
2	1,750	757	1,395	603	1,998
3	2,313	927	1,646	657	2,303
4	2,382	1,103	1,514	701	2,215
5	2,677	1,584	1,518	899	2,417
6	2,297	1,970	1,164	988	2,162
7	1,758	2,431	795	1,100	1,895
8	1,430	2,924	578	1,181	1,759
9	1,308	3,479	472	1,254	1,726
10	1,157	4,180	372	1,346	1,718
11 3/	---	4,598	---	1,322	1,322
12	---	5,058	---	1,298	1,298
13	---	5,564	---	1,275	1,275
14	---	6,120	---	1,252	1,252
15	---	6,732	---	1,230	1,230
16	---	7,405	---	1,208	1,208
17	---	8,146	---	1,186	1,186
18	---	8,960	---	1,165	1,165
19	---	9,856	---	1,144	1,144
20	---	10,842	---	1,124	1,124
Totals	---	---	$13,350	$45,487	$58,837

1/ Rounded to nearest thousand

2/ From Table G-1 (for first 10 yrs)

3/ For years 11-20, cost levels increase by 10 percent (inflation) each yr.

Projected Actual and Projected Present Value
of Costs for Training Abroad to the B.S. Level

Year	No. of Students Finishing	No. of Students Training	Actual Annual Costs Per Student		($1,000) *Total Annual Costs		($1,000) Present Value of Annual Costs	
			U.S.	Arab	U.S.	Arab	U.S.	Arab
0	0	0	---	---	---	---	---	---
1	0	29	22,000	8,000	638	232	638	232
2	0	81	24,200	8,800	1,960	713	1,563	568
3	0	157	26,620	9,680	4,179	1,520	2,975	1,082
4	0	256	29,282	10,648	7,496	2,723	4,764	1,730
5	26	379	32,210	11,713	12,208	4,439	6,927	2,519
6	48	477	35,431	12,884	16,901	6,146	8,562	3,112
7	72	522	38,974	14,172	21,514	7,823	9,733	3,539
8	96	600	42,872	15,589	25,723	9,353	10,390	3,858
9	120	624	47,159	17,148	29,427	10,700	10,611	3,858
10	120	624	51,875	18,863	32,359	11,771	10,420	3,790
11	120	624	57,062	20,749	35,607	12,947	10,237	3,723
12	120	624	62,769	22,824	39,168	14,242	10,052	3,656
13	120	624	69,045	25,107	43,084	15,667	9,875	3,59
14	120	624	75,950	27,617	47,392	17,233	9,696	3,52
15	120	624	83,545	30,379	52,132	18,956	9,524	3,46
16	120	624	91,899	33,417	57,345	20,852	9,353	3,40
17	120	624	101,089	36,759	63,080	22,932	9,184	3,33
18	120	624	111,198	40,434	69,388	25,231	9,020	3,28
19	120	624	122,318	44,478	76,326	27,754	8,861	3,22
20	120	624	134,550	48,925	83,959	30,529	8,706	3,16
Totals	1,682	---	---	---	---	---	$161,091	$ 58,65

Note: Total annual costs for U.S. were obtained by multiplying the respective factor in column three by the factor in column four. Total annual costs for Arab were obtained by multiplying the respective factor in column three by the factor in column five.

Table H-5
Calculation of Adjustment to
Number of B.S. Completed by the
End of the Planning Horizon

Study Years	Number of students in "pipeline" at end of planning horizona (bv training alternative)		Adjustment factor	"B.S. equivalen: in pipeline	
	FOA	U.S.,		FOA	US
1st	144	128	.2	29	26
2nd	138	124	.4	55	50
3rd	132	120	.6	79	72
4th	126	120	.8	101	96
Totals	---	---	--	264	244

Table H-6
Calculation of B.S. Graduates Available
to YAR and the MAF by Training Alternative

Description	Training Alternative		
	FOA	U.S.	Arab
No. of B.S. (completed) and B.S. equivalents (see Table H-5) by end of planning horizon	1,946	1,935	1,935
Retention rate (in percent) for:			
YAR	100	80	90
MOA	80	30	60
No. of B.S. (completed) and B.S. equivalents available to:			
YAR	1,946	1,548	1,742
MOA	1,557	580	1,161

Table H-7
Cost Per B.S. Trained by Various Training Alternatives and Available to YAR and the MAF

Cost 1/ Criteria	Cost per B.S. Trained by Various Training Alternativ		
	FOA	In Arab	In U.S.
		--$--	
1. Cost to AID/B.S. trained and available to YAR	6,860	33,671	104,064
2. Cost to AID, YARG, and other donors/B.S. trained and available to YAR	30,235	33,671	104,064
3. Cost to AID/B.S. trained and returning to MAF	8,574	50,521	277,743
4. Cost to AID, YARG, and other donors/B.S. trained and returning to MAF	37,789	50,521	277,743

1/ "Cost" means "present value of costs" based on assumptions stated above.

*Note: Total number of students completing their B.S. training is 1,682 for all alternatives over the planning horizon. In each case, there remains a number of 1st, 2nd, 3rd, and 4th year students in the pipeline. Hence, "present value of total costs" was divided by 1,946 and 1,935, respectively, for the FOA and the other alternatives to account for there partially completed B.S. degrees when computing "Cost per B.S."

FOA alternative than for any of the other two alternatives, although the differences are not as large as they are when costs to AID alone are being considered (Table H-7).

5. Sensitivity Analysis of Critical Assumption

Because the above results are clearly in favor of further pursuing the potential of establishing an FOA, a sensitivity analysis of the robustness of the results to the various assumptions was not performed for this SPID. It is suggested that such a sensitivity analysis for certain critical assumption be performed as part of an SPP.

H. Recurrent Cost Considerations

Careful analysis will need to be made of YARG's capacity to fully staff and operate an FOA on a continuing basis. This is of critical importance in light of expected development and staffing of Faculties of Engineering and Medicine on the University of Sana'a campus. Such an analysis will bring into focus the role of user fees, their possible effect upon student enrollment, and FOA operational capability. Donor lending limitations will be addressed as will implications that the recent earthquake may have upon modifying YARG planned development and recurrent budgets.

FOOTNOTES

1/ Reference sources for this section include:

1. AID/Yemen, Agricultural Sector Assessment, Yemen Arab Republic, 1982.

2. Swanson, Jon C. and Mary Hebert, Rural Society and Participatory Development: Case Studies of Two Villages in YAR, Cornell, 1981.

3. World Bank, Agricultural Sector Study, November 17, 1981.

4. YAR, Agricultural Census Date, 1977-80, for Six Governorates.

2/ Agricultural Education for Development in the Middle East, edited by John Ryan and Adib T. Saad, American University of Beirut, 1980, pp. 163-4.

3/ Rural Development in the Yemen Arab Republic Strategy Issues in a Capital Surplus - Labor Short Economy, John M. Cohen and David B. Lewis, Development Discussion Paper No. 52. Harvard Institute for International Development, February 1979, pp. 47-54.

4/ Yemeni Agriculture and Economic Change by Richard Tutwiler and Shelia Carapico, American Institute for Yemeni Studies, 1981, pp. 177-82. D. FOA Student Considerations

5/ Ibid., pg 167-8.

6/ "Cost" means "present value of costs" based on assumptions specified in the section entitled "Assumptions."

7/ A drop-out rate of 20 percent is assumed. Numbers given are degrees granted, net of drop-out rate.

8/ At the end of year 20, there will also be 144 first year students, 138 second year students, 133 third year students, and 126 fourth year students.

126

ANNEX I

Preliminary Technical Analysis

A. Objective of the Faculty of Agriculture (FOA)

B. Location and Physical Facilities of the FAO

C. Proposed Structure and Organization of the FOA

D. Training and Staffing Plan for the Proposed FOA

E. Proposed Curriculum of the FOA

F. Development of Sister University Relationships with U.S. Land-Grant Institutions

G. Construction Observation

121

ANNEX I

PRELIMINARY TECHNICAL ANALYSIS

A. Objective of the Faculty of Agriculture (FOA)

The objective of the FOA is to increase the supply of appropriately trained manpower in the YARG to plan, manage, implement and evaluate development activities in the private and public agricultural sector of the YAR.

B. Location and Physical Facilities of the FOA

A number of location alternatives have been carefully examined by University officials and outside consultants. The initial study prepared in 1980 by Dr. Naser A. Al-Aulaqi, then Associate Professor of Agricultural Economics in the Faculty of Business and Commerce, addressed this issue. In a strong argument for locating the proposed FOA within the University of Sana'a, Dr. Al-Aulaqi pointed out:

> "The big requirement for nonagricultural sciences, whether at the B.A. or M.A. and Ph.D. levels, indicates that agricultural colleges impose on their students an amount of non -agricultural sciences in which other colleges (faculties) specialize. This warrants the existence of an agricultural college within the campus of the university so that students could be able to study the other requirements." 1/

Dr. Al-Aulaqi also cited the economic advantage in avoiding the costs of duplicating staff that would be necessary to reach all the elements of a baccalaureate program in isolation from the rest of the university. He concluded that the proposed FOA must be located within the University of Sana'a campus and that a building of about 20,000 m^2 would adequately serve the needs of this new faculty. 2/

In April of 1981, Dr. I.A.M. Lucas, Principal of Wye College of the University of London, was invited to YAR by University of Sana'a officials and the British Council. In addition to other items, Dr. Lucas addressed the question of location and firmly supported the stance of Dr. Al-Aulaqi, citing the strong need to develop close ties, especially with the Faculty of Science. He also concluded that no single site in the YAR would be representative of all the country's diverse agricultural regimes. 3/

During 1982, CID/USAID developed a report on a month-long fact-finding tour by selected YARG officials of the Faculties of Agriculture in Jordan, the United Kingdom and the United States. This report also documents the need for locating the FOA within the University of Sana'a. 4/

In early 1982, at the request of YARG, the UNDP Food and Agriculture Organization (FAO) sent a team of consultants to the YAR to prepare feasibility studies and recommendations concerning the establishment of a FOA. This team did not question alternative sites, indicating their assumption that the FOA would be an intergral part of the campus. 5/

The League of Arab States sent a team to YAR to study the establishment of a Faculty of Agriculture in Yemen. The team considered a number of possible alternative sites and concluded with more than a dozen strong agruments for locating the FOA within the existing University of Sana'a. 6/

Thus, a number of studies have focused on the issue of location and all are unamimous in recommending that the FOA be located within the University of Sana'a. In this growing community of scholars, a young, indigenous faculty would have an opportunity to develop close ties with other faculties on the campus as well as to plant the seeds for the all-important linkages with the MAF and the MOE also located nearby and the remainder of the public and private agriculture sector.

While USAID will not finance the construction of buildings to house the FOA or purchase land on which to locate an instructional farm, both items will provide essential and needed support facilities for the FOA. YARG has agreed to finance the construction of a faculty building with funds expected to be made available through low-interest loans from sister Arab Nations. The buildings will include offices, classrooms, libraries, laboratories, and greenhouse space, and, according to World Bank estimates, will cost in the vicinity of $20-22 million. USAID is proposing to provide architectural and educational design consultants to work directly with construction architects and engineers to assure a functional relationship between offices, classrooms, and research facilities. USAID, through the provisions of this proposed FOA Subproject, will provide essential classroom materials, library resources, teaching equipment, and construction observation services.

This Subproject will also support the development of an instructional farm on about a 22 hectare site adjacent to the faculty building (see map, p. J-40, Annex J). The farm will provide an essential practical training element for students enrolled in the FOA, utilizing demonstration plots for agronomic and horticulture crops, facilities for livestock and poultry, and examples of rain-fed and irrigated crop production. The use of this facility will be an integral part of many of the courses in the curriculum as indicated in Table I-3 of this Annex. It can also be used as a demonstration resource for local farmers or extension agents where the latest cultural practices can be shown via tours and workshops sponsored by the FOA. The details of this important instructional tool are presented in Annex J of this report. The University will provide the land for the instructional farm, and USAID will finance site preparation, development and construction costs, as well as the procurement of necessary supplies, equipment, and participant training. USIAD/Yemen proposes that AID/W approve $664,000 for mobilization expenses for the instructional farm. Detailed analysis and justification is contained in Annex K. Based on prior CID experience with the poultry and

129

horticulture subprojects, it is recommended that two years be scheduled to bring the instructional farm to a functional stage.

C. Proposed Structure and Organization of the FOA

In accordance with the recommendation of the Faculty of Agriculture Planning Unit (FAPU), the land-grant model will serve as guide to shaping the proposed FOA. 7/ Initially, resident instruction will be the primary function of the FOA. It will take time for this Faculty to establish its credibility with the MAF and with the grassroots elements of the agricultural sector in terms of the additional functions of research extension and teaching. While the FOA may not fully take on the latter functions, it is critical that linkages be developed with the MAF as soon as possible to provide the needed backstopping and in-service training of MAF personnel. We have found in our discussions with MAF officials a highly favorable attitude of cooperation in achieving such an end.

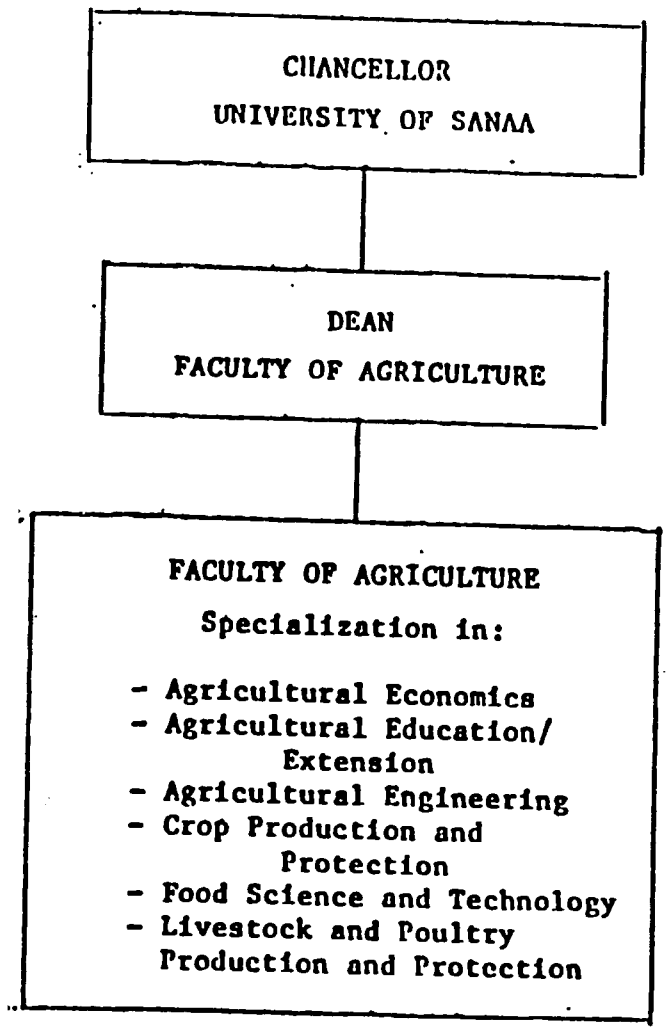
Figures I-1, I-2, and I-3 schematically depict the transition that would occur ideally if the land-grant model is to be achieved eventually. The end-of-project status (1993) will result in an indigenous faculty, functioning as a single unit, under the leadership of a dean (Figure I-1). This rudimentary faculty will include some degree of specialization in agricultural economics, agricultural education/extension, agricultural engineering, crop production and protection, food science and technology, and livestock (and poultry) production and protection. Within the general area of crop production and protection, prospective FOA will specialize in field crops, horticulture, and soil science. Agricultural engineering will include specialization in terms of irrigation and water relations, agricultural mechanization, and computer applications. At some point in the future, the FOA may want to address its country's training needs in fisheries science. This will be assessed further during the development of the SPP. By 1993, with only two or three faculty members in each area, there would be no need for separate departmental sub-units under the Dean.

As the FOA grows, departmental units could eventually emerge within the FOA as shown in Figure I-3 (e.g. 1999). Managed by appointed departmental heads, these units would operate expanded and more sophisticated programs of teaching, where students could option greater specialization of the baccalaureate level, if desired.

Figure I-3 depicts the long-range organizational structure where the Dean is assisted administratively by Associate Deans responsible for leadership in teaching, research, and extension. Faculty in each department would participate in all three activities, some holding joint appointments in at least two areas. In essence, this is the generalized land-grant model, and it may take 15 to 20 years to achieve its parallel in the YARG. The important point is not so much that this model be achieved; rather it is critical that the FOA eventually impact, through whatever means and linkages necessary, the rural agricultrual sector - which principally consists of the Yemeni farmers. If this can be done effectively through MAF channels of research and extension, the goals of this Subproject will very likely be realized.

FIGURE I-1

PROPOSED ORGANIZATION FOR FACULTY OF AGRICULTURE
UNIVERSITY OF SANAA, END-OF-PROJECT STATUS (1993)



(4)

FIGURE I-2

PROPOSED ORGANIZATION FOR FACULTY OF AGRICULTURE, UNIVERSITY OF SANAA, INTERMEDIATE STATUS (1999)

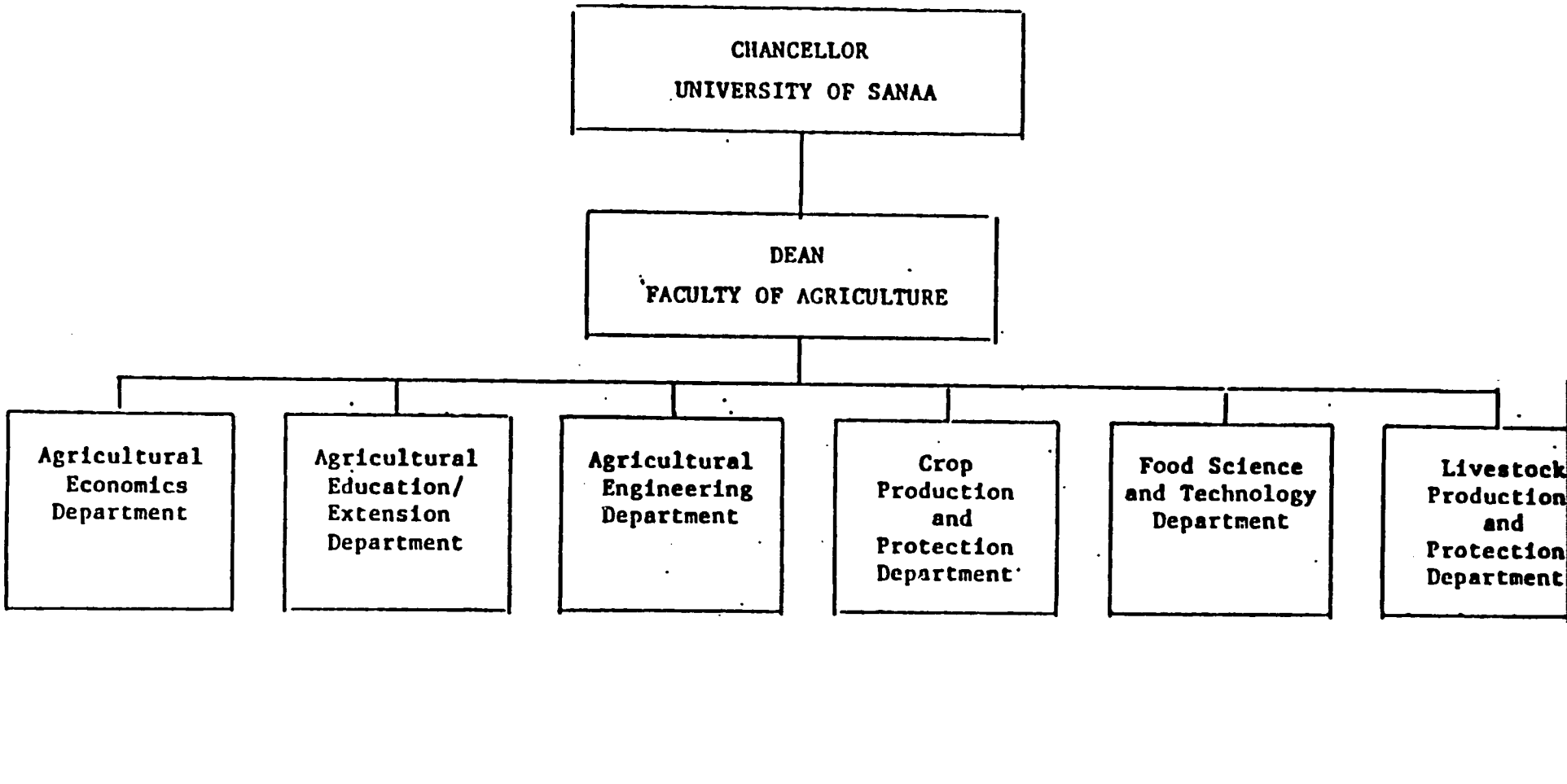
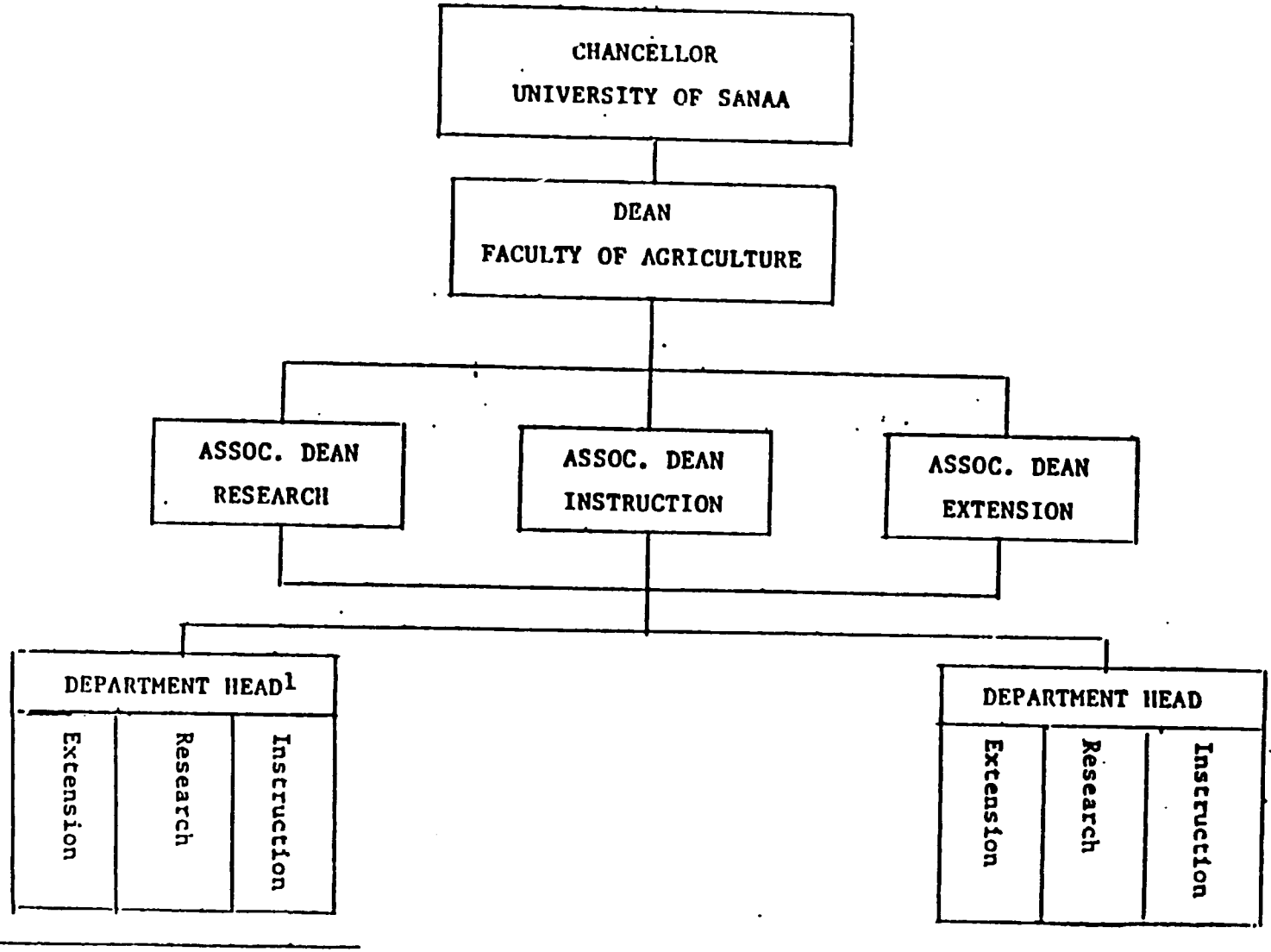


FIGURE I-3

PROPOSED ORGANIZATION FOR FACULTY OF AGRICULTURE, UNIVERSITY OF SANAA, ULTIMATE STATUS (2010)



[1]It is expected that multiple departments may eventually develop in response to changing needs.

D. Training and Staffing Plan for the Proposed FOA

A key element of this subproject is the graduate preparation of prospective Yemeni faculty in the areas of specialization targeted for the FOA. Table I-1 schematically illustrates the phasing of this participant training. Three individuals (dean designate, instructional farm manager designate, and librarian designate) will be sent abroad for non-degree internship training during the initial year. The internship will include working closely with counterparts at appropriate U.S. institutions of higher education.

The subproject will provide graduate training for prospective FOA members. Five scholarships have already been authorized under the Core Subproject for project mobilization. Additionally, three students will be selected for graduate training during the initial project year, and in each of four successive additional years. This could result in a total of 20 trained FOA members if all training positions are filled and if all successfully complete graduate programs through the Ph.D. degree. Graduate programs will be designed such that formal course work will be completed abroad, and the research and thesis will be done in-country with supervisory visits by the student's major professor at an appropriate point in the progress toward completion of the research. Some research supervision will be possible by CID in-country professional personnel. Such a mechanism will enable Yemeni graduate students to focus research projects on important problems of Yemeni farmers and will initiate the important process of establishing linkages and credibility with the agricultural sector of the YAR. It will also promote the development of important long range linkages between the FOA and U.S. land-grant institutions. Such a "sister" relationship could eventually be beneficial at both ends in terms of developing library research, sponsoring special seminars, etc.

By the end of the subproject, 20 Yemeni faculty members will be trained in six general areas of specialization as previously indicated. While this number is not large, it is sufficient to function adequately during the early years. It should be noted that other donors are involved in graduate training, and these trained professionals presumably would be eligible to join the FOA upon completion of advanced degrees. In addition, some attrition will likely occur as has been experienced in the past. Hopefully, this will be minimized by carefully matching graduate candidates with training experiences of appropriate U.S. land-grant institutions, and making it possible for participants to complete their graduate research in-country on Yemeni agricultural problems.

Table I-2 presents a staffing plan for the FOA showing the need for expatriate staff in order to meet anticipated enrollment projections during the third subproject year. Current plans are to enroll the first class of agricultural students in the fall of 1985, corresponding to the second subproject year. It is proposed that first year students be enrolled in the Faculty of Science, since the majority of their course will be in that area. Students will begin their agricultural course work during the third subproject year (second year of enrollment), thus necessitating some expatriate staffing as indicated in certain areas. Trained Yemeni faculty are already available in agricultural economics an crop

TABLE I-1

PROPOSED PHASING OF FOA PARTICIPANT TRAINING AT U.S. LAND-GRANT UNIVERSITIES BY AREA OF SPECIALIZATION, SUBPROJECT YEAR, STUDY EMPHASIS, AND TARGETED FOA RESPONSIBILITY

AREA OF STUDY AT U.S. LAND-GRANT UNIVERSITY	SUBPROJECT YEAR AND STUDY EMPHASIS										TARGETED FOA RESPONSIBILITY 1/
	1	2	3	4	5	6	7	8	9	10	
Agric. Administration 2/	←	→									Dean, FOA
Exp. Farm Management 3/	←	→									Manager, Inst. Farm
Library Science 4/	←	→									Librarian, FOA Library
Agric. Economics		← Farm Management				→					Agric. Economics
Agric. Engineering	← Irrigation, H O Relations					→					Agric. Engineering
				← Agric. Mechanization					→		Agric. Engineering
					← Computer Applications					→	Agric. Engineering
Agric. Education/Extension			← Secondary Teacher Training					→			Agric. Educ./Ext.
				← Extension Methods					→		Agric. Educ./Ext.
Animal Science			← Cattle, Sheep, Goat Prod.					→			Livestock Prod. and Protection
Crop Science		← Cereals, Forage Prod.				→					Crop Prod. & Protection
Foods and Nutrition					← Human Nutrition					→	Food Science & Technology
Food Science & Technology					← Food Chem. Processing					→	Food Science & Technology
Horticulture	← Citrus, Vegetable Prod				→						Crop Prod. & Protection
Poultry Science	← Layer, Broiler Prod.				→						Livestock Prod. & Protection
				← Livestock, Poultry Breeding				→			Livestock Prod. & Protection
Rangeland Resources			← Livestock Grazing Management					→			Livestock Prod. & Protection
Soil Science		← Morph., Fertility, Physics				→					Crop Production & Protection
TOTAL IN TRAINING 5/	4.5	6	9	12	15	12	9	6	3	-	

1/ See proposed organizational structure, p. I-5, Annex I

2/ Six-month administrative internship with Dean of FOA at U.S. Land-Grant Institution.

3/ Six-month management internship with manager of instructional farm at U.S. Land-Grant Institution.

4/ Six-month library science internship at U.S. Land-Grant FOA Library.

5/ Limited training was authorized prior to SPID approval; however, only two participants have been identified and approved for U.S. graduate training as of 1/83

135

STAFFING PLAN FOR FOA SHOWING PHASING OF EXPATRIATE STAFF BY TRAINED YEMENI FACULTY THROUGH SUBPROJECT DURATION

Area of Specialization or Responsibility	Subproject Year[1] and Staffing Source									
	1	2	3	4	5	6	7	8	9	10
Agric. Economics[2]			Trained Yemeni Staff							
Agric. Education/ Extension[3]					Expatriate Staff			Trained Yemeni Staff		
Agric. Engineering			Expatriate Staff			Trained Yemeni Staff				
Crop Production and Protection[4]			Trained Yemeni Staff							
Food Science and Technology[5]										Trained Yemeni
Livestock Production and Protection			Expatriate Staff			Trained Yemeni Staff				
Dean of FOA[6]			Expatriate Staff Advisor				Trained Yemeni			
Instr. Farm Manager[6]		Expatriate Advisor					Trained Yemeni			
FOA Librarian[6]		Expatriate Advisor				Trained Yemeni				

1/ Assumes prospective students enrolled in University of Sanaa Faculty of Science during second subproject year with enrollment in FOA during third subproject year.

2/ Assumes trained Yemeni available.

3/ Assumes first classes in agric. education/extension in third year of curriculum.

4/ Assumes trained Yemeni available.

5/ Assumes Food Science curriculum will be initiated in tenth year of subproject.

6/ Includes 6-month internship for Yemeni counterpart during first year of subproject.

136

production/protection. Expatriates would be provided by the subproject in agricultural engineering and livestock (and poultry) production/protection during years three through five, and in the area of agricultural education during subproject years five through seven.

The specialization of food science and technology is not phased in until year 10, when two trained Yemeni are scheduled to return to take up assignments with the FOA.

The Subproject also provides for expatriates in an advisory role to the Dean of the FOA, the Instructional Farm Manager, and the FOA Librarian. In each case, the Yemeni professional will have returned to country in time to join with their expatriate counterparts for the advisory period indicated.

E. Proposed Curriculum of the FOA

Recognizing that, for the most part, graduates of a baccalaureate program in agriculture in the YAR need a strong, broad base in all aspects of Yemeni agricultural production, as well as good practical experiences, the curriculum proposed in Table I-3 would appear to meet the needs quite adequately. Students would graduate with a general degree in agriculture sciences, with some opportunity for specialization during the final year.

The initial year would build competency in the basic sciences, as well as in English language capability. English competency is important as the extent of technical literature in Arabic in the agricultural sciences is very limited and many of the science classes are taught in English. This problem is not unique to the FOA. The faculty of Science also faces this problem. Its impact on the proposed project will be assessed during the development of the SPP.

Year two of the curriculum would focus on introductory agricultural sciences, resulting in an exposure to the broad aspects of agricultural production. Year three and four offer commodity oriented production courses as well as specialized coursework in pest management, physiology, and advanced management classes.

An important element in the curriculum is the planned practicum that occurs during each of the four vacation periods. Activities are specifically designed to expose students to the range of production variability in the YAR, teach them basic agricultural skills, and prepare them for leadership roles in various institutions and agencies of the public and private agricultural sectors. It is especially important that students enrolled in the program be exposed to a good balance between theory and practice in the courses they take. The curriculum should focus on agriculture in Yemem in order to assure relevance of the production practices the students will be exposed to.

The curriculum and school year calendar must take into consideration the rotating, month-long holiday of Ramadan. The implications of Ramadan on the proposed curriculum and school calendar will be assessed during the development of the SPP.

The curriculum must be dynamic. It must respond to changing needs of the agricultural sector. It will be subjected to close scrutiny and review, especially through the life of the subproject. CID/AID advisory staff will work closely with the FOA to assure the curriculum is responsive to perceived YAR agricultural sector needs. Teaching materials will be carefully selected on the basis of their relevance to those needs.

TABLE I-3

PROPOSED CURRICULUM AND PRACTICUM EXPERIENCES FOR STUDENTS ENROLLED IN THE FACULTY OF AGRICULTURE, UNIVERSITY OF SANA'A[1/]

FIRST YEAR [2/]	SECOND YEAR	THIRD YEAR	FOURTH YEAR
Formal Coursework: English Language Economics Chemistry Botany Mathematics Microbiology Zoology Computer Logic * Into. to Agriculture of YAR	Formal Coursework: Farm Management Agric. Cooperatives * Animal Science * Poultry Science * Plant Science * Soil Science * Intro. to Agric. Engr. Food Quality, Chemistry * Plant Diseases * Economic Entomology Statistics Leadership Development	Formal Coursework: Agric. Marketing Agric. Finance * Ruminant & Monogastric Nutrition * Animal Breeding and Improvement * Animal Reproduction * Soil Fertility * Plant Breeding and Improvement * Plant Growth & Dev. * Power & Farm Mech. * Irrig. Systems & Design * Farm Structures Food Processing Human Nutrition	Formal Coursework: Advanced Farm Mgt. * Poultry Prod. & Mgt. * Sheep, Goats, Cattle Prod * Livestock Grazing Mgt. * Soil Morph. & Develop. * Weed Control * Cereal and Forage Crops * Fruit & Vegetable Prod. Agric. Product Process. Secondary Teaching Meth. Extension Methods Secondary Agriculture Curriculum Rural Sociology * Experimental Design Computer Applications in Agriculture Personnel Management Fiscal, Budgetarty Mgt. and Control * Farming Systems R & D
Vacation Practicum: Supervised orientation and field trips to different agricultural regions of YAR. Purpose is to show variability in ecological and climatological conditions under which agriculture is practised in the YAR.	Vacation Practicum: Intensive and closely supervised training at Instructional Farm, where students are familiarized with various aspects of crop and animal husbandry, and learn basic skills.	Vacation Practicum: Assign students to different public and private organizations, institutions, and farms. Students expected to carry on normal practical work being performed and maintain diary of activities. Final evaluation based on report prepared by student at conclusion of experiences.	Vacation Practicum: Students will be assigned to various public and private organizations, institutions, secondary schools, etc., where they will obtain intensive management experience.

1/ In addition to the above curriculum, the COA will offer a variety of short courses, workshops, and in-service training classes for MAF personnel or other groups in the public and private agricultural sector.

2/ Students enrolled with Faculty of Science during first year.

* Courses that will have a laboratory portion which will utilize the resources of the Instructional Farm.

F. Development of Sister University Relationships with U.S. Land-Grant Institutions

It is especially important to design this subproject in such a way as to encourage the development of linkages between the FOA and a U.S land-grant universities (LGUs) which will continue and grow beyond the duration of the project. Such sister university relationships will support the subproject's purpose and subgoal and the Title XII collaborative arrangement by serving as a vehicle for the long-term exchange of ideas and personnel which will continue after U.S. AID funding ceases.

The subproject will be designed to develop and strengthen such linkages. CID will develop a list of CID-LGU agricultural faculty in various disciplines who want to serve on graduate advisory committees for Yemeni students or to serve as the chairman of such committees. Once a participant has been selected for U.S. training, the proposed major professor would be identified and brought to the YAR for orientation and consultation with AID, CID and FOA staff on a specific agricultural problem that would be appropriate for the participant's research and thesis or dissertation.

Following the selection of an appropriate dissertation topic, the major professor and the participant would return to the U.S. where the participant would complete the formal coursework, and initiate that phase of the research that could be completed stateside.

The balance of the graduate training would proceed as described in Section D. of this Annex. The participant's major professor would return to the YAR for final consultation and assistance in completing the graduate research, before both return to the U.S. to present and defend the thesis or dissertation. Upon successful completion of the graduate work, the trained participant would return to the YAR and join the FOA.

If competent people at both ends were encouraged to particiapte, this process would result in a cadre of professionals at USLGUs that would become increasingly aware of and involved in the agricultural development of the YAR. From this awareness and investment, it would be highly possible that U.S. graduate students will be encouraged to focus on agricultural problems in the YAR. A logical extension of such a cadre would be that courses or special seminars on agriculture in the YAR might be designed for integration into the university curriculum or program at the LGUs. It would also be likely that library resources would be developed at both ends (YAR and USLGUs) that would further encourage the exchange the ideas and appropriate technology.

The subproject has the provision for the use of consultants from USLGUs at regular intervals throughout the project. Such contracts would also nurture and strengthen linkages with U.S. land-grant universities.

Finally, as trained Yemeni participants return to the FOA, it will be important to modify existing policies at USLGUs in order to encourage these young faculty to serve as graduate advisory committee members in the YARG and eventually major professors for future Yemeni graduate participants. Such policies should also extend to CID/AID professional staff who could be directly involved in the YAR with the FOA.

It is crucial to the success of this subproject that the development of sister university linkages with USLGUs be given a high priority. If this is not done adequately, the impact of the subproject and the overall Agriculture Development Support Program could be short-lived, and fall short of its ultimate goal as envisioned in the Title XII legislation.

G. Construction Supervision

USAID/Yemen proposes that AID fund construction supervision services for the construction of the FOA classrooms, labs, offices and library buildings. Actual construction will be funded by other donors. Contracting for construction supervision services will be handled as an AID direct contract or as a sub-contract under the institutional contract with CID.

Construction Supervision Services should consist of the following types of tasks:

a. Assistance with evaluation of the construction bids received;

b. Full-time supervision of construction progress in Sana'a by one representative; and

c. Periodic visits by small teams of architects and engineers involved in the project.

The team visits should take place at approximately three to four month intervals, for a total of about six visits of the A and E firm. Although it is not necessary to engage the firm of architects and engineers who originally designed the project to do this work, there is one important advantage in doing so, i.e., the original design firm will have a thorough knowledge of design and its development history. Cost for the above services is expected to be about $550,000 plus $1,350,000 for design.

The SPP will include a more detailed scope of work and budget for the construction observation phase.

141

ANNEX J

Demonstration Farm Analysis

A Demonstration Farm Study for The University of Sana'a Faculty of Agriculture

a proposal designed by a
CID/USAID special study team
for the University of Sana'a

Team Members

James A. Vomocil, Professor of Soil Science,
Oregon State University

LeRoy Daugherty, Professor of Agronomy
New Mexico State University

John Leffel, Professor of Animal Science and
Agronomy, Oregon State University

CONSORTIUM FOR INTERNATIONAL DEVELOPMENT
Tucson, Arizona Corvallis, Oregon Sana'a, Yemen

CID/CORE Report 1983-1
February 1983

142

PREFACE

In October, 1981, representatives of the University of Sana'a suggested that a study should be made to determine the attributes of a demonstration and research farm for the proposed Faculty of Agriculture. The committee designated to design the faculty concurred. CID/USAID was asked to provide the expertise from CID universities for this task since the Land Grant University system of the United States bears similarity to the model suggested by the Faculty Design Committee.

Core/OSU provided the following individuals for the project:

Dr. James Vomocil; Professor of Soil Science and Extension Specialist, Oregon State University - Team Leader, with expertise in Soil Physics and Irrigation.

Dr. LeRoy Daugherty; Professor of Agronomy, New Mexico State University, with expertise in Crops and Soils.

Mr. John Leffel; Professor of Animal Science and Agronomy and Extension Specialist, Oregon State University, with expertise in Animal Science, Pasture Management, and Range Management.

The study team consulted officers of the University of Sana'a, the YARG Ministry of Agriculture and Fisheries (MAF), the YARG National Water and Sewage Authority, Food and Agriculture Organization of the United Nations, the World Bank, and representatives of various consulting firms with offices in Sana'a.

The team toured Y.A.R. to familiarize themselves with the agricultural industry and food systems of the nation. Research and extension sites of MAF at Dhamar, Yarim, Taiz, Jaruba, and Surdud were visited. The Ibb Secondary Agricultural Institute (MAF/MOE) was also visited. CID/USAID is involved as a cooperator in the activities at the Jaruba Horticultural Station and the Ibb Secondary Agricultural Institute. With this background, the team deliberated upon a plethora of alternatives and devised the suggestions contained in this report.

EXECUTIVE SUMMARY

University of Sana'a Demonstration Farm Plan

A CID/USAID study team was brought to Sana'a for one month on TDY and given the charge of developing a proposal for a demonstration farm facility to be used by the proposed Faculty of Agriculture at the University of Sana'a. The plan evolved was to contain sufficient detail and be sufficiently specific to become the basis for a proposal to be submitted for funding.

The modus operandi of the study team was to consult with national, local and university authorities, representatives of the World Bank, and various consultants working in YAR province. The team made an analysis of their findings and on the basis of this analysis, developed this plan.

The needs of the faculty and future students of the Faculty of Agriculture at the University of Sana'a were a prime consideration. Of principle concern was the development of an appropriate sized facility to accomodate a sufficient range of interests to meet the needs of a faculty charged with the responsibility of training the future agricultural leaders for YAR. The procedure has two long-term approaches:

First, it was our intention to seek the appropriate level of technology, to put the emphasis on the future, not the past. The significance of the level of technology was demonstrated to us by many references to the current and pending shortage of agricultural labor in the food system of this nation. The second principle was to guarantee an adequate level of flexibility in the use of land and water resources, and the need for physical arrangements to best meet the needs of students, the needs of the Province of Sana'a from the point of view of agricultural extension, and the needs of the future faculty with regards to their activities in research.

The availability of land and water were important factors in generating the attributes of the final system. Land is scarce and expensive. A special effort was made to determine the possibilities of developing an on-campus, rather than an off-campus, farm. Also, it would be desirable to accomodate students with a minimum of transport. There are some concerns about the prospect of water development on the farm site. Alternative proposals and projections which could guarantee the university farm a sufficient quantity, sufficient dependability and long-term security of water supply were appraised.

A projected enrollment of about 800 students in agriculture would require a faculty of about 80 scientists. Twenty-one hectares of land suitably apportioned for teaching and research among the various disciplines in agriculture should suffice.

144

Given sufficient water (at least 14 liters per second), one possible pattern of land use would be to assign approximately 3.0 hectares for use in demonstration plots and trials with agroeconomic crops, cereals, pulses, forages, oil seed, and fiber crops. An allocation of 5.3 hectares of land would be available for horticultural crops. The horticultural activities to be considered would include fruits, vegetables, and forestry and landscaping. Approximately 11.0 hectares of land would be available for animal husbandry work with sheep, goats, cattle and poultry. An additional 0.7 hectare of land could be used for student and faculty activities in soil and water management, for trials and demonstrations in tillage and irrigation methods. Approximately 1.0 hectare would be allocated for buildings, principal roads, ponds, yards, etc. Less available water would mean a proportionally smaller farm and a different distribution of land (see Table 4-1).

In the horticultural section, it was considered appropriate to partition the area three ways, establishing a zone for fruit involving approximately ten different kinds of trees, a vegetable section with about 30 different species of shade trees, fire wood trees, ornamentals, flowers, shrubs and turf.

The livestock section would be comprised of a flock of sheep of approximately 25 ewes, 15 goats involving both dairy and meat, and a cattle herd of about 8 milk cows. The poultry flock should have both egg and meat production using a flock of 250 layers and 250 broilers.

The teaching to be undertaken in the livestock section would involve breeding trials and effort on production efficiency and animal nutrition. Close cooperation with the MAF veterinarian service should be developed. The animal science section should provide opportunities for the students to make observations on pasture management and utilization with emphasis on labor-saving methods. Some range management demonstrations should be arranged on leased land, if available adjacent to the university campus.

Some land within the agronomic and horticultural plots as well as outside of those plots should be used for soil management and irrigation demonstrations. Demonstrations in tillage, tillage intensity, depth, and equipment are recommended. There should be demonstrations and trials in irrigation engineering to compare flood, rill, basin, furrow, drip, sprinkler, etc. The students should also have some opportunity to work with irrigation plumbing: pumps, valves, pipes, siphon tubes, open ditches, drop structures, flumes, weirs and so forth. The student should have some exposure to irrigation requirements of crops and to irrigation efficiency with an overall strong emphasis on energy and resource conservation.

For the benefit of the students, for extension activities, and for research activities by the faculty, the farm facilities should include the following buildings:

(a) Crops laboratory building and offices
(b) Shop and equipment barn
(c) Livestock barn and handling facility
(d) Poultry building
(e) Feed storage building
(f) Completely equipped weather station
(g) Two pump houses
(h) Water impoundment

It would be most appropriate if the facility could retain planning flexibility to be used for future research needs. This proposal needs strong support from the administration, faculty and from other faculties in the University. Looking toward the future, we would visualize the need for additional facilities - perhaps at Mabar, Dhamar, or Yarim and possibly a development at the Sana'a airport.

At the airport, use of chlorinated stabilized effluent may be considered. This should be an inexpensive source of water but it must be used with care.

Below is a Summary of the Budget. Cost estimates are given by category. Details on budget items can be found in the Appendix.

Proposed University Demonstration Farm Cost Estimate Summary

Water System to Farm	-	$ 457,800
On-Farm Water Distribution System	-	112,200
Irrigation Equipment	-	42,900
Irrigation Measurement Equipment	-	34,720
Office and Crop Science Building Equipment	-	217,950
Livestock Center and Feed Building, Equipment	-	192,100
Poultry Building and Equipment	-	25,400
Farm Shop	-	58,310
General Farm Machinery and Equipment	-	125,175
Perimeter Fencing	-	85,000
Establishment Cost	-	215,000
TOTAL COST IN U.S. DOLLARS		1,566,555

LIST OF TABLES

Table Number		Page
J-1:	Percentage of the 1,127,572 economically active Yemeni population (1975) engaged in various occupations	J13
J-2:	Agriculture vs total industrial output (79/80) for YAR	J14
J-3:	Education status (1975) for the Yemeni population 10 years and older	J16
J-4:	Estimated number of University trained manpower for agriculture compared to estimated need for the four-year period 1977-1980.	J17
J-5:	Distribution of pre-university students in 1979/80.	J18
J-6:	Students and faculty at the University of Sana'a during 1979/80.	J19
J-7:	Students on grants in Arab and friendly countries during 1979/80	J20
J-8:	Precipitation in 4 areas of YAR	J25
J-9:	Precipitation for Sana'a from 1963-1981	J26
J-10:	Temperature for Sana'a	J27
J-11:	Land use in the YAR	J28
J-12:	Type of agricultural land	J29
J-13:	Production of the main crops in YAR and in the Province of Sana'a for 1979/80.	J30
J-14:	Major plan commodities consumed in YAR	J31
J-15:	Suggested allocation of land to various uses as a function of the size of the water supply	J44

147

LIST OF FIGURES

Figure		Page
J-1	Map of Demonstration Farm	J41
J-2	Off Campus Well Location	J45
J-3	Farm Office and Crops Laboratory Building	J59
J-4	Farm Livestock Center	J60
J-5	Open Corral Area - Livestock Center	J62
J-6	Poultry Building	J63
J-7	Feed Center and Pump House	J64
J-8	Farm Shop and Equipment Storage	J65

TABLE OF CONTENTS

Page

Preface i
Executive Summary ii
List of Tables v
List of Figures vi
Table of Contents vii
Persons and Organizations Contacted x

1. Purpose of Study

1.1 Background 1
1.2 Purpose 10
1.3 Objectives 10
1.4 Significance 10
1.5 Study team procedure 11

2. Geography of Yemen and the Study Area

2.1 Location 12
2.2 Climate 13
2.3 Agriculture 21

3. Premises for Demonstration Farm

3.1 Assumptions 23
3.11 Uses and Objectives 23
3.12 Water Supply 23
3.2 Consulting Evidence 24
3.21 Faculty of Agriculture 24
3.211 Long-Range Plans 24
3.212 Short-Range Plans 24
3.213 Faculty Research Demonstration Farm Facility 24
3.22 Considerations from Topographic Maps and Soils Information 25
3.23 Climatic Information 25
3.24 Water Information 25
3.25 Crop Information 26
3.3 Analysis of the Agricultural Scenario 26
3.31 University Farm Location 26
3.32 Water Supply 26
3.33 Climatic Representatives 27
3.34 Topographic Information 27

Page

3.35 Soil Description 28
3.36 Crop Information 28

4. The Demonstration Farm Plan

4.1 Constraints 29
4.11 Water Flexibility 29
4.12 Land Availability 29
4.2 Analysis of Constraints 31
4.3 Basic Recommendations 32
4.31 Well Development 32
4.32 The Second Well 32
4.33 Water and Land Use Matrix 35

5. The Water Plan

5.1 The Highest Priority 36
5.11 Estimate of Water Requirements 36
5.2 Well Number One 37
5.21 Well Number One Pumping System 37
5.3 Well Number Two 37
5.31 Pipeline and Transport System 38
5.32 Irrigated Area Estimate 38

6. Plant Sector Plan

6.1 Premise of Plant Demonstration 39
6.2 Agronomy Plant Trials 39
6.3 Horticulture Plant Trials 40

7. Livestock and Livestock Protection

7.1 Introduction 41
7.2 The Livestock and Poultry Enterprises 41
7.21 Sheep and Goats 42
7.22 Cattle 42
7.23 Poultry 43
7.3 Livestock Protection 43
7.4 Land and Range Development 44
7.5 Development Recommendations for the Livestock Section of the Demonstration Farm 45
7.51 Phase 1 45
7.52 Phase 2 45
7.6 Future Needs 46

8. Buildings and Equipment

8.1 Buildings 47
8.11 Building for Office and Crops 47
8.12 Greenhouse 47
8.13 Livestock Center 47

150

page

8.14 Handling Facilities for Livestock 50
8.15 Poultry Building 50
8.16 Feed Center 50
8.17 Farm Shop and Equipment Storage 50
8.18 Pump House 55
8.2 Equipment 55

9. Irrigation and Mechnical Plan

9.1 Objectives 56
9.2 A Mixed System for Irrigation 56
9.3 The Delivery System 56
9.4 Tillage Systems 57
9.41 Tilth and Tillage 57
9.42 Minimum Tillage 57
9.43 Tillage for Water Control 57
9.44 Pre-Tillage Irrigation 57
9.5 Miscellaneous Machine Operation Practice 58
9.6 Physical and Mechanical Arrangements 58

10. Recommendations 59

11. Literature Cited 61

12. Appendices 62

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CID	Consortium for International Development
ISAI	Ibb Secondary Agricultural Institute
MAF	Ministry of Agriculture and Fisheries
MOE	Ministry of Education
MOH	Ministry of Health
NWSA	National Water and Sewage Authority
SURDP	Southern Uplands Rural Development Project
TDA	Tihama Development Authority
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WMO	World Meteorological Organization
YAR	Yemen Arab Republic

DISCLAIMER: The CID/ USAID special study team made every effort to make this list complete. We apologize for any omissions and attest that they were inadvertent.

1. PURPOSE OF STUDY

1.1 Background

Agriculture is the most important production economic sector in the Yemen Arab Republic. According to the World Bank (1979), agriculture accounts for approximately 40 percent of the gross domestic product (GDP). Agricultural practices are undergoing major changes. After centuries of subsistence farming through the efficient utilization of a meager resource base and employment of traditional cultivation techniques, farmers are now faced with new markets, labor shortages, high wages, relatively easy access to capital, and changing consumer tastes. These changes offer new opportunities for agricultural development, especially with respect to the high value crops and livestock.

Table 1-1 shows the relative importance of agriculture to the Yemeni worker. Table 1-2 shows the importance of agriculture to the gross domestic product. The role of agriculture is changing. Much of the change is due to the dynamics of other sectors, to emigration of rural labor, and to structural changes within agriculture itself. The relative share of the GDP for agriculture has fallen from an estimated 53 percent in the years 1969 and 1970 to a 1979 level of 40 percent. These changes do not reflect a stagnation or even a decline in the agricultural output. In the first half of the 1970's agricultural production increased by approximately 50 percent even though the labor force employed in agriculture declined significantly during the same period. Much of the change can be attributed to an improvement in weather conditions and in a shift from traditional subsistence farming to the production of high-valued cash crops. An increased use of modern inputs such as improved seeds, fertilizers, and pesticides caused the yields of some crops to rise. In some areas there have been substantial investments in irrigation. Increased use of female labor and mechanization partially compensated for the emigration of male labor from rural areas to other countries such as Saudi Arabia. These changes were further stimulated by a generally favorable economic climate with rising farm prices reflecting increased demand. The government is also providing increased institutional support. Agriculture is adapting quickly to the changing structure of the economy.

Commodities grown in the Yemen Arab Republic are significantly more expensive than imports and comparable commodities on the world market even though quite often the Yemeni products are lower in quality (Pratt, 1976). Substantial advances will need to be made in increasing yields coupled with decreasing production costs if local goods are to retail at realistic prices while maintaining returns for farmers. Currently, local commodities are becoming increasingly vulnerable to foreign competition on internal markets.

Even though there are substantial physical constraints, the present low level of agricultural productivity suggests potential for development even with limited and erratic rainfall. The World Bank (1979) considers significant increases in crop yields possible. Better techniques in animal husbandry and animal health care will most likley increase weight gains of animals and increase milk production.

Table J-1: Percentages of the 1,127,572 economically active Yemeni engaged in various occupations in 1975. (CPO, 1981)

Employment Area	Percent
Agriculture	73.6
Mining	0.1
Marufacturing	3.0
Electricity	0.1
Construction	4.7
Trade	6.1
Transport	2.2
Finance	0.2
Social Services	7.6
Not Stated	2.4
TOTAL	100.0

155

Table J.-2: Comparison of agricultural and total industrial output for YAR in 1979-80. (COP, 1981)

	Agriculture (million YR)	Total Industrial
Gross output at producer prices	4024	13,591
Gross domestic product at market prices	3458	8,721
Net domestic product at market prices	3416	8,442

In planning for increases in agricultural production through the introduction and development of new techniques, it must be kept in mind that the existing systems of agriculture have evolved through more than 3,000 years of experience. Suggestions for change should be carefully considered. It should be noted that there have been rapid changes in resource availability and in the relative prices for products. Many, if not most, of the existing farm systems have not sufficiently adjusted to new technological opportunities. Many of these new opportunities have not been sufficiently demonstrated to the farmers.

In order to meet the changing needs of a developing agriculture, the Yemeni people must be better educated. According to the Central Planning Office (CPO, 1981), the literacy rate in Yemen is very low (see Table 1-3). There is a serious shortage of trained professionals and technicians required to staff the new agricultural institutions and provide needed services. In information compiled by the World Bank (1979), the Ministry of Agriculture and Fisheries (MAF), in 1976, had only 72 university-trained agricultural specialists, which included veterinarians, and 219 agricultural technicians. There was a projected need for 288 professionals and 876 technicians by 1981, or four times the 1976 complement. This additional staff could not be provided each sufficient speed by present educational arrangements. Rapid increases must be made in the output of universities and other training institutes. Unless this is accomplished, the manpower in agricultural administrations and agricultural public institutions will be in short supply. Table 1-4 shows the estimated requirements for university-trained people in the agricultural sector from 1977 to 1981. It also shows the projected supply of university graduates during the same period and the projected shortfall. Table 1-5 and 1-6 show the educational structure and the number of students in Yemen from the primary level through the university level. Table 1-7 shows the number of students on grants in other countries in various specializations.

The University of Sana'a is the only institution of higher learning in the Yemen Arab Republic. It was established in 1970. It was opened with an enrollment of 61 students and a staff of 15 in three colleges: law, science, and arts (Nyrop et al., 1977). It has since added faculties of commerce and education. It has been determined that there is a critical need for the development of a Faculty of Agriculture at the University of Sana'a (Aulaqui et al., 1981). When established, the Faculty of Agriculture will provide YARG with the technological, scientific, and academic resource base for development of research programs to meet the needs of the Yemeni farmers, to increase agricultural production, to make more efficient use of Yemeni soil and water resources and a curriculum and teaching program to meet the needs of academically qualified Yemeni students interested in pursuing a career in agriculture. Initially, the Faculty of Agriculture will most likely provide program specialization in four departments: (a) animal production, (b) plant production, (c) soil, irrigation and mechanization, and (d) agricultural economics (farm management, marketing, cooperatives, extension and vocational agriculture).

159

Table J-3: Education status (1975) for the Yemeni population over 10 years of age. (CPO, 1981)

Illiterate	Read Only	Read & Write	Primary	Preparatory	Secondary	University	Not Stated	Total
			- - -	Percent	- - -			
				Male				
65.0	10.8	21.6	1.0	0.6	0.4	0.2	0.4	100
				Female				
97.3	0.7	1.3	0.1	0.1	0.03	0.02	0.02	100

158

Table J-4: Estimated number of university trained people for agriculture compared to estimated need for the four-year period 1977-1980 (World Bank, 1979).

Specilization	Estimated need	Estimated supply	Deficit
Crops	16	5	11
Livestock	15	4	11
Fisheries	27	5	22
Forestry	10	-	10
Horticulture	19	4	15
Plant Protection	23	9	14
Ag Statistics	26	-	26
Extension	27	3	24
Mechanization	8	-	8
General	24	100	+76
Irrigation Eng.	15	2	13
Veterinary	25	-	25

Table J-5: Distribution of pre-university students in 1979/80 (CPO, 1981).

Type School	Students			Classrooms	Schools
	Female	Male	Total		
Primary	41,707	293,542	335,249	9,650	2,543
Preparatory	2,795	17,969	20,764	655	197
Secondary	1,046	7,183	8,229	249	55
Technical Secondary	1	355	356	16	2
TOTAL	45,549	319,049	364,598	10,570	2,797

Table J-6: Students and faculty at the University of Sana'a during 1979/1980 (CPO, 1981).

Faculty	Students					Staff
	Year				Total	
	1	2	3	4		
Commerce & Economics	616	322	231	205	1,374	25
Law	513	155	108	136	912	17
Arts	546	164	81	47	838	60
Science	272	46	24	14	356	67
Education	284	183	142	131	740	12
Total	2,231	870	586	533	4,220	181

Table J -7: Students on grants in foreign countries in various specializations during 1979/80 (CPO, 1982)

Country	Speciality								
	Tech.	Educ.	Com.	Vet.	Agr.	Sci.	Phar.	Eng.	Med.
Egypt	-	43	29	5	18	14	2	-	-
Iraq	-	-	-	7	33	10	2	17	15
Syria	13	-	6	10	59	12	7	39	4
Libya	-	-	-	-	4	-	-	3	2
Kuwait	-	-	-	-	-	-	-	1	2
Sudan	-	1	-	-	-	-	-	-	-
Saudi Arabia	-	-	-	6	9	-	4	61	-
U. of Beirut	-	-	-	-	-	-	-	62	-
China	-	-	-	-	-	-	-	4	-
Romania	-	-	-	-	-	-	-	2	4
Pakistan	-	-	-	6	8	-	18	39	37
Total	13	44	35	34	131	36	33	228	64

It is presumed that the agricultural program will begin with 30 entering students. It is hoped that after approximately 15 years, as many as 150 students would enter the program each year. A general program is planned which would allow students to enter any area of specialization after four years.

Professional agriculturalists trained in extension techniques are probably the most critical need. The Yemeni farmers are highly industrious and skillful in their traditional ways of cultivating crops and caring for livestock. However, they are not knowledgeable or experienced in modern agricultural practices. Even when new techniques are successfully demonstrated, the farmers are not always ready to take the risks involved in the adoption of new practices. To move from subsistence agricultural systems to a market-oriented system based on cash crops, continuing extension guidance will be necessary.

1.2 Purpose

The University of Sana'a administration has determined that a Demonstration Farm should be designed to serve the Faculty of Agriculture. A design team from the Consortium for International Development (CID) was designated to plan the demonstration farm. The farm should be mainly for demonstration of existing technology. It will serve research needs of the Faculty of Agriculture.

1.3 Objectives

The Demonstration Farm could be located on the new campus of the University of Sana'a at the intersection of Ring Road and Wadi Dhar Road. Up to 25 hectares should be available for the farm. The farm should serve the needs of the disciplines planned for the Faculty of Agriculture: agronomy, horticulture, irrigation and mechanization, and animal husbandry.

In general, the demonstrations should represent as much diversity as possible. The climatic conditions of YAR are diverse; thus local conditions pose some limitations since Sana'a is on a high mountain plain. Most of the demonstrations should have widespread, immediate application. The physical and economic resources available to the farmers should be considered in designing demonstrations.

A Demonstration Farm at Sana'a campus cannot totally represent the diversified agriculture of the entire country. A network of demonstration and research farms throughout the Yemen Arab Republic is planned for the future. The planned demonstrations on the Sana'a campus should show optimum and deficit irrigation and simulated rainfed agriculture.

1.4 Significance

The students of the Faculty of Agriculture need "hands-on" exposure to the technology of modern agriculture. The farm background of most students will not be in modern agriculture. Eventually, as many as 300-400 students will need access to the demonstration each year. They will do many of the demonstrations themselves, providing much of the labor. Most of the demonstrations should have immediate practical significance so that the students can carry the knowledge to the farmer for direct application. Some of the demonstrations, however, will introduce new concepts not immediately acceptable to the producer. Some demonstrations will show problem situations. As far as possible, all crop and horticultural commodities produced in the Yemen Arab Republic should be demonstrated.

1.5 Study team procedure

The Faculty of Agriculture will have an organizational structure similar to that used in the Land-Grant System of the United States. Teaching, research, and extension components are planned. Members of a design team familiar with the U.S. Land-Grant System are the authors of this report. Interviews with University officials, Ministry of Agriculture Officials, local agriculture officials, National Sewage and Water Authority representatives, Food and Agriculture Organization United Nations representatives, World Bank representatives, and numerous consultants for agriculture, hydrology, and engineering were conducted. Well drilling companies were also interviewed. Field trips were taken to gain perspective of YAR agriculture.

2. GEOGRAPHY OF YAR AND THE STUDY AREA

2.1 Location

The Yemen Arab Republic is located in the southwestern corner of the Arabian peninsula between 12° 40' and 17° 26' north latitude and 42° 3' to 46° 31' east longitude. This country of nearly 8.5 million people is bounded on the west by the Red Sea, on the north and east by the Kingdom of Saudi Arabia and on the south by the Peoples Democratic Republic of Yemen, commonly called South Yemen. Some of the boundaries of the country toward the east with both Saudi Arabia and south Yemen have not been officially demarcated. Depending on the reference cited YAR has an area of between 135,200 square kilometers (Bernhardt, 1980) and 200,000 square kilometers (CPO, 1980). The study center for this report is located in Sana'a, the Capital of the Yemen Arab Republic.

There are at least three principal geographic regions in the YAR: The Tihama, which is a 400 kilometer long narrow coastal plain, the high mountain plains, and the eastern high desert.

The coastal lowlands of the Tihama cover an area 30 to 60 kilometers wide along the Red Sea. The elevation ranges from sea level to approximately 200 meters at the foothills. It ranges from a plain to slightly undulating foothills and is intersected by dispersed wide, shallow wadis draining from the central mountain range toward the sea. This narrow, hot, semi-arid, almost waterless strip extends along the entire sea coast from Maydi on the northern frontier with Saudi Arabia to the Bab Al Mandab at the country's southern limit and occupies approximately 10 percent of the country. Seven major wadis permit limited agricultural activity (Nyrop, et al., 1977).

The high mountain plains have been formed as a result of block faulting along a north-south axis parallel to the Red Sea and along an east-west axis parallel to the Gulf of Aden. The resultant uplift has formed a central mountain range starting around Taiz. The mountainous area can be divided into three regions, each with distinct climatic and vegetational characteristics. These are the foothills and middle elevations of the central mountain range, the central highlands, and the eastern semi-desert plateau.

The foothills and middle elevations of the central mountain region are situated between the Tihama and central highlands within the elevation range of 200 to 1500 meters. The landscape is very rugged, cut by deep wadis running through narrow gorges with very steep and long slopes.

The central highland regions comprise the higher reaches of the central mountain range exceeding 1500 meters in elevation. This area extends from Ibb in the south, into Saudi Arabia in the North. A chain of the high mountains is found between Ibb and Sana'a with several peaks exceeding 3,000 meters. Yemen's highest peak, Nabi Shu'Ayb (3,760 meters) also the highest peak on the Arabian peninsula is located in this zone. Topography to the west of the range is very rugged. The eastern slopes

of these mountains are more gentle and terminate at the high mountain plains of Sana'a, Mabar, Dhamar, and Yarim. These high plateaus are all above 2,000 meters in elevation. The central highlands, especially the area around Ibb, were in the past referred to as Felix Arabia or happy Arabia because of the moderate temperatures and the large amount of precipitation. This area has more cultivatable acreage than any other part of the peninsula. It should be remembered, however, that the description "happy" is applied relative to the general aridity of the rest of Arabia. The highlands, like most mountain areas, exhibit substantial ecological diversity (Swanson, 1979).

The eastern semi-desert plateau slopes gently toward the east and forms rolling country dropping in elevation to approximately 1,000 meters. It borders the "empty quarter", Rub El Khali of Saudi Arabia.

The geology of the YAR is quite varied. The country lies over a complex of igneous and metamorphic rock, consisting mainly of micas, schists, gneisses, quartzite, and marbles across which run massive intrusions of granitic and basaltic dikes. There are Jurassic beds and Tertiary rocks consisting of Cretaceous sandstones, volcanic tuffs, and basalts. There are also several quaternary volcanic lava flows. The more recent deposits are alluvial formations on the plains in the central part of the country and the coastal plains of the Tihama. Also of recent origin are the sand dunes of the edge of the empty quarter (Al-Thoor and Dewan 1978; Nyrop et al., 1977; CPO , 1981).

2.2 Climate

The climate in YAR is determined by the country's location and topography, with mountains rising from sea level along the Red Sea to an elevation of more than 2,700 meters within a distance of only 100 kilometers. Rainfall depends upon its position on the northern rim of the Indian Ocean monsoon system. Rainfall occurs at two maxima, one during March through April, and the second lasting from July through September. This summer rainfall is mainly influenced by moist air masses of the monsoon circulation systems which flow from the southwest against the Yemen highlands and cause heavy precipitation on the mountain slopes exposed to the west, mainly above 1500 meters. During the period October through February, the dry air masses originating with the central Asian anti-cyclone, are the main reason for the rainless season. Because the rains are borne on southwesterly winds, the amount of rainfall in the highlands decreases as one moves north.

Ibb in the south is known as the green province. It receives more than one meter of rain each year. Further north in Sana'a, however, rainfall averages only one-tenth to one-third as much as in Ibb. Tables 2-1 and 2-2 illustrate the rainfall distribution for Yemen. Most of the rainfall occurs as very heavy localized showers in the afternoon which are usually confined to limited areas. The frequency and intensity of rainfall decreases on the lee side of the western highlands, towards the central highlands and the eastern semi-desert plateau.

Climatic records for Yemen are limited. Data available indicate that rainfall is quite variable for a single location as illustrated in

Table J-8: Precipitation for four areas of YAR (World Bank, 1979).

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
						Rainfall ---------- mm ----------							
Taiz													
Mean	1.3	11.8	15.9	73.6	97.6	83.9	60.9	66.8	83.7	60.9	14.3	9.7	580.4
Max	15.2	84.6	60.9	138.6	213.4	149.8	134.7	141.7	137.1	130.0	53.9	36.5	831.4
Min	0.0	0.0	0.0	0.0	30.4	22.8	10.2	25.4	25.4	5.6	0.0	0.0	308.9
Zabid Camp													
Mean	5.0	0.7	5.4	21.9	29.1	4.4	35.7	80.7	128.4	36.9	2.4	1.6	352.2
Max	22.0	3.0	17.0	80.0	51.1	15.0	102.0	206.0	281.0	124.0	10.0	11.0	546.0
Min	0.0	0.0	0.0	0.0	0.0	2.0	12.0	68.0	0.0	0.0	0.0	0.0	226.0
Yarim													
Mean	2.0	16.3	51.3	66.0	65.0	45.2	65.5	132.9	35.1	4.9	9.7	3.8	497.6
Max	9.1	37.2	104.6	202.1	178.3	109.5	114.5	242.36	65.2	23.4	48.6	14.5	667.9
Min	0.0	0.0	2.4	10.7	2.4	4.3	4.3	69.7	5.3	0.0	0.0	0.0	356.8
Ibb													
Mean	10.1	17.1	46.3	124.7	219.2	246.2	246.7	250.0	193.5	68.9	35.8	9.9	1,468.4
Max	43.4	42.9	76.6	291.0	402.0	367.0	414.3	426.3	335.9	174.8	120.5	33.6	2,228.6
Min	0.0	0.0	0.0	44.6	77.5	185.5	174.2	199.2	109.8	15.5	0.0	0.0	1,050.1

Table J-9: Precipitation for Sana'a from 1963-1981. (World Bank, 1979).

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
						Rainfall							
						mm							
1963	14.3	3.8	10.6	13.0	128.0	80.8	20.9	81.5	0.0	0.0	47.2	14.5	414.6
1964	2.2	4.0	1.7	38.3	12.5	8.0	39.9	8.2	5.0	0.0	1.6	10.9	132.4
1965	0.0	0.0	25.9	56.4	0.0	0.6	28.5	88.9	0.0	0.0	11.7	0.0	212.0
1966	3.9	11.3	9.5	35.3	7.2	0.0	24.3	65.6	4.3	0.2	1.1	0.0	162.7
1967	-	-	-	-	-	-	-	-	-	-	-	-	nd
1968	0.0	0.0	8.4	84.1	11.1	14.9	0.0	0.0	1.0	0.0	3.0	0.0	122.5
1969	9.0	16.4	1.1	25.2	13.5	0.0	19.4	28.5	0.0	1.5	0.0	0.0	114.6
1970	4.1	0.0	1.0	1.7	1.0	1.0	0.0	136.7	12.5	0.0	0.0	0.0	158.0
1971	23.9	0.0	23.8	21.5	4.9	0.0	17.3	9.0	0.0	0.0	10.2	0.7	111.3
1972	0.0	3.0	10.3	83.1	6.0	0.5	0.0	6.9	0.5	0.0	6.0	0.5	116.5
1973	0.0	0.0	0.5	5.6	10.0	3.0	36.0	101.0	5.0	0.0	0.0	2.0	163.1
1974	0.0	0.0	34.8	44.2	89.1	0.0	1.5	45.8	0.0	0.0	0.0	0.0	215.4
1975	1.0	2.0	35.8	109.4	0.2	1.9	84.5	102.0	13.8	0.0	0.0	0.0	350.6
1976	0.0	1.1	27.7	32.0	36.6	0.0	18.5	3.7	0.0	0.0	31.5	3.0	154.1
1977	-	-	-	-	-	-	-	-	-	-	-	-	nd
1978	1.0	7.5	15.2	29.9	10.4	10.0	16.6	0.0	0.5	0.0	5.4	0.0	96.5
1979	18.5	1.0	21.5	0.2	20.3	4.0	9.5	20.9	0.0	0.0	0.0	0.0	95.9
1980	0.0	14.1	36.3	42.4	0.0	0.0	0.0	0.0	0.0	5.8	0.0	0.0	98.6
1981	0.0	0.0	112.9	18.9	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	139.7
Min	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Max	23.0	16.4	112.9	109.4	128.0	80.8	84.5	136.7	13.8	5.8	47.2	14.5	-
Mean	4.6	3.8	22.2	37.7	21.1	7.3	18.6	41.1	2.5	0.4	6.9	1.9	168.1
On-1	7.4	5.3	26.6	30.6	34.8	19.4	21.4	45.4	4.44	1.4	13.0	4.2	89.0

Source: World Bank (1979); Sana'a Airport; Central Planning Office.

Table J-10: Temperature for Sana'a

Jan	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
--Degrees Centigrade--												
Mean Temperature 1971-1976												
12.7	14.5	16.3	17.4	18.6	20.0	20.5	19.8	17.7	14.2	14.2	13.0	16.5
Minimum Temperature 1979-1980												
0.0	0.0	4.0	7.0	7.0	11.0	10.5	12.0	9.8	4.0	-1.0	0.0	-
Maximum Temperature 1979-1980												
27.0	28.6	30.0	31.0	29.8	31.2	32.0	30.2	31.4	29.0	28.0	36.0	-
Soil Temperature at 100 cm Depth 1976												
19.9	20.5	21.4	21.5	21.5	23.4	23.9	23.7	24.1	22.8	21.8	20.5	22.0

Source: CPO; Zschintzch (1978).

Table J-11: Land Use in the Yemen Arab Republic (CPO, 1981)

---- Land Use ----				
Cultivated land	Marginal area	Forest & shrub	Other	Total
---Hectares---				
1,515,000	2,000,000	1,600,000	14,885,000	20,000,00(

170

Table J-12: Type of agricultural land (CPC, 1981).

---- Type Water Application ----				
Rainfed	Flood	Perennial	Well	Total Ag Land
		---Hectares---		
		Sana'a		
3,728,000	-	20,000	7,200	400,000
		Yemen		
1,265,800	120,000	73,000	56,200	1,515,000

171

Table J-13: Production of the main crops in YAR and in the Province of Sana'a for 1979/80 (CPO, 1981)

Crop	Yemen			Sana'a		
	Prod. 1000T	Yield T/H	Area 1000H	Prod. 1000T	Yield T/H	Area 1000H
Sorghum & millet	692.1	0.9	790.6	109.9	0.7	191.0
Legumes	79.6	1.1	71.5	14.8	0.8	19.0
Maize	99.4	1.6	63.7	2.9	1.4	2.0
Barley	57.2	1.0	58.1	27.5	0.9	30.0
Wheat	52.6	1.0	51.5	17.1	0.8	20.9
Vegetables	253.7	9.6	26.4	49.5	8.2	6.1
Fruits	75.1	5.3	14.2	6.8	4.8	1.4
Grapes	55.0	4.8	11.5	43.5	4.8	9.0
Potatoes	127.2	12.0	10.6	4.7	7.9	0.6
Sesame	6.0	0.6	10.1	0.1	0.5	0.2
Tobacco	7.0	1.1	6.1	-	-	-
Cotton	2.8	0.9	3.0	-	-	-

172

Table J-14: Major plant commodities consumed in YAR (CPO, 1981, Pratt, 1976)

*Alfalfa
Almonds
*Apricots
Banana
*Barley
*Beans (white, red, broad)
*Cabbage
*Carrots
Chickpeas
Chilies
Citrus
Coffee
Coriander
Courrat
Dates
*Eggplant

*Fenugreek
*Grapes (raziky, assimi, white, black)
*Green Beans
Ground fenugreek
Jaw's mallow
Kahtah
*Lentils

*Lettuce
*Linseed
*Maize
Mint
*Mustard
*Okra
Olives
*Onions (red, white, green)
Parsley
*Peas
Peanuts
*Pomegranates
*Potatoes
*Quince
*Radish
*Sorghum (red, white, yellow, shami)
*Spinach
*Squash

*Sweet Melon
*Tomato
*Watermelon
*Wheat

*Commodities grown on highland plateau.

Table 2-2 for Sana'a. Varying data have been reported for any given year depending on the location of the rain gauge within a small geographic area (Berhardt, et al., 1980; Nyrop, et al 1977: Swanson, 1979; CPO, 1981). The rainfall data for Sana'a indicate that it would be very risky to attempt rainfed agriculture or surface water harvesting for a demonstration farm in that area.

Table 2-3 indicates the temperature for Sana'a. Although temperatures rarely get much below freezing, local frosts do occur during the winter months. Low winter humidity and low pressure in the highlands causes rapid evaporation which in turn results in surface frost even when atmospheric temperatures are above freezing (Swanson, 1979). The incidence of frost, therefore, varies considerably with altitude and exposure. In any given village, some fields may freeze while adjacent ones do not. These microecological differences play an important role in determining cropping strategy.

2.3 Agriculture of Yemen

The following is summarized from Bernhardt et al. (1980), World Bank (1979), U. of A. (1981), Swanson (1979), Pratt (1976), and the CPO (1981). Yemen is not richly endowed in agricultural resources. Labor intensive and sophisticated agricultural techniques have been practiced for centuries on the slopes of steep and rugged mountains. The Yemeni farmers have spared no effort to gain maximum profit from the scanty rainfall, even on difficult terrain. Out of the total land area of approximately 20 million hectares, only 1.5 million hectares or seven percent of the total area are regularly cultivated (see Table 2-4). An additional two million hectares of marginal agricultural land is cultivated only during high rain fall years. Woody vegetation or scrub growth covers approximately 1.6 million hectares. The rocky mountainous semi-arid to arid rangelands with very sparse vegetation cover about 15 million hectares.

The rainfed agricultural land comprises about 1.2 million hectares (see Table 2-5). The spate irrigated and spring-irrigated areas are estimated to cover 120,000 hectares and 73,000 hectares respectively. The area of pump-irrigated land has been increasing in recent years and occupies 50,000 to 60,000 hectares. The actual amount of cultivated land varies from year to year depending on rainfall.

Much of the agricultural land is on highland landforms of basically two types: (1) rugged mountain areas with relatively steep slopes and meadow valleys which are typically bisected by wadis and (2) broad highland plains. In the mountain valleys there is the invariably extensive terracing with step-like agricultural fields climbing from the valley floors up the slopes. Such terraces maximize the absorption of precipitation while minimizing soil erosion. Irrigation is likely in the valleys from water diverted to the lower terraces by damming the wadi upstream. On the highland plateaus, terracing is practiced to a far lesser degree or sometimes not at all.

A variety of agricultural crops is grown in the YAR. Table 2-6 lists the major crops and the production values. Table 2-7 lists the main commodities consumed in YAR and the main commodities produced on the highland plateau. Wheat, barley, maize, and sorghum are the main crops. Potatoes, vegetables, and fruits are also grown. The grains occupy about 90 percent of the total cultivated land in the country.

Of the grains, sorghum is by far the crop of preference. Maize produces approximately 50 percent more grain than does sorghum but the unreliable rainfall in most of the country makes maize a risky crop. The advantages of sorghum are that it is highly resistant to drought while at the same time producing grain for human consumption and fodder for animals. Its major disadvantages are that it requires six months to mature and grain yields are low. Of the other grain crops grown, only wheat produces less grain than sorghum. Barley has a far shorter growing season than sorghum, slighly over two months, and produces significantly more grain. As in the case of wheat, however, barley does not provide animal fodder. This is a major consideration in an economy where animals play an important role. Maize produces both fodder and slightly more grain than sorghum provided it receives ample water. Barley is usually limited to the higher terraces with poorer soils. The terraces are planted with sorghum after the first significant rain of the monsoon season.. If, however, as sometimes happens, these rains do not materialize, barley is planted during the next summer maxima of rainfall.

Pulses are important crops but do not account for a large percentage of the agriculture. The most important are lentils, fenugreek (hilba), peas, and beans.

Commercial market-oriented agricultural production is limited to a few enterprises such as cotton, hides, skins, coffee, qat, vegetables, fruit and livestock. Although subsistence agriculture predominates in the highlands, a limited number of these cash crops are grown. In the highlands, the cash crops are generally leeks, radishes, alfalfa, and qat. Aside from chilies and green tomatoes, these are the only vegetables consumed in rural areas.

In order of importance, the common domestic animals are cattle, sheep, goats, chickens, donkeys, camels, cats and dogs. Cattle are a source of milk, draft animals, and meat. Most bull calves are butchered shortly after birth to conserve milk and fodder although a few are castrated and allowed to mature into oxen which are the principal agricultural draft animals in the highlands. Camels are often used as draft animals in the Tihama. Cows, on the other hand, are more highly prized for their milk which is almost never drunk fresh but is transformed into clarified butter and buttermilk.

Sheep and goats are reared for their wool and hair, meat and milk. In general, they play a less central role in that agricultural regime than do cows. It appears that the decreased sheep and goat production are a result of migration-induced labor shortage.

3. PREMISES FOR DEMONSTRATION FARM

3.1 Assumptions

3.11 Uses and Objectives

In order to develop a working premise of the University of Sana'a Demonstration Farm, the CID study team found it essential to make certain assumptions about the University of Sana'a Faculty of Agriculture. It was visualized that the University of Sana'a will be the intellectual center for the training of future leaders of the agricultural industry in Yemen. These leaders will be responsible for the decisions affecting the growth of agriculture and changes in the agricultural industry, changes in the products of the nation, and the entire fabric of the agro-industrial complex underlying the food system of Yemen. Thus these individuals should be trained in the basic sciences and principles not only to understand current research, but to analyze new ideas, new perspectives, and inventions for their significance and usefulness in the agricultural complex of YAR. The Demonstration Farm needs a level of sophistication and complexity which allows it to look to the future.

It was assumed that the University of Sana'a will be the educational and cultural center of the nation for many decades to come. We thus felt that the agricultural faculty of this university would engage in both basic and applied research. The Demonstration Farm should provide opportunities for research, teaching, extension, and demonstration in agronomy, horticulture, animal science, agricultural economics, and the associated sciences of plant protection, soil science and agricultural engineering.

It was considered important that all of the students have hands-on experience at an appropriate technology level. As we toured YAR and spoke with agricultural leaders, we were reminded constantly that a shortage of agricultural labor currently exists and that, as educational opportunities in arts, sciences, and industries in the nation develop, this shortage of agricultural labor would likely persist for some decades in the future. Thus we felt that there was an appropriate level of technology which should be introduced into Yemen agriculture with the university agricultural faculty asisting and promoting the process of appropriate mechanization of the industry.

3.12 Water Supply

Observations on land use in the vicinity of Sana'a as well as consultation with municipal, national, and agricultural leaders indicated that a reliable supply of water may be one of the limiting factors for the development of the Demonstration Farm. Our impressions are that the ground water supply in the vicinity of the new university campus is limited, so the drilling of new wells is not promising. Harvesting of surface water is not considered sufficiently reliable for the purposes of the Demonstration Farm. We were forced to consider the advantages and disadvantages of locations for the University Farm near or somewhat removed from Sana'a. The possibilities of piping water to the University Farm were also considered. These considerations and deliberations are discussed under the appropriate headings in the report.

3.2 Consultary Evidence

Our conferences with the faculty representatives from the University of Sana'a provided a framework for the structuring of the institution.

3.21 Faculty of Agriculture

3.211 Long Range Plans

Discussions with the President of the University of Sana'a and several staff members indicated to us some long range plans. It is likely that the ultimate size of the College of Agriculture, the student body working under the direction of the Faculty of Agriculture, would comprise 800 to 1,000 students. In addition to this teaching load, the Faculty of Agriculture, in order to keep themselves abreast of the latest developments in their particular sciences, should participate in both basic and applied research activities. They will also engaged in consultation with the Ministry of Agriculture as well as other branches of federal and provincial governments. The faculty should, on occasion, consult with various private institutions of the emerging agricultural industry. They should participate in extension, address audiences of farmers and agro-business leaders, and work with extension workers from their own institutions and from the Ministry of Agriculture.

With this work load, it is reasonable to expect that the ultimate Faculty of Agriculture would consist of 80 to 100 professional scientists.

3.212 Short Range Plans

During the early formative years of the faculty, the student body would range from perhaps 50 to 200 students. The initial faculty would probably have one individual specialist in one of the plant sciences, either an agronomist or a horticulturalist; one professional responsible for the area of animal science and maintenance care in animal health; one individual with a mechanical orientation responsible for student instruction in soils, irrigation and agricultural engineering; and a fourth faculty member, a professor in agricultural economics and extension.

This faculty would be capable of handling 100 to 150 students and operating, with appropriate staff, a small demonstration farm appropriate to the needs of a student body that size.

With the passage of time and growth of enrollment in the College of Agriculture, the Faculty of Agriculture would grow. Additions to the faculty would be needed and a second professor in plant science should be added. Very early, faculty members should be added in the area of plant protection and in entomology or plant pathology. Also, one of the early additions should be a professor of agricultural extension.

3.213 Faculty Research Demonstration Farm Facility

It is essential that the Faculty of Agriculture stay abreast of agricultural science and technology for optimizing production in the nation's food system. The Demonstration Farm must provide opportunity for faculty research in plant breeding, animal breeding, plant protection, crop fertilization, animal nutrition, irrigation, mechanization, and other aspects of appropriate technology.

The long range plans for the University of Sana'a call for the development of a School of Veterinary Medicine. The School of Veterinary Medicine should have close rapport with the Faculty of Agriculture.

3.22 Considerations from Topographic Maps and Soils Information

The study team consulted with authorities and solicited their assistance in finding information about soils and relief of the land available for the University Farm. This information was needed to make judgments about the appropriate location, shape, size, and positioning of individual portions of the operation. It was noted that the soils information, information on the location and characteristics of the terraces, the location and size of the various land units that could be cultivated, irrigated and operated was available. Adequate information was found to develop our recommendations.

3.23 Climatic Information

Climatic information was gathered to make decisions with an appropriate margin of safety, taking into account the observed level of variability. We noted, as is typical for regions of low rainfall, especially those which lie close to the equator, that there were large spatial and temporal variations in air temperature, length of growing season, precipitation, pan evaporation, relative humidity, soil temperature and other kinds of climatic data (see Chapter 2). As will be indicated in the following sections, adjusted means were used in making recommendations with respect to irrigation requirements. We considered it important for the Demonstration Farm to be in a position to operate every year irrespective of the weather conditions. Each year a new group of students will have to be instructed. It was judged to be appropriate to be conservative rather than to risk the prospects that some students would be denied a crucial opportunity to learn due to lack of water.

3.24 Water Information

Consultation with the National Water and Sewage Authority, representatives of the Yemen Oil and Mineral Resources Corporation, representatives of American and British water development consultants, representatives of the Ministry of Agriculture, and representatives of the Province of Sana'a Department of Agriculture indicated concerns about ground water status in the Sana'a basin, especially on and around the site of the new campus. When information regarding the ground water recharge rate is combined with the projected population growth in the basin, questions arise with respect to the appropriate allocation of the ground water resources. Demographic projections indicate that by 1995, the population of YAR will probably be on the order of 8,000,000 with some 20 percent of the population living in the Sana'a basin. The projected population for the basin is 1,600,000 compared to an estimated population of 900,000 in 1980 (World Bank, 1979). Considering this prospect of population growth, it is important that the development of the Demonstration Farm be done very carefully with respect to the future water supply. It is our judgment that while other agricultural use of water in the basin might be denied in the future, the utilization of water by the Demonstration Farm should have a very high priority. The reasoning for this will be further emphasized in a later section of this report.

118

3.25 Crops Information

Consultation with agricultural authorities for the YARG as well as with consultants and agricultural officials of the Province of Sana'a indicated that dietary trends, assuming an increasing affluence of the Yemeni, will find increased emphasis on fruit and vegetables, meat, milk products, and eggs and decreasing emphasis on cereals in the food system. This dietary trend will become economically feasible with increasing affluence and is nutritionally a reasonable development. This change will require shifts in agricultural land use. Associated with this will be an emphasis on increased productivity, a shift toward horticultural crops and pulses, and the need for more livestock feed. Coupled with this must be greater utilization of fertilizers, particularly nitrogen and phosphorous, and an increased in efficiency of water utilization. This may be available through modification of water management techniques.

3.3 Analysis of the Agricultural Scenario

A cadre of professional agriculturalists is one of the most pressing needs of YAR. The professional leaders who will comprise the Ministry of Agriculture as it grows and the current leadership retires and the analysts and decision-makers who will influence the growth of the Yemeni food system to the point of diminishing dependence on foreign sources must be trained by experts. This faculty should be located where it is best able to use its talents, where it has access to some of the best thinking in the nations, and the collegial atmosphere of a full-fledged university. The development and appropriate and efficient use of such a faculty is a very significant concern to the YAR.

3.31 University Farm Location

Many factors become significant in the evaluation of where the agricultural faculty and the associated Demonstration Farm should be located. It is not our intent to dwell on this subject but observations by some of the leaders of the YAR will be stated. The collegial atmosphere and the association with the influential and articulate members of the existing University of Sana's faculty is important during growth and strengthening of the posture of the developing Faculty of Agriculture. Furthermore, the agriculture in the vicinity of Sana'a is itself not insignificant. There is a very significant agriculture on soils and with climate not too different from that available at the University of Sana'a.

Because of the combination of the arguments cited above, the Demonstration Farm study team made a serious effort to design the most practical and best possible Demonstration Farm facility on the new campus of the University of Sana'a. It would be most appropriate to develop a major facility there. Other secondary facilities might be added later at other locations as needed.

3.32 Water Supply

One of the most limiting factors in planning a Demonstration Farm at the Sana'a campus is the problem of finding an appropriate water supply to irrigate an adequate area for demonstration of the multitude of crops and to provide students, perhaps as many as 800, with the opportunity to maintain and operate a parcel of land to obtain experience in irrigation, fertilization, crop selection, plant protection, and animal care, feeding, and health.

The study team considered a number of alternatives with respect to the development of water supply. This will be more fully elaborated on in Chapter 5.

The concept of water harvesting was seriously considered and reviewed with respect to local rainfall probabilities. Runoff was considered not sufficiently dependable to be source of water for the Demonstration Farm. The possibility of drilling a new well on the new campus of the University was also considered. People familiar with the local water supply discouraged us from counting on any large supply of water from an on-campus well.

After consultation with a large number of firms and individuals in and outside YARG, we concluded that an on-campus well was not likely to produce more than one or two liters per second. This is far less than the amount of water needed for the irrigation of the University Demonstration Farm.

A third alternative was moving the University Farm to another location. This was rejected because of problems of logistics. In addition, the cost of land was a consideration in appraising alternate sites.

A fourth possibility examined as a water supply the development of a well about ten kilometers from the campus and transport of water through a pipeline. This has a certain appeal although the cost of this project is high. It was identified and considered by the study team to be an option worthy of detailed consideration.

Finally, there is the possibility of a combination of an on-campus well providing a small amount of the water with supplement water from a nearby well. This would provide the opportunity to enlarge the farm to its optimum size as the faculty and student body grow in number. This last consideration appears to be the most promising of various sources of water considered. It has the added attraction of offering a reserve supply of water in case of the failure of one well or pump. Both sources of water should be proven before development of the Demonstration Farm begins.

3.33 Climatic Representativeness

The climate at Sana'a is highly variable and representative of only some areas of YAR. These factors have to be taken into account as one plans a University Demonstration Farm. Adequate information about air and soil temperature, rainfall, relative humidity, and pan evaporation was available to make reasonable estimates of means and variances to provide a margin of safety appropriate for an institution like the University Demonstration Farm. The team was conservative in the selection of options of utilization of the farm as will become clear in chapters following.

3.34 Topographic Information

Examination of the site of the University Farm indicates that the present terraces should remain in place. The consequence of leveling them could be insufficient soil depth in some portions of the area. Pipelines or open channels are needed to conduct irrigation water to the various terraces from a single outlet. The topography in the vicinity of the Demonstration Farm and within the boundaries of the University

property lends itself to the development of an impoundment for storage of water to provide a buffer between the well capacity, pump capacity, and the intended use of the irrigated area. The demonstration of the use of a buffer in the water system could be a relatively important part of the students education, particularly in soil and water management and agricultural engineering.

The shapes and sizes of the existing terrace units will have some effect on the size and location of individual plots and the development of modules for an arrangement of these plots. This is a design consideration, the details of which can be worked out later.

3.35 Soil Descriptions

Significant attributes of soils are the texture and the depth. The combination of soil texture and depth are governing factors in the development of the water storage capacity which in turn is an important variable in the design of the appropriate irrigation program. Thus, this information should be used in the design of the irrigation system and in the design of water control practices. The soil was found to be at least 75 cm deep at all locations tested on the chosen site.

3.36 Crop Information

In the proposal which the study team has developed, an effort was made to assure that no significant crop was left out. In the general organization of the farm there will be an agronomic section comprised of a production and a research section. In the horticultural section it is believed desirable to have subsections for vegetable crops, fruit orchards, and ornamental crops. A livestock section would also incorporate some development of forages and possible rotation of fodder cereals. In the planning of land allocations for the different programs, the study team made both short-term and long-term projections and made suggestions with respect to the potentially usuable crop rotations and soil management practices.

4. THE DEMONSTRATION FARM PLAN

4.1 Constraints

Before going into the details of the proposed farm plan, some of the conditions which limit the size and flexibility of the proposed agricultural operation must be considered. It is important that the readers develop an appreciation for the perspective which evolved during the deliberations about the possible Demonstration Farm.

The Demonstration Farm design team assumed that the growth of the farm will be synchronized with the growth of the Faculty of Agriculture and of the student body. It would be an excessive load on a faculty of four or five members to operate a farm of 21 hectares. Thus, the development of plots can be postponed until a larger faculty and student body is present. However, the land and water should be available immediately. The land could be irrigated in larger blocks to establish a partitioning in an appropriate fashion and to appraise the best use of the available water. The land use patterns should remain flexible.

4.11 Water Flexibility

As has been already mentioned, one of the considerations in the evolution of the farm plan was the concept of minimizing risk. Risk reduction was deemed necessary to assure fair and impartial treatment for each of the successive groups of students who will use the facility. It would be unfair to burden random groups of students with the impact of a drought, for instance. Therefore, adequate water supply must be assured for teaching and demonstration purposes year after year. It is also important that the water utilization efficiency be maximized, that is, that the maximum amount of land is appropriately irrigated with a minimum amount of water. It is important that the students develop an appreciattion for maximizing efficiency of the utilization of the precious water resource. The farm should also have land for rainfed agriculture to be randomly irrigated as runoff or rainstorms create an adequate supply of water. These dry land areas could be used for management of grazing areas. They could be used for areas in which to study the action of tillage implements and other trials related to soil and water management. If excess water becomes available, these areas could occasionally be irrigated and operated with induced vegetation and limited utilization of the organic residues in efforts to develop varying levels of soil organic matter content to demonstrate the effect of this variable on soil tilth and management practices.

4.12 Land Availability

The detailed map of the new University of Sana'a campus indicates that the total area of the proposed campus is approximately 170 hectares (Figure 4-1). Our projection for the ideal farm area requires a maximum of 21 hectares. This farm area provides adequate space for a wide variety of agronomic crops, horticultural crops including fruit, vegetables, and landscaping and ornamental materials. Trees for firewood or construction materials could also be grown. Such an area would require a relatively

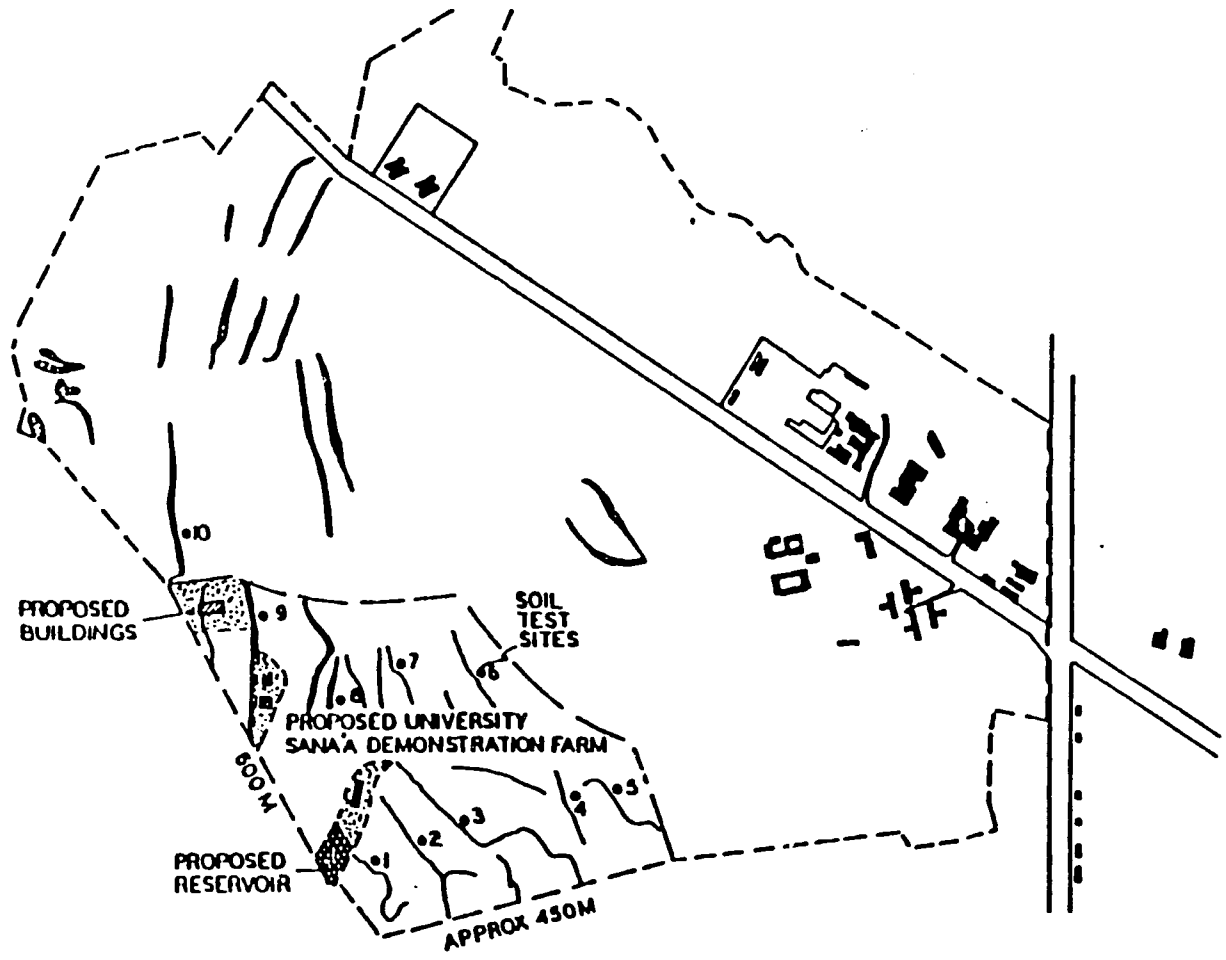


Figure J-1: Map of Demonstration Farm

large well, one which should produce at a rate of at least 14 liters per second (14 l/s). A combination of two wells which would produce about 14 liters per second would be acceptable. Twenty-one hectares would provide opportunities for research plots in plant and animal breeding, plant and animal protection, and plant and animal cultures as well as in irrigation and fertilization practices in addition to student plots and demonstration plots.

Another constraint on available land area might be soil depth or stoniness. The study team did not have sufficient time to make a detailed examination of the proposed site in the southwest corner of the campus (Figure 4-1). Cursory examination indicated that all terraces had soils at least 75 cm deep. Some portion of the area may prove too stony or too shallow for successful utilization. Manifestations of this constraint or further details of this constraint are in Chapter 6.

The proposed Demonstration Farm area has a series of existing terraces. The study team deemed it appropriate that these existing terraces remain in place. Plots should be arranged to fit the parcels delineated by the existing terraces. This approach is consistent with the characteristics of agricultural land use in the central highlands.

The Sana'a climate precludes the utilization of certain crops on the Demonstration Farm. For others, the climate is marginal. The design team suggests that the number of species and varieties demonstrated on the farm be maximized to the limits of the climatic constraints.

There will be other constraints on the farm plan. The area must be organized in relatively small plots to allow for the very large number of plots necessary for the many kinds of crops, the various conditions for their growth and development, and numerous agricultural practices associated with their culture. This means that special arrangements must be made for water control. It is important to make every effort to maximize the flexibility of the system and to allow relatively small plots to be irrigated individually while other plots in the vicinity are kept waterless. Simultaneously, it is important that access be provided for individual plots. Some significant fraction of the total available area will have to be allocated to roads and paths.

4.2 Analysis of Constraints

The constraints of water availability, soil quality (depth, texture), topography; climatic, parcel size must be accounted for in the farm plan. The most limiting constraint is that of water availability. If the farm is located on the new campus of the University of Sana'a, as recommended by the study team, an understanding will have to be developed between the University and the National Water and Sewage Authority (NWSA) with respect to the water rights and the priorities of the University. As the asin population increases, this constraint, if not pre-negotiated in a satisfactory and binding fashion, will become more limiting and more serious. This is one of the reasons it is important that the Demonstration Farm be developed in conjunction with the new campus so that it can have articulate spokesmen among its defenders. The battle for water will be difficult but must be concluded with vigor on behalf of the future agricultural leaders of YAR.

154

The agricultural Demonstration Farm requires approximately one-seventh of the total campus. This appears to be reasonable in a country where agriculture is the number one industry. The development of effective and intelligent stewards of the nation's land resources and continuing food supply must be assured.

Living with the constraints due to soil depth and/or rockiness and the constraints associated with the existing terraces is a matter of appropriate and judicious placement of individual plots and/or related clusters of plots. The placement should be left to the implementation of the farm and should not be fixed at the present time. The study team cautions the developers to exercise great care in the selection of terraces for certain plots so as to minimize the constraints due to unsuitable soils on the existing terraces.

4.3 Basic Recommendations

The design of the Demonstration Farm depends totally on the development of a water supply. Therefore the study team recommends that the detailed design of the Demonstration Farm be postponed until after an adequate, dependable, secure water supply has been developed.

4.31 Well Development

The first step in the development of the University Farm must be the drilling, testing, and pumping of a well on the university property. The university should proceed immediately with the drilling of a well at a location on the university property identified by a competent practicing hydrologist. The site should preferably be near the southwest corner of the property.

The university should develop a second well north of the campus. The land area to be irrigated by each well can be judged on the basis of the production of the well by using the relationship that a well production of one liter per second is, in the climate of Sana'a, adequate to irrigate an area of 1.5 hectares. After both wells are in production, the determination of farm size and land allocation can be made.

The size of the land area to be developed depends on the combined production of the two wells. The allocation of the land area to agronomic, horticultural, and livestock production should be done after the well production and thus the total farm area is known. Examples of allocations are in Table 4-1.

4.32 The Second Well

The second well should be several kilometers north of the campus in the vicinity of the NWSA well fields. (Figure 4-2). There is a good probability that a well developed in this location would yield from ten to fifteen liters per second. This water should be piped to the southwest corner of the University Farm site. Chapter 5 provides recommendations for the development of a pipeline and transport system to water from this second well to the farm.

<— After the development and testing of a second well, it will be possible to proceed with the development of corresponding land areas which can efficiently utilize the production of both wells. Examples of allocations are in Table 4-1. It was concluded that approximately 21 hectares of farm area can be irrigated with water from the two wells at a production of 14 l/s. Of these only about 13 hectares are actual plot area. If the

Table J-15: Allocation of Demonstration Farm land (as hectares, underlined numbers) to various uses. Total area of the farm will depend on water supply. Differing allocations of land are recommended depending on the amount of water available. Water supply values are in liters per second, (l/s).

WATER SUPPLY (L/s)	FARM* AREA	AGRONOMY REG. (3)	AGRONOMY SPEC. (4)	HORTICULTURE FRUIT (5)	HORTICULTURE VEG. (6)	HORTICULTURE F&L (7)	LIVESTOCK	SH & I (2)
14	21	2.4	0.6	1.8	3.0	0.5	12.0; 50 sheep, 30 goats, 16 cows, 250 layers, 250 broilers	0.7
7	10.4	2.2 (8) Yes	Yes	1.0	1.3	0.3	5.2; No's ½ of above chickens same	0.4
3.5	5.2	2.0 Yes	Yes	Yes	2.2 Yes	Yes	1.0 Same proportion, reduce numbers	No
1.7	2.6	0.8	No	1.5	Yes	No	0.3 Reduced numbers	No
0.9	1.3	0.3	No	0.7 Yes	Yes	No	0.3 Reduced numbers	No

(1) Forestry and Landscaping
(2) Soil Management and Irrigation
(3) 14 crops, 18 plots/crop, 5x10m plots; cereals, pulses, forges, etc.
(4) 6 crops, 12 plots/crop, 5x10m plots; genetics, oilseed, fiber, etc.
(5) 10 crops, 12 plots/crop, 5x20m plots; grapes, almonds, etc.
(6) 30 crops, 12 plots/crop, 5x10m plots; salad, root, cole, fruit
(7) 10 crops, 6 plots/crop, 5x10m plots; shade, wood, shrubs, flowers, turf
(8) Written in this fashion means the number between arrows is split between adjacent columns. For example 2.2 means some kind of partitioning of this area (2.2 hectares) between regular agronomic crops and specialty crops.
Total area including plots, roads, paths, fences, ditches, etc. Some of the non-plot area could provide

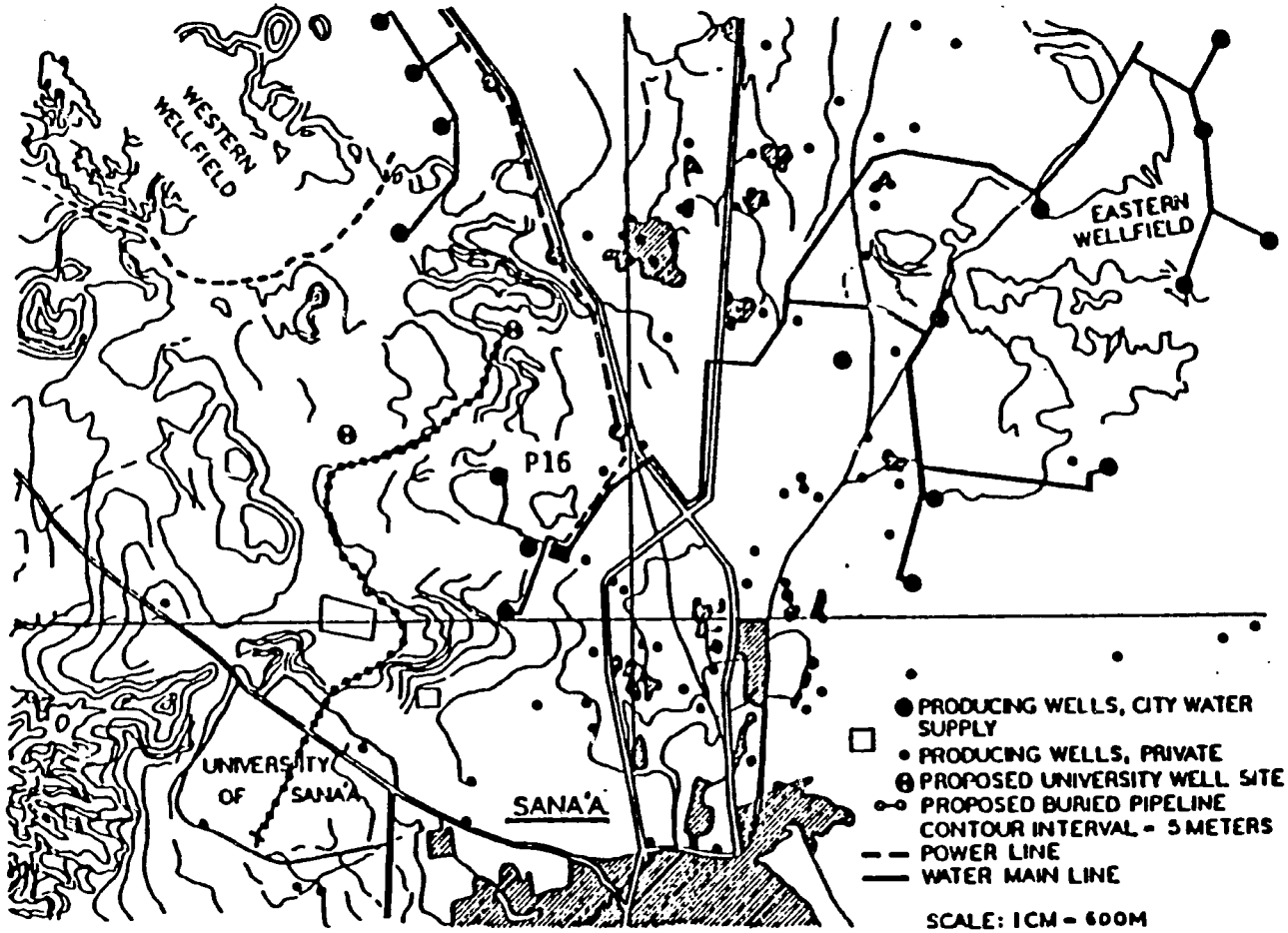


Figure J-2: Off Campus Well Location

187

combined well production is 7 l/s, the irrigated area could be approximately 10.4 hectares. This smaller area would be partitioned differently than the larger total farm area. Approximately half of the total area, about 5.2 hectares, would be allocated to various aspects of livestock production demonstrations. The other half would be devoted to the culture of agronomic and horticultural crops. A small irrigated area could be allocated to a soil and engineering practice area to provide students with the opportunities to study soil tilth and tillage and to examine various water management techniques; border check, basin, rill, furrow, flood, sprinkle, drip, trickle, etc. Additionally, this area might be used to demonstrate the effects of poor water quality on soil characteristics.

4.33 Water and Land Use Matrix

The relationship of land use to water supply is shown in Table 4-1. Farm sizes ranging from 21 hectarers down to 1.3 hectares are considered in a series of steps. The major emphasis is on horticultural crops when the water supplies are small.

The study team considers the 11 hectare farm to be the minimum size acceptable for an agricultural faculty enrollment of 800 to 1,000 students. The optimum size is the 20 to 22 hectare farm. It needs a water supply at the rate of 12 to 15 liters per second.

It is important to understand that these are suggestions. The Faculty of Agriculture should retain the maximum flexibility so that land use can be planned which is consistent with the needs of the students enrolled in their classes.

5. THE WATER PLAN

5.1 The Highest Priority

All of the significant attributes of the Demonstration Farm depend upon the successful development of an appropriate supply of water. The water supply must be large enough to provide water to an area consistent with the needs of the faculty. The water supply must be assured for the long term. The faculty and administration must be prepared to defend the importance of the Demonstration Farm and must make sure that water is allocated to the University Farm on a priority basis.

Timing and sequencing of the various phases of the development of the University Farm is important. Both wells must be drilled, proven, and tested before money is spent for buildings, equipment, fences, and walls for the University Demonstration Farm. The size of this operation, the proportioning of the total land to the various kinds of uses, the equipment needs, animal population, building sizes and other attributes of the Demonstration Farm depend on the water supply which can be proproduced. The University Demonstration Farm on the Sana'a campus should be augmented with land and facilities for teaching and research at other locations such as Mabar, Dhamar or Yarim.

The campus farm should be 20 to 22 hectares in size provided a sufficient quantity of water can be produced to irrigate that much land. That much land should be reserved even if some of the area is going to be managed on a deficit irrigation basis. For example, it would be useful to demonstrate to the students the yield increases possible for sorghums or cereals by utilization of a single irrigation during the spring dry spell. This means that the land area could be slightly larger than the acreages calculated using the estimate that 0.8 l/s are needed to irrigate one hectare of land. While planning water allocation, it must be remembered that much of the area is outside the crop plots and that in a rotation, some areas may be bare or with stubble during the time of peak consumptive use rates.

The simultaneous development of two wells to supply water for the farm is recommended to provide security for the continuous operation of the farm. Should one engine or pump be down there would still remain a water supply to meet the needs of the livestock and to meet special emergency needs of crops which would be lost if an extended dry spell were to occur. The design team believes that this investment is needed. This security is necessary. Thus, suggestions below describe the development of two wells, both to be completed, developed, and proven before steps are taken to arrange for water utilization.

5.11 Water Requirement

Weather information for the Sana'a area indicates that during the month of June, the precipitation was 3.6 mm on the average for the past 15 years. This amount is negligible compared to the 152 mm pan evaporation during the corresponding time. The moisture balance is only slightly more favorable in May with 145 mm of pan evaporation and 20 mm of precipitation. It is probable that during at least half of the years, the precipitation in May can be ignored. If these premises are accepted, then the probability of having at least two consecutive dry months becomes high. Under these circumstances the water requirements for irrigation can

be calculated on the basis of consumptive use estimated for the peak rate of pan evaporation. This rate is the 152 mm of evaporation during the month of June.

Considering that the variance is large in this region, it becomes necessary to use a 20 percent average in order to achieve a reasonable certainty of having adequate water during eight years out of ten. For the purposes of calculating the probable consumptive use on which to base the size of irrigation water supply, a pan evaporation estimate of 180 mm per month was used for the peak period level.

The coefficient relating consumptive use to pan evaporation varies with crop. A pan coefficient of 0.70 may be used for the Demonstration Farm involving a variety of crops to be used. On this basis, the amount of water which must be applied at a water application efficiency of 100 percent would be 180 x 0.70, or 126 mm during June. If the irrigation efficiency, estimated as the mean for the various kinds of irrigation programs to be used is at 65 percent, then the gross irrigation requirement would be 126 divided by 0.65 or 194 mm for June, approximately 6.5 mm per day. This is equivalent to 0.8 liters per second per hectare.

5.2 Well Number One

Ideally, the first well to be drilled should be on university property. Its location should be chosen by a skilled ground water hydrologist. If options are available, it should be located near the southwest corner of the university campus. This particular site was chosen because of its proximity to good agricultural land and to a potential impoundment site. Near the southwest corner of the university campus is a location where an impoundment could be constructed with earthen dams and a plastic lining. An impoundment for 1,500 cubic meters would be approximately 4 meters deep and 20 meters long. It would provide the amount of water needed to irrigate 15 hectares to a depth of one centimeter of water, a one-day water supply. This impoundment would provide a useful level of flexibility. It would allow a combination of several plots which demand water at a rate exceeding the production capacity of the well to be irrigated. This would allow time for refilling at night when irrigation is not in progress or during other off-demand time periods. The flexibility added to the system by the construction of an impoundment would be worth its construction cost. The use and maintenance of an impoundment would be a training experience for the students using this facility.

5.21 Pumping System for Well Number One

The pumping system for well number one should be a deep well submersible turbine. At this time it would be unwise to specify the size and characteristics of the pumping system. This cannot be done until the well is proven and tested so that one can ascertain the dynamic head and the discharge rates. Well One is expected to be small, i.e. less that 3 l/s. An estimate of probable costs is in Appendix 1.

5.3 Well Number Two

Consultation with the NWSA has indicated that the appropriate location for university well number two, a well which hopefully would produce about 10 to 20 l/s would be someplace between the eastern well field and the western well field of the city system. The NWSA has a well which could be viewed as a landmark from which to locate the University well. Our suggestion would be that the University should attempt to develop a well 1 to 1.5

kilometers to the west and perhaps a kilometer to the north of city well No. P16 (see Figure 4-2). The prospects for good production at this location appear adequate. An effort should be made to secure a well permit for that region. It is likely that drilling in this region would be in fractured basalt, which would be an expensive operation. It is suggested that the well be drilled to a depth of 300 meters. A cost estimate for developing the water delivery system is given in the Appendix, page A-1.

5.31 Pipeline and Transport System

The study team has observed that much of the agricultural water transport in the vicinity of Sana'a is through galvanized steel pipe lying on the ground. The pipeline to the University Demonstration Farm should be buried. The pipeline can be a low pressure plastic pipe because there is no reason for pressures exceeding 2 or 2.5 bars to develop in this system if it is laid on the contour. If later examination indicates that it would be necessary to carry this pipeline over a topography which would require greater lifts, it would be necessary to use a high pressure plastic pipe which would be more expensive. An estimate is given for the cost of installing 7 kilometers of buried pipeline. Without knowing the exact location of the well relative to the impoundment on the University Demonstration Farm, the distance is not precisely known but it is believed that 7 kilometers is a reasonable estimate for indicating probable costs for this task.

It would be desirable to pump water from well number 2 into an impoundment to increase the flexibility of irrigation water management on the farm. The impoundment described for well number 1 could serve both wells. This impoundment has been described in Section 5.2.

5.32 Estimate of Irrigated Area

Using the same assumptions that were used in Section 5.1, it is possible to make estimates of irrigable areas which the combination of the two wells might service. Results of the calculations for a series for assumptions regarding well production levels are in Table 4-1.

Further details of water distribution systems to individual plots, for the irrigation of particular crops, or for the operation of different kinds of demonstrations of conservative and efficient water use are given in Chapter 9. The detailed discussion of water distribution systems follows a consideration of the agronomic, horticultural, and animal management units involved in the utilization of the water.

6. PLANT SECTOR PLAN

6.1 Premise of Plant Demonstrations

The plant sector of the Demonstration Farm should, as far as possible, have all economic plants and crops which will grow on the highland plateau. Table 2-7 lists most of the commodities produced in YAR. Because of size and space constraints, not all plants can be demonstrated. Most plants not grown on the farm can be seen by careful field trip planning around the country. Major crops should be present on the farm.

Many treatments are possible for the crops on the farm. Simple and practical treatments will be used including yield tests on different varieties of plants, dates of planting and harvesting for optimum yield, planting densities, pesticide treatments (insecticide and fungicide) and herbicide treatments, fertilizer treatments, irrigation treatments (frequency and amounts), fertilizer/irrigation interaction treatments, crop rotation demonstrations, optimum cutting date for forage treatments, cultivation techniques with yield determinations, (types of equipment, frequency and timing of tillage, depth of plowing), and fallow and dust mulch practices to conserve water. This is only a partial list. Many of the treatments mentioned could be combined to create more trials. The possible combination of all the trials on all possible crops is prohibitively large.

Some of the plots must be large enough for mechanized management practice. Some crops can readily be grown on small plots while others require large plots. The design team determined that an optimum plot size module is 5 x 10 meters with a 1 meter border. Each plot will therefore occupy a space of 7 x 12 meters. Many of the horticultural plots will most likely be subdivided when farm operations begin. Tree plots should be 5 x 20 meters with 1 meter borders. Modules can be subdivided or combined as needed.

Most treatments can be moved from location to location. However, herbicide treatments may limit future plot use. Plots heavily fertilized will not be useful for later low fertility tests. Some plant breeding demonstrations will need isolation due to cross-pollination potential.

6.2 Agronomy Plant Trials

Crops proposed for part of the agronomy demonstration are important in the country or have high potential for adaptation: alfalfa, sorghum, millet, maize, wheat, barley, 4 pulses, sweet clover, sub clover, rye grass, and bermuda grass. These 14 crops are proposed for initial development. Priorities will most likely change during operation. Trials proposed are six levels of irrigation, fertilization, and plant protection with three replications. This combination totals 252 plots requiring 2.4 hectares.

Part 2 of the agronomy demonstration will be used by advanced students and faculty for both demonstration and research. This area will be used for plant breeding trials and for demonstration of new crops such as Triticale, sunflowers, soybeans, and oilseed crops. Twelve crops are planned with six trails requiring an additional 0.6 hectares of land.

6.3 Horticulture Plant Trials

Horticulture is divided into several aspects. The first area concerns orchard management and involves almonds, apricots, peaches, nectarines, pomogranates, dates, grapes (2 varieties), prunes and plums on 5 x 20 meter plots with the treatments of pruning, weed control, irrigation, fertilization, and interplanting. One hundred twenty plots are provided on 1.8 hectares.

A much larger area is proposed for vegetable crops. These will be on 5 x 10 meter plots with 1 meter borders. Some of these plots can be subdivided, creating more, smaller plots. Crops are listed on Table 2-7. Thirty vegetable crops are recommended, including tomatoes, chard, okra, onions, leeks, celery, sweet corn, squash, melons, potatoes, turnips, carrots, green onions, peas, green beans, popcorn, lettuce, radishes, cucumbers, watermelons, and egg plant. Suggested treatments are: cultural pest control, irrigation, and fertilization with three replications. Three hundred sixty plots are designed for this sector on 3.0 hectares.

An ornamental horticulture section is recommended. Trees, shrubs, turf, annual flowers and drought-tolerant perennials are planned. Some forestry components should be considered. Sixty plots on 0.5 hectares are suggested. One half of the area should be in trees and shrubs, 1/4 in turf and 1/4 in flowers. Ornamental horticulture students should be involved in landscaping the remainder of the campus.

7. LIVESTOCK AND LIVESTOCK PROTECTION

7.1 Introduction

Livestock and its importance to the people and the national economy of YAR is well documented and must play an important role in the university's Faculty of Agricultural teaching and research Demonstration Farm. Livestock is an important part of family subsistence by providing meat, milk, and work assistance.

Current development projects of the country aim at increased self-sufficiency in livestock production with emphasis on the economic production of meat, milk and eggs. Much of the rural country is farmed by traditional methods and these practices must be changed by education if agriculture is to progress and prosper.

According to the 1980 census data obtained from the Ministry of Agriculture Livestock Advisor, there are:

Cattle	840,000 head
Sheep and Goats	3,750,000 head
Poultry	4,100,000 birds
Camels	105,000 head

Most of the effort on the Demonstration Farm should be devoted to the first three species but consideration should also be given to donkeys and possibly horses if space and feed is available.

YAR is broken into four agricultural areas and the livestock husbandry techniques taught at the University of Sana'a should be easily adapted to each area. Present livestock reproductive information and observed production practices indicate that there are great needs for improved husbandry, management, and nutritional education. Increased understanding in these areas will greatly improve animal health and reduce diseases.

In addition to improved livestock management being demonstrated on the farm, an equal amount if not more time, should be spent demonstrating the importance of the grass (forage)-animal relationships. The shortage of feed is one of the main problems of the livestock industry. It restricts rapid development of the livestock industry.

The development of the farm livestock section must occur in two phases. Phase one should include construction of facilities (buildings and corrals) and the establishment of the pasture and forage base to support the livestock. Phase two should include the building of fences and the procurement of the livestock and poultry enterprises.

7.2 The Livestock and Poultry Enterprises

To effectively carry out teaching and research in animal and poultry husbandry, at least the following enterprises are recommended given the land restrictions and assuming a water supply of 7 liters per second.

(1) A flock of 25 ewes plus two rams
(2) A herd of 15 goats plus two billys
(3) A demonstration herd of 8 milk cows (dual purpose) plus one bull
(4) A flock of 250 laying hens
(5) A flock of 250 broilers

(6) Rabbits
(7) Aquaculture

If a water supply of more than 7 l/s is available, the numbers of livestock and the area used by the livestock can be increased proportionately up to double these numbers. The amount of pasture for grazing will be limited so that the animals may spend a large share of their time in a feedlot or drylot situation. However, the sheep and goats should be used for grazing other crop residues on the farm. Grazing techniques and forage production are vitally important and will be discussed in more detail in the land development section.

7.21 Sheep and Goats

The sheep and goat flock should initially be made of local types which appear adequately productive and well-suited. However, the local breeds have not been raised under the confined environment which they will encounter at the farm. Observation over time could indicate the need for other breeds.

In the future, cross-breeding with outstanding imported rams would be desirable. Such a program could increase the productivity of the sheep and goat industry. A promising breed to consider is the Chios from Cyprus. This breed has high milk production, a high rate of fertility and prolificacy, early maturity, and a long breeding season. Breeds from other middle east countries might also be considered.

Sheep have advantages over cattle in efficiency of meat production because of their greater prolificacy, early age of puberty, shorter gestation period, shorter growing period, and possibly somewhat greater feed efficiency with non-grain materials. Under good management, a ewe produces 100 percent of her body weight in marketable offspring per year whereas a cow produces only 55 percent of her body weight in marketable offspring per year. Sheep are also better converters of forage energy to food energy than are cattle. Sheep also produce wool which may become more valuable as petroleum products become less available for synthetic fiber manufacturing.

Initial programs which should be considered include: flock improvement and selection, improved management techniques, studies of nutrition, improved feeding methods, and flock health. The Veterinary Investigation Laboratory of MAF has identified severe mineral deficiencies throughout YAR. Liver flukes and gastro-intestinal parasites (stomach worms) in sheep are a problem. Training of students in recognition of symptoms and in care and treatment should be part of the educational program.

7.22 Cattle

The demonstration herd of milk cattle should mainly include the local zebu type, which appear to be well-adapted. Because they are small, they require a smaller feed base. However, the daily milk production is low and total lactation period is short (five months).

The herd should also include Frisian and Jersey cattle. These are the two imported breeds now in the country. It is important that the farm provide the opportunity to compare the advantages and disadvantages of these breeds.

One good bull will be necessary. The university should consider a dual-purpose type, for example, the milking shorthorn, which could improve their herds.

Artificial insemination is a program that should be considered as soon as possible. The large genetic pool that is available through this breeding scheme could greatly improve the local cattle, both from the standpoint of milk and meat production. The university should take the leadership of this program because of the advantage it would give their herd and also the country's cattle industry.

Educational programs should include production improvement, breed selection both within local cattle and cross-breeding, nutrition and feeding, and a herd health program. The MAF veterinary service project has identified mineral deficiencies, hoof and mouth diseases, and rinderpest as major problems with cattle. The prevention of tuberculosis and brucellosis along with methods of control of external and internal parasites, will need to be included in the livestock protection educational program.

7.23 Poultry

The poultry flock should include both layers and broilers. This industry is rapidly expanding and plays an important role by providing eggs and meat. Students need to be trained and have a basic understanding of poultry production techniques. A single house can be built and split into two parts so that both enterprises can be taught. The building to be constructed should be of the same style as those used in the government's Rawdah poultry project.

Officials of MAF poultry project have offered complete cooperation to the University. They indicated that both pullets and broilers can be purchased from them as well as feed which comes from Holland.

The pullets come from the MAF Hasaba farm and the broilers from the Rawdah farm. Day-old broilers should be purchased to give students training in brooding and rearing. Equipment may also be available through the Hasaba farm project.

7.3 Livestock Protection

Animal and poultry health are very important. Animal disease is one of the major restraints slowing industry progress. General animal health care and disease prevention and treatment should be included in the classes at the farm. Facilities should be constructed for the teaching of general treatment programs of the stock.

Co-managers of MAF veterinary service project have offered complete cooperation and support to the University in the development of its Demonstration Farm. The University should cooperate with the veterinary service project at the Sana'a training center to prevent costly duplication of facilities and technical equipment. Students would receive outstanding training from the veterinarians and also become familiar with services offered by MAF. This type of education should be advanced in nature and beyond the daily animal health program covered at the University. The training center is located just a few minutes (by car) from the University. A close working relationship should be established immediately with the veterinarians to help with the problems of livestock health protection. When a veterinary faculty is established at the University, it can take over this education responsibility.

7.4 Land and Range Development

The livestock unit has been allocated approximately 5 hectares of land, assuming that wells with a flow rate of 7 l/s are available. The land should be divided as follows:

2	hectares of perennial forages	alfalfa, grasses
1.5	hectares of annual forages	sorghums, corn, small grain and sudan grasses
1.5	hectares of perennial grass and clover pastures	ryegrass, orchard and white clover

If more water is available, additional land to a maximum of 11 hectares should be divided in the same proportions.

This land allocation provides a large amount of feed, based on information from the Ministry of Agriculture (MOA) experiment farm at Dhamar. For example, they have been able to produce over 60 ton per hectare of fresh cut Moapa alfalfa. Even at a conservative yield of 50 ton per hectare, this provides over 16 tons of dry alfalfa hay per year. With a mixture of RVP Italian and Cooper perennial ryegrass, over 141 ton per hectare of fresh weight were obtained in five cuttings. This is equivalent to about 35 tons of hay per hectare. If these yields can be achieved, a large fraction of the feed requirement could be produced on the farm. The work at the Dhamar station should be closely reviewed when varieties are selected for seeding.

The 1.5 hectares of perennial pastures should be seeded to a mixture of ryegrasses, orchard grasses, and a white clover. These varieties respond well to irrigation and can provide a large amount of grazing for the livestock, thus reducing the amount of other fodder needed. The livestock should also be allowed to graze the stubble of the agronomy and horticulture plots and any excess forage or fodder cut from the plots should be made available to the livestock operation, either in the form of green or dry feed.

The livestock unit should work diligently to demonstrate productive pastures, good pasture management, and animal utilization. These efforts can demonstrate new techniques in grazing which are needed in the country and are also important as less manpower is available to herd the stock.

Use of the New Zealand flex netting fence attached to a solar powered battery (12V.) will make grazing of the plots very easy and reduce shepherd responsibility.

The 1.5 hectares of pastures should be subdivided into plots of 0.3 hectare each. This gives 5 paddocks for rotational grazing. If more irrigated land is available for pastures, individual paddocks should be 0.3 hectares.

Range management is very critical to the YAR and its study and teaching should be part of the Demonstration Farm. There is a small hill not far from the farm site, near the northwest corner of the university property, that should be considered for lease. Demonstrations of range management here could provide direction for future programs and experiment stations. Practices can be worked out for rebuilding ranges and preventing soil erosion. Once these practices are clearly defined and demonstrated soil erosion.

One of the concepts that should be considered for demonstration at this range location, is the new grazing management approach known as the "savory grazing method" (Savory, 1981). It has been demonstrated in South Africa, Australia, and to some degree in America, that intensifying the number of livestock and grazing them in greater numbers for shorter periods and at higher densities under careful management, has improved the range.

This approach could be demonstrated on the suggested site and then expanded at the future research site being considered near Dhamar. An approach that should be considered would be to divide the hillside into three paddocks and show:

(1) where overstocking but no overgrazing is done;
(2) repeat practice number 1 and overseed some new grass varieties to improve the forage base; and
(3) use the present practice of understocking and over grazing now done in the country.

Using approach 1 and 2 would allow the natural forage selected through many years to prevail and possibly also add new highly productive legumes and grasses. This concept is also known as the "hoof and tooth" method of grazing. It allows the teeth of the animals to shock and graze the plants closely. The heavy concentration of hooves breaks the soil's surface, allowing better penetration of rainfall, and germinating seed.

The University of Sana'a Demonstration Farm can show this concept of range management because it can be done by the farm manager or livestock specialist who would have control of the grazing animals. They can accomplish this by working with the livestock in the program and by bringing in additional animals from cooperating farms in the Sana'a area if necessary. Livestock can be used as a reclamation tool of range through long term programs. If this recommendation is considered and the land leased, it must be remembered that it will require patience and considerable time to be successful.

7.5 Recommendations for Development of the Livestock Section of the Demonstration Farm

Development of the livestock section should occur slowly and be developed properly for maximum productivity. Development should be broken into two phases.

7.51 Phase 1

During the first phase, pastures and alfalfa should be established so that proper development can occur. At the same time, buildings and corrals should be constructed in preparation for bringing the livestock to the farm.

7.52 Phase 2

Livestock should be procurred at the beginning of this stage. By this time, an adequate forage base should have been established. One of the problems often observed in small producer livestock operations is the

procurement of the stock prior to obtaining a forage base. If possible, a reserve of forages should be amassed before any animal enterprise is procured. It may also be possible that as the land for the farm is developed, annual or perennial forages could be established to produce feed for the livestock operation until such time as all the land would be needed for the horticulture and agronomy sections. These forages could be stored for future consumption.

7.6 Future Needs

As the University of Sana'a looks to the future, it would be useful to consider additional teaching and research stations for livestock in the four different geographical areas. This would allow an additional research base for the faculty and other education and training sites for students and the country's farmers. These needs should be developed as the Faculty of Agriculture grows and student enrollment increases.

8. BUILDINGS AND EQUIPMENT

This chapter discusses buildings and equipment for the operation of the demonstration, teaching, and research farm. Additional equipment and buildings may be needed later depending on the faculty makeup and research being conducted.

8.1 Buildings

Eight buildings are recommended for the farm and descriptions of each follow. Building plans at the end of the chapter present concepts only. Detailed plans by an architect must be completed before construction can begin.

8.11 Building for Offices and Crops

This building (Figure 8-1) will house field offices and activities of the agronomy and horticultural departments. The building is 31 m x 12 m.

The facility includes a reception office and two co-manager offices, two restrooms, a lunch room for students and personnel working on the farm, and two large classrooms and work areas, divided by folding doors. Opening the folding doors allows the rooms to be joined into one large room when field days or other events of this type are held.

The area utilized by the agronomy section includes storage and a seed cleaning facility. The seed cleaning facility should be equipped with fans to remove dust and be vented to the outside. Also needed is a soils room and storage facility. This room should have work tables, equipment for weighing, an oven for moisture determinations, and an autoclave. The horticultural lab has a storage area with a walk-in cooler for horticultural products. There also needs to be a storage area for chemicals and fertilizers.

The building should have water piped into the restrooms, the soils room, the agronomy and hort lab, both classrooms, and the lunch room.

Compressed air lines should go to all three labs, the seed-cleaning facility and the two classrooms. Floor drains should be located in each of the laboratory rooms, the restrooms, the lunch room, the dry storage area, the open storage area, and the classroom. All rooms should have windows and ample electrical outlets of 110 V, and 220 V.

8.12 Greenhouse

It is recommended that a greenhouse be constructed for use by the horticulture and agronomy departments. This greenhouse should be located near the classroom buildings for the faculty of agriculture rather than on the Demonstration Farm.

8.13 Livestock Center

The livestock center (Figure 8-2) will be a facility 26 m x 20 m with two wings. Sheep and goats will be located in one wing, cattle in the other. In addition to the livestock wings, the building has an office, student or caretaker housing, restrooms, an animal protection lab and treatment classroom, milking facilities, and storage areas.

Water and floor drains should be provided in the bathroom, the animal protection lab and treatment room, the milk parlor and milk room. The storage facilities joining the office and the two livestock wings only need water. The building should have concrete floors, except the area where the livestock are housed. The floor of the livestock area

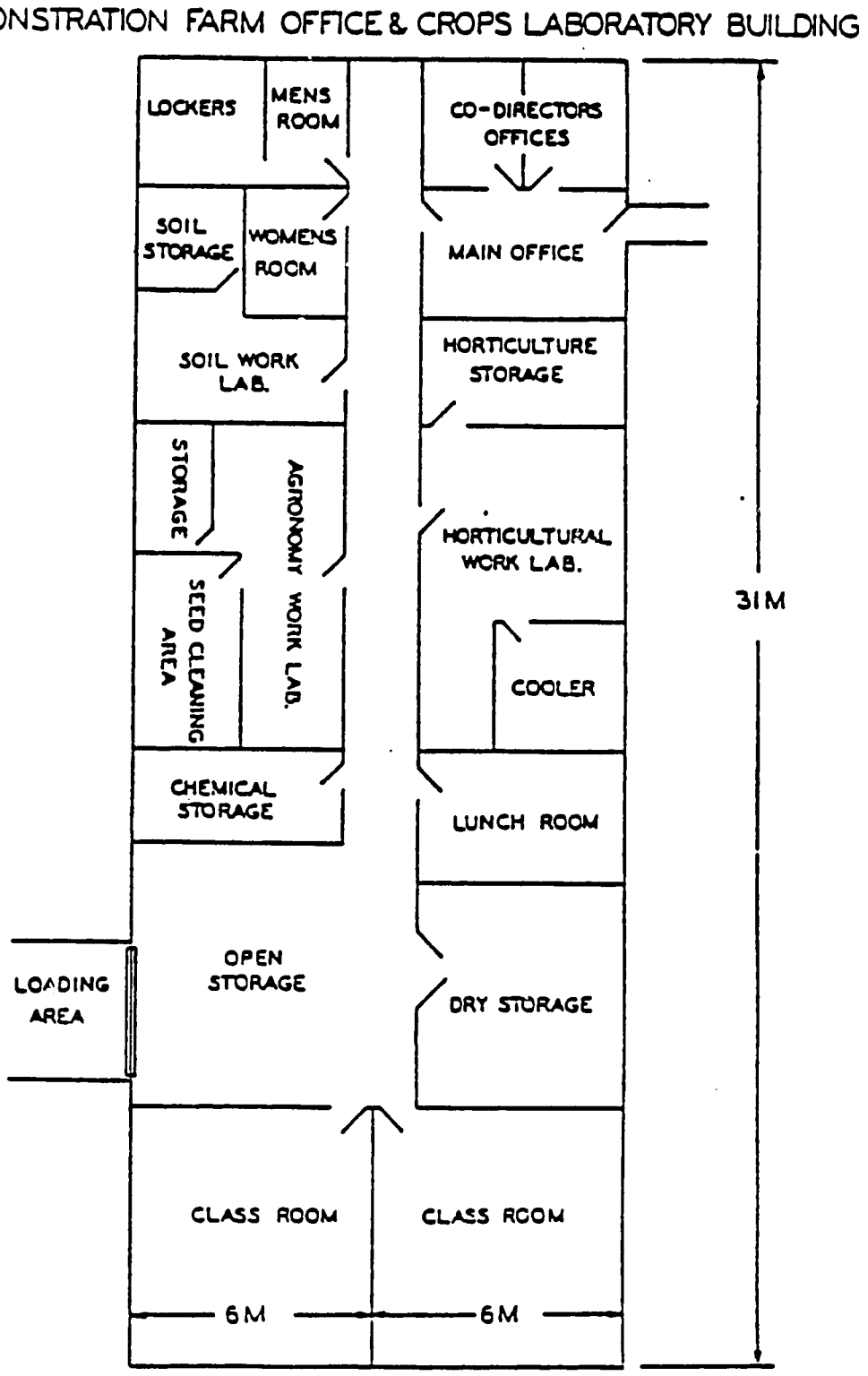


FIGURE J-3 Schematic drawing of Demonstration Farm Office and Crops Laboratory Building, University of Sana'a, Yemen Arab Republic.

101

DEMONSTRATION FARM LIVESTOCK CENTER

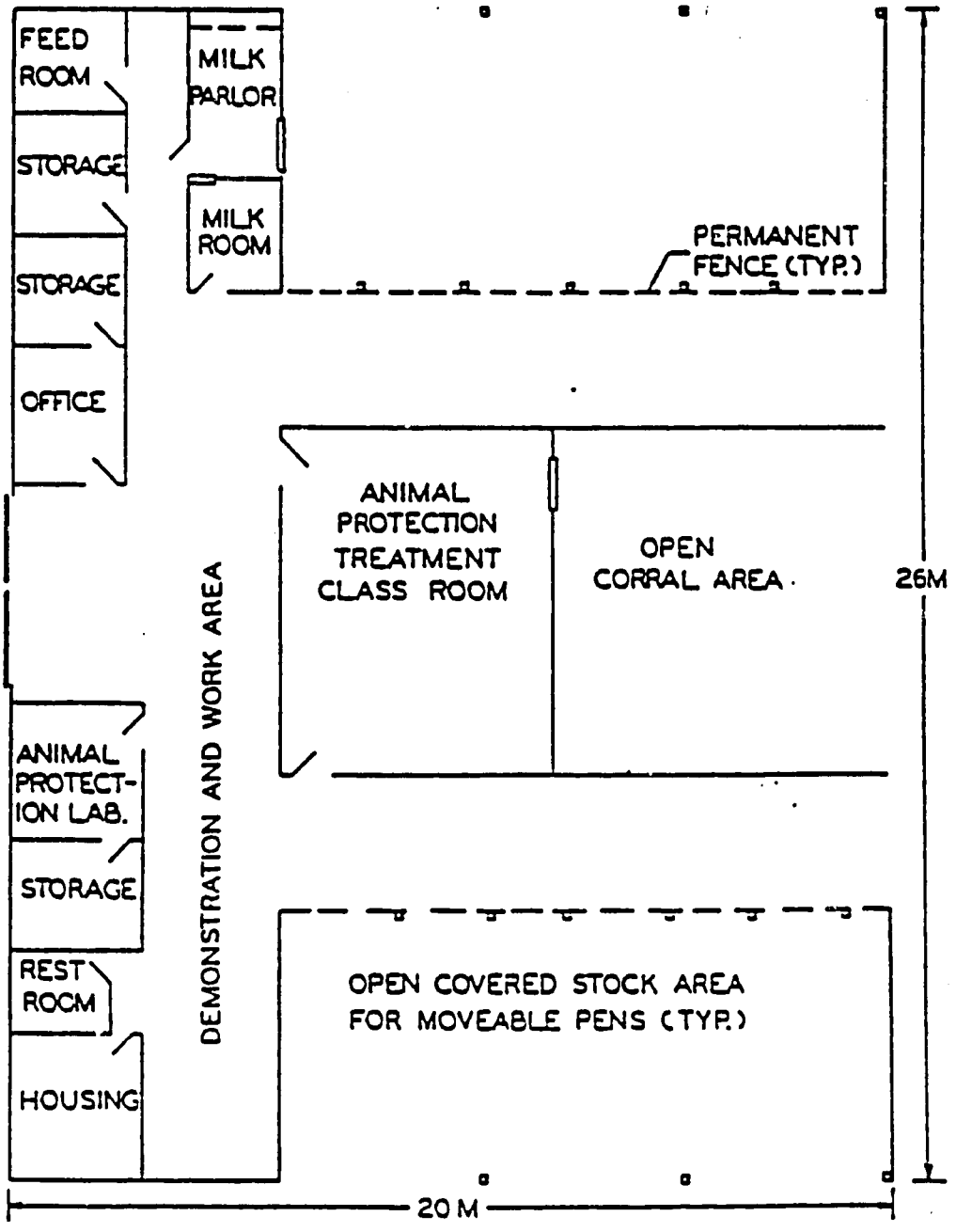


FIGURE J-4 Schematic drawing of Demonstration Farm Livestock Center, University of Sana'a, Yemen Arab Republic

should be packed clay. The open lot corrals should have 20 cm of sand. Refrigerators should be located in the animal protection lab and office storage area. The classroom should be built with bleachers. There will need to be sufficient electrical outlets throughout the building to run all equipment.

8.14 Handling Facilities for Livestock

Cattle performance can be improved with correct handling facilities. (Figure 8-3). The facilities for the Demonstration Farm must be functional for Yemen livestock and must be located between the two wings of the livestock center, immediately behind the animal protection classroom. By locating it in this position it will be easy to move animals through the faciltiies and into the classroom for instruction or treatment.

Working chutes should be adjustable to handle different size animals (sheep and cattle). It should be possible to close down to 35 cm at the bottom when working sheep and goats. The sheep table must be moveable so other portable equipment can be used in the same chute opening.

Two moveable panels should be used at the end of the cattle squeeze chute, so stock can be moved into the animal protection classroom or across to the scale and dip vat chute.

The chutes, holding pens, and corral fences and feeders can be built with used or damaged 5 cm pipe. Pipe is available through some of the local well drilling companies. Additional equipment is in Figure 8. .

8.15 Poultry Building

The poultry building (Figure 8-4) should be 20 m x 6 m and constructed similar to the new building of the MOAF poultry farm at Rawdah. The building should have a feed room and egg room. The storage facility, located in the center, should divide the layer flock and the broilers and reduce the chance of spreading disease from one to the other.

The building should have a concrete floor. Equipment needed includes feeders, waterers, nests, and miscellaneous equipment.

8.16 Feed Center

The building (Figure 8-5) is 7 m x 7 m and serves as the storage area for hay, grain, and other fodder. This building should be centered near the livestock and poultry facilities. Space should be allowed for a future mill. Included are bins for bulk grain storage as well as sacked feed (Figure 8.5).

8.17 Farm Shop and Equipment Storage

The farm shop and equipment building (Figure 8-6) is 7 m x 17 m. This facility has a farm shop at one end and equipment storage in the balance of the building. It should include restrooms with water supplied to the restroom, a wash-up area located in the farm shop, and an outside area to wash off equipment before it is brought into the shop. Construction in the shop will need to include a beam strong enough to support an overhead, 5-ton hoist.

The farm shop area should have a concrete floor. The equipment storage area should be gravelled. The farm shop should be equipped adequately to provide maintenance and up-keep of buildings and equipment but not to do major overhauls.

OPEN CORRAL AREA
LIVESTOCK CENTER

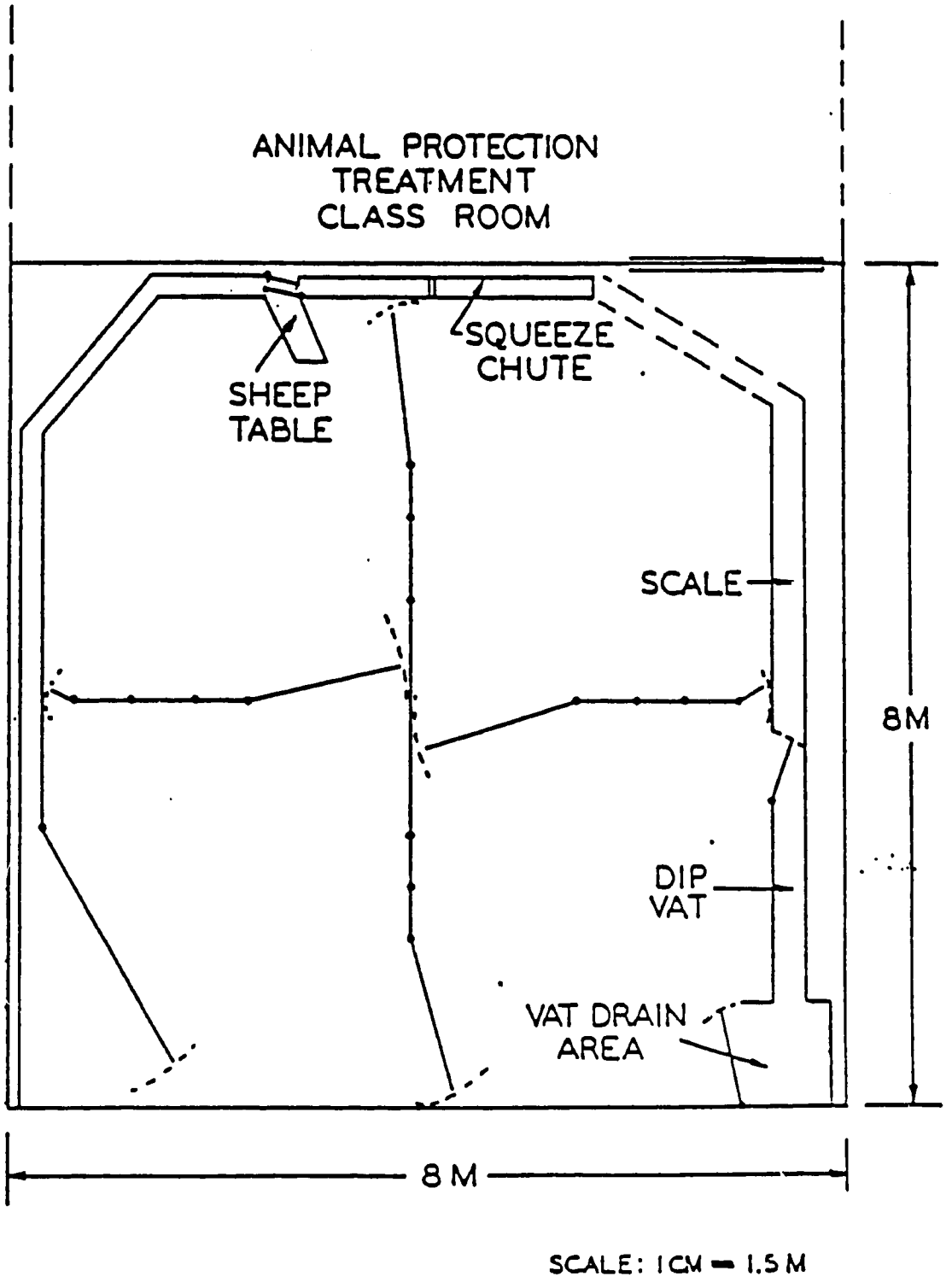


FIGURE J-5 Schematic Drawing of Open Corral Area Livestock Center, University of Sana'a, Yemen Arab Republic

204

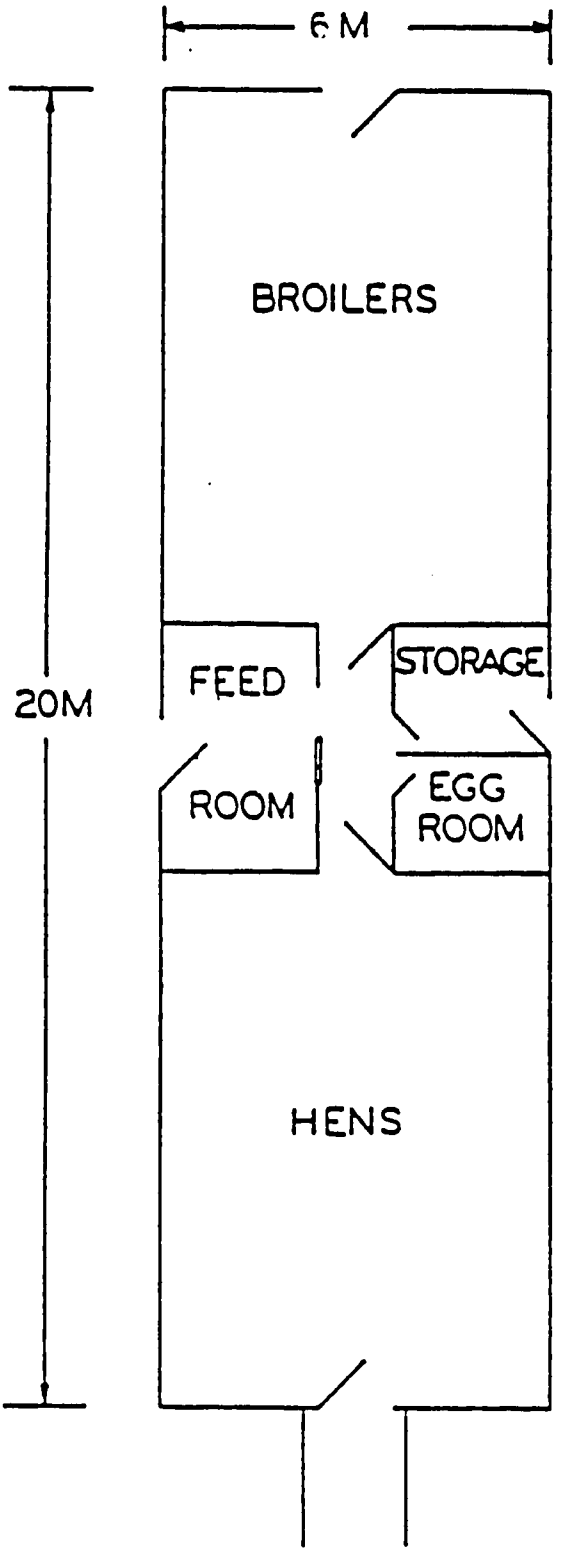


FIGURE J-6 Schematic drawing of Poultry Building, University of Sana'a, Yemen Arab Republic

205

FEED CENTER AND PUMP HOUSE

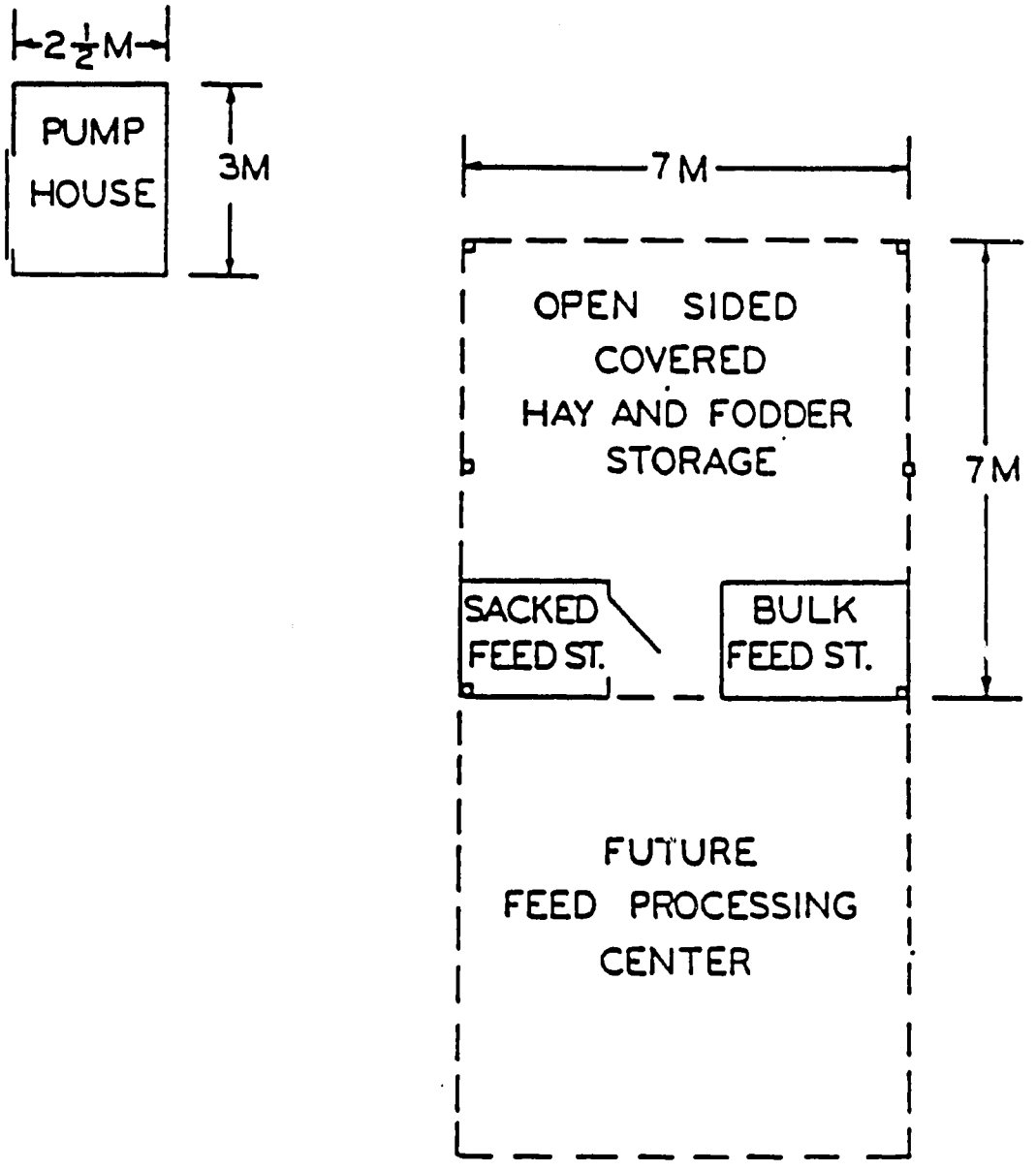
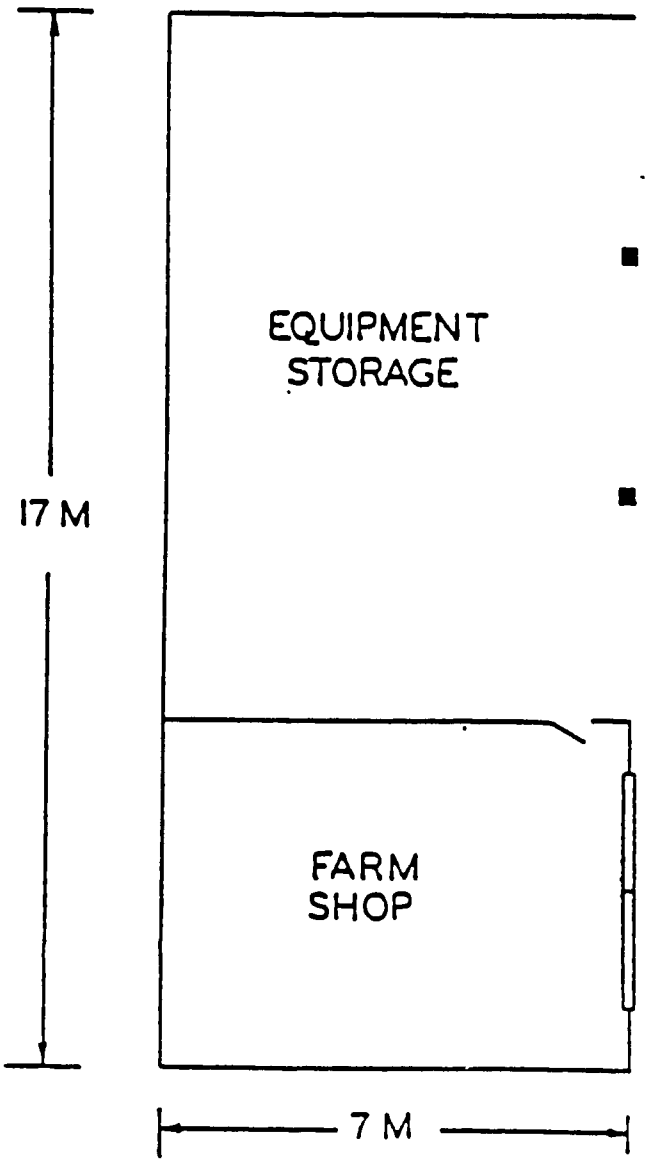


FIGURE J-7 Schematic drawing of Feed Center and Pump House, University of Sana'a, Yemen Arab Republic

206

FARM SHOP AND EQUIPMENT STORAGE



SCALE: 1 CM = 2.5M

FIGURE J-8 Schematic drawing of Farm Shop and Equipment Storage, University of Sana'a, Yemen Arab Republic

107

8.18 Pump House

Two pump houses (Figure 8.5), 4x6 m, should be constructed over the well holes. These houses should have nearby fuel storage servicing equipment and light and electric outlets.

8.2 Equipment

The equipment for the buildings and farm establishment are listed in the appendix.

9. IRRIGATION AND MECHANICAL PLAN

9.1 Objectives

The irrigation plan must be devised to provide the students and faculty the flexibility to optimize the teaching and learning processes. The system must provide for irrigation of small plots, but it must also be possible to irrigate large plots such as hayfields or pasture paddocks with it. The system should provide flexibility to allow various faculty members to conduct research with new irrigation techniques such as drip or trickle. The system must provide water for the numerous irrigation methods which might be appropriate for various terrains and various crops produced in YAR.

The mechanical plan of the University Farm, that is, the complement of equipment for agricultural operations, should have a similar flexibility. It should provide opportunities for students to appraise operations including tillage, planting, cultivation, plant protections, and harvesting. It should be targeted at several levels of technology including draft animals as well as small and moderate sized machines and power units.

9.2 A Mixed System for Irrigation

Consistent with these needs is the idea of using a mixed system for irrigation of crops. For instance, agronomic crops might be irrigated in rills or flood basins, or they might be irrigated by sprinkler systems. All three opportunities should exist for the faculty and students to work and experiment with. Similarly, horticulture crops will require beds and furrows, sprinklers, rills and basins, gated pipes, siphon tubes, gated ditches, or flooded basins for orchards. Drip and/or trickle systems along with other options for orchard or vineyard irrigation should be available. The availability of water under pressure and other such accommodations should be arranged so that these options are available.

9.3 The Delivery System

To provide the above flexibility, the delivery system should be constructed as a mixed system. It could start out from the impoundment with two main lines, one running essentially north by northwest and the other running in an easterly direction, towards the present university buildings. Each of the main lines could service a series of buried submains and at the same time, dump through valves into surface canals serving as submains for land on some terraces. Preferably, these irrigation ditches should be concrete lined to minimize percolation losses. For servicing terraces at different levels, stand pipes should be used on the buried laterals and sublaterals. Drop structures would be needed with gates and stoned terrace walls or stoned channels for drop structures in the open ditches. This sort of mixed system would provide for water delivery to several terraces which could be used in different fashions.

In situations where the submains would not be operating at an adequate pressure to operate sprinkler systems, small portable pumps could be connected to the submains or operated with a suction hose lowered into an open ditch to pressurize water to operate a trickle or sprinkler system without necessarily pressurizing the water in the whole system. Water could be pressurized for irrigation of individual plots or small blocks of plots depending on the needs of the faculty to demonstrate a particular

kind of operation. This delivery system would provide opportunity to broaden student experiences and expose students to a variety of techniques for the handling of irrigation water. At the same time, it would be important that the faculty build into these, every possible option for the conservation of water. They should take advantage of opportunities to illustrate to students how to avoid water losses through deep percolation and evaporation.

9.4 Tillage Systems

9.41 Tilth and Tillage

The tillage systems should be designed to give the students the opportunity to see and test comparisons of several kinds of tillage methods including rotary tillage, moldboard plowing, lister plowing, disc plowing, plowing with sweeps, and plowing with the ripper-thrust plow currently employed in draft animal agriculture. The students could be expected to practice with each of these tillage procedures and to observe the difference in soil condition obtained by these different procedures. Thus, they can learn to understand the reasons for and the principles of tillage.

9.42 Minimum Tillage

One of the variables which students should learn about is the affect of different tillage intensities and the influence of varying the tillage depth. They should be made conscious of the potential for energy conservation through reducing tillage depth and intensity. The students should learn about adequate tillage and about methods to avoid excessive amounts of tillage. The need exists to teach minimum tillage to future generations of farmers in YAR to conserve resources and energy.

Part of the minimum tillage trials and demonstrations for students and farmers might be to appraise the current plowing operation to see what its influence is on tilth and moisture conservation.

9.43 Tillage for Water Control

Students and faculty should have opportunities to study effects of dust mulch and weed control on the conservation of water. Weed control in these trials could be by tillage or herbicide or some combination thereof. Students might be asked to work out a comparison of the cost of controlling weeds by tillage and by the use of herbicides.

The effectiveness of dust mulch on water conservation involves a principle the students should be acquainted with. They should recognize the potential and the limitation of this practice for reducing soil moisture losses from evaporation. They should have the opportunity to try different depths of mulch and different levels of pulverization. They should study the effects of compaction of the mulch by roller or by plowing on the retention of water within the seed zone and throughout the soil. The students should examine the effect of mulches and tillage practices on soil temperature, especially early in the growing season when the soil might be cool.

9.44 Pre-Tillage Irrigation

Much of the practice area for students learning to operate machines (including tillage machines) could be on non-irrigated land. However, in some cases it can be important that the students examine the effect of tillage at various moisture contents. Therefore arrangements

should be made for some pre-tillage irrigation. Students may be required to understand the sequence of procedures which involves irrigation, very light tillage, and planting a crop into moist soil. They should also be aware of and be cautioned about the possibilities of adverse physical conditions due to soil compaction.

9.5 Miscellaneous Machine Operation Practice

One of the uses the faculty and students will made of the Demonstration Farm will be to work with various kinds of machines and become acquainted with principles of operation. They must become acquainted with the procedures for safely operating and servicing various machines: mowers, rotary rakes, binders, combines, corn harvesters, forage choppers, and other auxiliaries which might be mounted on power units. Machines should be available for students to use in the agronomy plots, the horticulture plots, or initially, in an area which is not cropped so that they can observe the operation before entering cropped plots for operation of the equipment.

9.6 Physical and Mechanical Arrangements

In Sections 6 and 7, consideration was given to the features of the crop and livestock management capabilities of the various plots. The irrigation and mechanical plans, as outlined in this chapter, are for uses described in previous chapters. However, it would be appropriate to set aside an area of irrigated land and an area of non-irrigated land, perhaps one hectare each, for demonstrating equipment and to allow students to practice with farm and irrigation equipment prior to their utilizing it in growing crops or with livestock. This land requirement is allocated in Table 4-1 only for the case where the farm size approaches 20 hectares. In the event that only smaller water supplies are available and the farm land area would be smaller, these irrigation and mechanical plans would be confined to the cropped plot areas.

The equipment referred to in this chapter and additional equipment described in Chapters 5, 6, and 7 is listed in the appendix along with estimated costs. The cost estimates are conservative, based on early 1982 prices for medium to high quality components. Efforts were made to select quality levels which would provide a probable longevity to obsolescence even under the adverse conditions of use by untrained, occasionally careless, student.

10. RECOMMENDATIONS

1. The size of the Demonstration Farm for the University of Sana'a depends on the water supply resulting from drilling two wells; one on campus and one several kilometers north of the campus.

2. If a water supply of 14 l/s is found, the University Farm should be 21 hectares. The first step is to develop a water supply to determine the appropriate farm size. It will be preferable to develop two wells. If less water is available for the farm, the land area should be scaled down to fit the water supply. (Table 4-1). A scaling factor of 1.5 hectare of area for 1 l/s of water is recommended.

3. If 21 hectares of land are irrigated, 3.0 hectares should be allocated to agronomy, 5.3 hectares to horticulture, 12 hectares to livestock, and 0.7 to soil management and irrigation. These parcel sizes are such as to allow students to accumulate data for microeconomic analysis.

4. If the water supply is only 7 l/s, 10.4 hectares should be partitioned as follows: agronomy, 2.2; horticulture, 2.6; livestock, 5.2; and soil management 0.4 hectares. On a very small farm the major emphasis should be on horticulture. If an area smaller than 21 hectares is to be used, the eastern boundary should be moved westward.

5. The study team strongly recommends that the Demonstration Farm should be at least 10.4 hectares, preferably 21 hectares.

6. In the agronomy section, there would be space to accomodate as many as 20 crops on 324 plots measuring 5 x 10 meters. Crops will be produced under full irrigation, deficit irrigation, and under dry land conditions. Equipment and facilities were selected to give students experience with modern technology, labor saving implements, and scientific measurements.

7. In the horticulture section, space has been allocated for fruit, vegetables, and forestry and landscape crops with as many as ten fruit crops on 120 - 5 x 20 meter plots, 30 vegetables on 360 - 5 x 10 meter plots, and 10 forest species and landscape species on 60 - 5 x 10 meter plots.

8. The 21 hectare farm accommodates 50 sheep, 30 goats, 16 cattle, and 500 chickens on an irrigated land allocation of 12 hectares. With smaller water supply, this would be scaled down and the proportions accordingly changed (see Table 4-1 of the text, Chapter 4).

9. Provisions should be made to instruct students in pasture management techniques; how to grow, use, and maintain productive pastures. Instruction in range management should be arranged on non-irrigated land. Opportunities for animal breeding trials should exist.

10. A piece of land should be set aside for soil management, tillage, tilth, and irrigation practices including basin, flood, rill, furrow, sprinkler, drop and trickle. About 0.7 hectares of irrigated land is recommended for this purpose.

212

11. The farm will include the following buildings:

A. Crops Laboratory Building and Offices (both agronomy and hort).
B. Farm Shop and Equipment Barn.
C. Livestock Barn and handling facilities.
D. Poultry Building.
E. Feed storage and future mill.
F. Greenhouse.
G. Pump House(s).

12. The faculty of agriculture must phase the development of the farm at a rate consistent with the growth of the faculty and student body.

13. Every effort should be made to retain for the faculty the maximum flexibility in the use of the land and water resources. This is planned for by an elaborate water supply system. It was considered proper to recommend the investment of funds to create a reserve of flexibility to be used as the student body, faculty and the agriculture of YAR grow and change.

14. The size of the land unit and water supply recommended will provide the faculty with research opportunities in a variety of disciplines in the plant and animal sciences. It will also create opportunities for effective extension work.

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214

A P P E N D I X

215

DEMONSTRATION FARM COST ESTIMATE

Water Delivery System	
Two wells, possibly to 1000 feet (300 meters) at $125,000 per well	$ 250,000
Seven kilometers of low pressure plastic pipeline, 12 inch (30 cm) plastic	$ 90,000
Installation of pipeline from well #2 to campus farm	$ 20,000
Two pump houses, flow meters and fuel tanks	$ 8,200
Two turbine pumps, one for each well, sized proportional to the dynamic head and equilibrium water production rate	$ 24,600
Impoundment - 2000 cubic yards (1750 cubic meters) of earth moved by carryall plus 575 square meters of plastic membrane facing	$ 65,000
Subtotal	$ 457,800
On Farm Water Distribution System	
Mainline, 1100 meters of 20 cm low pressure plastic buried	$ 12,000
Submains, 9400 meters of 15 cm low pressure plastic buried with surface valves every seven meters	$ 55,000
Submains II, 2400 meters of open 50 cm x 60 cm concrete lined ditch	$ 30,000
Appropriate drop structures open ditch terrace to terrace	$ 5 000
Concrete Stand Pipes 20 necessary	$ 3,000
50 reducers for couplers from submain outlet valves to 5 cm, 7.5 cm or 15 cm tubing -	$ 1,200
Elevated concrete water tank	$ 6,000
Subtotal	$ 112,200

216

Irrigation Equipment

200 items of 5 meter lengths of 5 cm aluminum tubing with couplers, 100 with riser orifices	$	4,000
100 cm and 200 cm riser tubes, 1.5 cm diameter to fit above orifices, 200 each length	$	2,200
600 items 2.5 cm siphon tubes	$	1,500
200 items 5 meter lengths 5 cm gated pipe gated every 50 cm	$	1,000
100 items 5 meter lengths 10 cm gated pipe, gated every 50 cm	$	3,000
200 small rainbird sprinkler heads	$	2,500
Assortment of nozzles; 2.38, 3.175, 4.76, 6.35, 7.94 mm; 200 each size -	$	2,000
200 meters of 15 cm plastic gated pipe	$	2,600
1650 meters of drip system, 3 cm, 2 cm and 1 cm tubing, 550 meters each with 300 microtube emitters with 4 pumps, each with capacity of 0.5 - 0.8 liters/sec at 0.5 bar pressure -	$	4,000
20 check gates, 100 ditch outlet flumes 100 ditch outlet gate pipes, hand checks miscellaneous small irrigation hardware	$	2,000
12 items small irrigation water pumps, capacity 0.5 liters per second valvable; pressures up to 4 bars.	$	10,000
20 meters of buriable automatic gated pipe lateral	$	1,000
One item 40 meter end tow sprinkler lateral with risers, skids, and nozzles at 10 meter spacing end cap for one end.	$	1,500
One item big gun nozzle 1.5 cm orifice on hose and on cart, including 40 meters of 4-5 cm hose. Capacity of about 5 liters per second at 6 bars pressure	$	2,100
One diesel driven high pressure pump for item above	$	3,500
Subtotal	$	42,900

27

Irrigation Measurement Equipment

Weather station; air temperature (maximum) minimum and current) soil temperature at 10, 20, 40, 80 cm depths, relative humidity, buried evaporation pan, standard U.S. weather service evaporation pan, standard accumulator rain gauge total solar radiation, net solar radiation, wind speed and direction	$	12,000
Water meters; 50 needed to measure water as applied to individual plots	$	6,500
20 small weirs, for measuring up to 0.5 liters per second maximum	$	2,000
150 soil moisture blocks, cylindrical concentric electrode with two meter leads and meter a neutronprobe.	$	10,000
50 tensiommeters of varying lengths 15, 30, 45, and 60 cm.	$	4,000
Infiltration cylinders, double ring, six in number	$	120
2 sets of catch cans and volumetric measure for sprinkler distribution pattern assessment	$	100
Subtotal	$	34,720

Office and Crops Building

Building	$	150,000
Office equipment (3 Offices)	$	6,200
Arm chairs (60)	$	9,300
Scales (Balance)	$	3,100
Soil drying oven	$	1,300
Autoclave	$	4,650
Horticulture lab equipment	$	9,300
Agronomy lab equipment	$	9,300

218

Horticulture cold box	$ 9,300
Misc equipment	$ 12,400
Lab tables and benches	$ 3,100
Subtotal	$ 217,950

Livestock Center and Feed Building

Building	$ 95,000
Feed building	$ 15,000
Office equipment	$ 1,550
Housing furniture	$ 1,550
Milking and milk house equipment	$ 10,000
Animal protection lab equipment	$ 9,000
Animal management equipment	$ 5,000
Animal protection classroom equipment	$ 8,000
Livestock handling equipment (Chutes, squeeze, scales, dip vat, etc)	$ 15,000
New Zealand style flex netting fence, Solar Power Unit and Electric Fence charger)	$ 4,000
Installed fencing (1 meter woven with 15 cm vertical stays) and 1 - strand barb wire at the top. Use steel "T" post (5000 meters @ $3.75/m)	$ 28,000
Subtotal	$ 192,100

Poultry

Building	$ 22,500
Feeders (16) (2½ m)	$ 500
Waters (20 liters) (8)	$ 300
Nests (6)	$ 600

Brooders	$ 500
Misc. equipment and tools	$ 1,000
Subtotal	$ 25,400

Farm Shop

Building	$ 40,000
180 amp arc welder	$ 400
Oxy-acet gas welding and cutting set	$ 500
Air compressor (gas motor)	$ 1,100
Portable generator	$ 1,550
Large bench vice	$ 230
Radial arm saw	$ 800
Overhead hoist (5 ton) (5 metric ton) and beam	$ 930
Drill press (floor model)	$ 550
Power hack saw	$ 400
Bench grinder (heavy duty)	$ 300
Fuel tanks (2) (diesel, gas) (800 L. each)	$ 600
Heavy anvil	$ 225
Tire equipment and floor hydraulic Jack	$ 625
Work benches and tool cabinets	$ 2,300
Misc tools	$ 7,800
Subtotal	$ 58,310

General Farm Machinery and Equipment 4/

Tractor J.D. Model 650 4.W.d. 1/	$ 29,300
Plow 1/	$ 2,790
Disk harrow 1/	$ 3,720
Spike tooth harrow 1/	$ 1,150
Rear blade 2/	$ 900
Front end loader 2/	$ 7,750
Tool bar 1/	$ 900
2 Row corn planter 2/	$ 3,100
Cultivators 1/	$ 4,650
5' Grain drill (1.75m) 3/	$ 5,425
Rototiller JD Model 448 1/	$ 5,800
Pull sprayer 3/	$ 1,395
6 (EA) Shovel openers 1/	$ 1,395
Hay rake (side delivery) 3/	$ 1,550
Hay mower 3/	$ 2,250
Hay baler 3/	$ 7,750
Valadane rototiller, plow, mower, cultivator attachments (3 each)	$ 15,000
5' Fertilizer spreader (1.75m) 3/	$ 1,850
Border disc ridger 2/	$ 2,170
2 Wheel trailer 2/	$ 3,100
Pick-up truck (4-WD) 3/	$ 23,200
Subtotal	$ 125,175

22

Perimeter Fencing	
Chain link fence (2000 meters)	$ 85,000
Subtotal	$ 85,000
Establishment Cost	
Rejuvination cost of land, expatriate manager, seed fertilizer and chemicals inflation allowance	$ 215,000
Subtotal	$ 215,000
TUTAL	$1,566,555

1/ Minimum represents 2 sets of equipment and maximum represent 3 sets
2/ Two sets of equipment
3/ One set of equipment
4/ Brand names are used strictly to illustrate size and nature of units.

ANNEX K

REQUEST FOR PROJECT MOBILIZATION FUND

DRAFT ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR, NEAR EAST BUREAU

THRU: NE/TECH/AGR

FROM: Charles F. Weden, Jr., Mission Director, USAID/Yemen

PROBLEM: To obtain your approval to spend up to $664,000 for mobilization activity prior to review and authorization of the Faculty of Agriculture Subproject Paper.

DISCUSSION: USAID/Yemen has submitted a Subproject Identification Document (SPID) proposing AID assistance to the Yemen Arab Republic Government (YARG) in establishing a Faculty of Agriculture in the University of Sana'a. A copy of the SPID is attached. The SPID includes a proposal for AID funding of selected activities prior to approval of a Subproject Paper, which is expected to be submitted for review o/a August for possible authorization in September 1983. The SPID proposes a project mobilization phase related to the development of an instructional farm on the FOA campus.

The estimated cost of these mobilization activities is $664,000 of the estimated total life of subproject cost of $21 million. Table I contains more details.

In addition to this proposed subproject funding, the Bureau has already approved, in the Core Subproject Workplan, the expenditures of $138,000 for training of prospective Yemeni faculty members. If this SPID or the SPP are not approved, this training will be concluded under the Core Subproject.

Following is a discussion of the justification, budget, and engineering analysis related to the above request. A discussion of the implication of advanced commitment of AID long-term funding to the FOA is also included below.

JUSTIFICATION: The Faculty of Agriculture tentatively plans to enroll its first class of students in September 1985. The current plan is for the first year of the curriculum to be in the existing Faculty of Science (See Annex I of SPID). The remaining years (Years 2-4) of study will be in the Faculty of Agriculture. The first year of actual instruction on the new FOA campus, therefore, will begin in September 1986. In order to meet this projected schedule, the University of Sana'a is negotiating now to have the FOA buildings and instructional farm completed and operational by September 1986.

Concerning the instructional farm, it is critical to have the farm operational at least one year prior to opening it up for student training. This will provide farm management personnel the necessary time

necessary time to plan the on-farm elements of their courses, and to initiate limited research activities. All of the above should be started no later than September 1985, and be well under-way prior to the arrival of students on the farm in September 1986.

The Preliminary Technical Analysis (Annex I of the SPID) concludes that, starting from ground zero, approximately 2 years will be required for the development of the farm. Considering CID's experience in Yemen under the Horticulture and Poultry projects, this is a very realistic conclusion. The illustrative schedule for farm development is as follows:

Design/Mobilization Phase	01/83	First participant initiates training in U.S.
		Farm site surveyed
		Farm lay-out completed
		Contractor selected
		Temporary fence installed
		Sub-contracts signed
		Land leveled/graded
		On-farm roads completed
		Permanent fence installed
		Farm building designs completed
		Faculty of Agriculture Subproject authorized
		Grant Agreement signed
Construction Phase		CPs to Disbursement Met
		Initiate bidding for construction of farm buildin
		Construction contract signed
		Construction initiated
		U.S. farm equipment/commodities ordered
		Farm utilities and construction completed
		Access road completed, farm staffing completed;
		local equipment/supplies ordered
		All equipment and supplies ordered/installed
Establishment Phase	9/85	Begin farm operations
Implementation Phase	9/86	Farm used for student instruction

124

In order to meet this schedule, USAID/Yemen requests authorization of up to $664,000 for a project mobilization phase, beginning as soon as possible following SPID approval. Mobilization activities will be limited to site preparation at the instructional farm. A budget is included as an attachment to this memorandum.

Should this request be disapproved, the instructional farm would not be completed by September 1985, and, most likely, will not have had sufficient time to become operational by September 1986 when the second year students arrive on the FOA campus. Moreover, the faculty members will not have the necessary time to become familiar with the farm before starting classes in September 1986. This would lead to an untenable situation in which a significant portion of the training for the first group of students is void of practical experiences on campus. The vacation practicums could possibly off-set this undesirable situation to some extent. However, even student performance in these field practicums would most likely be marginal without the critical on-campus experience that an instructional farm could provide. A further important consideration in this regard is the possibility of establishing a precedent of having a first class which, in effect, misses a large and necessary part of the curriculum. Successive classes may expect similar treatment.

A. Engineering Analysis

1. Budget and Preliminary Engineering

The budget for the mobilization phase of the instructional farm has been based on the study by Vermocil et al. A number of the estimates were spot-checked by referring to their worksheets which are available at CID/Sana'a, and by using other available information. The study cost estimates have been escalated to the time of anticipated construction by using an inflation factor of ten percent, and are considered to be reasonably firm.

The technical information in the draft study is sufficient to proceed with the design of the eight farm buildings, the layout and design of the farm plots, the fencing, the gravel roads, and the on-farm water distribution system.

2. Preconstruction Activities

It is anticipated that the proposed mobilization expenditures will be authorized at the same time this SPID is approved.

The Core Subproject's agricultural engineer at the CID office at Sana'a will then prepare a topographical survey of the area for the proposed instructional farm, with the help of a local survey crew. The survey data will be submitted to CID offices at Oregon State University where CID agronomists and engineers will lay out the farm plots, and prepare specifications for leveling, grading, roads, and for the purchase

of fencing and other equipment. They will also prepare scopes of work and contract documents for the mobilization construction contract and requests for proposals for the architectural-engineering contract for the design of the buildings.

Because of the small amounts of money involved in construction and design contracts, it is unlikely that any U.S. firms would be interested in competing for this work. Therefore, it is expected that CID/Sana'a, as the expected prime contractor for the FOA subproject, will ask for competitive bids from Yemeni contractors for the farm development, which will include leveling, grading, fencing, on-farm roads, and water systems. CID/Yemen will also request proposals from Yemeni architectural and engineering firms for the design and joint supervision (with the Core Subproject agricultural engineer) of the eight buildings. (See Annex J of the SPID) It is expected that contracts can be awarded in June 1983. USAID/Yemen will review and approve the contracting and selection procedures, and the contract awards.

Because of the relatively simple construction involved, it is expected that the Core Subproject agricultural engineer, with the assistance of a Yemeni engineer, can supervise the implementation of the mobilization activities. The proposed implementation schedule and cost estimates appear reasonable and realistic.

B. Precommitment of AID Support

USAID/Yemen believes that funding limited mobilization or pre-authorization activities does not pre-commit AID to funding proposed long-term assistance to the FOA. This point has been discussed openly with YARG officials in the Central Planning Office and the University of Sana'a. AID funding of longer term assistance must be based upon careful examination of the merits of the project , and cannot be pre-judged prior to the development and review of a Subproject Paper. This position will be reiterated to the YARG upon approval of this request for project mobilization funding.

USAID/Yemen further concludes that the assistance proposed under the mobilization phase will positively impact upon the Yemen agriculture sector development even if AID decides to assist the YARG in a development program which excludes the FOA. The YARG has decided conclusively that establishing an FOA is a top priority.

AID assistance to develop the farm should be beneficial to the overall 052 Program (even if there never is a Faculty of Agriculture Subproject) because:

1. It will provide an opportunity for AID involvement in the FOA through the integration of the farm into the curriculum;

2. The instruction and demonstration activities on the farm can link directly with, and support other AID/CID initiatives in horticulture, poultry, and on-farm water management;

3. The FOA farm will be a highly visible symbol of U.S. government assistance to Yemen; and

4. Early visible development of the FOA farm should positively influence other donors to commit funds for construction of the faculty buildings.

RECOMMENDATION: In order to achieve a timely and relatively smooth development of the Faculty of Agriculture in cooperation with other donors, and to avoid the possibility of initiating instruction without the critical, on-campus, practical experiences that an instructional farm can provide, USAID/Yemen strongly recommends that the budget for the Core Subproject be increased by $664,000 for mobilization activities for the proposed Faculty of Agriculture Subproject.

APPROVED: _____

DISAPPROVED: _____

DATE: _____

Attachment: Budget

ATTACHMENT

Pre-Subproject Authorization Budget

1.	Instructional Farm Development	$ 550,000
	A and E Design	40,000
	Development Costs (surveying, leveling, grading, road construction)	265,000
	Perimeter Fencing	105,000
	On-Farm Water Distribution System	140,000
2.	Technical Assistance	73,175
	CID Project Director 9 mo @ 1/2 time @ $45,000 p.a.	16,875
	CID Technical Advisory Committee 4 persons for 30 days @ $220/day	26,400
	Fringe Benefits (30% of salaries)	13,000
	Overhead @ 30%	16,900
3.	Travel	8,150
	Two round-trip, OSU-Sana'a @ $2,500	5,000
	Per Diem 30 days @ $105	3,150
	SUBTOTAL	$ 631,325
	Contingency (5%) and rounding	32,675
	TOTAL	$ 664,000

278

TELEGRAM FROM SECSTATE WASHDC, Unclassified
To Amembassy Sanaa, Priority 2315
BT

December 1982
P020522Z

Unclas STATE 335329
AIDAC
E.O. 2356: N/A
TAGS:
Subject: Parallel Financing - Yemen
Ref: (A) Ward - Desk Telecons of 11/29 and 11/30, (B) STATE 331718

FOR: Director Ward

1. AID/W agrees with Ward rationale discussed Ref A that Prefeasibility Study for Faculty of Agriculture construction should be viewed as a Pre-PID/PP activity financed from Core and that it should be conducted simultaneously with the PID design for the technical assistance component schedule for January.

2. We wish to clarify one point with respect to Ref B. Faculty of Agriculture construction itself should be treated as complete project (i.e. A and E, construction supervision, and construction) for which standard AID project design documentation will be required (i.e. PID, PP). Although another donor will play the major role in financing this project, AID paper will provide rationale and implementation plan for entire activity. Relevant issues should be identified during development of the PID. For the moment, however, we concur with mission's desire to get moving on prefeasibility study to lay groundwork for further design activity.

3. As soon as we receive PIO/T with Scope of Work, we will begin to line up consultant for projected January visit. AID/W welcomes USAID comments/views on Ref B and this message and an indication of how you intend to proceed with this activity. DAM
BT

Unclassified

TELEGRAM FROM AMEMBASSY SANAA, Unclassified February 1983
Action: SecState WashDC, Immediate 0R050700Z
Info: Amembassy Amman
Unclas Sanaa 0800
AIDAC
AID/W for NE/NENA/Y, C. Weden
Amman for RLA O'Donnell
Subject: Agricultural Development Support Project 279-0052; Faculty of Agriculture Component
Ref: (A) 82 STATE 331718, (B) 82 STATE 335329

1. Mission held detailed review on February one of overall strategy with CID personnel and with participation of Regional Legal Advisor. We came out as follows:

a. The Faculty of Agriculture (FOA) Subproject under 052 is clearly an integrated one to include, necessaryily, both construction elements and a CID technical assistance component. Neither make sense without the other and the Subproject paper for institutional development cannot, therefore, ignore the need for integration, nor can it leave open to serious doubt the possibility that the construction money might not be forthcoming.

b. It is not our intention, certainly, that AID fund the significant construction costs which will be involved (probably in magnitude of dols twenty million). However, in addition to funding the TA and other institutional inputs, a very appropriate and effective AID contribution toward the necessary administration/classroom/laboratory building construction components would be A&E package to consist of: (A) preliminary engineering study, (B) final design and (C) construction supervision. Item A of this package is, of course, well underway, following contract execution in January, with the draft report due in early March and the final report a month or so later. Item B, with an estimated cost, we understand, of perhaps dols 750,000, could get underway sometime this summer - i.e. once the report, drawings, etc., are in hand from the preliminary study. Prompt movement on Item B is especially attractive to us in terms of early implementation of the construction component, once funds are secured for the latter. Funding for Item B can logically come from funds already obligated under the 052 Core Subproject, just as did the funding for Item A, since design and similar costs are clearly eligible under Amendment III to the 052 Grant Agreement. Note that Annex One to that Amendment specifically envisions the use of Core funds for, inter alia, the identification and design of Subprojects, mobilization of resources, seeing to implementation arrangement, etc. While A/E services were not per SE S specifically envisioned under that Annex One, they were certainly not precluded; and, furthermore, we have the recent analogy and precedent of the funding of the preliminary A/E study from the same Core Subproject.

c. Funding of construction supervision services are a different matter. These, we believe, can and should properly be funded under the substantive subproject - FOA - to which they are directly attributable and as part of a total FOA package to include, in addition to construction supervision:

- AID funding of TA, training, lab equipment, development of teaching farm and related items; and
- Firmly assured other donor funding of all construction and related costs other than construction supervision (see below).

250

2. We propose that our PID for the FOA Subproject be based on the thinking outlined above. The results of the preliminary A/E study will be incorporated into the PID - which in its current form addresses only institutional development - thus yielding an integrated document and coordinated presentation. (We intend to request engineering and legal participation in this PID rewrite.) For PP/Design purposes, the results of the preliminary A/E study, which will provide preliminary drawings, a construction schedule and other relevant details, should certainly satisfy all 611(A) and other planning requirements even if (as is not the case) AID would be funding the construction costs. Also, concurrently with development and processing of our FOA Subproject paper, the YARG would be seriously seeking firm commitments from other donors RE the construction costs for the Admin/Classroom/Laboratory complex. Before obligation of any AID funds toward the FOA Subproject (other than limited pre-authorization expenditures to be requested in the PID), AID would insist on reasonably firm assurances that all necessary construction funds would be in hand on a schedule and on terms compatible with the AID-funded institutional assistance and construction supervision for FOA. As is the usual AID practice, a condition precendent to disbursement of our FOA funds would be firm documentary evidence RE this other donor construction contribution. Assuming FOA Subproject approval and funding, CID would of course remain the TA contractor, whereas the construction supervision contractor (and for that matter, the A/E design contractor to be funded under Core) would be chosen competitively. Both these latter contractors would be expected to coordinate with, but not be responsible to, CID.

3. We believe the scenario outlined above represents the most prudent and attractive way for AID to proceed with FOA development. A modest investment under the Core Subproject for the A/E design services - and, granted, the slight risk that this investment will not pay off if the YARG ultimately cannot find funding for the construction costs - seems amply justified by the high probability, based on recent YARG assurances, the construction funds will in fact be found from other donors, and by the compelling agrument that the software alone for the FOA would be a grossly imcomplete project for AID to finance. The FOA project paper therefore would include appropriately detailed treatment of the construction component, drawing on the preliminary A/E study for the purpose.

4. In sum, we find ourselves in basic agreement with what we take to be the substance and intention of REFTELS. The FOA should be viewed as a complete project and analyzed and packaged accordingly. Other donor funding will be a potential issue, but would be resolved before authorization/obligation. The only area where the above analysis seems to depart from REFTELS concerns the source of funding and procedures for financing of (1) A/E final design and (2) construction supervision. The former, as we see it, would come from already obligated Core funds; the latter would come from new FOA Subproject funds and PID/PP/CN procedures would pertain only to the latter. Finally, we agree fully with the view expressed in Para two Ref A that we be clearly on record with the YARG that no binding commitments are implied with respect to our ultimately funding the FOA Subproject by our funding A/E services (whether preliminary or final design) under Core, or by our proceeding with the PID/PP process RE the FOA. Further, such a discussion with the YARG will be an excellent opportunity to underscore the criticality of the YARG's identifying early on the necessary construction donor or donors.

231

5. Taking into account Ramadan, which begins on or about June 12, 1983, we see a schedule for PID/PP development and submission roughly as follows:

February 15 - CID completes internal review in Tucson of institutional component of PID.

March 1 - Mission receives both draft A/E preliminary report and draft PID as vetted by CID.

April 1 - Mission submits to AID/W revised and integrated PID, as explained above.

April 15 - Receipt of final preliminary A/E report

June 1 - PID approval, PP design team recruited

June 12 - Ramadan begins

August 1 - Contract signed for A/E design work

August 1 - PP design commences

October 1 - PP submitted to AID/W

December 1 - Funds obligated.

6. Will appreciate early concurrence or other views RE strategy proposed above. Please advise.

ZWEIFEL

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232

24 MARCH 1983

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ADM AID

SUBJECT: AGRICULTURAL DEVELOPMENT SUPPORT PROJECT 279-0052. FACULTY OF AGRICULTURE DRAFT PREFEASIBILITY REPORT AND A&E SCOPE OF WORK.

1. MISSION DIRECTOR WARD PLUS REPRESENTATIVES OF NE/TECH/AD:COBB, MORROW, HOGAN; NE/NENA:CROWLEY; NE/PD/ENGR:WEISS MET WITH MORRIS MARCH 10 TO REVIEW WORK CURRENTLY UNDERWAY ON SUBJECT REPORTS.

2. INITIAL REACTION OF GROUP WAS QUITE FAVORABLE. IN ORDER TO ACCELERATE RESPONSE FROM MISSION, TWO INITIAL COPIES WERE HANDCARRIED TO FIELD PAST WEEKEND. VIA POUCH WE HAVE FORWARDED IN ADDITION, 17 ARABIC COPIES EACH OF THE PREFEASIBILITY REPORT AND THE A&E SCOPE OF WORK, 4 ENGLISH COPIES OF THE PREFEASIBILITY REPORT AND 3 ENGLISH COPIES OF THE A&E SCOPE OF WORK. PLEASE REVIEW THESE DOCUMENTS - WITH THE APPROPRIATE YARG OFFICIALS - AND FORWARD COMMENTS OF MISSION AND YARG SOONEST. SUGGEST MISSION AND YARG COMMENTS BE INCORPORATED INTO FINAL A&E PREFEASIBILITY REPORT WHICH THEN CAN BE REVIEWED ALONG WITH FOA SPID.

3. OBSERVATIONS OF THE AID/W REVIEW GROUP AS GIVEN TO THE ARCHITECT WERE THE FOLLOWING:

....A. PREFEASIBILITY REPORT: FRONT PAGE AS WELL AS INNER PAGE AND INTRODUCTION SHOULD DOWNPLAY ROLE OF AID IN PREPARATION OF REPORT SINCE FINAL REPORT IS TO BE UTILIZED BY YARG TO SECURE FINANCING FROM OTHER DONORS.

....B. A&E SCOPE OF WORK: THE CONTRACTOR WAS ASKED TO DIVIDE THE A&E WORK SEE PP 14 OF THE SCOPE OF WORK, INTO THE FOLLOWING THREE PHASES:

.....PHASE 1 - PROGRAM OF REQUIREMENTS	$43,000
.....SITE INVENTORY	25,000
.....SCHEMATIC DESIGN	242,000
.....TOTAL	$310,000
.....PHASE 2 - DESIGN DEVELOPMENT	$323,000
.....CONTRACT DOCUMENTS	630,000
.....TOTAL...	$953,000
.....PHASE 3 - BID ANALYSIS	$ 80,000
.....CONSTRUCTION SUPERVISION	444,000
.....TOTAL...	$524,000

233

THIS PHASING PROVIDES A LOGICAL BREAKDOWN OF COMPONENTS. PHASE 1 COULD BE FINANCED BY CORE ONCE PRELIMINARY A&E WORK IS APPROVED. PHASES 2 AND 3 WOULD BE DEFERRED UNTIL OTHER DONOR FUNDS FOR THE CONSTRUCTION HAVE BEEN SECURED. PHASE 2 AND 3 COSTS COULD BE INCLUDED AS PART OF THE FOA PROJECT PAPER.

....C. COLOR SCHEME: THE ARCHITECT WILL PROVIDE COLOR IN THE FINAL REPORT. THIS WILL CONSIST OF TWO COLORS FOR THE LAYOUT OF THE FOA COMPLEX AS IS CURRENTLY OUTLINED ON FRONT OF THE PREFEASIBILITY REPORT AND AT OTHER STRATEGIC AREAS IN THAT REPORT. WARD HAND CARRYING SAMPLE OF COLOR LAYOUT. SHULTZ

234

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235

ANNEX M

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237