PERFORMANCE AUDIT REPORT

YEMEN ARAB REPUBLIC
AGRICULTURAL RESEARCH AND DEVELOPMENT PROJECT (CREDIT 1259-YAR)

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN
AGRICULTURAL RESEARCH AND EXTENSION PROJECT (CREDIT 1557-YDR)

April 19, 1996
Currency Equivalents

**Former Yemen Arab Republic**
(Credit 1259-YAR)

<table>
<thead>
<tr>
<th>Currency Unit:</th>
<th>Yemeni Rials (YR)</th>
<th>Currency Unit:</th>
<th>Yemeni Dinars (YD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appraisal (Oct/Nov 1981)</td>
<td>US$1.00 = YR 4.50</td>
<td>Appraisal (Mar/Apr 1984)</td>
<td>US$1.00 = YD0.343</td>
</tr>
<tr>
<td>1983</td>
<td>US$1.00 = YR 4.67</td>
<td>1991</td>
<td>US$1.00 = YD0.417</td>
</tr>
<tr>
<td>1986</td>
<td>US$1.00 = YR12.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td>US$1.00 = YR 9.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>US$1.00 = YR12.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Republic of Yemen**

Currency Unit: Yemeni Rials (YR)

| 1991 | US$1.00 = YR12.01 |
| 1995 | US$1.00 = YR50.00 |

Weights and Measures

metric system

Abbreviations and Acronyms

- **ACU**: Agricultural Communications Unit
- **ARA**: Agricultural Research Authority
- **ARDP**: Agricultural Research and Development Project
- **AREA**: Agricultural Research and Extension Authority
- **AREP**: Agricultural Research and Extension Project
- **ASMSP**: Agricultural Sector Management Support Project
- **DCA**: Development Credit Agreement
- **DG**: Director General
- **DRE**: Department of Research and Extension
- **ERR**: Economic Rate of Return
- **FAO**: Food and Agriculture Organization of the United Nations
- **GDP**: Gross Domestic Product
- **GOI**: Government of Italy
- **ICARDA**: International Center for Agricultural Research in Dry Areas
- **IDA**: International Development Association
- **IFAD**: International Fund for Agricultural Development
- **JATC**: Jaar Agricultural Training Center
- **MAAR**: Ministry of Agriculture and Agrarian Reform
- **MAWR**: Ministry of Agriculture and Water Resources
- **MDRT**: Multi-Disciplinary Research Team
- **MOE**: Ministry of Education
- **NARC**: National Agricultural Research Council
- **NAREC**: National Agricultural Research and Extension Council
- **NARS**: National Agricultural Research System
- **ODA**: Overseas Development Administration
- **OED**: Operations Evaluation Department
- **PAR**: Performance Audit Report
- **PCR**: Project Completion Report
- **PDRY**: People's Democratic Republic of the Yemen
- **PIU**: Project Implementation Unit
- **PPF**: Pre-Project Financing
- **RCC**: Research Coordination Committee
- **RDA**: Regional Development Authority
- **ROY**: Republic of Yemen
- **SAR**: Staff Appraisal Report
- **SMS**: Subject Matter Specialist
- **T&V**: Training and Visit
- **UNDP**: United Nations Development Program
- **VEA**: Village Extension Agent
- **YAR**: Yemen Arab Republic
MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Performance Audit Report on Yemen
Agricultural Research and Development Project (Credit 1259-YAR)
Agricultural Research and Extension Project (Credit 1557-YDR)

Attached is the Performance Audit Report on two agricultural projects in Yemen, Agricultural Research and Development project (ARDP) and Agricultural Research and Extension project (AREP), prepared by the Operations Evaluation Department. ARDP was supported by a credit for US$6 million equivalent to the former Yemen Arab Republic (YAR) approved in FY82 and AREP by a credit for US$5 million equivalent to the former People's Democratic Republic of the Yemen (PDRY) approved in FY85. Both credits were closed in FY92, Cr. 1259-YAR three and a half years behind schedule and Cr. 1557-YDR twelve months behind schedule. The two projects were merged in 1990 when YAR and PDRY were united to establish the Republic of Yemen (ROY). ARDP was co-financed by a loan from the International Fund for Agricultural Development (IFAD) and a loan and grant from the Government of Italy.

The objective of ARDP was to develop a viable national agricultural research and development organization for the former YAR. It was designed as Phase III of a long-term program following earlier support provided by the United Nations Development Program (UNDP), the World Bank and bilateral donors. The project provided support for the development of the new national research organization, including central offices and laboratories, regional research and extension centers. Support was provided for civil works, equipment, vehicles, library materials, technical assistance, training and incremental operating costs. While the overall design of the project was appropriate for its objective, it was too ambitious and did not sufficiently recognize the difficulties of establishing a viable semi-autonomous research authority in a country with little experience in management and a small commercial sector. The selection of a “greenfield” site, many miles from decision-makers in the capital, for the new research headquarters was risky and was compounded by the use of parallel tied-aid financing for house construction.

ARDP was well managed by the borrower and the Bank and most of the project objectives were achieved within budget. Technologies were developed and transferred to farmers. However, the problems of unification have been much longer-lived than expected and the new research organization has lost much of its autonomy and its research activity is constrained by over-staffing and under-funding. At audit, the national research organization was not viable and was generating little new technology despite further support being provided by a follow-on project.
The outcome of ARDP is rated as unsatisfactory, with modest institutional development and uncertain sustainability. This downgrades all the ratings assigned when the Project Completion Report was reviewed in 1993 and rated with a satisfactory outcome, substantial institutional development and likely sustainability. No comments have been received from the borrower or from the co-financiers on the audit findings.

Lessons that can be drawn from this project include: (i) support for research system development must take careful account of the borrower’s abilities to sustain investments that increase capacity, and the scale and scope of the intervention should be scaled accordingly; (ii) the development of a skilled scientific capacity to borrow, screen and adapt technology is generally the right choice for countries with comparatively small agricultural sectors; (iii) effective research requires that managerial control of staffing and budget allocation be delegated to managers in the research system; and (iv) a modest well-qualified staff in finance and administration is as important as well-qualified scientists, particularly when the major objective of the project is the development of a viable, semi-autonomous national research authority.

The objective of AREP was to strengthen national research and extension services in the former PDRY. The project involved the reorganization of agricultural research and extension services and the strengthening of the existing Agricultural Communications Unit (ACU). It provided vehicles and equipment, short-term staff training, long- and short-term technical assistance and limited civil works. The project was of an appropriate scale and design for the needs of the agricultural sector.

AREP was generally well managed by the borrower and the Bank although implementation was disrupted at times by civil unrest. The comparatively small civil works program was implemented largely as planned, equipment and vehicles were procured albeit slowly, and the technical assistance and training program proceeded as expected. AREP had significantly strengthened the capability of the research, extension and communications services in south Yemen and at audit there was some activity in the field despite a very constrained budget.

The outcome of AREP is rated as satisfactory, with substantial institutional development and uncertain sustainability. These ratings are in agreement with those assigned by the Project Completion Report with the exception of sustainability which had been earlier rated as likely.

Lessons that can be learned from this project include: (i) the purchase, installation, use and maintenance of scientific equipment are skilled tasks for which it may be necessary to provide technical assistance and training support throughout the life of a project; (ii) mass communication is an effective medium of technology transfer given a steady flow of tested and appropriate technologies; and (iii) the T&V methodology of extension proved appropriate for the former PDRY with its comparatively uniform farming environment, well-qualified field agents and specialist staff and steady flow of useful technology.

Attachment
This report was prepared by Mr. Andrew Spurling (Task Manager) who audited the project in October 1995. Ms. Silvana Valle and Ms. Megan Kimball provided administrative support.
Annexes

A. Related Bank Loans and/or IDA Credits ................................................................. 49
B. Project Results—Agricultural Research and Development Project
   (Credit 1259-YAR) ......................................................................................... 51
C. Project Results—Agricultural Research and Extension Project
   (Credit 1557-YDR) ......................................................................................... 53
   i. Recurrent Budget, AREA, 1994 .................................................................. 57
F. AREA Permanent Staff (1995) ............................................................................ 59
Preface

The Bank has provided the Republic of Yemen with assistance for rural development and national agricultural services since 1973. This is a Performance Audit Report (PAR) on the Agricultural Research and Development Project (ARDP) in the former Yemen Arab Republic (now north Yemen) and the Agricultural Research and Extension Project (AREP) in the former People's Democratic Republic of Yemen (now south Yemen). ARDP was funded by IDA with a Credit for SDR5.4 million approved in June 1982 and cofinanced by the International Fund for Agricultural Development (IFAD) with a loan of SDR5.25 million and by the Government of Italy with a loan of US$8.0 million equivalent and a grant of US$0.9 million equivalent. AREP was funded by IDA with a Credit for SDR5.1 million approved in March, 1985. Both ARDP and AREP were closed in December 1991, three and a half years, and twelve months behind schedule respectively. There is a follow-on Agricultural Sector Management Support Project (ASMSP, Credit 2299-YEM) funded by IDA with a Credit for SDR10.8 million approved in September, 1991 and the Government of the Netherlands with a parallel finance grant of US$3 million equivalent.

The PAR is based on Project Completion Reports (PCRs) for the two projects, Staff Appraisal Reports, credit documents, project files, and discussions with Bank staff in Washington, D.C. and in the Resident Mission in Sana'a and with project staff in Yemen. An OED mission visited Yemen in October 1995 and reviewed the projects in the field with staff of the Agricultural Research and Extension Authority (AREA) and regional development authorities. The mission later visited Rome for discussions with the cofinancers and with the Food and Agriculture Organization of the United Nations (FAO), which was responsible for managing the technical assistance components of both projects.

The PCRs are of good quality and provide a full assessment of the implementation of the two projects, including the performance of the Bank and the Borrowers. The PAR examines the results of the projects as designed and considers the sustainability of the increased capacity created.

Following standard OED procedures, copies of the draft PAR were sent for comment to the Government of the Republic of Yemen, the Government of Italy and the International Fund for Agricultural Development. No comments were received.

Basic Data Sheet

AGRICULTURAL RESEARCH AND DEVELOPMENT PROJECT
(CREDIT 1259-YAR)

Key Project Data (amounts in US$ million)

<table>
<thead>
<tr>
<th>Item</th>
<th>Appraisal estimate</th>
<th>Actual</th>
<th>Actual as % of appraisal estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Project Cost</td>
<td>32.40</td>
<td>29.50</td>
<td>91</td>
</tr>
<tr>
<td>Credit Amount</td>
<td>6.00</td>
<td>6.07</td>
<td>101</td>
</tr>
<tr>
<td>Cofinancing</td>
<td>14.40</td>
<td>11.70</td>
<td>81</td>
</tr>
<tr>
<td>Economic Rate of Return (%)</td>
<td>N/A</td>
<td>N/A</td>
<td>-</td>
</tr>
</tbody>
</table>

Cumulative Estimated and Actual Disbursements (amounts in US$ million)

<table>
<thead>
<tr>
<th></th>
<th>FY 83</th>
<th>FY 84</th>
<th>FY 85</th>
<th>FY 86</th>
<th>FY 87</th>
<th>FY 88</th>
<th>FY 89</th>
<th>FY 90</th>
<th>FY 91</th>
<th>FY 92</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appraisal Estimate</td>
<td>0.70</td>
<td>1.70</td>
<td>3.00</td>
<td>4.80</td>
<td>5.80</td>
<td>6.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual¹</td>
<td>-</td>
<td>0.95</td>
<td>3.07</td>
<td>3.81</td>
<td>3.93</td>
<td>4.10</td>
<td>4.50</td>
<td>4.81</td>
<td>5.44</td>
<td>6.07</td>
</tr>
<tr>
<td>Actual as % of Appraisal</td>
<td>Nil</td>
<td>56</td>
<td>102</td>
<td>79</td>
<td>68</td>
<td>68</td>
<td>75</td>
<td>80</td>
<td>91</td>
<td>101</td>
</tr>
</tbody>
</table>

Project Dates

<table>
<thead>
<tr>
<th>Date planned</th>
<th>Date Revised</th>
<th>Date actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification</td>
<td>May 1980</td>
<td></td>
</tr>
<tr>
<td>Preparation</td>
<td>August 1981</td>
<td>August 1981</td>
</tr>
<tr>
<td>Appraisal</td>
<td></td>
<td>October, November 1981</td>
</tr>
<tr>
<td>Negotiation</td>
<td>April 1982</td>
<td></td>
</tr>
<tr>
<td>Board Approval</td>
<td>June 1982</td>
<td>June 1982</td>
</tr>
<tr>
<td>Credit Signing</td>
<td>August 1982</td>
<td></td>
</tr>
<tr>
<td>Credit Effectiveness</td>
<td>November 1982</td>
<td>November 1983b</td>
</tr>
<tr>
<td>Project Completion</td>
<td>June 1988</td>
<td>December 1991</td>
</tr>
<tr>
<td>Credit Closing²</td>
<td>April 1992</td>
<td></td>
</tr>
</tbody>
</table>

¹. Eventual higher actual disbursement in US dollar terms than estimated at appraisal was possible because of depreciation of the US dollar against the SDR.
². Following four postponements.
³. Project closing extended four times.
## Staff Inputs (staff weeks)

<table>
<thead>
<tr>
<th>Year</th>
<th>FY81</th>
<th>FY82</th>
<th>FY83</th>
<th>FY84</th>
<th>FY85</th>
<th>FY86</th>
<th>FY87</th>
<th>FY88</th>
<th>FY89</th>
<th>FY90</th>
<th>FY91</th>
<th>FY92</th>
<th>FY93</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification/Preparation</td>
<td>2.0</td>
<td>7.0</td>
<td>0.3</td>
<td>1.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.1</td>
</tr>
<tr>
<td>Appraisal</td>
<td>8.4</td>
<td>34.9</td>
<td>5.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>48.9</td>
</tr>
<tr>
<td>Negotiations</td>
<td>3.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.3</td>
</tr>
<tr>
<td>Supervision</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Completion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10.4</td>
<td>45.9</td>
<td>10.9</td>
<td>12.7</td>
<td>11.1</td>
<td>8.2</td>
<td>10.0</td>
<td>11.0</td>
<td>9.4</td>
<td>7.0</td>
<td>11.6</td>
<td>12.0</td>
<td>9.3</td>
<td>169.5</td>
</tr>
</tbody>
</table>

## Mission Data

<table>
<thead>
<tr>
<th>Month/year</th>
<th>No of persons</th>
<th>Staff weeks</th>
<th>Specialization</th>
<th>Performance rating</th>
<th>Type of problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appraisal</td>
<td>10/81</td>
<td>4</td>
<td>5</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 1</td>
<td>08/83</td>
<td>2</td>
<td>2</td>
<td>Ag, Liv Sp</td>
<td>1</td>
</tr>
<tr>
<td>Supervision 2</td>
<td>02/84</td>
<td>1</td>
<td>1</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 3</td>
<td>11/84</td>
<td>1</td>
<td>2</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 4</td>
<td>03/85</td>
<td>1</td>
<td>1 1/2</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 5</td>
<td>09/85</td>
<td>2</td>
<td>1 1/2</td>
<td>Ag, Agec</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 6</td>
<td>03/86</td>
<td>1</td>
<td>1</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 7</td>
<td>10/86</td>
<td>1</td>
<td>3</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 8</td>
<td>01/87</td>
<td>1</td>
<td></td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 9</td>
<td>08/87</td>
<td>3</td>
<td>2</td>
<td>Ag, Agec</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 10</td>
<td>11/87</td>
<td>2</td>
<td>1 1/2</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 11</td>
<td>03/88</td>
<td>1</td>
<td>3 1/2</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 12</td>
<td>10/88</td>
<td>2</td>
<td></td>
<td>Agec, C (Ag)</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 13</td>
<td>06/89</td>
<td>1</td>
<td>1</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 14</td>
<td>10/89</td>
<td>3</td>
<td>2</td>
<td>Agec, Ag, Liv Sp</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 15</td>
<td>02/90</td>
<td>1</td>
<td></td>
<td>Agec</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 16</td>
<td>05/90</td>
<td>1</td>
<td>3</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 17</td>
<td>11/90</td>
<td>1</td>
<td></td>
<td>Agec</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 18</td>
<td>07/91</td>
<td>1</td>
<td>3</td>
<td>Ag</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 19</td>
<td>11/91</td>
<td>1</td>
<td>3</td>
<td>Ag</td>
<td>2</td>
</tr>
</tbody>
</table>

## Other Project Data

**Borrower:** Initially Government of Yemen Arab Republic, at completion Government of Republic of Yemen

**Executing Agency:** Ministry of Agriculture and Fisheries at effectiveness, Ministry of Agriculture and Water Resources at completion

**Follow-on Project:** Agricultural Sector Management Support Project (Credit 2299-YEM)

d. Specialization: Ag = agriculturists, Agec = agricultural economist, C = consultant, Liv Sp = livestock specialist

e. Performance rating: 1 = minor problems, 2 = moderate problems, 3 = major problems.

f. Type of problems: C = construction, M = management, P = procurement, O = operational, T = technical
Basic Data Sheet

AGRICULTURAL RESEARCH AND EXTENSION PROJECT
(CREDIT 1557-YEM)

Key Project Data (amounts in US$ million)

<table>
<thead>
<tr>
<th>Item</th>
<th>Appraisal estimate</th>
<th>Actual</th>
<th>Actual as % of appraisal estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Project Cost</td>
<td>7.00</td>
<td>8.13</td>
<td>116</td>
</tr>
<tr>
<td>Credit Amount</td>
<td>5.00</td>
<td>6.50</td>
<td>130</td>
</tr>
<tr>
<td>Economic Rate of Return (%)</td>
<td>N/A</td>
<td>N/A</td>
<td>-</td>
</tr>
</tbody>
</table>

Cumulative Estimated and Actual Disbursements (amounts in SDR million)

<table>
<thead>
<tr>
<th></th>
<th>FY 86</th>
<th>FY 87</th>
<th>FY 88</th>
<th>FY 89</th>
<th>FY 90</th>
<th>FY 91</th>
<th>FY 92</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appraisal Estimate</td>
<td>0.50</td>
<td>1.30</td>
<td>2.30</td>
<td>3.80</td>
<td>4.90</td>
<td>5.10</td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>0.69</td>
<td>1.22</td>
<td>2.00</td>
<td>3.00</td>
<td>4.00</td>
<td>4.67</td>
<td>5.07</td>
</tr>
<tr>
<td>Actual as % of Appraisal</td>
<td>138</td>
<td>94</td>
<td>87</td>
<td>79</td>
<td>82</td>
<td>92</td>
<td>99</td>
</tr>
</tbody>
</table>

Project Dates

<table>
<thead>
<tr>
<th>Date planned</th>
<th>Date actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification</td>
<td>July-August 1983</td>
</tr>
<tr>
<td>Preparation</td>
<td>October-November 1983</td>
</tr>
<tr>
<td>Appraisal</td>
<td>March-April 1983</td>
</tr>
<tr>
<td>Negotiation</td>
<td>N/A</td>
</tr>
<tr>
<td>Board Approval</td>
<td>N/A</td>
</tr>
<tr>
<td>Credit Signing</td>
<td>N/A</td>
</tr>
<tr>
<td>Credit Effectiveness</td>
<td>September 11, 1985</td>
</tr>
<tr>
<td>Project Completion</td>
<td>June 30, 1990</td>
</tr>
<tr>
<td>Credit Closing</td>
<td>December 31, 1990</td>
</tr>
</tbody>
</table>

a. IDA credit was for SDR 5.1 million (about US$ 5.0 million equivalent) at the time of approval depreciation of the US dollar against the SDR enabled US$ 6,501.5 million equivalent to the disbursed within the original Credit amount of SDR 5.1 million.
### Staff Inputs (staff weeks)

<table>
<thead>
<tr>
<th></th>
<th>FY 83</th>
<th>FY 84</th>
<th>FY 85</th>
<th>FY 86</th>
<th>FY 87</th>
<th>FY 88</th>
<th>FY 89</th>
<th>FY 90</th>
<th>FY 91</th>
<th>FY 92</th>
<th>FY 93</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification/Preparation</td>
<td>0.1</td>
<td>0.8</td>
<td>9.7</td>
<td>0.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.4</td>
</tr>
<tr>
<td>Appraisal</td>
<td>101.9</td>
<td>9.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>111.5</td>
</tr>
<tr>
<td>Negotiations</td>
<td>2.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.6</td>
</tr>
<tr>
<td>Supervision</td>
<td>1.2</td>
<td>7.6</td>
<td>10.2</td>
<td>8.1</td>
<td>8.7</td>
<td>10.0</td>
<td>12.9</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
<td>63.2</td>
</tr>
<tr>
<td>Project Completion</td>
<td>2.0</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>191.2</td>
</tr>
</tbody>
</table>

### Mission Data

<table>
<thead>
<tr>
<th>Month/year</th>
<th>No. of persons</th>
<th>Staff days</th>
<th>Specializationb</th>
<th>Performance ratingc</th>
<th>Type of problemsd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification</td>
<td>07/83</td>
<td>2</td>
<td>14</td>
<td>A,R</td>
<td></td>
</tr>
<tr>
<td>Preparation</td>
<td>10/83</td>
<td>5</td>
<td>25</td>
<td>A,R,Ext,E</td>
<td>Ext,FM</td>
</tr>
<tr>
<td>Appraisal</td>
<td>04/84</td>
<td>3</td>
<td>24</td>
<td>Ec,R,Ext</td>
<td></td>
</tr>
<tr>
<td>Board Approval</td>
<td>03/85</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effectiveness</td>
<td>11/85</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervision 1</td>
<td>11/85</td>
<td>2</td>
<td>13</td>
<td>A,Ec</td>
<td>1</td>
</tr>
<tr>
<td>Supervision 2</td>
<td>07/86</td>
<td>2</td>
<td>15</td>
<td>E</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 3</td>
<td>03/87</td>
<td>1</td>
<td>8</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 4</td>
<td>10/87</td>
<td>2</td>
<td>9</td>
<td>E,A</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 5</td>
<td>08/88</td>
<td>3</td>
<td>10</td>
<td>E</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 6</td>
<td>01/89</td>
<td>3</td>
<td>15</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 7</td>
<td>12/89</td>
<td>3</td>
<td>13</td>
<td>E</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 8</td>
<td>07/90</td>
<td>3</td>
<td>6</td>
<td>Ec,F,A</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 9</td>
<td>06/91</td>
<td>3</td>
<td>22</td>
<td>Ec,A,Env,Ac,W</td>
<td>2</td>
</tr>
<tr>
<td>Supervision 10</td>
<td>10/91</td>
<td>1</td>
<td>18</td>
<td>E</td>
<td>2</td>
</tr>
</tbody>
</table>

### Other Project Data

- **Borrower:** Initially Government of People's Democratic Republic of Yemen, at completion
- **Government of Yemen**
- **Executing Agency:** Ministry of Agriculture and Agrarian Reform until May 1990, thereafter, Ministry of Agriculture and Water Resources
- **Follow-on Project:** Agricultural Sector Management Support Project (Credit 2299-YEM)

---

b. Specialization: A = agriculturist, Ac = accountant, Ec = economist, E = engineer, Env = environment specialist, Ext = extension specialist, F = financial analyst, R = research specialist, W = women in development specialist
c. Performance rating: 1 = problem free or minor problem, 2 = moderate problem, 3 = major problem
d. Type of problem: P = procurement, M = management
Evaluation Summary

A tent can be erected only
If there are poles to support it,
And no pole will stand
Unless the pegs are anchored.
Only if the pegs work together with the poles
Will the tent serve those living in it.
Source: al-Afwah al-Awdi
Sheikh of the Madhij tribe, mid-6th Century A.D.

Introduction

1. This Performance Audit Report (PAR) reviews the Agricultural Research and Development Project (ARDP) in the former Yemen Arab Republic (YAR) and the Agricultural Research and Extension Project (AREP) in the former People's Democratic Republic of Yemen (PDRY). The projects under review were approved in FY82 and FY85 respectively and both were closed in FY92. The PAR examines the results of the projects as designed and considers the sustainability of the increased capacity that has been created.

Background

2. The Republic of Yemen (ROY) was established in May 1990, when the capitalist YAR in the north and the socialist PDRY in the south were united. While agricultural production is relatively limited by generally inhospitable natural conditions, output in 1994 contributed 18.8 percent of GDP, provided employment to 1.8 million people and generated more than 50 percent of national food needs.

Objectives

3. The overall objective of the ARDP was the establishment of a viable national agricultural research and development organization in the former YAR. The overall objective of AREP was to strengthen national research and extension services in the former PDRY.

Design

4. The ARDP, approved in June 1982, funded major civil works for a new research headquarters, two regional research centers, extension centers, the purchase of research and farm equipment and vehicles, training and technical assistance, and incremental operating costs for the recruitment of additional staff and the payment of incentive salaries. Project design was ambitious. The project was cofinanced by the International Fund for Agricultural Development (IFAD) and by a parallel Loan and Credit from the Government of Italy (GOI).

5. The AREP, approved in March 1985, involved the reorganization of agricultural research and extension services and the strengthening of the existing Agricultural Communications Unit (ACU). It provided vehicles and equipment, short-term staff training,
long- and short-term technical assistance and limited civil works. The project was of an appropriate scale and design for the needs of the agricultural sector.

Implementation Experience

6. Both projects achieved most of the objectives established at appraisal. However, the development of the research authority in the former YAR was disrupted from the outset by the failure of the Italian contractor to complete the housing construction financed by a tied loan from the Government of Italy (GOI) and, subsequently, by management and financial problems following unification in 1990. Both projects were supervised regularly and all the covenants of the two Credits were complied with. The audit rates the performance of both the Bank and the Borrower(s) as satisfactory.

7. ARDP became effective 12 months later than planned, was extended four times, and closed on December 31, 1991 three and a half years later than originally scheduled. Delays were caused by over-ambitious appraisal targets, delayed procurement of scientific equipment and slow development of the research farms, slow housing construction and implementation problems caused by the process of national unification. Project costs were 91 percent of appraisal estimates.

8. The civil works financed by IDA and IFAD were fully completed and furnished as planned but the staff houses and ancillary buildings financed by GOI have never been completed. As a result, the work of the research authority and regional research centers in the central highlands and tropical lowlands has been less than expected. Much laboratory and research equipment arrived late, some items have proved to be inappropriate, and some have not yet been installed. The Agricultural Research Authority (ARA) library was built and appropriately furnished and provided with a good selection of textbooks and journals.

9. The Food and Agriculture Organization of the United Nations (FAO) successfully managed the ARDP training and technical assistance programs. The availability of scholarships from bilateral donors enabled the output of postgraduate trainees to substantially exceed SAR targets, with 21 fellows receiving PhD and 42 MSc degrees as compared to the 9 and 23 respectively planned. The technical assistance program was successful.

10. ARA was established as planned in 1983 and transformed in 1990 into the Agricultural Research and Extension Authority (AREA) which was given a wider mandate and responsibilities for extension and research in the unified Yemen. Progress with the implementation of the project, including the institutional development of the new research authority, was satisfactory until unification in 1990. Thereafter, the merger of the two research systems and changes in management disrupted development and the output of technology fell away significantly.

11. AREP became effective as scheduled in September 1985 and was closed 12 months later than scheduled in December 1991. Project costs, with 20 percent financed by the Borrower, were 16 percent above SAR estimates. The comparatively small program of civil works was implemented largely as planned, the procurement of vehicles and equipment was slow and some of the research equipment arrived after project closing.
12. FAO managed the AREP training and technical assistance program effectively with 54 national staff benefiting from short-term training courses. The technical assistance support of 96 person months of specialists contributed strongly to the institutional development objectives of AREP.

Outcome

13. Both projects improved the capacity of the responsible public agencies to develop and transfer productivity—increasing technologies to farmers. But, the merging of the administrations and the realignment of the two different economic systems of the former YAR and PDRY in 1990 proved to be much more difficult than envisaged, and the inheritance of many redundant research staff from the south combined with falling budgets has almost paralyzed agricultural research and the audit was concerned by the low research activity. The audit found that the new national research organization (AREA) was not presently viable in a real sense and therefore rates the overall outcome of ARDP as unsatisfactory. On the other hand, the audit found that AREP had significantly strengthened the capability of the research, extension and communication services in south Yemen to such an extent that some activity was evident despite the lack of budget. The audit therefore rates the overall outcome of AREP as satisfactory.

14. A national research authority has been established with a comprehensive country-wide network of reasonably equipped research centers. The quantity and quality of the national research team has been enhanced through the training and technical assistance support provided by the two interventions. A number of technologies developed during the implementation of ARDP and AREP have been adopted by farmers.

15. An adapted Training and Visit (T&V) system of extension was successfully established in the south through AREP and provided an effective mechanism for transferring technologies to the centrally-managed cooperatives and state farms. The comparatively high educational level of subject matter specialists and village extension agents (VEA), the steady flow of useful technology and a supportive communications unit contributed significantly to the effectiveness of the extension system.

16. The institutional development of ARDP is rated as modest since although a potentially effective national research organization has been established, its management at audit was unable to make effective use of its human, organizational and financial resources. The institutional development of AREP is rated as substantial since the intervention has significantly contributed to strengthening the capacity of the research, extension and agricultural communication services to develop and transfer technology to farmers.

Sustainability

17. There was always a danger, which was foreseen during the appraisal process, that the research and extension systems would prove unsustainable. Experience in Yemen demonstrates the reluctance of government to appropriate the funds necessary to sustain new developments created through the investment budget. The PCRs of both projects considered that sustainability was favorable given the satisfactory output of technology and its adoption, although the PCRs did note that special attention would need to be given to ensuring adequate funding for essential recurrent expenditures. Events since project completion have unfortunately led to a steadily
diminishing budget for research programs causing the flow of technology to significantly decline. Extension activities in both the north and south have also been considerably constrained since unification by budget problems. The audit therefore rates the sustainability of both projects as uncertain.

Findings and Lessons Learned

18. The designs of ARDP and AREP were appropriate for the different socio-economic environments of the former YAR and PDRY, although ARDP was too ambitious. Project advisers had recommended that initial support for research in the north should have helped Yemen to develop a capacity for borrowing and adapting technology that had been developed elsewhere rather than establish a comprehensive national system for applied research. This advice was relevant given the inexperience of research management and the newly trained national research scientists. Although a sound institutional base for agricultural research was developed through the two projects, the audit is concerned that this may be dissipated through weak management and inadequate budgetary support.

19. There are lessons for the Bank from the experiences of ARDP and AREP which have wide applicability:

- Support for research system development must take careful account of the capacity of the sector to sustain investments that increase capacity, and plan the scale and scope of the intervention accordingly. It is preferable to economize on scope in order to assure achievement of goals and impact.

- A long-term commitment is required from both the Borrower and the Bank to build a sustainable and viable research capacity, particularly when national capacity is initially weak. Support for the hardware of research, buildings and equipment, must always be complemented with assistance for software elements, such as management and implementation of research.

- Effective research requires that research managers control staffing and budget allocation.

- Important objectives, for example the establishment of a permanent financing mechanism for adaptive research, should always be supported by specific project actions or components, in this example the development of contractual research arrangements between the beneficiaries and the research organization.

- A modest well-qualified staff in finance and administration is as important as well-qualified scientists, particularly when the major objective of the project is the development of a viable, semi-autonomous national research authority. Training may therefore be necessary in finance and administration as well as in scientific subjects.

- Parallel financing and tied-aid provided for critical inputs such as specialist technical assistance and key buildings, can entail risks to the success of the whole operation when delivery is delayed. Tied-aid financing should not be used to finance a
component for which the Borrower has a strong national capacity, i.e. building houses in Yemen.

- The purchase, installation, use and maintenance of scientific equipment are skilled tasks for which it may be necessary to provide technical assistance and training support throughout the life of the project.
1. Background

1.1 The Republic of Yemen (ROY) was established in May 1990, when the Yemen Arab Republic (YAR) in the north and the People’s Democratic Republic of Yemen (PDRY) in the south were united. North and South Yemen, before their unification, differed in two respects: their agricultural resource endowments and their politico-economic systems. The north has a greater area of agricultural land, more water resources and wider climatic variations than the south and the economic system in the north was capitalist in contrast to the socialist command economy of the south. Despite its basic physical, social and institutional infrastructure, social indicators rank Yemen as one of the lowest income countries. South Yemen’s inheritance of mature educational and administrative structures from its colonial period contrasted sharply with the North’s young institutions, formed since 1962 during a period of rapid growth as the country evolved from feudalism into the modern world. This rapid growth increased the pressure on a narrow natural resource base and on a cadre of inexperienced managers.

1.2 Yemen’s agriculture sector (crops, livestock and fisheries) contributed 18.8 percent of GDP in 1994.¹ Sixty percent of the population live in rural areas and some 1.8 million people work and depend directly on agriculture (about 58 percent of the national labor force). The agriculture sector (excluding qat)² is estimated to have grown at 3.7 percent per annum during the 1970s before falling off to 2.2 percent during the following decade as a result of high labor costs (caused by the emigration of labor), an over-valued currency, lack of production inputs and three consecutive years (1981–3) of drought. In the past fifteen years, agricultural production has failed to keep pace with the rising demand for food from a population which has been growing at 3.3 percent per annum. Accordingly, Yemen is only 52 percent food self-sufficient.³ The economy has been in free fall since the end of the civil war in 1994 and unemployment in April 1995 was estimated at 50 percent and annual inflation at 100 percent.⁴ In October 1995, the official exchange rate was Yemeni Riyal (YR) 50 = US$1 whereas the rate on the free market was YR100.

1.3 The approximately 1.3 million hectares (ha) of agricultural land that is cultivated each year, comprises around 320,000 ha of land irrigated from spate flows and groundwater and 1 million ha of rainfed agriculture. Agricultural products (mainly cotton lint and coffee) represent less than one percent of total merchandise exports. In addition to conventional agricultural crops, although not included in the national statistics, qat is estimated to occupy about 80,000 ha and to generate an output of some 280,000 tons with a value added of nearly 1.7 times that from all other agricultural products. Driven by strong domestic demand and high profitability, the cultivation of qat is expanding at the expense of coffee plantations and other crops (Box 1.1).

---

1. Report No. 14029 YEM, Republic of Yemen: Dimensions of Economic Adjustment and Structural Reform, Country Operations Division, Middle East Department, Middle East and North Africa Region, May 17, 1995
2. Qat (Catha edulis) is a perennial shrub, a crop of antiquity, yielding leaves and young shoots which are chewed for their stimulating or hypnotic effect. Its cultivation has become a significant industry in Yemen occupying more than 25 percent of the controlled irrigation area. The crop provides employment for some 500,000 people and generates large incomes. By any measure, it is the most profitable agricultural commodity.
Box 1.1: Qat and Coffee by Salem Shabbazi, 17th Century Poet

A quarrel had begun
Between Coffee and Qat.
Tell us, they challenged me,
Which of us do you prefer.

It was Qat who spoke first:
Choice are my leaves
And precious too.
Proudly my shrub
Raises its head
On Mount Sabor

And it is there
The nightingale will build her nest
And hide her eggs
In crevices
Of ruined walls.
Perched on my branch,
She sweetly sings
Her song at night.

Now it was Coffee’s turn:
I am the early morning glory
Brightening the start of each day.
It is Shazli
To whom I owe my reputation.

Qat interrupted here:
Your fame cannot compare with mine.
No gathering is complete without me.
My little shrub has greater beauty
Than yours. Look at its shining leaves.
Both nobleman and scholar are
My followers, and quick to serve me.

Coffee was quick to counter:
Which of us wears the crown?
Let those decide the question
who drink me every morning.
Let them be our judges.
In Syria and in Rome

I am very much in demand,
And ships are sent to bring me back
From China’s shores and India.

But Qat had this to say:
I cause a festive mood
Because I am the force
That swells the choir’s voices.
People from Ibb to Taiz,
Know poetry and songs
That praise and honour me.
And all over Teman
My name enjoys great fame.

Coffee was not convinced
Empty words!
Let me remind you once again:
The pleasant memory of that cup
Of coffee which marks the beginning
Of every day, it lingers long.
You grow on high, in solitude,
Where no one can disturb your peace.
My fruits are always closely guarded
To keep them safe from thieving hands.

But Qat replied:
Self-praise alone is not the answer.
Show me a man that shuns my leaves
Whose beauty, when the day is over,
Seems only heightened by the dusk.

Shazliyah had these words to say:
Surely one fact speaks in my favor:
A coffee drinker remains sober
And, whether judge or layman, he
Is left without a muddled mind.

But Qat replied:
Much more refined is what
Noble princes partake of me.
Young girls look at me with sweet longing,
Whilst with unwonted gentleness
Restless young men will touch my leaves,
Each according to his manner.

Coffee had the last word:
Let’s put an end to this exchange.
At noon, at night people have qat.
Coffee is special: wedding-guests
Would not enjoy the day without me.

Now came my turn:
You give me equal joy,
I long for both of you.
To each of you I owe
A vote of gratitude.
Yet I extend this praise
To wine, enjoyed with friends.
To comfort, to console
Is my, the poet’s, part.

And now, my worthy friends,
Let’s drink to fellowship,
And let us spend the time
With poetry and songs.

All discord be dismissed.
Thanks be and praise to God.
Lord, grant your Salem peace
And keep him from all ills.
1.4 Except for a few oil rich and island states, Yemen has one of the lowest per capita renewable water supplies in the world; moreover it has the fastest rate of depletion of non-renewable resources and countrywide estimates put annual withdrawals of water at nearly 140 percent of resource renewal.\textsuperscript{5} Groundwater is heavily mined in many areas, with levels in certain aquifers declining by more than seven meters annually and a risk that the water supply for the capital city, Sana’a, will run dry by the year 2008, as presently estimated.

1.5 \textit{Agricultural services.} Formal agricultural research in the north started in 1973 with support from a UNDP/FAO project that established a research station at Taiz and started a research program in the southern uplands region. This was followed in 1974 by the inclusion of a research component in the IDA-supported Tihama I project. Other programs were supported by bilateral assistance.\textsuperscript{6} Coordination and prioritization of agricultural research in the north became possible following the establishment in 1983 of the Agricultural Research Authority (ARA) supported by the Agricultural Research and Development Project funded by IDA, IFAD and Italy. In the south, formal agricultural research was started on long-staple cotton at El Kod in 1955 by the British. After independence in 1967, research activities were extended through the support of UNDP/FAO to cover other crops and a second research center was opened at Seiyun in the Hadramawt in 1972.

1.6 There is no national extension service in ROY; in the north services are provided by the five Regional Development Authorities (RDAs) and in the south by the agricultural offices in the five Governorates. The oversight of extension is the responsibility of the Director General of Agriculture, Extension and Training, Ministry of Agriculture and Water Resources (MAWR). Technical support\textsuperscript{7} for extension is now provided by the Agricultural Research and Extension Authority (AREA), formerly ARA.

1.7 \textit{Universities and agricultural schools.} Both the Universities of Sana’a and Aden have agricultural faculties. The faculty at Sana’a is extensive and modern while that at Aden is smaller and has older facilities. Neither faculty has collaborative links with the research and extension services and constrained resources severely limit their capacity for research. Vocational training in agriculture is sponsored by the Ministry of Education (MOE) and MAWR, but the training provided has lacked focus and has failed to adequately prepare students for productive employment in the agricultural sector.

1.8 \textit{Other research agencies.} Yemen has established links with several of the international agricultural research centers\textsuperscript{8} and participates in several inter-country networks.\textsuperscript{9}

\begin{itemize}
\item \textsuperscript{6} A British project at Risaba (near Dhamar), a Dutch project at Radaa, a German project at Amran, an American project in Sana’a and a Chinese project at Al-Batina.
\item \textsuperscript{7} Counsel on methodology, provision of technical assistance, facilitation of training workshops and, in the future through formal training of extension agents and provision of mass media services.
\item \textsuperscript{8} International Center for Agricultural Research in Dry Areas (ICARDA), Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Asian Vegetable Research Development Center (AVRDC), International Board for Plant Genetic Resources (IBPGR), and Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD).
\item \textsuperscript{9} Sorghum and millet with Egypt, Somalia, Sudan and Syria; oilseeds with Somalia and Sudan; supplementary irrigation and water management with various Arab countries in the Mashraq and Maghreb countries.
\end{itemize}
2. Design and Implementation

Yemen Arab Republic—Agricultural Research and Development Project

Objectives and Design

2.1 The ARDP (Credit 1259-YAR), approved in June 1982, had the overall objective of developing a viable national agricultural research and development organization. It was designed as Phase III of a long-term program following earlier support provided by UNDP, IDA and bilateral donors. The means to achieve this objective were to: (a) establish an organization to manage the existing diffuse and uncoordinated research programs; (b) increase adaptive research; (c) establish a system for the permanent financing of adaptive research; (d) extend adaptive research and extension to the central highlands region; and (e) train and provide incentives for Yemeni research staff.

2.2 The project design included:

- civil works and physical development of a combined research headquarters, central support services and regional research center in the central highlands and a regional research center in the tropical lowlands, including offices, laboratories, ancillary buildings and housing;

- civil works for two extension supervision centers and nine extension centers in the central highlands;

- vehicles and farm equipment including four-wheel drive utility vehicles, pick-ups and farm tractors; general furniture and equipment for furnishing offices and housing; laboratory furniture and equipment;

- library and documentation service for a central library;

- research farm development for the regional research centers in the central highlands and tropical lowlands, including irrigation and access roads;

- technical assistance, including 50 person-years of long-term and 20 person-months of short-term scientific specialists, consulting engineers for the project implementation unit (PIU) and fellowships for 23 MS and 9 PhD degrees;

- incremental operating costs for recruitment of additional Yemeni staff, higher salaries and increased operating costs;

10. Formal agricultural research in the former YAR started in 1973, when UNDP supported a project executed by the Food and Agricultural Organization of the United Nations (FAO). This established an agricultural research station in the southern uplands region and started a research program on key crops. It was followed in 1974 by a research component funded by IDA in the tropical lowlands region (Tihama I project, Credit 0376-YAR). Bilateral assistance also supported various research programs from this time. In 1979, UNDP initiated Phase II of its agricultural research project with IDA as its executing agent and FAO as its sub-contractor for technical assistance and research equipment.
• the establishment of a PIU to assist project management with the development of the research infrastructure and with the procurement of vehicles and equipment;

• provision for an internationally recruited organization to provide the international staff, administer the postgraduate training program overseas, and purchase research equipment.

2.3 The central support services were designed to backstop field research in the regional research centers and included: agricultural economics; soil, water and agricultural chemistry; plant protection; information, training and communication; and a library. These specialized departments and ARA headquarters were to be located at the same location as the regional research center for the central highlands at Dhamar, 75 kms south of the capital, Sana’a.

2.4 Three design weaknesses have negatively affected the outcome and sustainability of the project. First, project design did not provide for graduate training in administration and finance, although the central component of the project was the establishment of a semi-autonomous research authority in a country with little experience of administrative and financial management. Second, it did not provide funding for training in the installation and maintenance of scientific equipment, although there was a lack of such expertise in Yemen. Third, the project design did not include a component to develop a mechanism for the permanent financing of adaptive research. This omission contributed to the uncertainty of a sustainable outcome.

Implementation

2.5 The ARDP became effective in November 1983, 12 months later than planned due to delayed presidential signature of the ordinance establishing the Agricultural Research Authority.11 IDA’s Development Credit Agreement (DCA) and the IFAD Loan were amended after effectiveness in September 1984 in order to accommodate impending difficulties with the tied Italian Credit for civil works for certain sites. Under the amendment, the IDA Credit would finance 85 percent of the total expenditure on civil works for ARA headquarters, the regional research center in Dhamar and extension centers in Mabar; while the IFAD Loan was applied to the laboratories and offices in the new regional center in the southern lowlands. The Italian Loan would then finance the housing and specified ancillary buildings at Dhamar and Surdud.

2.6 After four extensions, the project was closed on December 31, 1991 three and a half years later than originally scheduled. Delays were caused by over-ambitious appraisal targets; delayed procurement of scientific equipment and slow development of the research farms (partially caused by the Gulf war); and implementation problems caused by the process of national unification.12 An unutilized balance of US$286,000 equivalent was canceled when the Credit was closed. Project costs were 91 percent of SAR estimates in US dollar terms, despite the longer than expected implementation period. The “saving” was the unspent residual of the Italian Loan caused by the failure of the Italian contractor to complete staff accommodation and ancillary buildings for the research centers, which meant that though closed the project was incomplete.

11. Law No. 32 of 1983

12. Memorandum of June 21, 1991 from Director, EM3 to Regional Vice President requesting the final Extension of the Closing Date
Photograph 1: Surdud Research Center Planned Development

Photograph 2: Surdud Research Center Unfinished Building
The PCR\(^{15}\) details achievements with the hardware components of the project (Annex B). The civil works financed by IDA and IFAD were 100 percent completed and furnished as planned, but none of the Italian-financed houses at Dhamar and Surdud were completed (Photographs 1 and 2). The audit was advised that the unspent residual of US$2.379 million in the Italian Loan was insufficient to complete the planned house construction. The design of the offices at Surdud has proved satisfactory for the hot conditions of the tropical lowlands, but it might have been more efficient to construct one larger fully-equipped laboratory instead of the three small laboratories. The two extension supervision centers and nine extension centers in the Central Highlands region were completed as planned.

Laboratory and research equipment was procured as planned, although many items arrived very late and some of the more expensive equipment has proved inappropriate. No technicians were made available to assist with the installation of the equipment at Surdud and the audit mission found that some of the equipment had not yet been unpacked and installed (Photograph 4). The audit mission was shown the fume cupboard in the central soils laboratory at Dhamar which had been originally installed against an inside wall. It has now been transferred to an external wall but still cannot be used due to the lack of about US$200 equivalent to complete the exhaust pipe. The new laboratories have never been fully used. The

The vehicles and farm equipment were procured as planned. Similarly, the new ARA library was completed and furnished and 6000 accessions made between 1983 and 1990. Some 1300 textbooks and subscription journals covering a wide range of subjects were procured. Accessions ceased in 1990 and all journal subscriptions have lapsed. The audit considers that the scale and scope of the library was appropriate for an active organization conducting adaptive research, and the follow-on project (Credit 2299-YEM) should have provided further support for continued procurement of journals and textbooks. The librarian was provided with three weeks training in library management at ICARDA and has properly completed classifying the new accessions according to the AGRIS/CARIS system.

Research farms were developed as planned at the regional research centers in Dhamar and Surdud although the latter’s important irrigation network was not finished and ancillary buildings at Dhamar and Surdud remain incomplete due to the bankruptcy of the Italian contractor.
Human Resource Development

2.11 The training program substantially exceeded the SAR targets with some fellows using scholarships from bilateral donors (Table 2.1). FAO, contracted by YAR with funding from IDA and IFAD, efficiently managed the technical assistance and training program. Only three candidates failed to gain their intended degrees (all MSc) and all returned to work in Yemen after graduation. More scientists were given scholarships for postgraduate training than planned and this has contributed to the increasing lack of efficacy of AREA, with the numbers of scientists employed exceeding the capacity of the budget to provide sufficient recurrent funds for research.

Table 2.1: Training Program (Credit 1259-YAR)

<table>
<thead>
<tr>
<th>SAR</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overseas degrees:</td>
<td></td>
</tr>
<tr>
<td>PhD</td>
<td>9</td>
</tr>
<tr>
<td>Msc</td>
<td>23</td>
</tr>
<tr>
<td>Short courses</td>
<td></td>
</tr>
<tr>
<td>Farm Managers</td>
<td>2</td>
</tr>
<tr>
<td>Librarian</td>
<td>1</td>
</tr>
<tr>
<td>Administration</td>
<td>1</td>
</tr>
<tr>
<td>Procurement</td>
<td>1</td>
</tr>
<tr>
<td>Finance</td>
<td>1</td>
</tr>
<tr>
<td>Scientific</td>
<td>4</td>
</tr>
<tr>
<td>Courses at IARCs:</td>
<td>66</td>
</tr>
</tbody>
</table>

Technical Assistance

2.12 The project planned to provide 50 person years of long-term and 20 person-months of short-term technical assistance to assist with on-the-job training, administration of the three research centers and infilling for national staff on training. In the event, the contract between YAR and FAO provided 17 long-term experts (41 person years), two associate experts and 48 person months from 14 short-term consultants (Annex D) and the Italian Government provided eight person years under its tied grant. The FAO-managed technical assistance team, which was coordinated by a Chief Technical Adviser, was based in the field, initially at Taiz and later at Dhamar and Surdud, and provided leadership and in-service training to national staff. International experts were not recruited until a national counterpart had been identified. The team was effectively managed and a number of technologies were produced and extension material prepared. The government expressed the traditional concern about the comparatively high cost of the FAO experts vis-à-vis national scientists. Recruitment of the Italian experts was slow due to the restricted recruitment opportunities of the tied Credit.

2.13 A PIU was established as planned and assisted the management of the Agricultural Research Authority (ARA) with the overall coordination of planning and physical development. Consulting engineers were contracted to design the research buildings and supervise construction of the offices and laboratories funded by IDA and IFAD with funding provided from a Pre-Project Financing Facility (PPF). After project effectiveness, ARA retained one specialist as
chief engineer in its PIU throughout the implementation of the project to supervise construction and assist with procurement.

Institutional Development

2.14 ARA was established in December 1983 following signature of the relevant ordinance by the President. It was initially based at the Taiz research station in the southern uplands, until a new headquarters building was completed at Dhamar in the agriculturally important area of the central highlands. The location of the headquarters and central laboratories of the new parastatal research authority was vigorously debated by national management and donor representatives during project preparation. Finally, the new Director-General (DG) of ARA who was a native of the Dhamar area, swayed the vote and it was decided to build the facilities on a "greenfield" site, 75 km south of Sana’a and 25 km north of the town of Dhamar. This comparatively remote location was justified at project preparation by its central position between Sana’a and Taiz, by its comparative proximity to Surdud and by the importance of the central highlands for crop and livestock production. The audit was advised by the current managers of AREA that this decision was wrong, as it resulted in the separation of research management from decision-makers in central government and from the agricultural faculty of the university. The failure of the Italian contractors to complete the housing at Dhamar has increased the difficulties of developing the new research authority. ARA was re-organized into a comprehensive Agricultural Research and Extension Authority (AREA) on national unification in May 1990.

2.15 The Research Coordination Committee (RCC), comprising the DG of ARA, his two deputies for research and administration and the regional research directors, was established in 1987 and functioned as proposed in the SAR. It was responsible for planning and supervising the annual research program. In 1988, following a review of technical progress in each commodity, a listing of the major constraints confronting farmers and two national workshops, the RCC formulated and published the first National Research Program for the 1987–91 Five-Year Plan.

2.16 The National Agricultural Research Council (NARC) was established as planned in 1986 and comprised ARA management, the commodity research coordinators, and representatives of extension and other organizations, such as the rural development authorities. The NARC held workshops each year in January at which research programs and results were reviewed with Ministry of Agriculture and Fisheries (MAF) and regional development authority (RDA) staff. The NARC was enlarged to the National Agricultural Research and Extension Council (NAREC) following unification.

2.17 No action appears to have been taken during project implementation to establish a mechanism for the permanent financing of adaptive research (para. 2.1) such as RDAs contracting with ARA for the development of specific technologies. The audit found that there was practically no on-farm adaptive research being carried out in 1995, and managers of two RDAs expressed no interest in establishing contracts with ARA (now AREA) for this work.

---


Funding

2.18 The salaries of ARA scientists were increased to match that of the academic staff of Sana’a University in order to provide some incentive for graduate scientists, who were in high national demand, to remain with the authority. The research staff of ARA increased as per project design from 40 national and 31 expatriate scientists in 1983 to 120 national scientists in 1991. ARA administrative and other staff also increased significantly from 23 in 1983 to more than 200 in 1990. The audit was advised by a previous project manager of ARDP that two-thirds of the authority’s recurrent budget was available for the direct operating costs of research programs and indirect overheads of the organization in 1983.\textsuperscript{16} Supervision ratings show that the availability of recurrent finance for the research program became an increasing problem as the project proceeded and the program expanded. The Borrower maintained its allocation of counterpart funds for investment, but the recurrent budget for operating costs became increasingly constrained from 1986 with less than half that estimated as necessary by the project office being made available. Salaries took up 90 percent of AREA’s recurrent budget for 1994 (Annex E), leaving a negligible proportion for research and the indirect overhead costs of the research system.

Bank Supervision

2.19 The project was supervised regularly at six-month intervals, except when civil unrest made this impossible. Review missions were coordinated with those of the cofinanciers and other donors and supervision mission staff always stopped off in Rome when returning to Washington to brief the cofinanciers and FAO. Thus the performance of the Bank is rated as satisfactory. The project did finance research on rainfed agriculture, complementing work financed by ODA on irrigated agriculture, as agreed before project effectiveness, but with insufficient impact\textsuperscript{17} and supervision missions should have pressed management to carry out more work on the problems of rainfed agriculture. This weakness in the research program limited project impact.

Borrower Performance

2.20 The Borrower established ARA as planned, procured the land for the new centers at Dhamar and Surdud, created a new statute and salary structure for the research personnel and generally met the demand for counterpart funds for project investments. However, recurrent operating funds for research became increasingly scarce as the staff complement in ARA (AREA) increased without commensurate increases in the recurrent budget for research. MAWR management should also have become more involved with the management of the project and with monitoring the output of the scientists. The reduction in the managerial autonomy of AREA is constraining its capacity to manage its resources efficiently. All the Credit covenants were complied with and all in all the performance of the Borrower is rated as satisfactory.

\textsuperscript{16} Anecdotal information
\textsuperscript{17} Project Completion Report, Credit 1259-YAR, World Bank, Report # 11652, March 8, 1993.
People's Democratic Republic of Yemen—Agricultural Research and Extension Project

Objectives and Design

2.21 The AREP (Credit 1557-YDR), approved in March 1985, had the overall objective of strengthening national research and extension services in PDRY. The scale of the project was reduced during the preparation process to render it compatible with the economic importance of the agricultural sector and to balance project investment with project duration. The specific actions to be taken by the project were: (a) establishment of priority programs on commodities of economic importance to PDRY including fruits and vegetables, cereals, fodder and industrial crops; (b) establishment of multi-disciplinary research teams; (c) strengthened linkages between research, extension and the farming community; and (d) strengthened extension services in three governorates (Abyan, Lahej and Hadramawt) to serve 35,000 farmers in about 40 cooperatives and 20 state farms.

2.22 The project design included:

- strengthening the Directorate of Research and Extension (DRE) through internal reorganization and provision of technical assistance;
- strengthening the research services through internal reorganization, reformulation of research programs, provision of technical assistance, training and research equipment;
- strengthening existing extension services in the three agriculturally most prominent governorates through provision of technical assistance, training and funding for civil works;
- expanding the existing Communications Unit through provision of technical assistance and equipment.

2.23 The project was appropriately designed to service a centrally managed agricultural economy where 60 percent of agricultural value added came from 60 cooperatives, 20 percent from state farms and 20 percent from private farms. The project built on an experienced and comparatively well qualified research team, for whom it provided short-term training. A modified (hierarchical layers reduced) Training and Visit (T&V) methodology of extension was established while civil works were kept to a minimum. Long-term technical assistance was provided to assist with the reorganization of agricultural services and with the strengthening of agricultural communications. The unwillingness of the Director of Animal Husbandry to participate in project preparation and appraisal led to the proposed component for animal husbandry research and extension being excised from the project design.

18. Formal agricultural research started in the 1950s, but only on cotton. Following Independence in 1967, UNDP/FAO provided support for research on all crops through its Farming Systems Research project (1969–81) and for extension through its Development of Extension project from 1982. Prior to 1980, technology was extended to the farming community by research scientists. After 1980, extension and training was separated from research in two sections responsible to the Director of Research and Extension (DRE) in Aden.
2.24 In order to minimize costs, it was decided that the project should be managed by the Director of the Department of Research and Extension (DRE) without the support of a project implementation unit (PIU). However, project management belatedly realized that a PIU would facilitate implementation and allow management to focus on improving the quality of research and extension. A Pre-Project Financing Facility (PPF) was granted to enable early international recruitment of a Senior Technical Adviser.

2.25 One issue raised during project preparation showed great foresight, it concerned the potential risk to the future sustainability of the project that might be caused by the government’s commitment to employ all graduating agriculturists. This warning was not heeded and no conditionality was included to limit recruitment to an agreed critical mass. Research staff at the El Kod Research Center argued against the consolidation of the research teams and the low capital intensity of the operation as they wanted a more substantial budget for purchase of equipment. Project designers were correct in reducing the cost of the four-year project from the original Government proposal of US$23 million before contingencies to US$7 million. Project design included provision for a consulting firm or internationally recruited organization to assist the Borrower in the recruitment of international staff and in the administration of the training program.

Implementation

2.26 The Credit became effective as scheduled in September 1985 and was closed in December 1991 12 months behind schedule, the same time as Credit 1259-YAR in the recently unified ROY. An unutilized balance of US$50,050 equivalent was canceled when the Credit was closed. The Bank authorized a re-allocation of project funds between categories in March 1989 to cover price increases in construction, equipment and vehicles, the addition of a soils laboratory at Seiyun, and an extension of the contracts of two technical assistance experts. Project costs were US$8.130 million dollar equivalent, for which the Government provided US$1.628 million equivalent or 20 percent of total costs. Project costs were 16 percent above SAR estimates.

Infrastructure, Equipment and Vehicles

2.27 The PCR details achievements with the hardware components of the project (Annex C). The 18-bedroom dormitory at El Kod and the six-bedroom hostel at Lawdar research stations were completed as planned by January, 1990. Modernization of the offices and research laboratories was completed. The audit mission was advised by the research scientists at El Kod Research Center that improvement of the research facilities was centrally planned at DRE headquarters in Aden, and did not necessarily match the specific needs and requests of the scientists. A new soil analysis laboratory was constructed at the Seiyun Research Station. The

---

19. Letter from FAO/CP Division Chief to World Bank, 14 March, 1984 identified the potential risk to the project of the PDRY’s commitment to employ all graduating agriculturists and the prospect that there would then be little left in departmental budgets to pay anything other than salaries.

20. Project files, June 20, 1984 Back-to-Office Report from the Loan Officer, EM1DD.

21. Agricultural GDP in PDRY had stagnated at US$42 million per annum since 1975.

erection of greenhouses at El Kod and Seiyun Research Centers was postponed. Sixteen housing units were constructed for field extension agents instead of the twenty planned, as four proved to be surplus to requirements.

2.28 The procurement of vehicles, motorcycles and equipment proceeded slowly due to cumbersome procedures and port delays, and greater than expected contingency costs eroded some of the Credit’s purchasing power. Equipment was ordered according to needs as determined by DRE management and did not follow the detail of the project file. Procurement of the vehicles and communications equipment was completed in PY4, but much of the research equipment arrived after project termination. The audit was advised that the detailed equipment lists prepared by research teams were subsequently modified in DRE headquarters and some items procured were not appropriate. Subsequently, problems have developed with the use and maintenance of some research equipment, as no training was provided and servicing facilities are unavailable in ROY. This design fault mirrored a similar one in Credit 1259-YAR.

2.29 The project assisted with the acquisition of textbooks and scientific journals. The audit was advised that acquisition had been intermittent during the project and had been completely discontinued after project closing.

**Institutional Development**

2.30 DRE executed the project according to the general plan in the SAR. The number of research sections were reduced through the consolidation of individual commodity programs into multi-disciplinary research teams (MDRTs). The audit enjoyed lively discussions with the scientists at El Kod Research Center who advised of the success of the reorganization of research into MDRTs. This was an interesting conclusion as they had apparently objected to the MDRT proposal at the time of project design. Research-Extension coordinators assigned to the DRE offices in the Abyan, Lahej and Hadramawt Governorates, assisted with the transfer of proven technology from the research stations to the verification trials and demonstrations on the cooperatives and state farms. The newly established farming systems section, which assisted with the diagnosis of farm problems and the establishment of appropriate verification trials, worked well with the cooperatives but less successfully with private farmers. On-farm research, which was progressively introduced during the project, has now completely ceased due to an inadequate budget. The MDRTs formulated a medium-term research program for 1986/7–1989/90 based on a prioritization of the research program within the context of the national Medium-Term Program. An Agricultural Research and Extension Council (AREC) was established as planned in 1987 and was later superseded by a National Council for Science in 1989.

---

23. Five such teams were constituted at the El Kod Agricultural Research Center, viz. (i) Industrial crops consisting of 24 scientists working on cotton, sesame and tobacco; (ii) Cereal crops consisting of 15 scientists working on sorghum, millet and maize; (iii) Legumes and forage crops with 17 scientists working on groundnut, cowpeas, green gram and phaseolus beans; (iv) Vegetable crops with 25 scientists working on tomatoes, potatoes, cucurbits, onions and other tropical vegetables; and (v) Fruit crops with 21 scientists working on banana, papaya, mangoes, citrus and other tropical fruits.

24. Verification trials compare 2–3 improved technologies against the local practice (control) using a simple randomized block design and with 2–3 replications.
2.31 Agricultural extension was reorganized according to a modified T&V methodology in which the Directorate of Agriculture in each governorate worked through four subject matter specialists (SMS) directly to the Village Extension Agents (VEA) who were housed in villages. A positive design feature was that no block or supervision centers were constructed and no block supervisors were recruited. All the extension staff recruited during the project, including the 55 VEAs, had at least a bachelor's degree in agriculture and most of the SMSs had a master's degree as well. Extension agents were trained in communications and T&V extension methods at Jaar Agricultural Training Center (JATC). During the project, 15 technologies were transferred by extension from research to the cooperatives and state farms, but the absence of a reliable database and the difficulties of separating out effects on production and yields precludes an assessment of incremental production.

2.32 The agricultural communications unit (ACU) in DRE headquarters (Aden) and in the three governorates were equipped as planned and staff trained on the job by internationally recruited experts. The ACU produced regular radio and TV programs and printed various leaflets for different audiences on different technologies. An innovation was the provision of a 30-second “slot” after the 9 a.m. news each morning giving topical advice to farmers. TV programs were found to be more effective for extension of new technologies than radio and are appropriate for farmers in PDRY where 80 percent of households have television sets. Regular radio programs are still produced and transmitted four years after project closing, despite the looting of most of the unit's equipment during the civil unrest in 1994.

Human Resource Development

2.33 Thirty-three staff at El Kod and 21 at the Seiyun Research Center benefited from short courses outside Yemen in a variety of subjects ranging from administration and finance through plant breeding and genetics to agricultural economics. The audit was advised that the training was not well planned, and little use was made of the opportunity to acquaint members of the MDRTs with new research methods.

Technical Assistance

2.34 The project planned to provide an international organization or business to provide 96 person months (90 LT and 6 ST) of internationally recruited staff to assist in the strengthening of DRE, select candidates for short-term training, promote association with various international agricultural research centers, and purchase specialized equipment. FAO was recruited and exceeded the SAR targets with provision of 96 person months of long-term technical assistance and 12 person months of short-term consultancies. Bank rules prohibit FAO from procuring equipment and they were able to act as advisers only. The impact of the experts was satisfactory, with the exception of the Agricultural Economist who became ill soon after arrival and had to be retired after six months. The audit was advised that the Senior Technical Adviser and leader of the FAO team provided effective scientific support to the research teams.

---

25. For field crops, horticulture, plant protection and livestock.

26. One long-term for 12 months and two short-term for six months each.
Funding

2.35 Availability of funds was satisfactory until October 1989 (PY4) when a shortage of recurrent budget funds for research and extension began to affect operations. Bank supervision missions attempted to curb continued recruitment and the increasingly short days worked by the research scientists at El Kod, but it proved impossible to rectify the situation, and all field activities effectively ceased at unification in May 1990. In 1994, only two percent and nine percent respectively of the El Kod and Seiyun Research Centers recurrent budgets were available for non-salary expenditure (Annex E). Extension services are now better funded than research, as they receive their budget directly from the agricultural offices in the governorates.

Bank Supervision

2.36 The project was supervised regularly, except when civil unrest made this impossible. The audit was advised that the Bank task manager for the project provided valuable assistance to project management with the reorganization of the research and extension services and with the selection and supervision of technical assistance. The performance of the Bank is rated as satisfactory.

Borrower Performance

2.37 In general, the Borrower performed well, and DRE and the research teams were reorganized as proposed. The limited civil works program and procurement of equipment was implemented according to the outline plan, but it was slow and the equipment procured was not always what the various research teams had requested. The output of the research teams was satisfactory and was effectively interfaced with the extension and communications programs. All the Credit covenants were complied with and the audit rates the performance of the Borrower as satisfactory.
3. Outcome

3.1 The projects were designed to improve the institutional capacities of the public agencies involved to develop and transfer productivity-increasing technologies to farmers. Technologies were generated during the implementation of the projects, but the weak database in Yemen has made it infeasible to trace their impact, if any, on production. Due to the difficulty of linking cause and effect in determining the impact of agricultural services projects and estimating the possible benefits attributable to a project, no ERRs were calculated for these two projects either 

*ex-ante* at appraisal or *ex-post* at project completion. The audit was unable to remedy this situation. However, despite the correctly predicted risks of rigidity in the overall institutional and policy frameworks and insufficient recurrent budgets for operations (because of the dangers of excess recruitment), the interventions were justified at appraisal on the premise of the generally high pay-off from research and extension projects in developing countries.27 The audit found that the new national research organization (AREA) was not presently viable in a real sense and therefore rates the overall outcome of the ARDP as unsatisfactory. On the other hand, AREP had clearly significantly strengthened the capability of the research, extension and agricultural communication services in south Yemen which were still active despite budget problems. The audit therefore rates the overall outcome of AREP as satisfactory.

Yemen Arab Republic—Agricultural Research and Development Project

*Research Hardware (infrastructure, vehicles and equipment)*

3.2 The headquarters for the new Agricultural Research Authority (ARA) and two new regional research centers for the tropical lowlands and central highlands agro-ecological regions were established and equipped as planned (Annex B). Unfortunately, pressure from MAWR for extension messages for all areas made the Borrower decide to push ahead more rapidly with the expansion of research activities than originally planned at project design, and research facilities were also established and staffed in two additional agro-ecological areas (northern and eastern regions). The first leader of the FAO team in his final hand-over report in December 1986, strongly recommended that: “the project may not and should not try to do too much both in terms of geographical and crop coverage, albeit evidently necessary. However, the main criteria of the project should be to strengthen what can be sustained and eventually widen the program (sic) of ‘off-station trials’.”28 The expansion of the program negatively affected the whole research program, since the demand for resources then exceeded the national capacity to supply sufficient recurrent budget and experienced scientists. It is not clear from supervision records what action was taken by the Bank to curb this development.

3.3 The restrictive conditions governing the Italian loan required that research staff housing for the new ARA headquarters and research center at Dhamar and for the regional center at Surdud be built by Italian contractors with materials imported from Italy. The Italian contractors selected by the Borrower failed to complete their contracts. Thus research management and staff were, and are still, unable to be housed at these new locations and staff morale is understandably


low due to the need to find "temporary" bachelor accommodation away from their homes. In addition, output is constrained by poor attendance and increased costs caused by traveling long distances between home and work.

3.4 The site finally selected for ARA headquarters at Dhamar has caused both administrative and social problems. Despite incentive salaries paid by ARA, research staff resisted moving from the original research headquarters site in Taiz in the southern uplands until practically the end of the project. Moreover, at the time of the audit several of the more experienced research scientists are considering resigning from the authority to join the university because of the unfavorable living conditions in Dhamar. This would reduce the excessive numbers of scientists in AREA although such benefits would probably be outweighed by the departure of the best qualified and most experienced staff.

3.5 The use of the two extension supervision centers and nine extension centers constructed under the project in the Central Highlands has been constrained by recurrent budget shortfalls for extension services.

3.6 The vehicles were procured as planned but were not fully utilized for field research as intended, because they were used to transport staff from distant housing areas to the research stations. Much of the laboratory equipment arrived during the closing months of the project (para. 2.8) and after the departure of the experienced technical specialists. Its use for the purposes intended has therefore been prejudiced as most national staff do not know how to use or maintain the equipment, and no training has since been provided under the follow-on project (Credit 2299-YEM).

3.7 The value of the central library to the scientific community and its impact on the quality of research was constrained from the outset by the lack of copying and computer equipment and later by the lack of funds to continue purchases of journals and textbooks, despite the implementation of a follow-on project (Credit 2299-YEM).

Staff Development

3.8 The ARDP human resource development program has increased the numbers and quality of the national research team in the former YAR. At project inception, the development or adaptation of agricultural technologies was severely constrained by lack of qualified local research scientists, as there were only four national scientists adequately qualified for agricultural research with postgraduate degrees (1 PhD and 3 MScs). At project completion in 1991, there were 19 and 32 holders of doctorate and masters degrees respectively29 and most of the expatriate research staff had been replaced. The national agricultural research team has continued to increase since project completion and at audit numbered 263 with 42, 61 and 160 holders of doctorate, masters and bachelors degrees in that order (Annex F). Unfortunately, this continued growth in numbers has almost paralyzed the research system as available resources are now spread too thinly over the larger number of researchers, reducing their efficiency. The problem is exacerbated by AREA management being prevented from switching funds in the recurrent budget from salaries (category I) to other expenses (category II). Although the

distribution of scientists is not optimal (Annex F), AREA management cannot easily make staff transfers. The field experience, confidence and morale of Yemen's research team is presently so low that the successful capacity building in human resources that was accomplished during the project is in danger of being lost.

Output of Technology

3.9 ARA set priorities for agricultural research for the first time during a workshop in 1986 during which research scientists, extension workers and some progressive farmers considered the technical constraints of each commodity and agreed priorities for work. After further work, ARA developed the first national plan for research in the former YAR with outline plans for the proposed programs of work. The output of technology during the project was significant, particularly for irrigated farming areas. A number of improved varieties of millet, sorghum, wheat, maize, grain legumes, vegetables and fruits were tested and released for use by farmers (Annex B). Pests and diseases were identified and described and recommendations made for their control. Livestock research focused on the selection of local breeds of sheep and goats and development of nutrition recommendations. Research findings were regularly published during the project in leaflets and broadcast on the radio. The quality of farming in Yemen is generally high (Photograph 5) particularly where irrigation is available, and it is, therefore, likely that the project had some impact in those areas. Unfortunately, the output of technology since unification seems to have been much lower, both for irrigated and rainfed farming systems.

Agricultural Research Authority (ARA)

3.10 ARA was established as a semi-autonomous organization within the Ministry of Agriculture of the former YAR on November 29, 1983 as planned. The project, largely through the long-term assistance provided by the FAO team, was successful in building a capability in the new national research organization for planning, implementation and coordination of applied research in the former YAR. The establishment of a semi-autonomous research authority could have been an appropriate institutional model for managing agricultural research in a liberal politico-economic environment, provided that its management was given control of staff and finances; although, there is some question as to whether Yemen could afford to develop a comparatively large and comprehensive national research system. Coordination of applied research was assisted by regular consultation meetings held by the Bank with other donors supporting agricultural research. The project was less successful at refocussing its research program on the problems of smallholder farmers, particularly in the rainfed areas, and in developing effective links with extension services in the regional development authorities.

3.11 The project implementation unit (PIU) established with technical assistance in ARA prior to project effectiveness provided good support to ARA in the management of the civil works program and procurement of equipment. The internationally recruited expert left in 1990 and the counterpart position was frozen at project completion at the end of 1991. But the value


31. Anecdotal information from the Tihama and Southern Uplands Development Authorities.

32. Rainfed farming occupies 80 percent of cultivated land.
of such a unit to project management had been demonstrated and a PIU is now being re-established in the follow-on project (Credit 2299-YEM).

3.12 However, the merger of the two research systems into AREA\textsuperscript{35} at national unification in 1990 disrupted the institutional development already underway in the north. Management changes and the reorganization of research teams has left the new authority (AREA) with a non-functioning system. The addition of many scientific and support personnel from the south has further upset the balance in the budget between personnel and operating costs. The process of unification of two widely different bureaucracies proved difficult and adversely affected the outcome of this key project component before project closing.

3.13 At audit, AREA management appeared to have little autonomy and was not able to optimally manage its human and financial resources. The authority had become effectively dysfunctional with little research work being undertaken and few new proven technologies to extend. Little on-farm adaptive research was being undertaken due to lack of finance and transport. The national agricultural research system has become completely dependent on donor support for its investment budget. And, once again, it is developing research processes and a research program driven by different donors rather than by the demands of its own farming community. The continued dependence on long-term technical assistance for research in the Bank’s follow-on project\textsuperscript{36} to introduce a farming systems research methodology reflects

---

35. ARA was transformed into the Agricultural Research and Extension Authority (AREA) in 1990.

36. Agricultural Sector Management Support project (Credit 2299-ROY) and a contract with ICARDA signed in October, 1995.
adversely on the quality of Yemeni research capacity. The audit rates institutional development as modest.

**Links between Research and Extension**

3.14 At unification, the project merged with Credit 1557-YDR and so assumed responsibility for providing advice on extension methodology and training and for forging links between research and extension. Little was accomplished before project closing and the training that is now being provided with funding from the follow-on project is based on the T&V methodology. The training is of little immediate use owing to the low activity of both AREA’s research teams and the RDA’s extension services due to funding constraints. The National Agricultural Research Council (NARC) became, on paper, the National Agricultural Research and Extension Coordinating Committee (NARECC) before project closing in 1990. However, it has not yet been formed and the Supreme Technical Committee in AREA is still responsible for the oversight of AREA’s activities.

**Funding**

3.15 The accelerating operational support funding problems during the implementation of ARDP have already been mentioned (para. 2.20). A survey of research institutions by a national study team in 1993\(^35\) showed that the difference between budget received and budget approved was a serious problem, while the implementation of research programs was further constrained by delays in receiving approved funds from national sources, variability in total resources from one year to the next and inadequate adjustment for inflation in the annual budget. Research expenditure quadrupled between 1980 and 1989 during the development of the national research system but with donors providing a decreasing proportion of the budget.\(^{36}\) Expenditure on agricultural research in the former YAR averaged 0.27 percent of AgGDP between 1983 and 1989.\(^{37}\)

3.16 The audit was advised that central government is now unwilling to assume responsibility for financing incremental institutional capacity created through projects. The only field or laboratory research evident at audit was that funded by external sources. Sustainability of the research capacity created through this project, which seemed likely at project completion is therefore now rated as uncertain. AREA management advised the audit that the salaries of AREA scientists will be significantly increased in 1996, therefore further unbalancing the budget. While this restoration of AREA scientists’ salaries to university levels might provide some incentive, it will be unlikely to increase the output of technology unless some autonomy can be restored to AREA management.

---


\(^{36}\) In 1980, external sources provided 65 percent of the research budget as compared to only 26 percent in 1989 in relative terms. Source: ibid.

\(^{37}\) The World Bank has recommended that a desirable level of investment in agricultural research for a poorly developed agricultural research system should be an annual expenditure (recurrent plus capital) equivalent to about two percent of agricultural gross domestic product. Source: Agricultural Research, Sector Policy Paper, World Bank, June 1981.
People's Democratic Republic of the Yemen—Agricultural Research and Extension Project

Department of Research and Extension (DRE)

3.17 The DRE, Ministry of Agriculture and Agrarian Reform (MAAR), developed a capacity to direct research and extension in the former PDRY. Long-term technical assistance was provided to assist with the development of both the management and research capacity of DRE. The senior technical adviser was recruited with PPF financing as it was envisaged at project design that he would provide much of the intellectual and managerial stimulus. But, in the event, little support was needed in management due to strong national direction and the senior technical adviser concentrated on the reorganization of the research system. DRE management sought to develop the department as a facilitating agency behind the field research and extension services managed by the five governorates. The project manager advised the audit that the good grounding in management and straight dealing that had been inherited from the former colonial power helped the former PDRY to establish an efficient bureaucracy. The success of Credit 1557-YDR in supporting the direction of national research and extension contrasts sharply with the comparative failure of the previous farming systems research project, which operated outside MAAR, to establish a national research and extension service. The project clearly assisted with the strengthening of the research and extension services in the former PDRY. The audit therefore rates the overall outcome as satisfactory and institutional development as substantial.

Agricultural Research

3.18 The project's main impact was on the reorganization of research into priority topics and the coordination and strengthening of the research effort through the establishment of multidisciplinary research teams (MDRTs). The medium-term research program developed during the project established time limits and goals for outputs of specific technologies. Outputs that were successfully transferred to extension and then to farmers included: new varieties of vegetables (especially early maturing onions), sesame, groundnuts and sorghum; improved cultural practices for the main crops including a system for harvesting two crops a year through the intercropping of cotton with groundnuts under spate irrigation; and timing of planting of watermelon to avoid a particularly pernicious virus disease. Adoption was facilitated by the ready availability of inputs for the recommended technical packages and assured market and prices and the audit was advised that average production increments of 20–30 percent were achieved.

3.19 The MDRT methodology was successful in strengthening the output of the researchers through peer pressure and coordination of effort. Research scientists were working principally with an audience of centrally-managed state farms and cooperatives operating within an economic environment of subsidized production inputs and fixed prices. Thus, research goals were comparatively easy to define and focused on maximizing output from intensive irrigated agriculture. The senior technical adviser assisted with the establishment of the new MDRTs.

38. UNDP/FAO Extension and Farming Systems Research Project.

39. Anecdotal information as no database could be accessed to verify this claim.
The health of the internationally recruited agricultural economist was poor and he had to leave before the end of his contract. Unfortunately the pre-project void in financial and economic evaluation of technologies and farming systems persisted and the necessary skills were not developed within the research system.

3.20 Research scientists in the former PDRY were comparatively well qualified at project inception, and because the Borrower wisely didn’t wish to invest in long-term graduate training, the project focused on giving opportunities to scientists to participate in short-term courses in various countries. The audit was impressed with the intellectual quality of the scientists met and concludes that skills and knowledge were enhanced by the 280 person months of training received by the 54 beneficiaries. The supply of laboratory and agricultural research equipment did not significantly improve the output and quality of research services due to late delivery of sometimes inappropriate equipment.

**Extension Service and Communications**

3.21 The relocation of the front-line extension agents to villages improved communication and no problems were recorded, either in the files, or anecdotally during audit discussions, of graduate staff objecting to postings outside the main towns. The quality of extension personnel was high from the Director of Extension in the governorate through the subject matter specialists to the field extension agents and anecdotal evidence indicates that new proven technologies were rapidly transferred and adopted by the state farms and cooperatives. It was not possible to discern the impact on the comparatively small numbers of private farmers. The output of the internationally recruited extension adviser was positive and helped DRE to introduce the T&V system and train staff. The adapted T&V methodology employed proved appropriate for a centrally managed irrigated agriculture utilizing complete technology packages in an economic environment of fixed costs and prices, where farmers had little freedom to make decisions. Extension activities continued after unification with funding provided by the departments of agriculture in the governorates, but the effectiveness of the T&V methodology has fallen away as there is no longer a steady stream of appropriate technologies and the centrally-managed large-scale farming units are being replaced by individually-managed smallholder farms.

3.22 The equipment and training provided for the expansion of the existing Agricultural Communications Unit (ACU) in Aden and in the governorates of Abyan, Lahej and Hadramawt had a successful outcome and a multi-faceted program of radio and TV shows and advisory leaflets was produced during the project in support of the extension program. This medium of technology transfer proved effective in the former PDRY and was apparently interfaced efficiently with the person-to-person contact of the field extension agents. The successful institutionalization of this program into agricultural services in south Yemen is demonstrated by the survival of the regular agricultural programs on radio four years after project completion. As a consequence of a poor start to project implementation and paucity of extension messages to communicate, the proposed redevelopment of a central agricultural communications unit in ROY with funding provided under the follow-on project (Credit 2299-YEM) has been wisely postponed, following the mid-term review of the project.
Links Between Research and Extension

3.23 The links between the research teams and extension staff were well developed during the implementation of the project with the support of the internationally recruited advisers. The effectiveness of the communication between research scientists and extension staff was aided because they were all graduates and the message to be transferred did not require any interpretation for different client groups.

Funding

3.24 There was sufficient counterpart recurrent funding for project activities until October 1989 when project supervision noted that shortfalls were having an adverse impact on the efficiency of research and extension operations, as had been foreseen by the FAO/CP Division Chief during project preparation (para. 2.25). After unification in May 1990, the funding situation deteriorated further, exacerbated by unsatisfactory accounting practices at AREA. The sustainability of the agricultural services strengthened through Credit 1557-YDR is uncertain given the present political environment in which semi-autonomous authorities are not allowed to trim staff to match financial availability.
4. Findings and Issues

4.1 At the time of project completion in December 1991, just over one year after unification, the outcome of both projects was considered satisfactory with positive institutional development of the research and extension systems in two contrasting socio-political environments. Both projects had been generally well-managed by the Borrowers and the Bank and most of the project objectives had been achieved within cost. Technologies had been developed and transferred to farmers. However, the optimistic hope that the problems of unification would be short-lived and that assistance for research would continue as a priority for funding under MAWR has not been fulfilled and Yemen’s NARS is now producing little new technology despite further support being provided by a follow-on project. At audit in October 1995, it was evident that a potentially effective national research organization had been established in north Yemen and that technologies had been generated during the implementation of ARDP. However, the audit found that this organization was not presently viable with little research (especially field research) being conducted. Since this shortcoming is major, the audit rates the overall outcome of ARDP as unsatisfactory and institutional development as modest. On the other hand, the audit found that AREP had significantly strengthened the capability of the research, extension and agricultural communication services in south Yemen to such an extent that some activity was evident in all three agricultural services despite the lack of budget. The audit therefore rates the overall outcome as satisfactory with substantial institutional development.

4.2 A satisfactory base for an active national research system has been developed by the two projects, with the establishment of a national research authority, development of a network of regional research centers in the main agro-ecological regions and many trained scientists. But lack of counterpart funding and weak management since unification has severely constrained the effectiveness of this structure. The audit rates the sustainability of both investments as uncertain.

4.3 The weaknesses of both projects which had been identified at project design was the risk that Yemen would attempt to build too large a scientific team, and so leave insufficient financial resources to pay anything other than salaries. The payment of higher salaries to research authority staff has magnified this problem, a situation that is mirrored in some African countries that have transformed their public sector research systems to para-public authorities. The recurrent budget allocated for agricultural research ceased expanding in real terms from the late 1980s, as in many other developing countries, necessitating more efficiency in the use of resources. The problems of unification have aggravated this inherent weakness of project


41. Agricultural Sector Management Support Project (Credit 2299-YEM). Staff Appraisal Report, Report No. 8432-YEM, August 14, 1991. Excerpt from Supervision Mission report, November 20, 1995: “Project implementation has suffered from general lack of ownership, poor coordination among the implementing agencies, weak management, lack of effective channels for resolution of project implementation problems, lack of counterpart funds, lack of qualified counterpart staff working with project technical assistance staff and cumbersome administrative procedures.” Useful technologies are still being produced by two of the AREA research centers (Marib in Eastern Region and Selayun in the Hadramawt).

design. The merging of the two research systems has brought more problems than benefits, including unstable management and counterpart funding problems exacerbated by excess personnel, and an increasingly inefficient use of available resources. The planned reorganization of MAWR involving, *inter alia*, significant reduction of staff numbers and a Bank-supported Public Expenditure Review in 1996, should improve the current serious situation.

4.4 In 1993, Yemen earned US$770 million equivalent from its agricultural sector and invested US$3.6 million equivalent in AREA or 0.47 percent AgGDP. Although this is significantly lower than the 2 percent AgGDP recommended by the World Bank, it compares satisfactorily with other developing countries and would be sufficient if it had been appropriately allocated. However, the allocation of funds within this budget was far from optimal with 90 percent being used to cover salary costs instead of a preferred 50 percent. Sustainability of incremental capacity created through project interventions is prejudiced because the Ministry of Finance and Ministry of Planning and Development manage the recurrent and development budgets separately. Consequently, new capacity created through projects is difficult to sustain without the provision of a follow-on project to pick up the resulting recurrent costs.

4.5 Despite the harsh climatic conditions and limited natural resource base of Yemen, the agricultural sector remains important, both in its contribution to GDP and its capacity productively to absorb increasing numbers of the country’s unemployed population. Nonetheless, the comparatively small product of the sector constrains the size of the national agricultural research system (NARS) that it can afford to sustain. The scale of resources that small developing countries can afford to invest in agricultural research imposes a fixed constraint on the types of research that they should attempt to carry out. The development of a small country research system requires more sophistication than for a large country and does not obviate the need for an effective research system to deliver the appropriate technological products to farmers, regardless of the source. There are economies of scope that involve selecting areas of research in which the NARS is likely to achieve its goals, make the best use of linkages and technology flows, and have the greatest impact. The establishment and use of links to external sources of knowledge and technology is therefore crucial to the development of small-country research systems. The development of a skilled scientific capacity for borrowing, screening and adapting technology makes more sense for many countries such as Yemen than does the development of a comprehensive research system for applied research. Also, Yemen clearly has a comparative advantage in building a capacity to carry out basic, strategic and applied research on the stimulant drug, qat (*Catha edulis*), for which it is impossible to borrow technology from elsewhere, and from which Yemen derives an increasing proportion of its agricultural product. In a number of countries, donor support for the development of NARSs, combined with domestic political pressures for recruitment of all university graduates, has often increased the number of scientists, research stations, equipment, research projects and operating budgets beyond the ability to sustain these activities from national budgets. Yemen is no exception.

44. Agricultural Research, Sector Policy Paper, World Bank, June 1981
46. A proposed commodity research program on qat is being incorporated into the agricultural research policy being developed by AREA for the next Five Year Plan (1996–2000).
Yemen Arab Republic—Agricultural Research and Development Project

Project Design

4.6 The overall design of this institution-building project was appropriate in its establishment of a national research organization, with a capacity for planning and coordination of research that had been previously serviced by disparate research activities largely manned by expatriates and funded by external donors. It was sensibly planned as Phase III of a long-term program of support for agricultural research and followed two previous projects funded by UNDP. But, it was too ambitious and did not sufficiently recognize the difficulties of establishing a viable semi-autonomous research authority to manage the national research system in a country with little experience in such management and a small commercial sector. It would have been preferable to have initially helped Yemen develop a capacity for borrowing and adapting technology created elsewhere. The project was successful in establishing a national research authority (ARA), but it has neither provided the expected immunity from MAWR budget cuts nor has it freed the research system from the over-staffing inherent in public personnel policies.

4.7 Moreover, the decision to locate the new ARA headquarters in a “greenfield” site in the Central Highlands with its concomitant difficulties of creating a satisfactory working and social environment and establishing good communications with decision-makers in the capital was risky. The risks were increased when the government accepted parallel and tied bilateral donor support for the critical component of staff housing. The Borrower and the Bank should not have agreed to the utilization of expatriate building contractors working with imported house designs and building materials, when Yemenis are quite capable of constructing houses. It is also possible that if this “foreign” housing had been completed, that it would not have provided the living environment in which scientists and their families would have been content to remain for much of their working lives. Failure to complete the construction of the housing at Dhamar and Surud has significantly contributed to the destabilization of the new national research system. It would have been much better to have sited the headquarters of the research authority either at Taiz or at Sana’a, and to have developed a small regional research center in the central highlands sufficiently close to Dhamar and for accommodation to have been purchased or rented by research staff. There would have been no need for the bilateral loan if this housing component had been eliminated.

4.8 A further risk foreseen at appraisal was the danger that the research program would not respond to farmers’ needs. Although actions during project implementation tried to minimize this risk by developing a national research plan and siting research centers in all the agro-ecological regions, the development of technology for the important rainfed farming systems has lagged.

Management

4.9 The audit noted two characteristics of Yemeni culture that have flourished in AREA and are inimical to good agricultural research management. First, AREA now has many layers of
management which absorb valuable resources. Moreover, these managers take few substantive decisions on programs or the allocation of resources and personally contribute little to the development of technology. Second, national research managers seem to be unwilling to take risks in developing methodologies themselves, e.g. farming systems research, and prefer to leave this to expatriate technical assistance and external donors who can later be blamed if the program doesn't produce good results. As a result, the national research system is still afflicted by an instability caused by changing directions in methodology emanating from the ideas of different donors, just as it was before the project. Two new programs that are providing funds for research are farming systems research being funded under Credit 2299-YEM and “participatory bottom-up” research being funded by Germany in its Innovation Development in the Agricultural Sector (IDAS) project with AREA.

Human Resource Development

4.10 As one RDA Project Manager commented to the audit, “agricultural projects financed by the Bank are good at building buildings but less good at building people.” The overseas postgraduate training program and well-coordinated technical assistance support funded by the project provided an excellent base for building a strong and capable national research team. But this base is of little use if it cannot be complemented by subsequent field experience. Also, it is important for the capacity building process that new laboratory equipment is delivered on time and that it is of an appropriate design suitable for use by the returning trainees. Unfortunately, the continued development of the scientific teams in the north has been interrupted by management changes and lack of sufficient resources for research since 1990. Bank advisers were right to be concerned about the capacity of the agricultural sector and the wisdom of expecting government to provide sufficient recurrent resources to sustain an applied research program of commodity research.

Research-Extension Links

4.11 The transfer of new technology to farmers through the extension departments of the RDAs was inadequate as no funds were specifically included in Credit 1259-YAR for adaptive research with farmers or for joint activities with RDA staff. This was a significant design fault given that the project aimed to “establish a system for the permanent financing of adaptive research” (SAR, para. 3.02). This deficiency has been rectified in the follow-on project with bilateral funding support from the Government of the Netherlands. However, it is bizarre that the technical assistance team recruited to train extension and research staff in the research-extension interactions of the T&V methodology are doing so in an environment in which there is now practically no operational funding for research or for extension and little technology being generated.

Funding

4.12 Project management initially succeeded in establishing some autonomy in managing its budget, including funds from government and income from research farms, and the audit was advised that ARA management was able to maintain a satisfactory ratio between personnel and

47. Director-General, Deputy Director-General, Assistant Director-Generals, Directors, Research Coordinators, MDRT team leaders and research scientists.
operational expenditure until 1989. AREA management now has little power to manage its finances. The government’s decision to provide significant salary increases to AREA staff in 1996 may provide scientists with some incentive to remain with the authority, but any inducement to a greater output of work will be defeated by an even greater scarcity of funds for research operations. A further burden may be placed on AREA from 1996 if government retreats further from its funding obligations, as is now rumored, and requires AREA to depend more on revenue from its research farms for financing the non-salary recurrent costs of research.

People’s Democratic Republic of Yemen—Agricultural Research and Extension Project

Project Design

4.13 The final design of this project was appropriate for its socio-political environment—the project was small and matched the relative importance of the agricultural sector in the economy; its training program was appropriate for an already comparatively well-qualified research team; and civil works were kept to a minimum. There is some evidence that indicates that agricultural research was revitalized through the introduction of the multi-disciplinary teams and that 25–30 percent increases in agricultural productivity were achieved. The risk to future sustainability foreseen at project preparation through recruitment of excess personnel has been borne out by events. The research team, which was substantial at project preparation for such a small agricultural sector (82 graduate scientists and 21 technicians), had grown to 122 graduates, 144 technicians and 441 administrative and other staff by 1995. Prior to unification and the merging of DRE into AREA, the recurrent costs of research were subsidized with the revenue from adjoining state farms. However, after unification and the removal of this “crutch,” research in the south collapsed as the AREA budget allocated for research was almost totally absorbed by salaries.

Extension Methodology

4.14 The adapted T&V methodology of extension introduced into the former PDRY proved appropriate. Extension service staff (subject matter specialists and agents) were of a comparatively high caliber (all graduates); extension was provided with a steady flow of appropriate technologies; person-to-person contact visits were complemented with an efficient mass communication system; and farming systems were fairly uniform and were supported by a good supply of production inputs and by guaranteed fixed prices.

Research-Extension Links

4.15 Initially, the interactions between research scientists and extension agents were effectively developed during this project and demonstrated firstly the value of financing these two services within a single project, and secondly the synergy that can be derived from this interaction when both services are working actively in the field. Unfortunately, the institutional

48. Anecdotal evidence, Project Manager, Credit 1557-YDR.
development of this interaction was initially interrupted by financial problems in government and then by institutional change at unification.
5. Lessons for the Bank

5.1 The design and outcome of these two projects offer some important lessons for agricultural research projects:

- Support for research system development must take careful account of the capacity of the sector to sustain investments that increase capacity, and the scale and scope of the intervention should be scaled accordingly. Projects should not be over-ambitious and seek to fully develop a comprehensive and effective research system over a short period.

- A long-term commitment is required from both the Borrower and the Bank to build a sustainable and viable research capacity, particularly when national capacity is initially weak.

- Provision through a project intervention of the buildings and equipment for research must be complemented with assistance to help the Borrower develop the capacity to effectively manage and exploit its increased capacity.

- The development of a skilled scientific capacity for borrowing, screening and adapting technology is generally the right choice for countries with comparatively small agricultural sectors rather than the development of a comprehensive capacity for applied and adaptive research over a wide range of commodities.

- Effective research requires that managerial control of staffing and budget allocation be delegated to research management.

- Important objectives, for example the establishment of a permanent financing mechanism for adaptive research, should always be supported by specific project action or components, such as the development of research contracting arrangements between the beneficiaries and the research organization.

- A modest well-qualified staff in finance and administration is as important as well-qualified scientists, particularly when the major objective of the project is the development of a viable, semi-autonomous national research authority. Training may therefore be necessary in finance and administration as well as in scientific subjects.

- Parallel financing and tied-aid, if provided for critical inputs such as specialist technical assistance and key buildings, can entail risks to the success of the whole operation. Tied-aid financing should not be used to finance a component for which the Borrower has a strong national capacity, i.e. building houses in the case of Yemen.

- The purchase, installation, use and maintenance of scientific equipment are skilled tasks for which it may be necessary to provide technical assistance and training support throughout the life of the project.
• Mass communication is an effective medium of technology transfer given a steady flow of tested and appropriate technologies.
### Related Bank Loans and/or IDA Credits

<table>
<thead>
<tr>
<th>Loan/Credit Number</th>
<th>Title</th>
<th>Year of Approval</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cr. 376-YAR</td>
<td>Research component of Tihama I</td>
<td>1974</td>
<td>Completed</td>
</tr>
<tr>
<td>Cr. 545-YAR</td>
<td>Rural Development Project I</td>
<td>1975</td>
<td>Completed</td>
</tr>
<tr>
<td>Cr. 615-YDR</td>
<td>Wadi Hadramawt Ag. Devt. I</td>
<td>1976</td>
<td>Completed</td>
</tr>
<tr>
<td>Cr. 968-YDR</td>
<td>Wadi Tuban Ag. Development</td>
<td>1978</td>
<td>Completed</td>
</tr>
<tr>
<td>Cr. 880-YAR</td>
<td>Research component in Tihama III</td>
<td>1979</td>
<td>Completed</td>
</tr>
<tr>
<td>Cr. 1346-YDR</td>
<td>Wadi Hadramawt Ag. Devt. II</td>
<td>1983</td>
<td>Completed</td>
</tr>
<tr>
<td>Cr. 2299-YEM</td>
<td>Agric. Sector Mgt. Support Project</td>
<td>1991</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

### Other Financing

- **UNDP**
  - FAO executed, Research and Training project, South Yemen 1969-71
  - FAO executed, Research and Training project, South Yemen 1972-76
  - FAO executed, Crop Production Improvement project, South Yemen 1977-81
  - FAO executed, Extension & Farming Systems Research project, S.Yemen 1980-90
  - UNDP supported, FAO executed, Central Research, North Yemen and Training Organization, Taiz, Southern Uplands Region, North Yemen 1973-78
  - UNDP initiated, IDA executed, FAO sub-contracted 1979-82
  - 545-YAR Southern Uplands, North Yemen

### Bilateral Donor Support for Research, North Yemen

- **Netherlands**
  - bilateral technical assistance for livestock completed
- **ODA**
  - bilateral technical assistance for forestry completed
- **USAID**
  - research component in rural development project completed
- **Germany**
  - research component in rural development project completed
- **China**
  - research component in rural development project completed
Project Results—Agricultural Research and Development Project (Cr. 1259-YAR)

A. Direct Benefits

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Appraisal Estimate</th>
<th>Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment of ARA</td>
<td>1983</td>
<td>established in Dec. 1983</td>
</tr>
<tr>
<td>Research Headquarters building, Dhamar</td>
<td></td>
<td>completed &amp; furnished, 1991</td>
</tr>
<tr>
<td>Research stations, Dhamar &amp; Surud</td>
<td>1987 (PY4)</td>
<td>completed &amp; furnished, 1991</td>
</tr>
<tr>
<td>Housing complexes, Dhamar &amp; Surud</td>
<td>Italian cofinance</td>
<td>incomplete</td>
</tr>
<tr>
<td>Postgraduate training</td>
<td>9 PhD &amp; 23 MSc</td>
<td>21 PhD &amp; 42 MS</td>
</tr>
<tr>
<td>Short-term training</td>
<td></td>
<td>66 completed</td>
</tr>
<tr>
<td>Development of natl. scientific manpower</td>
<td></td>
<td>1983: 40 scientists, 31 technicians, 23 other staff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1990: 91 scientists, 42 technicians, 233 other staff</td>
</tr>
<tr>
<td>FAO experts</td>
<td>50 manyears of international staff &amp; 20 manyears of ST staff</td>
<td>17 LT &amp; 2 assoc. experts, 3 ST consultants</td>
</tr>
<tr>
<td>Salaries of scientists</td>
<td></td>
<td>equivalent to university awarded</td>
</tr>
<tr>
<td>Block &amp; Extension Centers</td>
<td>2 Block and 9 Extension</td>
<td>constructed as planned</td>
</tr>
<tr>
<td>Vehicles &amp; equipment</td>
<td></td>
<td>procurement completed</td>
</tr>
<tr>
<td>Library</td>
<td>6000 accessions</td>
<td>completed</td>
</tr>
<tr>
<td>Estab. Research Coordination Committee</td>
<td></td>
<td>established 1987</td>
</tr>
</tbody>
</table>

B. Agricultural Benefits

<table>
<thead>
<tr>
<th>Crop Group</th>
<th>Increase over local varieties</th>
<th>Yield (t/ha)</th>
<th>Specific crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Released</td>
<td>63% to 240%</td>
<td>3.5-5.7</td>
<td>sorghum, maize, wheat, barley</td>
</tr>
<tr>
<td>Promising</td>
<td>40% to 333%</td>
<td>1.3-6.6</td>
<td>sorghum, maize, millet, wheat, barley</td>
</tr>
<tr>
<td>Legumes:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promising</td>
<td>11%-175%</td>
<td>0.5-2.9</td>
<td>faba bean, bean, lentil, soybean</td>
</tr>
<tr>
<td>Vegetables:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Released</td>
<td></td>
<td></td>
<td>potatoes, tomato, onion, watermelon, sweet melon, okra, eggplant, radish,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>spinach, garlic, carrot, bean, peas, cucumber, squash, cabbage, cauliflower,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>sweet pepper, hot pepper</td>
</tr>
<tr>
<td>Fruits:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperate</td>
<td></td>
<td></td>
<td>apple, peach, apricot, cherry, pear, prune, sapota, passion fruit</td>
</tr>
<tr>
<td>Tropical</td>
<td></td>
<td></td>
<td>banana, mango, citrus, papaya, guava</td>
</tr>
</tbody>
</table>

Source: Project Completion Report, World Bank, Report No. 11652, March 8, 1993
Project Results - Agricultural Research and Extension Project (Credit 1557-YDR)

A. Direct Benefits

**Indicators**

**Civil Works Construction**
- 18-bedroom dormitory at El Kod Research Center (Abyan) completed January, 1990
- 6-bedroom hostel at Lodar Research Station (Abyan) completed January, 1990
- 20 housing units for village extension agents
- Modernization of research facilities
- Erection of g'houses at El Kod and Seiyun Res. Centers postponed for follow-on project

**Vehicles and Equipment**
- 17 x 4 WD vehicles, 3 trucks, 3 pick-ups & 120 m'cycles delivery of vehicles completed 10/89
- Equipment for research farms, laboratories, libraries
- Equipment for Communications Unit completed October, 1989
- Equipment for research farms, laboratories, libraries lab equipment delayed and 90% complete

**Training**
- Research scientists 30 ST/MT courses (312 man months) completed October, 1990
- Extension & Communications 5 ST/MT courses (72 mm) 280 man months completed

**Technical Assistance**
- Sr. Research Adviser (42 mm) Fulfilled (48 mm) departed 7/89
- Extension Adviser (18 mm) Fulfilled (30 mm) departed 4/89
- Communications Adviser (12 mm) Fulfilled (12 mm) departed 10/88
- Ag. Economics Adviser (12 mm) Completed (6 mm) departed 10/89
- Consultancies (6 mm) 9 mm completed

**Institutional Developments**
- Strengthening of the Department of Research and Extension Achieved as planned, with formation of MDRTs and appointment of Research-Extension Coordinators
- Creation of Agricultural Research and Extension Technical Committees within DRE and estab.of National Agricultural Research and Extension Council
- Technical Research Committees operating effectively at EL Kod and Seiyun, ARE Council estab.in 1987 and superseded by National Council for Sciences in 1989

Source: Project Completion Report, World Bank, Report No. 11731, April 2, 1993

<table>
<thead>
<tr>
<th>Task</th>
<th>Person/years</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chief Technical Adviser</td>
<td>66</td>
<td>12/83-03/90</td>
</tr>
<tr>
<td>Soil Analysis Expert</td>
<td>22</td>
<td>3/83 - 01/85</td>
</tr>
<tr>
<td>Horticulture (vegetables)</td>
<td>39</td>
<td>1/83 - 04/86</td>
</tr>
<tr>
<td>Agronomy (wheat &amp; barley)</td>
<td>25</td>
<td>1/83 - 01/85</td>
</tr>
<tr>
<td>Entomology</td>
<td>24</td>
<td>1/83 - 12/84</td>
</tr>
<tr>
<td>Soil Classification</td>
<td>16</td>
<td>1/83 - 05/84</td>
</tr>
<tr>
<td>Plant Pathology</td>
<td>25</td>
<td>1/83 - 02/85</td>
</tr>
<tr>
<td>Agronomy (cereals)</td>
<td>48</td>
<td>1/83 - 01/87</td>
</tr>
<tr>
<td>Cotton/Industrial Crops</td>
<td>37</td>
<td>1/83 - 02/86</td>
</tr>
<tr>
<td>Communication/Training</td>
<td>60</td>
<td>4/84 - 03/90</td>
</tr>
<tr>
<td>Livestock</td>
<td>60</td>
<td>5/85 - 03/90</td>
</tr>
<tr>
<td>Horticulture (tropical fruits)</td>
<td>39</td>
<td>9/85 - 12/88</td>
</tr>
<tr>
<td>Agricultural Economics</td>
<td>15</td>
<td>10/85 - 01/87</td>
</tr>
<tr>
<td>Soil Chemistry/Fertility</td>
<td>22</td>
<td>3/85 - 01/87</td>
</tr>
</tbody>
</table>

Associate Experts
- Cereals
- Wheat seeds

Short-term consultants
- Animal Nutrition, Greenhouse design, Virology, Irrigation research & design, genetic resources, agricultural mechanization, landscape and floriculture, farming systems, soils, library, coffee and laboratory & equipment.

Technical assistance funded by the Italian Grant (96 person months)
- Irrigation
- Temperate fruits
- Forestry
### Recurrent Budget, AREA, 1994
(Yemeni Rials millions)

<table>
<thead>
<tr>
<th>Research Center</th>
<th>Salaries</th>
<th>Operations include. travel</th>
<th>Office &amp; stationery</th>
<th>Total</th>
<th>% of total AREA budget</th>
<th>Salaries as % of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headquarters</td>
<td>17.346</td>
<td>2.237</td>
<td>0.381</td>
<td>19.964</td>
<td>14</td>
<td>87</td>
</tr>
<tr>
<td>Central RRC, Dhamar</td>
<td>8.344</td>
<td>0.647</td>
<td>0.056</td>
<td>9.047</td>
<td>6</td>
<td>92</td>
</tr>
<tr>
<td>Southern RRC, Taiz Lowlands</td>
<td>15.752</td>
<td>1.520</td>
<td>0.226</td>
<td>17.498</td>
<td>12</td>
<td>90</td>
</tr>
<tr>
<td>RRC, Surdud Northern RRC</td>
<td>12.700</td>
<td>1.578</td>
<td>1.074</td>
<td>15.352</td>
<td>11</td>
<td>83</td>
</tr>
<tr>
<td>Al Boun Eastern RRC</td>
<td>3.634</td>
<td>0.503</td>
<td>0.054</td>
<td>4.191</td>
<td>3</td>
<td>87</td>
</tr>
<tr>
<td>Marib Al Kod</td>
<td>2.407</td>
<td>0.230</td>
<td>0.495</td>
<td>3.132</td>
<td>2</td>
<td>77</td>
</tr>
<tr>
<td>Seiyun Animal Imp. Center, Aden</td>
<td>45.088</td>
<td>0.989</td>
<td>0.069</td>
<td>46.146</td>
<td>33</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>17.448</td>
<td>1.094</td>
<td>0.607</td>
<td>19.149</td>
<td>14</td>
<td>91</td>
</tr>
<tr>
<td>Animal Imp.</td>
<td>7.079</td>
<td>0.430</td>
<td>0.000</td>
<td>7.509</td>
<td>5</td>
<td>94</td>
</tr>
<tr>
<td>Total</td>
<td>129.798</td>
<td>9.228</td>
<td>2.962</td>
<td>141.988</td>
<td>100</td>
<td>91</td>
</tr>
</tbody>
</table>
### AREA permanent staff (1995)

<table>
<thead>
<tr>
<th>Site</th>
<th>PhD</th>
<th>MS</th>
<th>BS</th>
<th>Tech</th>
<th>Total</th>
<th>Admin staff</th>
<th>Others</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>AREA Headquarters</td>
<td>8</td>
<td>11</td>
<td>19</td>
<td>18</td>
<td>56</td>
<td>28</td>
<td>16</td>
<td>100</td>
</tr>
<tr>
<td>Trop. Lowlands RRC</td>
<td>3</td>
<td>3</td>
<td>15</td>
<td>15</td>
<td>36</td>
<td>6</td>
<td>88</td>
<td>130</td>
</tr>
<tr>
<td>South Uplands RRC</td>
<td>6</td>
<td>10</td>
<td>16</td>
<td>29</td>
<td>61</td>
<td>20</td>
<td>88</td>
<td>169</td>
</tr>
<tr>
<td>Central Highlands RRC</td>
<td>3</td>
<td>7</td>
<td>10</td>
<td>19</td>
<td>39</td>
<td>7</td>
<td>40</td>
<td>86</td>
</tr>
<tr>
<td>Northern RRC</td>
<td>2</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>25</td>
<td>5</td>
<td>31</td>
<td>61</td>
</tr>
<tr>
<td>Eastern RRC</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>9</td>
<td>2</td>
<td>20</td>
<td>31</td>
</tr>
<tr>
<td>Al Kod Res. Center</td>
<td>14</td>
<td>10</td>
<td>56</td>
<td>91</td>
<td>171</td>
<td>50</td>
<td>231</td>
<td>452</td>
</tr>
<tr>
<td>Livestock Res. Center</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>5</td>
<td>15</td>
<td>8</td>
<td>43</td>
<td>66</td>
</tr>
<tr>
<td>Hadramawt RRC</td>
<td>1</td>
<td>11</td>
<td>20</td>
<td>48</td>
<td>80</td>
<td>28</td>
<td>81</td>
<td>189</td>
</tr>
<tr>
<td>Sana'a Liaison Office</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Aden Liaison Office</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>61</td>
<td>160</td>
<td>241</td>
<td>502</td>
<td>163</td>
<td>640</td>
<td>1305</td>
</tr>
</tbody>
</table>
YEMEN ARAB REPUBLIC
AGRICULTURAL RESEARCH
AND DEVELOPMENT PROJECT
REGIONAL AGRICULTURAL RESEARCH CENTERS

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

ETHIOPIA

DJIBOUTI
AGRICULTURAL RESEARCH AND EXTENSION PROJECT

PROJECT FEATURES

- Main Agricultural Areas
- Project Research Stations

EXISTING FEATURES
- Selected Towns and Villages
- Governorate Capitals
- National Capital
- Airports
- Ports
- Primary Roads
- Secondary Roads
- Tracks
- Wadis
- Governorate Boundaries
- International Boundaries

ELEVATIONS

- 2000 meters
- 1000
- 200
- 0

The map has been prepared by The World Bank's staff exclusively for the convenience of the readers and is exclusively for the internal use of The World Bank and the International Finance Corporation. The denominations used and the boundaries shown on this map do not imply, on the part of The World Bank and the International Finance Corporation, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.
IMAGING

Report No: 15545
Type: PPAR