

3.4 Distribution

[ND-1] Establishment of Wholesale Market

(Combination of NM-1, NM-2 and NM-3 shown in detailed project tables)

Objective:

The objective of this project is to establish a wholesale market which will contribute to the formation of fair wholesale prices and the smooth circulation of agricultural produce, corresponding with the agricultural production increase expected under the 10-year Master Plan.

Description:

The wholesale market has two functions: price determination and physical distribution. In Oman, one of the problems concerning distribution is the fact that the price determination system does not function well enough to reflect the balance of supply and demand. There is no adequate place where producers can sell produce and retailers can purchase required goods at the same time. In order to combine production and consumption in an acceptable manner for both producers and consumers, the establishment of a wholesale market is essential.

Under the project, the wholesale market will be established gradually to avoid confusion in the present distribution structure. In order to achieve a favorable co-existence between public distribution organizations like PAMAP and private traders, it is indispensable for all parties to cooperate together to supplement insufficient functions.

The project's three stages are shown below.

1) First Stage

In the first stage, necessary studies and preparatory work are

conducted to establish the wholesale market. The following are the main activities at this stage:

- Feasibility study on the establishment of a wholesale market
- Study on the expansion of collection and distribution volume handled by PAMAP in which both methods to facilitate the shipment of produce, and policies including subsidies for collecting materials will be examined
- Implementation of distribution volume expansion by PAMAP so that it can maintain fundamental market functions during the first stage of the project
- Training of PAMAP staff for the implementation of the second stage project (pilot wholesale market)

2) Second Stage

At the second stage, a pilot wholesale market will be established to verify the effectiveness of the wholesale market in Oman. The activities are:

- Operation of pilot wholesale market

A pilot wholesale market will be established in Muscat and Salalah by utilizing the existing facilities in the retail market. PAMAP will direct the functions of the wholesale market on an experimental basis.

- Detailed design of wholesale market

A detailed design of the wholesale market, targeting the most promising site, will be prepared in parallel with operating and appraising the pilot wholesale market.

3) Third Stage

The final stage consists of the following:

- Construction of a central wholesale market

PAMAP will construct central wholesale markets in large consumption centers in Oman, namely Muscat (Muttrah and Seeb) and Salalah. The central wholesale market will function as a nation-wide distribution center.

-Operation of central wholesale market

The newly constructed market will be operated by PAMAP on the basis of the method developed under the pilot project. PAMAP will provide training guidance and supervision materials to the wholesale traders in order to facilitate physical distribution and price determination.

-Construction of local wholesale markets

The need for local wholesale markets would be studied, and they would be subsequently constructed on a step by step basis as the demand arose.

The factors to be considered when a wholesale market is established are:

1) Dealing Volume

A realistic and reasonable volume of agricultural produce to be dealt with through the wholesale market should be estimated. The present and forecasted future production volume and dealing volume by PAMAP and the wholesale market are described in Tables 3.4.1-3.4.3.

2) Organization

The operation functions of organizations concerned with the distribution sector should be clearly demarcated. The future roles of these organizations are suggested in Tables 3.4.4-3.4.5.

3) Balanced Development

Well-balanced development among regions should be reflected in the selection of local wholesale markets. Table 3.4.6 shows the selection criteria and target locations for establishing wholesale markets. After rough examination, the JICA team recommends the construction of 8 local wholesale markets in each regional center, namely Sohar, Rustaq, Sur, Ibra, Nizwa, Sumair, Ibri, and Buraimi as shown in Table 3.4.7.

The detailed contents of the project are described below:

1) First Stage

- a) Feasibility study on establishing a wholesale market (NM-1-1)

Table 3.4.1 Production Amount

| ITEM | 1988 | 1995 | 2000 |
|------------------------|---------------|-----------------|---------|
| | ACTUAL (1) | PROSPECT (2) | (3) |
| 1. VEGETABLES | 133,909 | 172,950 | 204,005 |
| 2. TUBERS | 5,900 | 19,382 | 22,754 |
| 3. FRUITS | 167,442 | 248,768 | 286,500 |
| DATES | 100,000 | 126,651 | 145,020 |
| 4. SPICES | 5,553 | 7,934 | 9,777 |
| 5. TOTAL | 212,804 | 322,383 | 378,016 |
| INCREASE IN PRODUCTION | | | |
| | 100% | 151% | 178% |

NOTES : ITEM5=1+2+3+4-DATES

SOURCE : JICA TEAM ESTIMATE

Table 3.4.2 Distribution Volume Prospect by PAMAP

| ITEM | 1988 | 1995 | 2000 | REMARKS |
|-------------------|---------------|-----------------|---------|---------|
| | ACTUAL (4) | PROSPECT (5) | (6) | |
| # ALTERNATIVE-1 | 17,669 | 38,686 | 94,504 | * |
| RATIO FOR | | | | |
| PAMAP/PROD. | 8% | 12% | 25% | |
| INCREASE IN PAMAP | 100% | 219% | 535% | |
| ALTERNATIVE-2 | 17,669 | 51,581 | 124,745 | ** |
| RATIO FOR | | | | |
| PAMAP/PROD. | 8% | 16% | 33% | |
| INCREASE IN PAMAP | 100% | 292% | 706% | |
| ALTERNATIVE-3 | 17,669 | 80,596 | 189,008 | *** |
| RATIO FOR | | | | |
| PAMAP/PROD. | 8% | 25% | 50% | |
| INCREASE IN PAMAP | 100% | 456% | 1070% | |
| ALTERNATIVE-4 | 17,669 | 128,953 | 283,512 | |
| RATIO FOR | | | | |
| PAMAP/PROD. | 8% | 40% | 75% | |
| INCREASE IN PAMAP | 100% | 730% | 1605% | |
| ALTERNATIVE-5 | 17,669 | 161,192 | 283,512 | |
| RATIO FOR | | | | |
| PAMAP/PROD. | 8% | 50% | 75% | |
| INCREASE IN PAMAP | 100% | 912% | 1605% | |

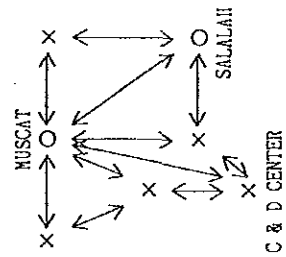
Table 3.4.3 Dealing Volume Prospect in Wholesale Market in 2000

| | | POPULATION NUMBER | | |
|---|---------------------------|-------------------|---------|--------|
| CENTRAL W/M | 3 PLACES | 612,000 | 29% | |
| | (MUTTRAH, SEEB, SALALAH) | | | |
| REGIONAL W/M | 4 PLACES | 572,000 | 27% | |
| | (SOHAR, SUR, NIZWA, IBRI) | | | |
| (TOTAL POPULATION IN OMAN IN 2000 : 214,6000) | | | | |
| RATIO VIA W/M | | 50 % | 67 % | 100 % |
| TOTAL DEALING VOLUME IN W/M (TON) | | | | |
| | | 94,000 | 124,000 | 18,800 |
| | | * | ** | *** |

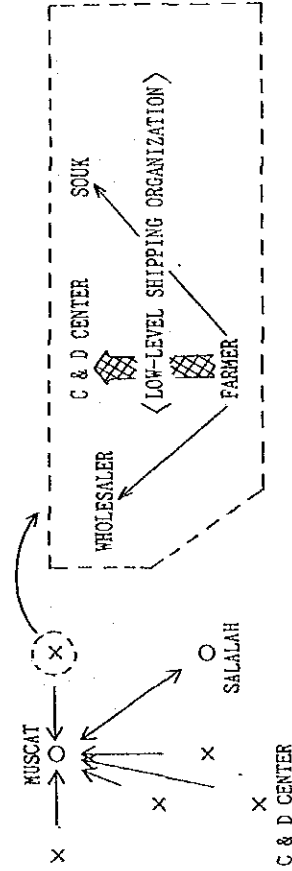
Table 3.4.4 Future Role of Organizations Concerned with Distribution

| ORGANIZATION | ROLE | PRESENT 1990 | INTRODUCTION STAGE 1991-1994 | CONSTRUCTION STAGE 1995-2000 | OPERATION STAGE 2001- |
|------------------|--|-----------------|------------------------------------|---------------------------------|----------------------------------|
| PUBLIC SECTOR | 1. TO PURCHASE AND DISTRIBUTE | ○ | ○ (EXPANSION WITH DECREE) | △ | △ (ON CONSIGNMENT OR PURCHASE) |
| | 2. TO SELL | ○ | ○ (EXPANSION WITH DECREE) | △ | △ (PILOT PROJECT) |
| | 3. TO PROCESS | ○ | △ (PILOT PROJECT) | ○ | ○ (PRODUCE & LIVESTOCK) |
| | 4. TO ISSUE IMPORT PERMITS | ○ | ○ (PRODUCE & LIVESTOCK) | ○ | ○ (PRODUCE & LIVESTOCK) |
| | 5. TO SUPERVISE AND SUPPORT W/M OR OPERATE W/M * | ○ | ○ (STUDY, PILOT, ANNOUNCE & TRAIN) | ○ | ○ (CONSTRUCTION & OPERATE) |
| | 6. TO ASSIST LOW-LEVEL SHIPPING ORGANIZATION | ○ | ○ | ○ | ○ (AUCTION OR NEGOTIATED MARKET) |
| | 7. TO IMPLEMENT NATION-WIDE DISTRIBUTION SYSTEM | ○ | ○ | ○ | ○ |
| | 8. TO PROMOTE BALANCE | ○ | ○ (PRODUCE & EGGS) | ○ | ○ (PRODUCE & EGGS) |
| | 9. TO IMPLEMENT PRICING POLICY | ○ | ○ | ○ | ○ |
| | 10. TO MAKE STRATEGY | ○ | ○ | ○ | ○ |
| | 11. TO COORDINATE AMONG ORGANIZATIONS CONCERNED | ○ | ○ | ○ | ○ |
| | 12. TO CONDUCT NUTRITION SURVEY | ○ | ○ | ○ | ○ |
| | 13. TO CONSTRUCT RETAIL MARKETS | ○ | ○ | ○ | ○ |
| | 14. TO PURCHASE AND DISTRIBUTE | ○ | ○ | ○ | ○ |
| | 15. TO SELL | ○ | ○ | ○ | ○ |
| | 16. TO PROCESS | ○ | ○ | ○ | ○ |
| | 17. TO IMPORT AND EXPORT | ○ | ○ | ○ | ○ |
| | 18. TO OPERATE W/M * | ○ | △ | △ | △ (AUCTION OR NEGOTIATED MARKET) |
| PRIVATE SECTOR | | | | | |

TO PURCHASE AND DISTRIBUTE AT PRESENT
BY PRESENT



OPERATION STAGE
6. TO IMPLEMENT LOW-LEVEL SHIPPING ORGANIZATION
7. TO IMPLEMENT NATION-WIDE DISTRIBUTION SYSTEM



14. TO PURCHASE AND DISTRIBUTE

Table 3.4.5 Future Role of PAMAP

| ITEM | PRESENT | FUTURE | REMARKS | | | | | | | | | | | | | | | | | | | | |
|------------------------------|--|---|---------|------|------|------|-------------------|--------|--------|--------|------------------------------|-------|-------|-------|----------------|----|-----|-----|-------------------|------|------|------|--|
| 1. DEVELOPMENT TARGET | | <p>TO CONNECT PRODUCTION AND CONSUMPTION IN A WAY ACCEPTABLE TO BOTH PRODUCERS AND CONSUMERS</p> <p>TARGET FIGURE</p> <table border="1" data-bbox="379 488 528 1151"> <tr> <td>YEAR</td> <td>1988</td> <td>1955</td> <td>2000</td> </tr> <tr> <td>PRODUCTION AMOUNT</td> <td>212804</td> <td>322383</td> <td>378016</td> </tr> <tr> <td>DISTRIBUTION VOLUME IN PAMAP</td> <td>17669</td> <td>38686</td> <td>94504</td> </tr> <tr> <td>SHARE OF PAMAP</td> <td>8%</td> <td>12%</td> <td>25%</td> </tr> <tr> <td>INCREASE IN PAMAP</td> <td>100%</td> <td>219%</td> <td>535%</td> </tr> </table> | YEAR | 1988 | 1955 | 2000 | PRODUCTION AMOUNT | 212804 | 322383 | 378016 | DISTRIBUTION VOLUME IN PAMAP | 17669 | 38686 | 94504 | SHARE OF PAMAP | 8% | 12% | 25% | INCREASE IN PAMAP | 100% | 219% | 535% | |
| YEAR | 1988 | 1955 | 2000 | | | | | | | | | | | | | | | | | | | | |
| PRODUCTION AMOUNT | 212804 | 322383 | 378016 | | | | | | | | | | | | | | | | | | | | |
| DISTRIBUTION VOLUME IN PAMAP | 17669 | 38686 | 94504 | | | | | | | | | | | | | | | | | | | | |
| SHARE OF PAMAP | 8% | 12% | 25% | | | | | | | | | | | | | | | | | | | | |
| INCREASE IN PAMAP | 100% | 219% | 535% | | | | | | | | | | | | | | | | | | | | |
| 2. OBJECTIVES | <p>1) TO ENCOURAGE THE OMANI FARMERS TO INCREASE THEIR PRODUCTION OF FRUITS, VEGETABLES AND OTHER AGRICULTURAL CROPS BY CREATING A BODY TO MARKET SUCH PRODUCTS</p> <p>2) TO ENSURE THE AVAILABILITY OF SUCH PRODUCTS IN THE LOCAL MARKET, IN THE REQUIRED QUANTITIES AND AT REASONABLE PRICES</p> | <p>1) TO FORM PRICE DETERMINATION AND PHYSICAL DISTRIBUTION THROUGH THE WHOLESALE MARKET</p> <p>2) TO PROMOTE WELL-BALANCED SUPPLY AND DEMAND RELATIONSHIPS</p> <p>3) TO PROMOTE DISTRIBUTION EFFICIENCY OF NATION-WIDE DISTRIBUTION SYSTEM</p> <p>4) TO STRENGTHEN FARMER-LEVEL SHIPPING ORGANIZATIONS</p> | | | | | | | | | | | | | | | | | | | | | |
| 3. ROLE | <p>1) TO PURCHASE AGRICULTURAL PRODUCE BROUGHT INTO CENTERS BY THE FARMERS AND TO DISTRIBUTE IT TO THE CONSUMER AREA</p> <p>2) TO SELL PRODUCE THROUGH EACH CENTER</p> <p>3) MANAGE AGRICULTURAL PROCESSING FACILITIES</p> <p>4) TO ISSUE IMPORT PERMITS FOR AGRICULTURAL PRODUCE TO TRADERS</p> | <p>1) TO PURCHASE AGRICULTURAL PRODUCE AND EGGS BROUGHT INTO CENTERS BY FARMER-LEVEL SHIPPING ORGANIZATIONS AND FARMERS ON CONSIGNMENT OR PURCHASING BASIS AND TO DISTRIBUTE IT TO MUSCAT AND SALALAH AS MAIN CONSUMER AREAS THROUGH NATION-WIDE DISTRIBUTION SYSTEM</p> <p>2) TO MANAGE PILOT AGRICULTURAL PROCESSING PROJECTS</p> <p>3) TO ISSUE IMPORT PERMITS FOR AGRICULTURAL PRODUCE AND LIVESTOCK TO TRADERS ACCORDING TO PROSPECTS FOR DEMAND AND SUPPLY</p> <p>4) TO SUPERVISE AND SUPPORT THE WHOLESALE MARKET OR OPERATE THE WHOLESALE MARKET WHICH CONTRIBUTES TO THE FORMATION OF PRICE DETERMINATION AND PHYSICAL DISTRIBUTION</p> <p>5) TO FORM, TRAIN AND ASSIST FARMER-LEVEL SHIPPING ORGANIZATIONS</p> <p>6) TO PROMOTE WELL-BALANCED SUPPLY AND DEMAND RELATIONSHIP THROUGH VARIOUS COUNTERMEASURES</p> <p>7) TO IMPLEMENT PRICING POLICY FOR AGRICULTURAL PRODUCE</p> | | | | | | | | | | | | | | | | | | | | | |

Table 3.4.6 Target Region for Wholesale Market and Farmer-Level Shipping Organizations

| NO | WILAYAT | REGION | NUMBER OF HOLDINGS | | AREA UNDER CULTIVATION (ha) | | POPULATION | | REGIONAL CENTER | PAPAP CAD CENTER PLACE | PURCHASE (TON) IN 1988 | CENTRAL WHOLESALE MARKET (POPULATION 1988-2010) | REGIONAL WHOLESALE MARKET (POPULATION 1988-2010) | LOW-LEVEL SHIPPING ORGANIZATIONS |
|----|-----------------|----------|--------------------|-------|-----------------------------|-------|------------|------|-----------------|------------------------|------------------------|---|--|----------------------------------|
| | | | (178/79) | RANK | (70/79) | RANK | 1988 | RANK | | | | | | |
| 1 | SEEB & MUSCAT | MUSCAT | 1,584 | 22 | 1,314 | 32 | 43,000 | 21 | MUSCAT | CAPITA AREA CURIYAT | 1,724 | MUTTRAH (175,000-240,000) | | |
| 2 | CURIYAT | MUSCAT | 2,244 | 34 | 801 | 27 | 43,000 | 21 | | | 84 | MUTTRAH (175,000-240,000) | | |
| 3 | MUSCAT TOTAL | | 3,828 | 52 | 2,115 | 52 | | | | | | | | |
| 4 | MADI MAHIL | BATINAH | 650 | 04 | 294 | 14 | 30,000 | 18 | | | | | | BARQA |
| 5 | AL AMBI | BATINAH | 2,398 | 34 | 2,000 | 52 | 45,000 | 31 | | | | | | |
| 6 | MAKHAL | BATINAH | 1,326 | 22 | 499 | 12 | 83,000 | 35 | | | | | | |
| 7 | AL MUSANNA | BATINAH | 1,400 | 22 | 1,400 | 32 | 34,000 | 15 | | | | | | AL MUSANNA |
| 8 | AL SUWALO | BATINAH | 2,420 | 32 | 2,708 | 72 | 31,000 | 1 | | | | | | AL SUWALO |
| 9 | AL RUSTAQ | BATINAH | 4,134 | 52 | 1,182 | 32 | 75,000 | 4 | | | | | | AL RUSTAQ |
| 10 | MASIRAH | BATINAH | 154 | 02 | 14 | 02 | | | | | | | | |
| 11 | AL KHABURA | BATINAH | 1,892 | 22 | 1,074 | 32 | 22,000 | 21 | | | | | | |
| 12 | SAHAR | BATINAH | 3,036 | 42 | 2,043 | 52 | 73,000 | 5 | | | | | | |
| 13 | SOHAR | BATINAH | 3,564 | 42 | 4,424 | 112 | 34,000 | 3 | | | | | | SOHAR (84,000-143,000) |
| 14 | LIHA | BATINAH | 1,298 | 22 | 1,815 | 42 | 36,000 | 13 | | | | | | |
| 15 | SHINAS | BATINAH | 2,398 | 32 | 4,117 | 102 | 84,000 | 6 | | | | | | SHINAS |
| 16 | MADI BANI KHALI | SHARQIYA | 24,970 | 302 | 21,416 | 522 | | | | | | | | |
| 17 | IBRA | SHARQIYA | 500 | 12 | 69 | 02 | 5,000 | 35 | | | | | | |
| 18 | BANI ABU HASSAN | SHARQIYA | 1,210 | 12 | 350 | 12 | 30,000 | 17 | | | | | | IBRA (18,000-41,000) |
| 19 | AL QABIL | SHARQIYA | 748 | 12 | 346 | 12 | 12,000 | 32 | | | | | | |
| 20 | MADI DINA | SHARQIYA | 1,938 | 22 | 365 | 12 | 16,000 | 24 | | | | | | |
| 21 | KARIL & WAFI | SHARQIYA | 924 | 12 | 548 | 12 | 14,000 | 29 | | | | | | |
| 22 | BANI ABU ALI | SHARQIYA | 2,266 | 32 | 353 | 12 | 50,000 | 5 | | | | | | |
| 23 | SUR | SHARQIYA | 1,804 | 22 | 631 | 22 | 80,000 | 7 | | | | | | |
| 24 | AL MUDHAIBY | SHARQIYA | 3,498 | 42 | 1,269 | 32 | 35,000 | 14 | | | | | | AL MUDHAIBY |
| 25 | BI'DIYA | SHARQIYA | 636 | 12 | 461 | 12 | 15,000 | 28 | | | | | | |
| 26 | BAHLA | DAKHLIYA | 2,668 | 22 | 1,075 | 32 | 30,000 | 12 | | | | | | |
| 27 | NIZWA | DAKHLIYA | 2,288 | 32 | 882 | 22 | 59,000 | 8 | | | | | | NIZWA (59,000-125,000) |
| 28 | AL HARRA | DAKHLIYA | 968 | 12 | 665 | 22 | 19,000 | 22 | | | | | | |
| 29 | MARAH | DAKHLIYA | 608 | 12 | 181 | 02 | 26,000 | 19 | | | | | | |
| 30 | ADRAH | DAKHLIYA | 374 | 02 | 121 | 02 | 12,000 | 33 | | | | | | |
| 31 | JABAL AKHDAR | DAKHLIYA | 484 | 12 | 138 | 02 | 8,000 | 34 | | | | | | |
| 32 | IZKI | DAKHLIYA | 1,628 | 22 | 663 | 22 | 17,000 | 25 | | | | | | |
| 33 | SABAIL | DAKHLIYA | 2,024 | 22 | 857 | 22 | 41,000 | 11 | | | | | | SABAIL (41,000-88,000) |
| 34 | BI'DIYD | DAKHLIYA | 792 | 12 | 388 | 12 | 17,000 | 26 | | | | | | |
| 35 | DHAK | DAKHLIYA | 11,286 | 142 | 5,167 | 132 | | | | | | | | |
| 36 | IBRA | DHAKHIRA | 4,498 | 52 | 2,481 | 62 | 50,000 | 2 | | | | | | IBRA (50,000-175,000) |
| 37 | MARJUL | DHAKHIRA | 1,878 | 12 | 376 | 12 | 16,000 | 27 | | | | | | |
| 38 | AL BURAIMI | DHAKHIRA | 1,276 | 22 | 447 | 12 | 33,000 | 16 | | | | | | BURAIMI (33,000-93,000) |
| 39 | MHADHA | DHAKHIRA | 748 | 12 | 436 | 12 | 25,000 | 20 | | | | | | |
| 40 | DHAKHIRA TOTAL | | 9,426 | 102 | 4,189 | 102 | | | | | | | | |
| 41 | DHAKHIRA | JANUBIYA | 17,468 | 212 | 2,411 | 62 | 5 | | | | | | | |
| 42 | JANUBIYA TOTAL | | 17,468 | 212 | 2,411 | 62 | | | | | | | | |
| 43 | KHASAB | MUSANDAR | 1,342 | 22 | 546 | 12 | 22 | | | | | | | |
| 44 | AL BIYA | MUSANDAR | 632 | 12 | 312 | 12 | 34 | | | | | | | |
| 45 | BURKA | MUSANDAR | 440 | 12 | 172 | 02 | 39 | | | | | | | |
| 46 | MUSANDAR TOTAL | | 2,420 | 32 | 1,030 | 32 | | | | | | | | |
| 47 | GRAND TOTAL | | 83,204 | 1,002 | 41,021 | 1,002 | | | | | | | | |
| | | | | | | | | | 18 PLACES | | 3 PLACES | €12,000 | 8 PLACES | -2900:572,000 |
| | | | | | | | | | | | | | | 2005:696,000 |

SOURCE : REGIONAL DEVELOPMENT PLAN BY DEVELOPMENT COUNCIL
TABLE 3.3.4 IN PROGRESS REPORT (1) BY JICA TEAM

Table 3.4.7 Establishment of Wholesale Market

| REGION | MUSCAT | | JANUBIYA | | BATINAH | | SHARQIYA | | DAKHLIYA | | DHAHIRA | | TOTAL |
|---------------------------------|---------|---------|----------|---------|---------|---------|----------|---------|----------|---------|---------|-----------|-------|
| | MUTTRAH | SEEB | SALALAH | SALALAH | SOHAR | RUSTAQA | SUR | IBRA | NIZWA | SAMAIL | IBRI | BURAIMI | |
| POPULATION | 248,000 | 174,000 | 190,000 | 143,000 | 101,000 | 128,000 | 44,000 | 126,000 | 88,000 | 175,000 | 93,000 | 1,510,000 | |
| VOLUME PER DAY (TONS) | 179 | 126 | 137 | 126 | 91 | 91 | 32 | 91 | 64 | 126 | 64 | | |
| WHOLESALE MARKET | | | | | | | | | | | | | |
| BUILDING AREA (m ²) | 6,185 | 4,523 | 4,862 | 4,523 | 3,278 | 3,278 | 1,334 | 3,278 | 2,412 | 4,523 | 2,412 | 40,608 | |
| PARKING AREA (m ²) | 7500 | 5,500 | 5,750 | 5,500 | 4,000 | 4,000 | 1,750 | 4,000 | 3,000 | 5,500 | 3,000 | 42,000 | |
| SITE (m ²) | 30000 | 22,000 | 23,000 | 22,000 | 16,000 | 16,000 | 6,800 | 16,000 | 12,000 | 22,000 | 12,000 | 167,800 | |
| CONSTRUCTION YEAR | 1,995 | 1,997 | 1,997 | 1,998 | 2,002 | 2,000 | 2,002 | 2,000 | 2,002 | 1,998 | 2,002 | | |
| COST (1000 R.O.) | 2,527 | 1,845 | 1,979 | 1,844 | 1,339 | 1,339 | 551 | 1,339 | 989 | 1,844 | 989 | 16,585 | |

- b) Study on the expansion of collection and distribution volume handled by PAMAP (NM-1-2)
- c) Implementation of collection and distribution expansion of PAMAP (NM-1-3)
- d) Training of PAMAP staff for implementation of the pilot project (NM-1-4)

2) Second Stage

- a) Consultant support for the operation of the pilot wholesale market (NM-2-1)
- b) Detailed design on wholesale market establishment (NM-2-2)

3) Third Stage

- a) Construction and operation of the central wholesale market (NM-3-1, NM-3-2, NM-3-3)
- b) Construction and operation of local wholesale markets (NM-3-4, NM-3-5, NM-3-6, NM3-7)
- c) Training of staff engaged in the operation of wholesale markets (NM-3-8)

Responsibility:

The first and second stage will be done by PAMAP. The government will construct wholesale markets in Muscat and Salalah during the third stage. Also, the government will hire consultants to assist with the supervision of construction. PAMAP will organize an executing body for wholesale markets which will be composed of persons from both private and public sectors. The operation will be conducted by both PAMAP and the executing body at the initial stage. After completely achieving a stable level of operation, the whole management authority will be transferred to the executing body. However, the government will continue to subsidize a part of the operation cost through PAMAP.

Timing:

1) First Stage

-F/S on the wholesale market and study on PAMAP collection and

distribution expansion will be conducted in 1991.

- Implementation of PAMAP collection and distribution expansion will come after the study from 1992-1995.
- Training of PAMAP staff for operating the pilot wholesale market will be conducted from 1992-1993.

2) Second Stage

- The pilot wholesale market will be established in 1992.
- Consultant support for the operation of the pilot project will start in 1993 and be completed in 1996.

3) Third Stage

- D/D on the central wholesale market at Muttrah and on that of Seeb and Salalah will be conducted in 1994 and 1996, respectively.
- Construction of central wholesale market will follow after the completion of D/D, i.e. Muttrah in 1995 and Seeb and Salalah in 1997.
- Subsidy for the operation of wholesale markets will be granted for three years from the start of operation, i.e. Muttrah from 1996 to 1998 and Seeb and Salalah from 1998 to 2000.
- Construction and operation of the local wholesale markets will start in 1998 according to priority confirmed by F/S.
- Training of staff engaged in wholesale market operation will start in 1994 and continue for 6 years.

Table 3.4.8 shows the detailed schedule.

Budget:

The outline of cost estimate is:

- First stage: R.O. 322,000
- Second stage: R.O. 904,000
- Third stage: R.O. 17,100,000

The detailed cost estimate for construction is shown in Table 3.4.9. That for total consulting services in the distribution sector is shown in Table 3.4.10.

Table 3.4.8 Time Schedule of ND-1 Project (10-Year Plan)

| DESCRIPTION NUMBER | PROJECT NUMBER | NAME OF PROGRAM/PROJECT | EXECUTING AGENCY | SCHEDULE | | | | | | | | | | | | | | | | |
|--------------------|----------------|--|------------------|----------|------|------|------|------|------|------|------|------|------|--|--|--|--|--|--|--|
| | | | | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | | | | | | | |
| ND-1 | NM-1 | ESTABLISHMENT OF WHOLESALE MARKET (STUDY) | | | | | | | | | | | | | | | | | | |
| | | STUDY ON ESTABLISHING WHOLESALE MARKET | PAMAP | | | | | | | | | | | | | | | | | |
| | | STUDY ON EXPANSION OF DISTRIBUTION VOLUME IN PAMAP | PAMAP | | | | | | | | | | | | | | | | | |
| | | IMPLEMENTATION OF EXPANSION OF DISTRIBUTION VOLUME IN PAMAP | PAMAP | | | | | | | | | | | | | | | | | |
| | | TRAINING STAFF OF PAMAP FOR IMPLEMENTATION OF THE PILOT PROJECT | PAMAP | | | | | | | | | | | | | | | | | |
| | NM-2 | PILOT WHOLESALE MARKET | | | | | | | | | | | | | | | | | | |
| | NM-2-1 | OPERATION OF PILOT WHOLESALE MARKET (SUPPORT BY CONSULTANT) | PAMAP | | | | | | | | | | | | | | | | | |
| | NM-2-2 | DETAIL DESIGN OF WHOLESALE MARKET | PAMAP | | | | | | | | | | | | | | | | | |
| | NM-3 | CONSTRUCTION AND OPERATION OF WHOLESALE MARKET | | | | | | | | | | | | | | | | | | |
| | NM-3-1 | CONSTRUCTION OF WHOLESALE MARKET | PAMAP | | | | | | | | | | | | | | | | | |
| | | PHASE-1 | MUTTRAH | | | | | | | | | | | | | | | | | |
| | | PHASE-2 | SEEB | | | | | | | | | | | | | | | | | |
| | NM-3-2 | CONSTRUCTION OF WHOLESALE MARKET (SUPERVISION BY CONSULTANT) | | | | | | | | | | | | | | | | | | |
| | | PHASE-1 | MUTTRAH | | | | | | | | | | | | | | | | | |
| | | PHASE-2 | SEEB | | | | | | | | | | | | | | | | | |
| | NM-3-3 | SUBSIDY FOR REMUNERATION OF OPERATION IN WHOLESALE MARKET | | | | | | | | | | | | | | | | | | |
| | | PHASE-1 | MUTTRAH | | | | | | | | | | | | | | | | | |
| | | PHASE-2 | SEEB | | | | | | | | | | | | | | | | | |
| | NM-3-4 | STUDY & O/D OF LOCAL WHOLESALE MARKET | | | | | | | | | | | | | | | | | | |
| | | PHASE-1 | MUTTRAH | | | | | | | | | | | | | | | | | |
| | | PHASE-2 | SEEB | | | | | | | | | | | | | | | | | |
| | NM-3-5 | CONSTRUCTION OF LOCAL WHOLESALE MARKET | | | | | | | | | | | | | | | | | | |
| | | PHASE-1 | SOHAR | | | | | | | | | | | | | | | | | |
| | | | IBRI | | | | | | | | | | | | | | | | | |
| | | PHASE-2 | SUR | | | | | | | | | | | | | | | | | |
| | | | NIZWA | | | | | | | | | | | | | | | | | |
| | | PHASE-3 | RUSTAQ | | | | | | | | | | | | | | | | | |
| | | | IBRA | | | | | | | | | | | | | | | | | |
| | | | SAMAIL | | | | | | | | | | | | | | | | | |
| | | | AL-BURAIMI | | | | | | | | | | | | | | | | | |
| | NM-3-6 | CONSTRUCTION OF LOCAL WHOLESALE MARKET (SUPERVISION BY CONSULTANT) | | | | | | | | | | | | | | | | | | |
| | | PHASE-1 | SOHAR | | | | | | | | | | | | | | | | | |
| | | | IBRI | | | | | | | | | | | | | | | | | |
| | | PHASE-2 | SUR | | | | | | | | | | | | | | | | | |
| | | | NIZWA | | | | | | | | | | | | | | | | | |
| | NM-3-7 | SUBSIDY FOR REMUNERATION OF OPERATION IN LOCAL WHOLESALE MARKET | | | | | | | | | | | | | | | | | | |
| | | PHASE-1 | SOHAR | | | | | | | | | | | | | | | | | |
| | | | IBRI | | | | | | | | | | | | | | | | | |
| | | PHASE-2 | SUR | | | | | | | | | | | | | | | | | |
| | | | NIZWA | | | | | | | | | | | | | | | | | |
| | NM-3-8 | TRAINING STAFF FOR OPERATION OF WHOLESALE MARKETS (SUPPORT) | | | | | | | | | | | | | | | | | | |
| | | | PAMAP | | | | | | | | | | | | | | | | | |

Table 3.4.9 Detailed Cost Estimation of ND-1 Project
(10-Year Plan)

| 1. VOLUME OF DEALING ON WH | | DEMANDS OF FOOD PER CAPITA | | S/S RATE | |
|----------------------------|---------|----------------------------|---------|-----------|---------|
| ITEMS | kg/year | kg/person | kg/year | kg/person | kg/year |
| TOMATOES | 14.8 | 35.0% | 13.9 | 35.0% | 13.9 |
| ONIONS | 9.7 | 50.0% | 4.8 | 50.0% | 4.8 |
| GARLIC | 0.6 | 100.0% | 0.6 | 100.0% | 0.6 |
| PELONS | 13.7 | 92.0% | 12.6 | 92.0% | 12.6 |
| CABBAGE | 11.7 | 95.0% | 9.0 | 95.0% | 9.0 |
| CUCUMBERS | 6.1 | 95.0% | 5.8 | 95.0% | 5.8 |
| OKRA | 0.3 | 95.0% | 0.3 | 95.0% | 0.3 |
| EGLPLANTS | 4.8 | 95.0% | 4.6 | 95.0% | 4.6 |
| CAROTS | 2.1 | 95.0% | 2.0 | 95.0% | 2.0 |
| RADISHES | 0.0 | 95.0% | 0.0 | 95.0% | 0.0 |
| SQUASH | 1.8 | 95.0% | 1.7 | 95.0% | 1.7 |
| CALIFLOWER | 0.9 | 95.0% | 0.9 | 95.0% | 0.9 |
| OTHERS | 30.3 | 6.7% | 2.0 | 6.7% | 2.0 |
| POTATOES | 6.8 | 100.0% | 6.0 | 100.0% | 6.0 |
| OTHERS | 2.8 | 100.0% | 2.6 | 100.0% | 2.6 |
| DATES | 48.2 | 100.0% | 48.2 | 100.0% | 48.2 |
| LIMES | 8.2 | 100.0% | 8.2 | 100.0% | 8.2 |
| CITRUS | 6.5 | 95.3% | 6.2 | 95.3% | 6.2 |
| BANANAS | 6.8 | 100.0% | 6.8 | 100.0% | 6.8 |
| COCONUTS | 0.3 | 100.0% | 0.3 | 100.0% | 0.3 |
| GRAPES | 2.3 | 95.0% | 2.2 | 95.0% | 2.2 |
| PAPAYAS | 0.9 | 100.0% | 0.9 | 100.0% | 0.9 |
| MANGOES | 4.2 | 76.0% | 3.2 | 76.0% | 3.2 |
| OTHERS | 11.6 | 37.5% | 4.4 | 37.5% | 4.4 |
| TOTAL | 205.5 | | 158.8 | | 158.8 |

| BATTAR REGION | | SALALAN CENTRE | | RURAL-1 | | RURAL-2 | | RURAL-3 | | RURAL-4 | | TOTAL | |
|---------------|------------|----------------|------------|----------|------------|----------|------------|----------|------------|----------|------------|----------|------------|
| PRICE | ESTIMATION | PRICE | ESTIMATION | PRICE | ESTIMATION | PRICE | ESTIMATION | PRICE | ESTIMATION | PRICE | ESTIMATION | PRICE | ESTIMATION |
| (1000RS) | (1000RS) | (1000RS) | (1000RS) | (1000RS) | (1000RS) | (1000RS) | (1000RS) | (1000RS) | (1000RS) | (1000RS) | (1000RS) | (1000RS) | (1000RS) |
| 24800.0 | 174800 | 174800.0 | 126000.0 | 80000.0 | 44000.0 | 44000.0 | 44000.0 | 44000.0 | 44000.0 | 44000.0 | 44000.0 | 44000.0 | 44000.0 |
| 39389.9 | 27632.3 | 38173.2 | 27632.3 | 20000.6 | 19974.9 | 6887.5 | | | | | | | |
| 179.0 | 125.5 | 137.2 | 125.5 | 91.0 | 63.5 | 31.8 | | | | | | | |

| 2. WHOLESAL PLACE | | 3. MIDDLESALE PLACE | |
|-------------------|------------------------|---------------------|------------------------|
| RATIO VIA M/M | VOLUME VIA M/M PER DRY | RATIO VIA M/M | VOLUME VIA M/M PER DRY |
| 89.5 | 52.8 | 60.6 | 45.5 |
| 314.1 | 228.4 | 248.6 | 159.6 |
| 1258.3 | 881.4 | 982.5 | 638.3 |
| 314.1 | 228.4 | 248.6 | 159.6 |
| 1258.3 | 881.4 | 982.5 | 638.3 |

| 2. WHOLESAL PLACE | | 3. MIDDLESALE PLACE | |
|-------------------|------------------------|---------------------|------------------------|
| RATIO VIA M/M | VOLUME VIA M/M PER DRY | RATIO VIA M/M | VOLUME VIA M/M PER DRY |
| 89.5 | 52.8 | 60.6 | 45.5 |
| 314.1 | 228.4 | 248.6 | 159.6 |
| 1258.3 | 881.4 | 982.5 | 638.3 |
| 314.1 | 228.4 | 248.6 | 159.6 |
| 1258.3 | 881.4 | 982.5 | 638.3 |

Table 3.4.9 (continued)

| POPULATIONS | MUTIRAH | SEEB | SALALAH | RURAL-1 | RURAL-2 | RURAL-3 | RURAL-4 | UNIT PRICE | MUTIRAH | SEEB | SALALAH | CENTRE | RURAL-1 | RURAL-2 | RURAL-3 | RURAL-4 | TOTAL |
|------------------------------------|---------|-------|---------|---------|---------|---------|---------|------------|-----------------|-----------------|-----------------|-----------------------|-----------------|-----------------|-----------------|-----------------------|----------|
| TOTAL VOLUME PER YEAR (TONS) | 24800 | 17400 | 13000 | 17400 | 12500 | 8900 | 4300 | (1000R0/2) | COST ESTIMATION | COST ESTIMATION | COST ESTIMATION | TOTAL COST ESTIMATION | COST ESTIMATION | COST ESTIMATION | COST ESTIMATION | TOTAL COST ESTIMATION | (1000R0) |
| VOLUME PER DAY (TONS) | 68 | 48 | 36 | 48 | 34 | 25 | 12 | | (1000R0) | (1000R0) | (1000R0) | (1000R0) | (1000R0) | (1000R0) | (1000R0) | (1000R0) | (1000R0) |
| 4. DOCK | | | | | | | | | | | | | | | | | |
| RATIO VIA DOCK | | | | | | | | | | | | | | | | | |
| VOLUME VIA U/M PER DAY | 17.9 | 12.6 | 13.7 | 12.6 | 9.1 | 6.4 | 3.2 | | | | | | | | | | |
| DEALING VOLUME PER M2 | 0.0825 | | | | | | | | | | | | | | | | |
| SIZE (M2) | 217.0 | 152.2 | 166.2 | 152.2 | 110.2 | 77.0 | 38.5 | | | | | | | | | | |
| PATH (M2) | 72.3 | 50.7 | 55.4 | 50.7 | 35.7 | 25.7 | 12.8 | | | | | | | | | | |
| TOTAL (M2) | 289.3 | 203.0 | 221.7 | 203.0 | 147.0 | 102.7 | 51.3 | | 0.275 | 55.8 | 61.0 | 196.3 | 55.8 | 48.4 | 26.2 | 14.1 | 318.9 |
| 5. PARKING AREA | | | | | | | | | | | | | | | | | |
| NUMBER TRACKS FOR PEOPLE CONCERNED | | | | | | | | | | | | | | | | | |
| NUMBER CARS | 201.1 | 141.1 | 154.1 | 141.1 | 102.2 | 71.4 | 35.7 | | | | | | | | | | |
| TOTAL NUMBER | 180.0 | 80.0 | 90.0 | 90.0 | 50.0 | 50.0 | 30.0 | | | | | | | | | | |
| SIZE (M2) | 300.0 | 220.0 | 230.0 | 220.0 | 160.0 | 120.0 | 70.0 | | | | | | | | | | |
| 5. WAREHOUSE | | | | | | | | | | | | | | | | | |
| RATIO VIA WAREHOUSE | | | | | | | | | | | | | | | | | |
| VOLUME VIA U/M PER DAY | 21.5 | 15.1 | 16.5 | 15.1 | 10.9 | 7.6 | 3.8 | | | | | | | | | | |
| KEEPING PERIOD | 6 DAYS | | | | | | | | | | | | | | | | |
| KEEPING VOLUME (TONS) | 129.0 | 90.4 | 98.7 | 90.4 | 65.5 | 45.7 | 22.9 | | | | | | | | | | |
| DEALING VOLUME PER M2 | 0.75 | | | | | | | | | | | | | | | | |
| SIZE (M2) | 168.1 | 96.9 | 105.8 | 96.9 | 78.2 | 49.0 | 24.5 | | | | | | | | | | |
| PATH (M2) | 48.0 | 32.3 | 35.3 | 32.3 | 23.4 | 16.3 | 8.2 | | | | | | | | | | |
| TOTAL (M2) | 184.1 | 129.2 | 141.1 | 129.2 | 93.6 | 65.3 | 32.7 | | 0.300 | 55.2 | 38.8 | 136.3 | 55.2 | 28.1 | 19.6 | 9.8 | 221.4 |
| 7. REFRIGERATOR | | | | | | | | | | | | | | | | | |
| RATIO VIA REFRIGERATOR | | | | | | | | | | | | | | | | | |
| VOLUME VIA U/M PER DAY | 14.3 | 10.8 | 11.0 | 10.8 | 7.3 | 5.1 | 2.5 | | | | | | | | | | |
| KEEPING PERIOD | 6 DAYS | | | | | | | | | | | | | | | | |
| KEEPING VOLUME (TONS) | 85.9 | 60.3 | 65.8 | 60.3 | 43.7 | 38.5 | 15.2 | | | | | | | | | | |
| DEALING VOLUME PER M2 | 0.75 | | | | | | | | | | | | | | | | |
| SIZE (M2) | 128.9 | 90.4 | 98.7 | 90.4 | 65.5 | 45.7 | 22.9 | | | | | | | | | | |
| PATH (M2) | 25.8 | 16.1 | 19.7 | 16.1 | 13.1 | 9.1 | 4.6 | | | | | | | | | | |
| TOTAL (M2) | 154.7 | 108.5 | 118.5 | 108.5 | 78.6 | 54.9 | 27.4 | | 0.458 | 69.6 | 48.8 | 171.8 | 69.6 | 35.4 | 24.7 | 12.3 | 279.0 |

Table 3.4.9 (continued)

| POPULATIONS | MUTTRAH | SEEB | SALALAH | RURAL-1 | RURAL-2 | RURAL-3 | RURAL-4 | UNIT PRICE | MUTTRAH COST ESTIMATION (1988R0) | SEEB COST ESTIMATION (1988R0) | SALALAH COST ESTIMATION (1988R0) | RURAL-1 COST ESTIMATION (1988R0) | RURAL-2 COST ESTIMATION (1988R0) | RURAL-3 COST ESTIMATION (1988R0) | RURAL-4 COST ESTIMATION (1988R0) | TOTAL COST ESTIMATION (1988R0) | | | |
|--|---------|---------|---------|----------|----------|---------|---------|------------|----------------------------------|-------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|--------------------------------|-------|---------|---------|
| TOTAL VOLUME PER YEAR (TONS) | 248000 | 174000 | 190000 | 174000.0 | 126000.0 | 80000.0 | 40000.0 | | | | | | | | | | | | |
| VOLUME PER DAY (TONS) | 39383.3 | 27632.3 | 30173.2 | 27632.3 | 20309.6 | 13974.3 | 6987.5 | | | | | | | | | | | | |
| | 179.0 | 125.6 | 137.2 | 125.6 | 91.0 | 63.5 | 31.6 | | | | | | | | | | | | |
| 8. STAFF OFFICE | | | | | | | | | | | | | | | | | | | |
| ANNUAL DEALING VOLUME PER CAPITAL | 2000.0 | 2000.0 | 2000.0 | 2000.0 | 2000.0 | 2000.0 | 2000.0 | | | | | | | | | | | | |
| NUMBER OF STAFF | 19.7 | 13.8 | 15.1 | 13.8 | 10.0 | 7.0 | 3.5 | | | | | | | | | | | | |
| TOTAL STAFF | 25.0 | 19.0 | 20.0 | 19.0 | 15.0 | 12.0 | 8.0 | | | | | | | | | | | | |
| SIZE OF OFFICE (M2) | 500.0 | 300.0 | 400.0 | 300.0 | 300.0 | 240.0 | 180.0 | | | | | | | | | | | | |
| OTHER OFFICE | 150.0 | 114.0 | 120.0 | 114.0 | 99.8 | 72.0 | 54.0 | | | | | | | | | | | | |
| TOTAL OFFICE (M2) | 650.0 | 494.0 | 520.0 | 494.0 | 390.0 | 312.0 | 234.0 | | 0.400 | 260.0 | 197.6 | 208.0 | 665.6 | 197.6 | 156.0 | 124.8 | 92.6 | 1248.0 | 1913.5 |
| 9. OFFICE FOR RELATED COMPANIES | | | | | | | | | | | | | | | | | | | |
| ANNUAL DEALING VOLUME PER STAFF | 250.0 | 250.0 | 250.0 | 250.0 | 250.0 | 250.0 | 250.0 | | | | | | | | | | | | |
| NUMBER OF STAFF | 157.5 | 110.5 | 120.7 | 110.5 | 90.0 | 55.9 | 27.9 | | | | | | | | | | | | |
| TOTAL STAFF | 160.0 | 110.0 | 120.0 | 110.0 | 90.0 | 60.0 | 30.0 | | 0.400 | 960.0 | 660.0 | 720.0 | 2340.0 | 660.0 | 480.0 | 360.0 | 180.0 | 3840.0 | 6180.0 |
| SIZE OF OFFICE (M2) | 2400.0 | 1650.0 | 1800.0 | 1650.0 | 1500.0 | 900.0 | 450.0 | | 0.400 | 120.0 | 120.0 | 120.0 | 360.0 | 120.0 | 80.0 | 60.0 | 40.0 | 680.0 | 1040.0 |
| 10. TRAINING OFFICE (M2) | 300.0 | 300.0 | 300.0 | 300.0 | 200.0 | 150.0 | 100.0 | | 0.300 | 90.0 | 90.0 | 90.0 | 270.0 | 90.0 | 60.0 | 45.0 | 30.0 | 510.0 | 780.0 |
| 11. OTHER FACILITIES (M2) | 300.0 | 300.0 | 300.0 | 300.0 | 200.0 | 150.0 | 100.0 | | | | | | | | | | | | |
| 12. TOTAL AREA FOR BUILDING | 6195.4 | 4522.8 | 4862.4 | 4522.8 | 3278.1 | 2411.6 | 1333.9 | | 2301.9 | 1679.4 | 1806.0 | 5787.3 | 1679.4 | 1219.0 | 899.2 | 498.3 | 498.3 | 8772.8 | 15560.1 |
| 13. TOTAL AREA FOR WHOLESALE MARKET (M2) | | | | | | | | | | | | | | | | | | | |
| AREA FOR BUILDING AND PARKING (M2) | 13685.4 | 10022.8 | 10612.4 | 10022.8 | 7276.1 | 5411.0 | 3083.9 | | 2526.9 | 1844.4 | 1978.5 | 6349.8 | 1844.4 | 1339.0 | 989.2 | 550.0 | 550.0 | 10740.3 | 17990.1 |
| GREEN RESERVE AREA | 6432.1 | 4719.7 | 4987.8 | 4719.7 | 3428.7 | 2543.5 | 1449.4 | | | | | | | | | | | | |
| TOTAL AREA FOR W/M | 30176.2 | 22100.4 | 23400.4 | 22100.4 | 16048.3 | 11932.7 | 6799.8 | | | | | | | | | | | | |
| | 30000.0 | 22000.0 | 23000.0 | 22000.0 | 16000.0 | 12000.0 | 6000.0 | | | | | | | | | | | | |

SOURCE : JICA TEAM ESTIMATE

Table 3.4.10 Detailed Cost Estimation of Consultant Services
(10-Year Plan)

| PROJECT NUMBER | NAME OF PROJECT/PROGRAM | PRIORITY | TOTAL BUDGET (1000R.O.) | DETAIL COST ESTIMATION |
|----------------|--|----------|-------------------------|---|
| NH-1 | ESTABLISHMENT OF WHOLESALE MARKET (STUDY) | A | 322 | |
| NH-1-1 | STUDY ON ESTABLISHING WHOLESALE MARKET | | 210 | 32 M/M X 0.5,000 R.O./M/M X 1.25 (INDIRECT COST) X 1.05 (CONTINGENCY) |
| NH-1-2 | STUDY ON EXPANSION OF DISTRIBUTION VOLUME IN PAPAP | | 33 | 5 M/M |
| NH-1-3 | IMPLEMENTATION ON EXPANSION OF DISTRIBUTION VOLUME IN PAPAP | | - | |
| NH-1-4 | TRAINING STAFF OF PAPAP FOR IMPLEMENTATION OF THE PILOT PROJECT | | 79 | 12 M/M |
| NH-2 | PILOT WHOLESALE MARKET | | 364 | |
| NH-2-1 | OPERATION OF PILOT WHOLESALE MARKET (SUPPORT BY CONSULTANT) | A | 280 | 44 M/M |
| NH-2-2 | DETAIL DESIGN OF WHOLESALE MARKET | | 816 | 34 M/M |
| NH-3 | CONSTRUCTION AND OPERATION OF WHOLESALE MARKET | A | 17,100 | |
| NH-3-1 | CONSTRUCTION OF WHOLESALE MARKET | | 6,328 | |
| PHASE-1 | MUTIRAH | | 2,520 | |
| PHASE-2 | SEEB | | 1,844 | |
| PHASE-3 | SALALAH | | 1,970 | |
| NH-3-2 | CONSTRUCTION OF WHOLESALE MARKET (SUPERVISION BY CONSULTANT) | | 316 | |
| PHASE-1 | MUTIRAH | | 125 | 19 M/M |
| PHASE-2 | SEEB | | 32 | 14 M/M |
| PHASE-3 | SALALAH | | 98 | 15 M/M |
| NH-3-3 | SUBSIDY FOR REMUNERATION OF OPERATION IN WHOLESALE MARKET | | 1,875 | |
| PHASE-1 | MUTIRAH | | 800 | (50*100*160) X 0.10,000 X 25% (PERSON X 3YEARS X 6 RO/YEAR X 25%) |
| PHASE-2 | SEEB | | 550 | (40*70*110) X 0.10,000 X 25% |
| PHASE-3 | SALALAH | | 625 | (50*80*120) X 0.10,000 X 25% |
| NH-3-4 | STUDY & B/D OF LOCAL WHOLESALE MARKET | | 6,480 | |
| NH-3-5 | CONSTRUCTION OF LOCAL WHOLESALE MARKET | | 1,874 | |
| PHASE-1 | SOHAR | | 1,844 | |
| PHASE-2 | SUR | | 1,320 | |
| PHASE-3 | NIZWA | | 1,399 | |
| NH-3-6 | CONSTRUCTION OF LOCAL WHOLESALE MARKET (SUPERVISION BY CONSULTANT) | | 322 | |
| PHASE-1 | SOHAR | | 92 | 14 M/M |
| PHASE-2 | IBRI | | 92 | 14 M/M |
| PHASE-3 | SUR | | 69 | 11 M/M |
| PHASE-4 | NIZWA | | 69 | 11 M/M |
| NH-3-7 | SUBSIDY FOR REMUNERATION OF OPERATION IN LOCAL WHOLESALE MARKET | | 550 | |
| PHASE-1 | SOHAR | | 275 | (40*70) X 0.10,000 X 25% |
| PHASE-2 | IBRI | | 275 | (40*70) X 0.10,000 X 25% |
| NH-3-8 | TRAINING STAFFS FOR OPERATION OF WHOLESALE MARKETS (SUPPORT) | | 474 | 78 M/M |
| NH-4 | BASIC DATA COLLECTING PROGRAM | | 240 | |
| NH-4-1 | BASIC DATA COLLECTING PROGRAM (STUDY) | A | 96 | 16 M/M |
| NH-4-2 | BASIC DATA COLLECTING PROGRAM (EQUIPMENT) | | 43 | 7 M/M |
| NH-4-3 | BASIC DATA COLLECTING PROGRAM (SUPPORT BY CONSULTANT) | | 47 | 7 M/M |
| NH-4-4 | PREPARATION & PUBLICATION OF SUPPLY AND DEMAND FORECAST | | 26 | 4 M/M |
| NH-4-5 | INTRODUCTION FOR PRICING POLICY (STUDY) | | 26 | 4 M/M |
| NH-5 | PREPARATION & PUBLICATION OF SUPPLY AND DEMAND FORECAST (SUPPORT) | A | 144 | 22 M/M |
| NH-6 | MEASURES FOR ADJUSTMENT OF SUPPLY AND DEMAND (STUDY) | A | 60 | 9 M/M |
| NH-7 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS (STUDY) | A | 100 | 24 M/M |
| NH-8 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS | A | 810 | |
| NH-8-1 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS (SUPPORT) | | 60 | 9 M/M |
| NH-8-2 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS (EQUIPMENT) | | 750 | 2 TON TRUCK 100 NOS. X 0.7,500 R.O./NOS. |

Table 3.4.10 (continued)

| PROJECT NUMBER | NAME OF PROJECT/PROGRAM | PRIORITY | TOTAL BUDGET (10000 P.) | DETAIL COST ESTIMATION |
|----------------|--|----------|-------------------------|--|
| NH-9 | STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PARAP (STUDY) | A | 468 | |
| NH-9-1 | STUDY ON STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PARAP | | 238 | 35 M/M |
| NH-9-2 | D/D ON STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PARAP | | 238 | 35 M/M |
| NH-10 | STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PARAP | A | 3,730 | R.O. 103,000 R.O. 150,000 R.O. 10,800 |
| NH-10-1 | INTRODUCTION OF PRE-COOLING FACILITIES | | 780 | 3 PLACES X WAREHOUSE + VACUUM PRE-COOLING FACILITIES - 2 FORKLIFTS |
| NH-10-2 | CONSTRUCTION OF 3 NEW AND 10 EXPANSION CENTERS | | 3,000 | 3 NEW CENTERS AND 10 EXPANSION CENTERS UNDER DETAIL COST ESTIMATION BY PAMAP |
| TOTAL | DEVELOPMENT BUDGET TOTAL | | 23,988 | |
| | (ORAF LOAN) | | | |
| | STRENGTH PROGRAM FOR CENTRAL & LOCAL RECIPE AGENT AND WHOLESALER (EQUIPMENT & CAPITAL) | | 7,500 | 2 TON TRUCK 100 NOS./YEAR X @ 7,500 R.O./NOS. X 10 YEARS |

SOURCE : JICA TEAM ESTIMATE

[ND-2] Supply and Demand Forecast for Agricultural Produce
(Combination of NM-4, NM-5 and NM-6 shown in detailed project tables)

Objective:

The objective of the project is to study the possibility of providing stable production and planned delivery of agricultural produce by means of establishing a supply and demand forecast system and adjusting the market by either direct or indirect policies.

Description:

Statistical information for adjusting the relationship between demand and supply has not yet been satisfactorily sorted out in Oman, although some data are available. Statistical information which will clarify the present situation regarding production, distribution and consumption is urgently needed. Based on this information, future supply and demand for agricultural produce will be forecasted. Necessary measures should then be taken based on the data analysis and the results of the forecasted supply and demand.

The project is composed of three parts:

1) Collection of basic data

In order to prepare supply and demand forecasts and the measures for the adjustment of the unbalanced marketing situation, the collection of basic data regarding planted crops, cropped areas, the date for planting and harvesting, volume of distribution and consumption, retail prices and so forth is essential. Consulting services will be provided to determine an efficient method to collect and process such basic data.

2) Preparation and announcement of supply and demand forecast

The government will prepare a demand forecast of agricultural produce based on the analysis of both production and consumption trends and will announce the same to farmers through the press, PAMAP, and

agricultural institutes like extension centers, to enable the farmers to determine the best times for planting and shipping of produce. Under this project, consulting services will be provided to introduce and establish the method of forecasting. Following this, the forecasting activity will be initiated with support from the consultants for approximately the first 3 years.

3) Adjustment of supply and demand imbalance

The appropriate measures to adjust supply and demand imbalance will be studied and examined by the project consultants. The following measures are deemed to be effective:

- to determine the specific agricultural produce which is to be supplied on a regular basis and is intended for the supply and demand forecast
- to guarantee a stable profit for the farmers
- to require farmers to follow the adjustment schedule for production and shipment as directed by the government
- to secure incentive funds for the immediate shipping of produce at the time of a marked rise in the price of produce
- to secure price-sustaining funds for adjusting shipments at the time of a marked drop in the price of produce

Responsibility:

PAMAP will conduct all the components of the project. MAF will support the activities of PAMAP.

Timing:

1) Collection of basic data

- Basic data collection: 1991 (NM-4-1)
- Introduction of equipment to PAMAP for processing basic data: 1992 (NM-4-2)
- Support for data collection and processing: 1992-1994 (NM-4-3)
- Study on preparation for supply and demand forecast: 1991 (NM-4-4)

2) Preparation and announcement of supply and demand forecast

-Study on introduction of pricing policy: 1991 (NM-4-5)

-Support for supply and demand: 1992-1994 (NM-5)

3) Adjustment of supply and demand imbalance

-Study on the measures to adjust supply and demand imbalance:

1994 (NM-6)

Budget:

The outline of the cost estimate is:

| | |
|--|--------------|
| -Collection of basic data: | R.O. 240,000 |
| -Preparation and announcement of supply and demand forecast: | R.O. 144,000 |
| -Adjustment of supply and demand imbalance: | R.O. 60,000 |

A detailed cost estimate is shown in Table 3.4.10.

[ND-3] Establishment of Shipping Organization for Farmers
(Combination of NM-7 and NM-8 shown in detailed project
tables)

Objective:

The objective of the project is to assist farmers in establishing a farmer-level shipping organization in order to reduce shipping costs, increase the marketing volume of agricultural produce, and raise farmers' incomes.

Description:

The transportation sector has not yet been well developed due to the relatively limited volume of goods distributed in the Sultanate. As a result, PAMAP or other public organizations are required to collect the produce for the small farmers, or to assist them until farmer shipping groups are organized.

In the project, a method for establishing farmer-level shipping organizations in villages having adequate size and scale is to be studied first, and then to be implemented. The farmer-level shipping organization would have the following functions:

- collecting and shipping (using its own staff) its own agricultural produce to the PAMAP collection and distribution center
- the organization has responsibility for grading and packing of produce
- for grading, packing, collecting and shipping, the organization will be provided with materials and equipment free of charge by PAMAP
- producing and shipping its produce in accordance with the demand forecast and the directives of PAMAP

The organization should be composed of both farmer representatives and PAMAP staff. The farmer representatives will be elected from the members of the municipal committee formed in each village or community. The PAMAP staff working for the organization will assist

and train farmer representatives in how to collect, handle, grade, pack, transport and in the future, how to deal in the wholesale market. Training for forming and operating farmer-level shipping will be provided by PAMAP at the initial stage. Furthermore, transport vehicles and working capital will be provided to the organization by PAMAP. It should be noted that farmers are responsible for the sale of produce and the operation of the organization regardless of whether or not a profit is made.

The target regions and the number of farmer-level shipping organizations are recommended in Table 3.4.11.

Responsibility:

PAMAP will conduct the project. The responsibility of operation will be transferred to farmers gradually. When self-reliance is established, the farmer representatives will have full responsibility for the operation.

Timing:

The study on the project will be completed in 1992. The equipment (trucks) will be provided between 1993 and 1995 after establishing farmer-level shipping organizations. Consultants are required to support the establishing and operating of the organizations from 1993-1995.

Budget:

- 1) Study on the project (NM-7): R.O. 160,000
- 2) Support for the project (NM-8-1): R.O. 60,000
- 3) Provision of equipment (NM-8-2): R.O. 1,000,000
(100 organizations times R.O. 10,000)
(unit price R.O. 10,000 includes 5t truck)

Table 3.4.11 Target Region for Farmer-Level Shipping Organization

| NO | WILAYAT | REGION | NUMBER OF HOLDINGS | AREA UNDER CULTIVATION (ha) | | POPULATION | | REGIONAL CENTER | PAPAP & SD CENTER PLACE | CENTRAL WHOLESALE MARKET (POPULATION 1988-2010) | REGIONAL WHOLESALE MARKET (POPULATION 1988-2010) | LOW-LEVEL SHIPPING ORGANIZATIONS |
|-------------|-------------|----------|--------------------|-----------------------------|--------|------------|------|-----------------|-------------------------|---|--|----------------------------------|
| | | | | RANK | RANK | 1988 | 2010 | | | | | |
| 5 | BARKA | BATINAH | 2,329 | 34 | 2,800 | 54 | 7 | 45,000 | 10 | 83,000 | 11 | BARKA |
| 7 | AL RUSARRA | BATINAH | 1,430 | 24 | 1,486 | 32 | 9 | 34,000 | 15 | 65,000 | 16 | AL RUSARRA |
| 9 | AL RUSTAQ | BATINAH | 2,420 | 34 | 2,788 | 74 | 3 | 31,000 | 1 | 54,000 | 8 | AL RUSTAQ |
| 13 | SOHAR | BATINAH | 4,934 | 54 | 4,162 | 32 | 12 | 75,000 | 4 | 101,000 | 7 | SOHAR (75,000-101,000) |
| 15 | SHINGAS | BATINAH | 3,564 | 44 | 4,424 | 114 | 2 | 84,000 | 3 | 143,000 | 2 | SHINGAS |
| 24 | AL RUDHAIBY | SHARQIYA | 3,488 | 34 | 4,117 | 104 | 2 | 64,000 | 6 | 65,000 | 15 | AL RUDHAIBY |
| 33 | SAMAIL | SHARQIYA | 2,024 | 24 | 1,289 | 34 | 11 | 35,000 | 14 | 65,000 | 14 | SAMAIL |
| 36 | IBRI | DHARIRAH | 4,488 | 64 | 2,481 | 64 | 4 | 90,000 | 2 | 175,000 | 1 | IBRI (90,000-175,000) |
| 40 | DHOEFAR | JANUBIYA | 17,468 | 214 | 2,414 | 64 | 5 | | | | | DHOEFAR |
| GRAND TOTAL | | | 40,022 | | 22,697 | | | | 10 PLACES | 612,000 | 8 PLACES | 2000:572,000 2005:998,000 |

GROUND

AREA WITH L.S.O. 40,000 FARMERS
 AREA SHIPPING TO PANAP 50% 20,000 X 50% (10,000)
 FUTURE AREA SHIPPING TO PANAP 25% 10,000 X 50% (8,000)
 AREA SHIPPING TO SOUQ 25%
 TOTAL NUMBER OF L.S.O. = 100

AREA WITHOUT L.S.O. 43,000 FARMERS
 AREA SHIPPING TO PANAP 20% 8,600 X 30% (2,700)
 AREA SHIPPING TO SOUQ 80%
 TOTAL AREA 83,000 (20,700)

NOTE : JICA TEAM ESTIMATE
 SOURCE : REGIONAL DEVELOPMENT PLAN BY DEVELOPMENT COUNCIL
 TABLE 3.3.4. IN PROGRESS REPORT (1) BY JICA TEAM

[ND-4] Fortification of PAMAP

(Combination of NM-9 and NM-10 shown in detailed project tables)

Objective:

The objective of the project is to improve and develop the facilities of PAMAP in order to cope with the handling volume increase of agricultural produce in the future.

Description:

PAMAP will continue to play an important role in the nation-wide collection and distribution system in the future. In addition, the authority will be endowed with new roles to manage central wholesale markets, to supervise local wholesale markets, to foster farmer-level shipping organizations, to implement supply and demand forecasts, etc. From a 10-year perspective, establishing a new sophisticated nation-wide distribution system will be required. In this respect, it is essential to strengthen and reorganize PAMAP and its functions.

As efficient distribution will be achieved through the improvement of handling techniques in collecting, grading, packing, transporting and storing, the improvement of facilities, as well as the enhancement of human capabilities is of prime importance. The details of necessary facilities and functions to be improved or developed in PAMAP are:

1) Additional cold/dry storage facilities

- Establishment of additional cold storage for potatoes with an approximate capacity of 3,500 tons to be located in Sohar. Grading and packing facilities should be added.
- Dry storage for garlic and onions to be located in Nizwa with a capacity of approximately 1,000 tons and 300 tons for onions and garlic, respectively.
- Establishment of additional cold storage and ripening facilities for bananas at Muscat, as well as facilities for receiving in Salalah to meet the increase in turnover.

- Dry storage for dry limes at Mawaleh with a capacity of 200 tons.
- Increase in cold storage facilities in general, and specifically for Muscat to meet the increase in turnover.
- Long-term cold storage for fresh limes.
- Long-term cold storage for fresh dates.
- Other:
 - Racking for existing and proposed cold storage.
 - Dry storage facilities for frankincense either in the Dakhliya or in Mawaleh.

2) Grading and packing facilities

- Grading and packing unit for papayas in Salalah.
- Grading and packing facilities for coconuts in Salalah.
- Receiving unit for frankincense in Salalah. Grading and packing facilities located either at Salalah or at Mawaleh should be added.
- Grading and packing facilities for other produce.
- Packing materials for local as well as export marketing.

3) Additional centers, retail outlets and expansion of existing facilities

- Expansion of Shina collection center to meet the increased production of tomatoes.
- Development of Ibra center to meet the requirements of receiving and storage, whether in the receiving or in the cold storage facilities.
- Establishment of various retail outlets in the present collection and distribution center as well as in other markets.
- Establishment of collection points in Nejd, Hailat Araka areas in the Dhofar Region and seasonal collection points in the areas required.
- Expansion and development of Suwaiq banana receiving unit.
- Additional building for head office.
- Expansion of computer facilities.
- Other:
 - Establishment of new collection centers in Khasab, Mehda, Mussanah, and other areas.

4) Transportation facilities

- Development of transportation arrangements for selling functions in the various markets where there are no centers or retail outlets.

5) Others

- Development of exports

Quality increase in packing and grading

Development of exports of papayas, bananas, etc.

- Promotional activities

Development of promotional activities to meet the increase in turnover, and to target both local and international markets.

- To make representatives available from the import permit section of various customs points for the inspection of imported produce and the collection of import statistics.

- Development of laboratory in order to offer more services to the authority and also to provide the service to outside parties for a fee.

- Activity center for training purposes including an audio-visual and production unit.

- Building of a mosque in Muscat head office.

- Sewage treatment plant for re-use of water for irrigation purposes in Muscat.

The recommended nation-wide distribution system is shown in Table 3.4.12.

Responsibility:

PAMAP has full responsibility for the project.

Timing:

- 1) Feasibility study and detailed design on nation-wide distribution system will be conducted from 1991-1992.
- 2) Project implementation will take place from 1993-1995.

Table 3.4.12 Nation-Wide Distribution System

| SYSTEM | PLACE | DESCRIPTION |
|-------------------------------------|------------|---|
| 1. COLD-CHAIN SYSTEM | 1 SOHAR | C & D FACILITIES WITH PRECOOLING FACILITIES, FORKLIFT |
| | 2 SHINAS | C & D FACILITIES WITH PRECOOLING FACILITIES, FORKLIFT |
| | 3 SALALAH | C & D FACILITIES WITH PRECOOLING FACILITIES, FORKLIFT |
| 2. RE-ORGANIZATION FOR C & D CENTER | 1 HAILET | COLLECTION UNITS |
| | 2 IBRA | EXPANSION OF CENTER |
| | 3 KHASAB | NEW CENTER |
| | 4 MAHAKH | STORAGE FACILITIES |
| | 5 MEHDA | NEW CENTER |
| | 6 MUSCAT | EXPANSION OF CENTER, STORAGE FACILITIES |
| | 7 MUSSANAH | NEW CENTER |
| | 8 NIJD | COLLECTION UNITS |
| | 9 NIZWA | STORAGE FACILITIES |
| | 10 SALALAH | GRADING AND PACKING FACILITIES |
| | 11 SHINAS | EXPANSION OF CENTER |
| | 12 SOHAR | STORAGE FACILITIES |
| | 13 SUMAIQ | EXPANSION OF CENTER |

Budget:

- 1) Feasibility study and detailed design: R.O. 468,000
 - 2) Project implementation: R.O. 9,609,000
- (Detailed cost estimate is shown in Table 3.4.13.)

Table 3.4.13 Detailed Cost Estimation of ND-4 Project

| Item | Unit | Volume | Unit Price (RO 1,000) | Amount (R.O.) | Region |
|--|------|--------|--------------------------|------------------|----------------|
| 1. Additional Cold/Dry Storage Facilities | | | | | |
| 1) Cold storage for potato | set | 1 | 900 | 900 | Batinah |
| 2) Dry storage for garlic and onion | set | 1 | 250 | 250 | Dakhliya |
| 3) Cold storage and ripening facilities for banana | set | 1 | 2,200 | 2,200 | Muscat & South |
| 4) Dry storage for dry lime | set | 1 | 160 | 160 | South |
| 5) Increase cold storage in Muscat | set | 1 | 900 | 900 | Muscat |
| 6) Long term cold storage for fresh lime | set | 1 | 1,500 | 1,500 | All Oman |
| 7) Long-term cold storage for fresh dates | set | 1 | 1,500 | 1,500 | All Oman |
| Subtotal | | | | 7,410 | |
| 2. Grading & Packaging Facilities | | | | | |
| 1) Papaya | set | 1 | 80 | 80 | South |
| 2) Coconut | set | 1 | 80 | 80 | South |
| 3) Frankincense | set | 1 | 95 | 95 | South |
| 4) Other produce | set | 1 | 80 | 80 | All Oman |
| 5) Packing materials | set | 1 | 100 | 100 | All Oman |
| Subtotal | | | | 435 | |
| 3. Additional Centers/Retail Outlets | | | | | |
| 1) Shina collection center | set | 1 | 60 | 60 | Batinah |
| 2) Ibra center | set | 1 | 300 | 300 | Sharqiya |
| 3) Retail outlets | set | 1 | 180 | 180 | All Oman |
| 4) Collection points in Dhofar | set | 1 | 20 | 20 | South |
| 5) Head office | set | 1 | 19 | 19 | Muscat |
| 6) Computer facilities | set | 1 | 120 | 120 | Muscat |
| Subtotal | | | | 699 | |
| 4. Transport Facilities | | | | | |
| 1) Transport facilities | set | 1 | 350 | 350 | All Oman |
| 5. Others | | | | | |
| 1) Development of export | set | 1 | 100 | 100 | All Oman |
| 2) Promotional activities | set | 1 | 25 | 25 | All Oman |
| 3) Import inspection & statistics | set | 1 | 25 | 25 | All Oman |
| 4) Laboratory development | set | 1 | 175 | 175 | All Oman |
| 5) Training center | set | 1 | 300 | 300 | All Oman |
| 6) Building of mosque | set | 1 | 40 | 40 | Muscat |
| 7) Sewage treatment plant | set | 1 | 50 | 50 | Muscat |
| Subtotal | | | | 715 | |
| 6. Grand Total | | | | | |
| | | | | 9,609 | |

Appendix for Section 3.4

The following are appendix tables and figures prepared for better understanding of the new projects in the distribution sector. The list of tables and figures is shown below:

1. JICA team's estimate of the incremental recurrent budget required for new projects

Table 3.4.14 Recurrent Budget Total for Distribution Sector -
10-Year Plan

Table 3.4.15 Total Number of Additional PAMAP Staff Required for New
Projects - 10-Year Plan

2. Price Data of PAMAP

Table 3.4.16 PAMAP Produce-wise Margin Rate in 1989

Table 3.4.17 Farm Gate Price and Retail Price (Private and PAMAP)

Table 3.4.18 PAMAP Produce-wise Purchase Price per Unit in 1989

Table 3.4.19 PAMAP Produce-wise Sale Price per Unit in 1989

Table 3.4.20 Percentage of Purchase/Sale Price per Unit of PAMAP
by produce

Table 3.4.21 PAMAP Produce-wise Margin Rate in 1989

Table 3.4.22 Value and Quantity of Imports by Entry Points

3. Figures

Figure 3.4.1 PAMAP Organizational Structure in Future

Figure 3.4.2 Location Map of New Projects in Distribution Sector -
10-Year Plan

Table 3.4.14 Recurrent Budget Total for Distribution Sector - 10-Year Plan

| PROJECT NUMBER | NAME OF PROJECT/PROGRAM | PRIORITY | TOTAL RECURRENT (1988RO) | ANNUAL RECURRENT BUDGET | | | | | | | | | | | | | | | | |
|----------------|--|----------|--------------------------|-------------------------|------|------|------|------|------|------|------|------|------|-----|-----|-----|----|----|----|----|
| | | | | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | | | | | | | |
| NM-1 | ESTABLISHMENT OF WHOLESale MARKET (STUDY) | A | 250 | | 125 | 125 | | | | | | | | | | | | | | |
| NM-1-1 | STUDY ON ESTABLISHING WHOLESale MARKET | | | | | | | | | | | | | | | | | | | |
| NM-1-2 | STUDY ON EXPANSION OF DISTRIBUTION VOLUME IN PANAP | | | | | | | | | | | | | | | | | | | |
| NM-1-3 | IMPLEMENTATION ON EXPANSION OF DISTRIBUTION VOLUME IN PANAP | | | | | | | | | | | | | | | | | | | |
| NM-1-4 | TRAINING STAFF OF PANAP FOR IMPLEMENTATION OF THE PILOT PROJECT | | | | | | | | | | | | | | | | | | | |
| NM-2 | PILOT WHOLESale MARKET | A | 428 | | | 197 | 107 | 107 | 107 | | | | | | | | | | | |
| NM-2-1 | OPERATION OF PILOT WHOLESale MARKET (SUPPORT BY CONSULTANT) | | | | | | | | | | | | | | | | | | | |
| NM-2-2 | DETAIL DESIGN OF WHOLESale MARKET | | | | | | | | | | | | | | | | | | | |
| NM-3 | CONSTRUCTION AND OPERATION OF WHOLESale MARKET | A | 875 | | | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | | | | |
| NM-3-1 | CONSTRUCTION OF WHOLESale MARKET | | | | | | | | | | | | | | | | | | | |
| | PHASE-1 NUTTRAH | | | | | | | | | | | | | | | | | | | |
| | PHASE-2 SEEB | | | | | | | | | | | | | | | | | | | |
| | SALALAH | | | | | | | | | | | | | | | | | | | |
| NM-3-2 | CONSTRUCTION OF WHOLESale MARKET (SUPERVISION BY CONSULTANT) | | | | | | | | | | | | | | | | | | | |
| | PHASE-1 NUTTRAH | | | | | | | | | | | | | | | | | | | |
| | PHASE-2 SEEB | | | | | | | | | | | | | | | | | | | |
| NM-3-3 | SUBSIDY FOR REMUNERATION OF OPERATION IN WHOLESale MARKET | | | | | | | | | | | | | | | | | | | |
| | PHASE-1 NUTTRAH | | | | | | | | | | | | | | | | | | | |
| | PHASE-2 SEEB | | | | | | | | | | | | | | | | | | | |
| | SALALAH | | | | | | | | | | | | | | | | | | | |
| NM-3-4 | STUDY & D/D OF LOCAL WHOLESale MARKET | | | | | | | | | | | | | | | | | | | |
| NM-3-5 | CONSTRUCTION OF LOCAL WHOLESale MARKET | | 300 | | | | | | | | | | | | | | | | | |
| | PHASE-1 SOHAR | | | | | | | | | | | | | | | | | | | |
| | PHASE-2 SUR | | | | | | | | | | | | | | | | | | | |
| | PHASE-2 SUR | | | | | | | | | | | | | | | | | | | |
| NM-3-6 | CONSTRUCTION OF LOCAL WHOLESale MARKET (SUPERVISION BY CONSULTANT) | | | | | | | | | | | | | | | | | | | |
| | PHASE-1 SOHAR | | | | | | | | | | | | | | | | | | | |
| | PHASE-2 SUR | | | | | | | | | | | | | | | | | | | |
| NM-3-7 | SUBSIDY FOR REMUNERATION OF OPERATION IN LOCAL WHOLESale MARKET | | | | | | | | | | | | | | | | | | | |
| | PHASE-1 SOHAR | | | | | | | | | | | | | | | | | | | |
| | PHASE-2 SUR | | | | | | | | | | | | | | | | | | | |
| NM-3-8 | TRAINING STAFF FOR OPERATION OF WHOLESale MARKETS (SUPPORT) | | | | | | | | | | | | | | | | | | | |
| NM-4 | BASIC DATA COLLECTING PROGRAM | A | 414 | | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 |
| NM-4-1 | BASIC DATA COLLECTING PROGRAM (STUDY) | | | | | | | | | | | | | | | | | | | |
| NM-4-2 | BASIC DATA COLLECTING PROGRAM (EQUIPMENT) | | | | | | | | | | | | | | | | | | | |
| NM-4-3 | BASIC DATA COLLECTING PROGRAM (SUPPORT BY CONSULTANT) | | | | | | | | | | | | | | | | | | | |
| NM-4-4 | PREPARATION & PUBLICATION OF SUPPLY AND DEMAND FORECAST | | | | | | | | | | | | | | | | | | | |
| NM-4-5 | INTRODUCTION FOR PRICING POLICY (STUDY) | | | | | | | | | | | | | | | | | | | |
| NM-5 | PREPARATION & PUBLICATION OF SUPPLY AND DEMAND FORECAST (SUPPORT) | A | | | | | | | | | | | | | | | | | | |
| NM-6 | MEASURES FOR ADJUSTMENT OF SUPPLY AND DEMAND (STUDY) | A | | | | | | | | | | | | | | | | | | |
| NM-7 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS (STUDY) | A | | | | | | | | | | | | | | | | | | |
| NM-8 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS | A | | | | | | | | | | | | | | | | | | |
| NM-8-1 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS (SUPPORT) | | | | | | | | | | | | | | | | | | | |
| NM-8-2 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS (EQUIPMENT) | | | | | | | | | | | | | | | | | | | |

Table 3.4.14 (Continued)

| PROJECT NUMBER | NAME OF PROJECT/PROGRAM | PRIORITY | TOTAL RECURRENT (STANDARD) | ANNUAL RECURRENT BUDGET | | | | | | | | | | | | | | | |
|----------------|--|----------|----------------------------|-------------------------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|
| | | | | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | | | | | | |
| NH-9 | STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PAPAP (STUDY) | A | | | | | | | | | | | | | | | | | |
| NH-9-1 | STUDY ON STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PAPAP | | | | | | | | | | | | | | | | | | |
| NH-9-2 | END ON STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PAPAP | | | | | | | | | | | | | | | | | | |
| NH-10 | STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PAPAP | A | 231 | | | | 77 | 77 | | | | | | | | | | | |
| NH-10-1 | INTRODUCTION OF PRE-COOLING FACILITIES | | | | | | | | | | | | | | | | | | |
| NH-10-2 | CONSTRUCTION OF 3 NEW AND 10 EXPANSION FOR CENTERS | | 2155 | | | | 120 | 240 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 |
| TOTAL | RECURRENT BUDGET TOTAL | | 8004 | 0 | 171 | 278 | 475 | 595 | 1016 | 893 | 1623 | 1715 | 1838 | | | | | | |
| | (DRAF. LOAN) | | | | | | | | | | | | | | | | | | |
| | STRENGTH PROGRAM FOR CENTRAL & LOCAL RECIPT AGENT AND WHOLESALER (EQUIPMENT & CAPITAL) | | | | | | | | | | | | | | | | | | |

NOTES : 1) NH-1-3 THIS PROGRAM IS TO BE CONDUCTED BY THE RESULTS LIKE THE RELATIVE PROJECT/PROGRAM AS SHIPPING ORGANIZATIONS FOR FARMERS E.T.C.

SOURCE : JICA TEAM ESTIMATE

Table 3.4.15 (continued)

| PROJECT NUMBER | NAME OF PROGRAM/PROJECT | NUMBER OF NEW STAFF | | RECURRENT ANNUAL TOTAL MAX. | EXECUTING AGENCY | IMPLEMENTATION SCHEDULE AND ANNUAL RECURRENT | | | | | | | | | | | | | | |
|----------------|---|---------------------|--------------------|-----------------------------|------------------|--|------|------|------|------|------|------|------|------|------|--|--|--|--|--|
| | | DEPAR. SPECIALIST | FIRST SECOND THIRD | | | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | | | | | |
| NM-5 | PREPARATION & PUBLICATION OF SUPPLY AND DEMAND FORECAST (SUPPORT) | | | | CONSULTANT | | | | | | | | | | | | | | | |
| | OPERATION FOR PREPA. & PUBLI. OF SUPPLY AND DEMAND FORECAST | | | | PARAP | | | | | | | | | | | | | | | |
| NM-6 | MEASURES FOR ADJUSTMENT OF SUPPLY AND DEMAND (STUDY) | | | | CONSULTANT | | | | | | | | | | | | | | | |
| NM-7 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS (STUDY) | | | | CONSULTANT | | | | | | | | | | | | | | | |
| NM-8 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS | | | | | | | | | | | | | | | | | | | |
| NM-8-1 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS (SUPPORT) | | | | CONSULTANT | | | | | | | | | | | | | | | |
| NM-8-2 | ESTABLISHMENT OF SHIPPING ORGANIZATION FOR FARMERS (EQUIPMENT) | | | | PARAP | | | | | | | | | | | | | | | |
| NM-8 | OPERATION FOR SHIPPING ORGANIZATION | | | | PARAP | | | | | | | | | | | | | | | |
| NM-9 | STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PARAP (STUDY) | | | | | | | | | | | | | | | | | | | |
| NM-9-1 | STUDY ON STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PARAP | | | | PPD | | | | | | | | | | | | | | | |
| NM-9-2 | D/D ON STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PARAP | | | | PPD | | | | | | | | | | | | | | | |
| NM-10 | STRENGTH PROGRAM FOR MAIN DISTRIBUTION CHANNELS IN PARAP | | | | | | | | | | | | | | | | | | | |
| NM-10-1 | INTRODUCTION OF PRE-COOLING FACILITIES | | | | RSD | | | | | | | | | | | | | | | |
| NM-10-2 | CONSTRUCTION OF 3 NEW AND 10 EXPANSION CENTERS | | | | RSD | 5 | | 77 | | | | | | | | | | | | |
| | OPERATION | | | | | | | | | | | | | | | | | | | |
| NM-10 | OPERATION FOR NEW CENTERS | | | | RSD | 3 | 15 | 5 | 9 | 359 | | | | | | | | | | |
| | OPERATION | | | | | | | | | | | | | | | | | | | |
| | DEVELOPMENT BUDGET TOTAL | | | | | | | | | | | | | | | | | | | |
| | (ORAF LOAN) | | | | | | | | | | | | | | | | | | | |
| | STRENGTH PROGRAM FOR CENTRAL & LOCAL RECEIPT AGENT AND WHOLESALER | | | | | | | | | | | | | | | | | | | |

NOTE : (1) PPD = PROJECT & PLANNING DEPT.
RSD = RESEARCH & STATISTICS DEPT.
PRTD = PUBLIC RELATIONS & TRAINING DEPT.
CHMD = CENTRAL WHOLESALER MARKET DEPT.
LHMD = LOCAL WHOLESALER MARKET

SOURCE : JICA TEAM ESTIMATE

2) NEW RECURRENT CLASSIFICATION
SPECIAL GRADE (ADMINISTRATIVE OFFICIAL)
FIRST GRADE (OFFICIAL)
SECOND GRADE (SECRETARY ASSISTANT STAFF)
THIRD GRADE (LABOUR)

ANNUAL FINANCIAL ALLOCATION (A)
20,000 R.O./YEAR
12,000 R.O./YEAR
5,000 R.O./YEAR
1,200 R.O./YEAR

OTHER CHARGES (B)
(A) X 28%
(A) X 28%
(A) X 28%
(A) X 28%

TOTAL RECURRENT (A) + (B)

Table 3.4.16 PAMAP Produce-wise Margin Rate (%) in 1989

1 PAMAP PRODUCEWISE MARGIN RATE (%) IN 1989

| No. | PRODUCE | J | F | M | A | M | J | J | A | S | O | N | D | TOTAL |
|-----|---------------|------|------|-----|------|------|------|------|------|------|------|------|------|-------|
| 1 | Banana | 98% | 92% | 94% | 83% | 78% | 79% | 76% | 76% | 73% | 72% | 66% | 72% | 76% |
| 2 | Cabbage | 70% | 78% | 82% | 112% | 98% | 10% | 45% | 20% | 39% | 46% | 30% | 43% | 48% |
| 3 | Carrot | 29% | 53% | 66% | 72% | 90% | 124% | 34% | 4% | -17% | 61% | 58% | 57% | 58% |
| 4 | Cauliflower | 45% | 65% | 31% | -2% | 44% | | -3% | 17% | 33% | 49% | 40% | 43% | 41% |
| 5 | Chilli Pepper | 41% | 31% | 24% | 46% | 44% | 28% | 31% | 24% | 30% | 40% | 37% | 33% | 31% |
| 6 | Coconut | 39% | 39% | 35% | 36% | 34% | 36% | 47% | 37% | 40% | 39% | 43% | 55% | 39% |
| 7 | Cucumber | 26% | 29% | 24% | 37% | 37% | 21% | 25% | 20% | 27% | 48% | 40% | 35% | 35% |
| 8 | Eggplant | 117% | 81% | 67% | 47% | 85% | 39% | 35% | 30% | 32% | 52% | 77% | 72% | 57% |
| 9 | Frankincense | 199% | | | 74% | 55% | 37% | 88% | 20% | -15% | 143% | -27% | -42% | -2% |
| 10 | Garlic | 106% | -4% | 18% | 40% | 45% | 64% | 30% | 17% | 11% | 34% | 36% | 20% | 34% |
| 11 | Lettuce | 45% | 79% | 81% | 53% | 50% | 112% | | 88% | 12% | 92% | 67% | 51% | 58% |
| 12 | Line | 18% | 13% | 11% | 23% | 30% | 51% | 98% | 84% | 96% | 78% | 47% | 9% | 60% |
| 13 | Mango | | | 51% | 29% | 105% | 35% | 40% | 11% | 3% | 20% | 7% | -28% | 28% |
| 14 | Onion | -17% | -10% | 26% | 39% | 49% | 37% | 28% | 36% | 31% | 16% | 37% | 38% | 37% |
| 15 | Papaya | 52% | 60% | 61% | 37% | 40% | 38% | 43% | 54% | 44% | 42% | 58% | 90% | 56% |
| 16 | Potato | 23% | 29% | 25% | 37% | 25% | -13% | 4% | 0% | | 40% | 42% | 36% | 31% |
| 17 | Pumpkin | 133% | 81% | 61% | 62% | 96% | 36% | 57% | 31% | 40% | 80% | 79% | 69% | 61% |
| 18 | Squash | 34% | 27% | 30% | 68% | 69% | 0% | 40% | 44% | -4% | 43% | 66% | 42% | 37% |
| 19 | Sweet-Melon | 15% | 255% | 7% | 11% | 28% | 4% | 28% | -13% | -32% | 22% | 30% | 4% | 20% |
| 20 | Sweet Pepper | 48% | 63% | 52% | 59% | 60% | 70% | 52% | 59% | 20% | 51% | 42% | 49% | 55% |
| 21 | Sweet Potato | 22% | 51% | 49% | 12% | 40% | -19% | 18% | 18% | 17% | 24% | 20% | 24% | 31% |
| 22 | Tomato | 12% | 41% | 27% | 15% | 45% | 14% | -35% | 44% | 21% | 35% | 13% | 25% | 23% |
| 23 | Water Melon | 3% | | 23% | 17% | 28% | 14% | 0% | -7% | 35% | 8% | 27% | 50% | 14% |
| 24 | Total | | | | | | | | | | | | | |
| 25 | Other local | | | | | | | | | | | | | |
| 26 | Imported | | | | | | | | | | | | | |
| 27 | GRAND TOTAL | | | | | | | | | | | | | |

SOURCE : PAMAP PRODUCEWISE PURCHASE QUANTITY (kg) IN 1989 (1)
 PAMAP PRODUCEWISE PURCHASE VALUE (RO) IN 1989 (2)
 PAMAP PRODUCEWISE SELL QUANTITY (kg) IN 1989 (3)
 PAMAP PRODUCEWISE SELL VALUE (RO) IN 1989 (4)

NOTE : MARGIN = $(4 \div 3) \div (2 \div 1)$

2 PRESENT PRICE DETERMINATION SYSTEM IN PAMAP

PURCHASING PRICE = AUCTION PRICE
 SELLING PRICE = PURCHASING PRICE + 10-15% + STORE FEE (WHOLESALE)
 PURCHASING PRICE + 20% + STORE FEE (RETAIL)

SOURCE : PRICING COMMITTEE IN PAMAP

Table 3.4.17 Farm Gate Price and Retail Price (Private and PAMAP)

3 FARM GATE PRICE AND RETAIL PRICE ON PRIVATE AND PAMAP

| Crop | Distribution between the farmer and the retailer | | | | | Distribution between the farmer and PAMAP | | | | | Note |
|--------------|--|-----|-----|------|------|---|-----|-----|------|------|------|
| | (1) | (2) | (3) | (4) | (5) | (1) | (2) | (3) | (4) | (5) | |
| Banana | 138 | 287 | 149 | 48.9 | 51.9 | 140 | 266 | 120 | 54.9 | 45.1 | |
| Cabbage | 85 | 199 | 114 | 37.2 | 42.8 | 52 | 91 | 39 | 57.1 | 42.9 | |
| Cauli Flower | 191 | 387 | 196 | - | - | 294 | 381 | 87 | 77.3 | 22.8 | |
| Potato | 153 | 238 | 85 | 64.3 | 35.7 | 128 | 186 | 58 | 68.8 | 31.2 | |
| Tomato | 236 | 308 | 72 | 76.6 | 23.4 | 135 | 179 | 44 | 75.4 | 24.6 | |

Note :
 (1) Farm Gate Price (Producer's Price) Baiza/kg
 (2) Retail Price Baiza/kg
 (3) Profit (2)-(3) or (6)-(3) Baiza/kg
 (4) $[(1)/(2)] \times 100$ %
 (5) $[(3)/(2)] \times 100$ %
 (6) PAMAP Baiza/kg

Each figure is weighted year averaged price in 1988.

SOURCE : ABSTRACT IN INTERNATIONAL SYMPOSIUM ON AGRICULTURE & FISHERIES DEVELOPMENT IN OMAN IN MUSCAT ON 15-19 OCTOBER 1989

Table 3.4.18 PAMAP Produce-wise Purchase Price per Unit (R.O./ton)
in 1989

| No. | Produce | JA | FE | MA | AR | MA | JU | JU | AU | SE | OC | NO | DE | TOTAL |
|-----|---------------|------|-----|-----|------|------|------|------|------|------|-----|------|------|-------|
| 1 | Banana | 140 | 139 | 139 | 151 | 146 | 142 | 141 | 140 | 141 | 144 | 146 | 146 | 143 |
| 2 | Cabbage | 59 | 38 | 35 | 31 | 46 | 109 | 143 | 172 | 172 | 178 | 185 | 186 | 74 |
| 3 | Carrot | 214 | 171 | 152 | 145 | 139 | 168 | 317 | 430 | 313 | 204 | 228 | 189 | 173 |
| 4 | Cauliflower | 176 | 83 | 186 | 302 | 295 | 687 | 396 | 316 | 314 | 296 | 273 | 171 | 171 |
| 5 | Chilli Pepper | 159 | 292 | 335 | 231 | 206 | 432 | 483 | 428 | 358 | 298 | 261 | 247 | 268 |
| 6 | Coconut | 161 | 154 | 169 | 175 | 168 | 178 | 167 | 179 | 176 | 176 | 165 | 154 | 170 |
| 7 | Cucumber | 314 | 393 | 373 | 276 | 259 | 326 | 345 | 396 | 331 | 224 | 215 | 229 | 279 |
| 8 | Eggplant | 24 | 51 | 75 | 56 | 64 | 127 | 169 | 189 | 160 | 126 | 82 | 61 | 76 |
| 9 | Frankincense | 2000 | | | 2000 | 2000 | 2038 | 2083 | 1994 | 2011 | 556 | 2000 | 1933 | 2028 |
| 10 | Garlic | 321 | 653 | 570 | 472 | 426 | 391 | 504 | 595 | 705 | 572 | 544 | 579 | 483 |
| 11 | Lettuce | 277 | 149 | 141 | 204 | 204 | 200 | 297 | 303 | 278 | 284 | 233 | 198 | 198 |
| 12 | Lime | 390 | 403 | 444 | 399 | 300 | 214 | 96 | 77 | 80 | 108 | 175 | 285 | 194 |
| 13 | Mango | | | 388 | 331 | 111 | 132 | 97 | 229 | 309 | 482 | 571 | 676 | 162 |
| 14 | Onion | 163 | 150 | 95 | 87 | 69 | 74 | 101 | 98 | 88 | 106 | 89 | 81 | 83 |
| 15 | Papaya | 122 | 123 | 122 | 142 | 151 | 148 | 124 | 99 | 129 | 147 | 136 | 99 | 124 |
| 16 | Potato | 166 | 130 | 126 | 128 | 144 | 213 | 192 | 210 | | 149 | 145 | 151 | 129 |
| 17 | Pumpkin | 25 | 51 | 86 | 88 | 68 | 145 | 122 | 183 | 169 | 103 | 86 | 59 | 94 |
| 18 | Squash | 111 | 161 | 196 | 123 | 74 | 256 | 250 | 214 | 280 | 203 | 110 | 119 | 145 |
| 19 | Sweet Melon | 150 | 100 | 282 | 372 | 172 | 196 | 195 | 205 | 181 | 148 | 143 | 174 | 179 |
| 20 | Sweet Pepper | 177 | 149 | 149 | 149 | 162 | 256 | 326 | 247 | 318 | 255 | 239 | 198 | 169 |
| 21 | Sweet Potato | 177 | 139 | 130 | 192 | 144 | 195 | 222 | 243 | 250 | 258 | 286 | 292 | 165 |
| 22 | Tomato | 107 | 72 | 125 | 190 | 143 | 174 | 187 | 137 | 213 | 157 | 275 | 345 | 136 |
| 23 | Water Melon | 108 | | 183 | 192 | 104 | 127 | 131 | 119 | 72 | 58 | 93 | 77 | 125 |
| 24 | Total | | | | | | | | | | | | | |
| 25 | Other local | | | | | | | | | | | | | |
| 26 | Imported | | | | | | | | | | | | | |
| 27 | GRAND TOTAL | | | | | | | | | | | | | |

Table 3.4.19 PAMAP Produce-wise Sale Price per Unit (R.O./ton)
in 1989

| No. | PRODUCE | JA | FE | MA | AR | MA | JU | JU | AU | SE | OC | NO | DE | TOTAL |
|-----|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 1 | Banana | 266 | 265 | 269 | 276 | 261 | 255 | 249 | 246 | 244 | 247 | 242 | 252 | 252 |
| 2 | Cabbage | 101 | 67 | 64 | 65 | 92 | 120 | 209 | 206 | 238 | 259 | 240 | 151 | 109 |
| 3 | Carrot | 276 | 263 | 252 | 250 | 264 | 377 | 426 | 445 | 259 | 329 | 347 | 297 | 273 |
| 4 | Cauliflower | 256 | 137 | 243 | 297 | 427 | 458 | 669 | 463 | 421 | 469 | 414 | 390 | 242 |
| 5 | Chilli Pepper | 225 | 382 | 415 | 338 | 298 | 554 | 631 | 532 | 466 | 417 | 357 | 320 | 350 |
| 6 | Coconut | 224 | 214 | 228 | 239 | 225 | 242 | 246 | 246 | 246 | 243 | 235 | 238 | 237 |
| 7 | Cucumber | 396 | 505 | 464 | 378 | 355 | 394 | 431 | 474 | 421 | 330 | 302 | 310 | 376 |
| 8 | Eggplant | 53 | 93 | 124 | 83 | 118 | 176 | 228 | 245 | 212 | 191 | 146 | 104 | 119 |
| 9 | Frankincense | 5984 | 3055 | 3269 | 3477 | 3109 | 2794 | 3739 | 2398 | 1783 | 1350 | 1468 | 1129 | 1980 |
| 10 | Garlic | 663 | 624 | 670 | 660 | 616 | 642 | 656 | 698 | 780 | 768 | 738 | 694 | 649 |
| 11 | Lettuce | 401 | 267 | 255 | 312 | 305 | 424 | 630 | 559 | 338 | 535 | 474 | 354 | 312 |
| 12 | Lime | 459 | 457 | 494 | 492 | 388 | 324 | 190 | 141 | 157 | 191 | 257 | 310 | 311 |
| 13 | Mango | 682 | 778 | 574 | 426 | 227 | 178 | 136 | 255 | 319 | 578 | 611 | 484 | 208 |
| 14 | Onion | 136 | 135 | 128 | 121 | 102 | 102 | 130 | 133 | 115 | 126 | 122 | 112 | 113 |
| 15 | Papaya | 185 | 197 | 198 | 195 | 212 | 204 | 178 | 152 | 185 | 209 | 215 | 189 | 193 |
| 16 | Potato | 205 | 167 | 158 | 175 | 180 | 185 | 201 | 209 | 204 | 209 | 207 | 205 | 169 |
| 17 | Pumpkin | 58 | 93 | 138 | 142 | 133 | 197 | 192 | 240 | 246 | 186 | 154 | 101 | 151 |
| 18 | Squash | 149 | 205 | 256 | 206 | 141 | 257 | 350 | 308 | 269 | 289 | 183 | 170 | 198 |
| 19 | Sweet Melon | 172 | 355 | 382 | 412 | 221 | 203 | 250 | 179 | 124 | 180 | 186 | 182 | 216 |
| 20 | Sweet Pepper | 262 | 242 | 226 | 237 | 259 | 435 | 494 | 393 | 381 | 384 | 338 | 294 | 263 |
| 21 | Sweet Potato | 216 | 211 | 194 | 216 | 202 | 158 | 261 | 286 | 293 | 320 | 345 | 363 | 216 |
| 22 | Tomato | 120 | 102 | 158 | 220 | 208 | 199 | 122 | 197 | 259 | 211 | 310 | 438 | 167 |
| 23 | Water Melon | 112 | 152 | 226 | 223 | 133 | 145 | 132 | 111 | 97 | 63 | 119 | 116 | 143 |
| 24 | Total | | | | | | | | | | | | | |
| 25 | Other local | | | | | | | | | | | | | |
| 26 | Imported | | | | | | | | | | | | | |
| 27 | GRAND TOTAL | | | | | | | | | | | | | |

Table 3.4.20 Percentage of Purchase/Sale Price per Unit of PAMAP by Produce

| No. | PRODUCE | JA | FE | MA | AR | MA | JU | JU | AU | SE | OC | NO | DE | TOTAL |
|-----|---------------|------|------|-----|------|-----|------|------|------|------|-----|------|------|-------|
| 1 | Banana | 53% | 52% | 52% | 55% | 56% | 56% | 57% | 57% | 58% | 58% | 60% | 58% | 57% |
| 2 | Cabbage | 59% | 56% | 55% | 47% | 50% | 91% | 69% | 83% | 72% | 69% | 77% | 70% | 68% |
| 3 | Carrot | 78% | 65% | 60% | 58% | 53% | 45% | 74% | 97% | 121% | 62% | 63% | 64% | 63% |
| 4 | Cauliflower | 69% | 60% | 77% | 102% | 69% | | 103% | 85% | 75% | 67% | 72% | 70% | 71% |
| 5 | Chilli Pepper | 71% | 76% | 81% | 68% | 69% | 78% | 77% | 81% | 77% | 71% | 73% | 75% | 77% |
| 6 | Coconut | 72% | 72% | 74% | 73% | 75% | 73% | 68% | 73% | 71% | 72% | 70% | 64% | 72% |
| 7 | Cucumber | 79% | 78% | 80% | 73% | 73% | 83% | 80% | 84% | 79% | 68% | 71% | 74% | 74% |
| 8 | Eggplant | 46% | 55% | 60% | 68% | 54% | 72% | 74% | 77% | 75% | 66% | 57% | 58% | 64% |
| 9 | Frankincens | 33% | | | 58% | 64% | 73% | 56% | 83% | 118% | 41% | 136% | 171% | 102% |
| 10 | Garlic | 48% | 105% | 85% | 72% | 69% | 61% | 77% | 85% | 90% | 74% | 74% | 83% | 74% |
| 11 | Lettuce | 69% | 56% | 55% | 65% | 67% | 47% | | 53% | 90% | 52% | 60% | 66% | 63% |
| 12 | Lime | 85% | 88% | 98% | 81% | 77% | 66% | 51% | 54% | 51% | 56% | 68% | 92% | 63% |
| 13 | Mango | | | 66% | 78% | 49% | 74% | 72% | 90% | 97% | 83% | 93% | 139% | 78% |
| 14 | Onion | 120% | 111% | 79% | 72% | 67% | 73% | 78% | 73% | 76% | 84% | 73% | 72% | 73% |
| 15 | Papaya | 66% | 63% | 62% | 73% | 71% | 73% | 70% | 65% | 70% | 70% | 63% | 52% | 64% |
| 16 | Potato | 81% | 78% | 80% | 73% | 80% | 115% | 96% | 100% | | 71% | 70% | 74% | 76% |
| 17 | Pumpkin | 43% | 55% | 62% | 62% | 51% | 74% | 64% | 76% | 69% | 56% | 56% | 59% | 62% |
| 18 | Squash | 74% | 79% | 77% | 60% | 53% | 100% | 71% | 70% | 104% | 70% | 60% | 70% | 75% |
| 19 | Sweet Melon | 87% | 28% | 93% | 90% | 78% | 96% | 78% | 114% | 148% | 82% | 77% | 96% | 83% |
| 20 | Sweet Pepper | 67% | 62% | 66% | 63% | 63% | 59% | 66% | 63% | 84% | 66% | 71% | 67% | 65% |
| 21 | Sweet Potato | 82% | 66% | 67% | 89% | 71% | 123% | 85% | 85% | 85% | 81% | 83% | 88% | 76% |
| 22 | Tomato | 89% | 71% | 79% | 87% | 69% | 87% | 153% | 69% | 83% | 74% | 89% | 80% | 81% |
| 23 | Water Melon | 97% | | 81% | 86% | 78% | 88% | 100% | 108% | 74% | 93% | 79% | 67% | 88% |
| 24 | Total | | | | | | | | | | | | | |
| 25 | Other local | | | | | | | | | | | | | |
| 26 | Imported | | | | | | | | | | | | | |
| 27 | GRAND TOTAL | | | | | | | | | | | | | |

Table 3.4.21 PAMAP Produce-wise Margin Rate (%) in 1989

| No. | PRODUCE | JA | FE | MA | AR | MA | JU | JU | AU | SE | OC | NO | DE | TOTAL |
|-----|---------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 1 | Banana | 190% | 192% | 194% | 183% | 178% | 179% | 176% | 176% | 173% | 172% | 166% | 172% | 176% |
| 2 | Cabbage | 170% | 178% | 182% | 212% | 198% | 110% | 145% | 120% | 139% | 146% | 130% | 143% | 148% |
| 3 | Carrot | 129% | 153% | 166% | 172% | 190% | 224% | 134% | 104% | 83% | 161% | 158% | 157% | 158% |
| 4 | Cauliflower | 145% | 165% | 131% | 98% | 144% | | 97% | 117% | 133% | 149% | 140% | 143% | 141% |
| 5 | Chilli Pepper | 141% | 131% | 124% | 146% | 144% | 128% | 131% | 124% | 130% | 140% | 137% | 133% | 131% |
| 6 | Coconut | 139% | 139% | 135% | 136% | 134% | 136% | 147% | 137% | 140% | 139% | 143% | 155% | 139% |
| 7 | Cucumber | 126% | 129% | 124% | 137% | 137% | 121% | 125% | 120% | 127% | 148% | 140% | 135% | 135% |
| 8 | Eggplant | 217% | 181% | 167% | 147% | 185% | 139% | 135% | 130% | 132% | 152% | 177% | 172% | 157% |
| 9 | Frankincens | 299% | | | 174% | 155% | 137% | 180% | 120% | 85% | 243% | 73% | 58% | 98% |
| 10 | Garlic | 206% | 96% | 118% | 140% | 145% | 164% | 130% | 117% | 111% | 134% | 136% | 120% | 134% |
| 11 | Lettuce | 145% | 179% | 181% | 153% | 150% | 212% | | 188% | 112% | 192% | 167% | 151% | 158% |
| 12 | Lime | 118% | 113% | 111% | 123% | 130% | 151% | 198% | 184% | 196% | 178% | 147% | 189% | 160% |
| 13 | Mango | | | 151% | 129% | 205% | 135% | 140% | 111% | 103% | 120% | 107% | 72% | 128% |
| 14 | Onion | 83% | 98% | 126% | 139% | 149% | 137% | 128% | 136% | 131% | 118% | 137% | 138% | 137% |
| 15 | Papaya | 152% | 168% | 161% | 137% | 140% | 138% | 143% | 154% | 144% | 142% | 158% | 190% | 156% |
| 16 | Potato | 123% | 129% | 125% | 137% | 125% | 87% | 184% | 100% | | 140% | 142% | 136% | 131% |
| 17 | Pumpkin | 233% | 181% | 161% | 162% | 196% | 136% | 157% | 131% | 146% | 180% | 179% | 169% | 161% |
| 18 | Squash | 134% | 127% | 130% | 168% | 169% | 100% | 140% | 144% | 96% | 143% | 166% | 142% | 137% |
| 19 | Sweet Melon | 115% | 355% | 107% | 111% | 128% | 104% | 128% | 87% | 68% | 122% | 130% | 104% | 120% |
| 20 | Sweet Pepper | 148% | 163% | 152% | 159% | 160% | 170% | 152% | 159% | 120% | 151% | 142% | 149% | 155% |
| 21 | Sweet Potato | 122% | 151% | 149% | 112% | 140% | 81% | 118% | 118% | 117% | 124% | 120% | 124% | 131% |
| 22 | Tomato | 112% | 141% | 127% | 115% | 145% | 114% | 65% | 144% | 121% | 135% | 113% | 125% | 123% |
| 23 | Water Melon | 183% | | 123% | 117% | 128% | 114% | 100% | 93% | 135% | 108% | 127% | 150% | 114% |
| 24 | Total | | | | | | | | | | | | | |
| 25 | Other local | | | | | | | | | | | | | |
| 26 | Imported | | | | | | | | | | | | | |
| 27 | GRAND TOTAL | | | | | | | | | | | | | |

Table 3.4.22 Value and Quantity of Imports by Entry Points

TABLE . . . VALUE AND QUANTITY OF IMPORTS BY PORTS OF ENTRY

| IMPORT EXPORT QUANTITY | POINT OF ENTRY | 1988 | | 1987 | | 1986 | | 1985 | | 1984 | | REMARKS | | |
|------------------------|----------------|--------|-------------------|-------|-------|-------|--------|-------|--------|-------|--------|---------|--------|------|
| | | WHOLE | VEGETABLE & FRUIT | WHOLE | WHOLE | WHOLE | WHOLE | WHOLE | WHOLE | WHOLE | WHOLE | | | |
| IMPORTS | | | | | | | | | | | | | | |
| VALUE | TOTAL | 848.3 | 100% | 30.0 | 100% | 4% | 700.7 | 100% | 916.7 | 100% | 1038.9 | 100% | 949.2 | 100% |
| (1000RO) | BY SEA PORTS | 556.1 | 66% | | | | 445.3 | 64% | 609.1 | 66% | 704.4 | 65% | 653.5 | 69% |
| | MINA CABOOS | 538.5 | 64% | 1.5 | 5% | 0% | 416.5 | 59% | 554.2 | 60% | 639.6 | 59% | 598.1 | 63% |
| | OTHERS | 17.6 | 2% | | | | 28.7 | 4% | 54.9 | 6% | 64.8 | 6% | 55.4 | 6% |
| | BY LAND | 189.0 | 20% | | | | 146.6 | 21% | 175.4 | 19% | 237.3 | 22% | 176.2 | 19% |
| | WAJAJA | 132.3 | 16% | 22.0 | 73% | 17% | 112.5 | 16% | 135.5 | 15% | 186.5 | 17% | 132.0 | 14% |
| | OTHERS | 36.6 | 4% | | | | 34.1 | 5% | 39.8 | 4% | 50.9 | 5% | 44.1 | 5% |
| | BY AIR | 121.5 | 14% | | | | 108.9 | 16% | 132.2 | 14% | 147.2 | 14% | 119.6 | 13% |
| | SEEB AIR CARGO | 99.4 | 12% | 1.1 | 4% | 1% | 100.1 | 14% | 122.8 | 13% | 135.4 | 12% | 108.1 | 11% |
| | OTHERS | 22.1 | 3% | | | | 8.2 | 1% | 9.5 | 1% | 11.8 | 1% | 11.5 | 1% |
| QUANTITY TOTAL | | | | | | | | | | | | | | |
| VALUE | TOTAL | 1524.1 | 100% | 79.8 | 100% | 5% | 1562.5 | 100% | 2121.8 | 100% | 3121.6 | 100% | 2852.9 | 100% |
| (1000TON) | BY SEA PORTS | 1062.0 | 70% | | | | 1059.9 | 68% | 1188.8 | 56% | 1565.2 | 50% | 1537.2 | 54% |
| | MINA CABOOS | 888.2 | 58% | 5.6 | 7% | 1% | 899.3 | 58% | 997.4 | 47% | 1248.8 | 40% | 1205.1 | 42% |
| | OTHERS | 173.9 | 11% | | | | 160.7 | 10% | 191.4 | 9% | 316.5 | 10% | 332.1 | 12% |
| | BY LAND | 451.3 | 30% | | | | 491.4 | 31% | 916.2 | 43% | 1535.0 | 49% | 1299.5 | 46% |
| | WAJAJA | 337.2 | 22% | 55.9 | 70% | 17% | 293.4 | 19% | 461.1 | 22% | 857.5 | 27% | 743.9 | 26% |
| | OTHERS | 1.3 | 0% | | | | 193.0 | 12% | 455.1 | 21% | 677.5 | 22% | 555.6 | 19% |
| | BY AIR | 10.7 | 1% | | | | 11.2 | 1% | 16.8 | 1% | 21.3 | 1% | 16.2 | 1% |
| | SEEB AIR CARGO | 7.1 | 0% | 2.3 | 3% | 32% | 6.2 | 0% | 10.4 | 0% | 15.5 | 0% | 10.8 | 0% |
| | OTHERS | 3.6 | 0% | | | | 5.0 | 0% | 6.4 | 0% | 5.8 | 0% | 5.4 | 0% |

SOURCE : FOREIGN TRADE STATISTICS ON MARCH 1989 BY DEVELOPMENT COUNCIL
FOREIGN TRADE STATISTICS 1988 BY ROYAL OMAN POLICE

FUTURE PAMAP ORGANIZATIONAL STRUCTURE

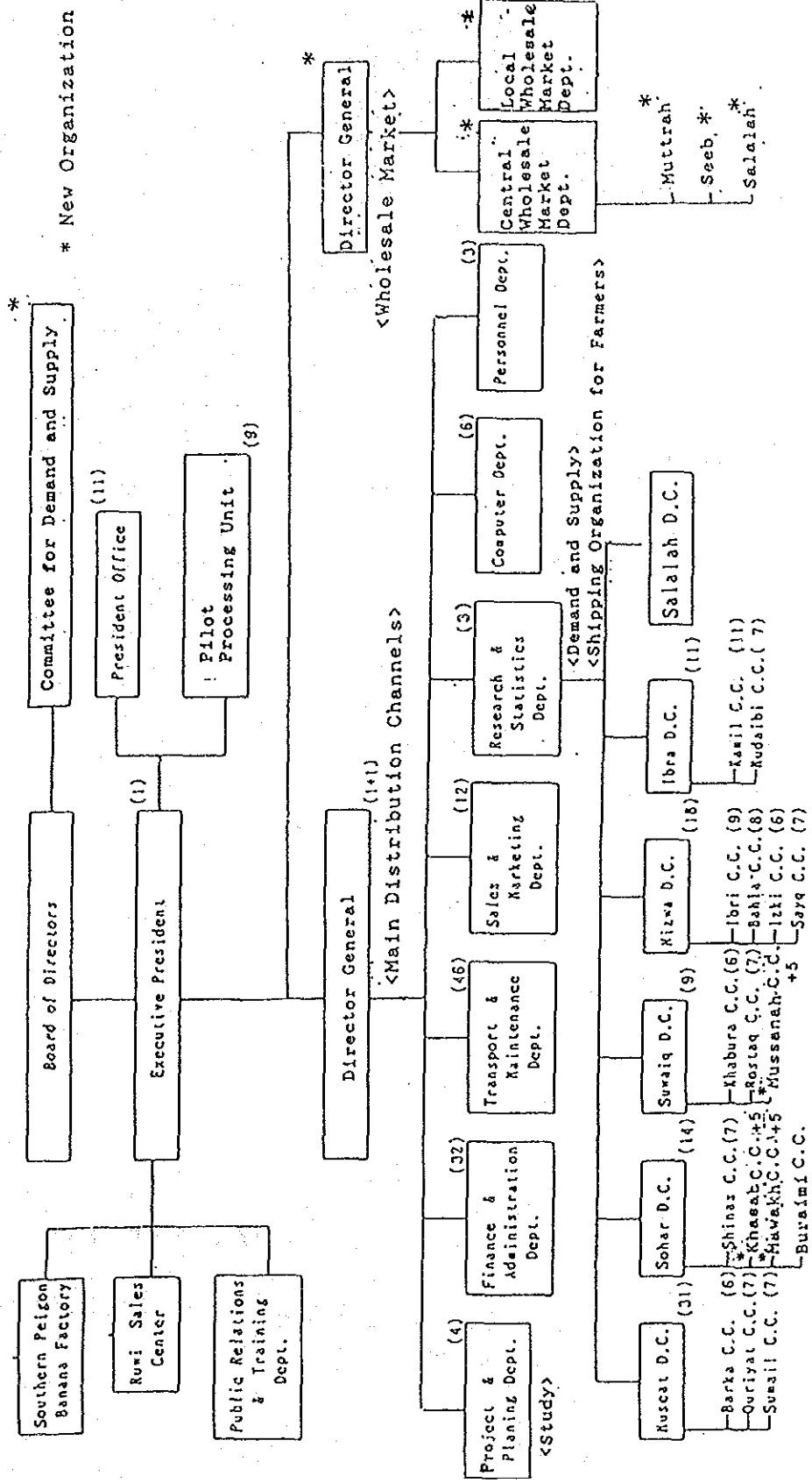


Figure 3.4.1 PAMAP Organizational Structure in Future

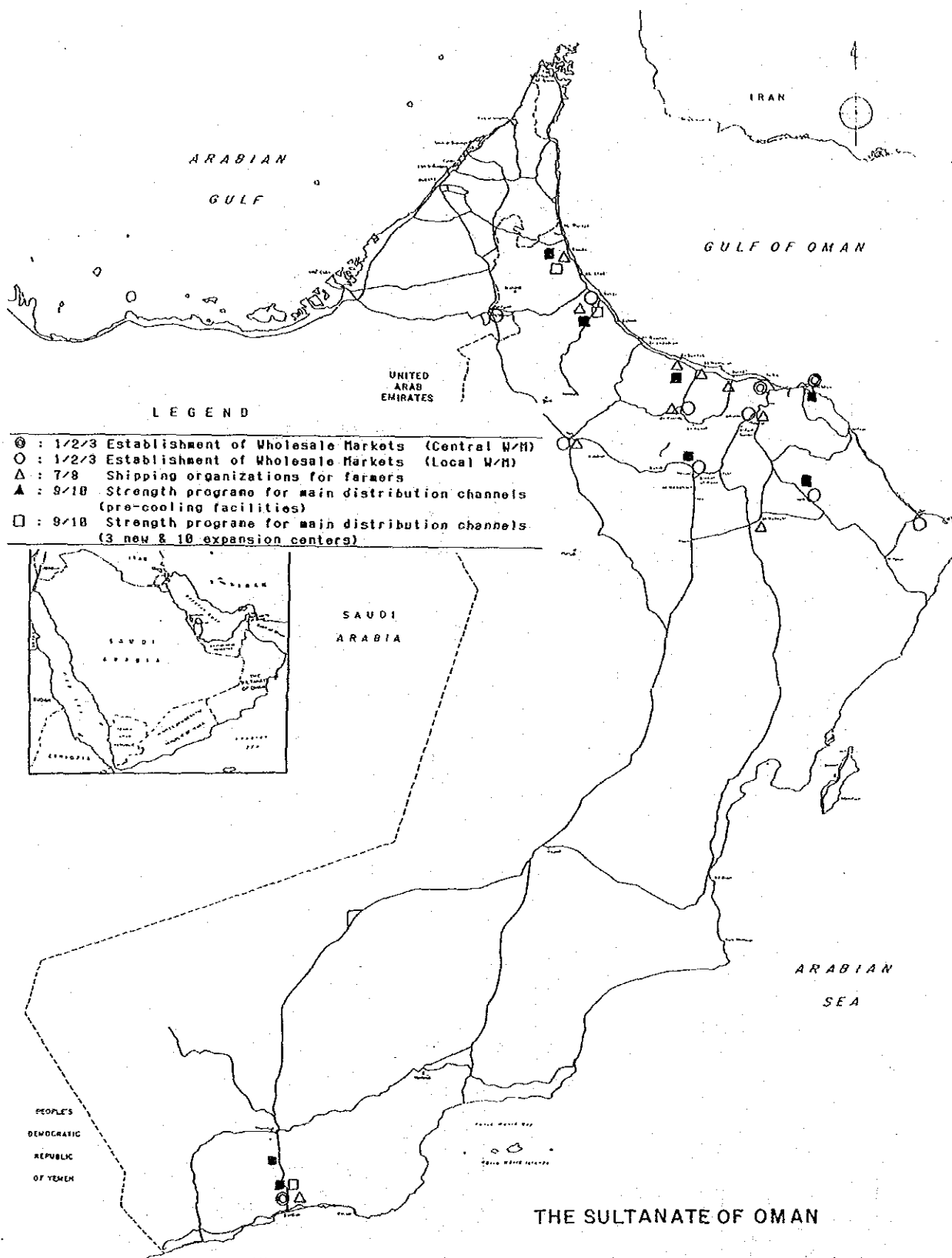


Figure 3.4.2 Location Map of New Projects in Distribution Sector
- 10-Year Plan

3.5 Agricultural Produce Processing

[NP-1] Establishment of Private Company for Agro-Industry and Supply of Agricultural Inputs and Services

Objective:

The objectives of establishing a private company to manage the agro-industry and the supply of agricultural inputs and services to farmers are:

- 1) To provide agricultural inputs such as seed, fertilizer and chemicals to farmers.
- 2) To provide agricultural services such as plowing, aerial spraying and leasing of agricultural machinery.
- 3) To improve agricultural land and farm management.
- 4) To raise and fatten animals to produce red meat and dairy products.
- 5) To promote poultry production such as chickens, eggs and white meat.
- 6) To provide animal health services such as vaccination and veterinary services.
- 7) To conduct purchasing, processing and packaging of dates and other crops.
- 8) To distribute crops and animal products which are produced or processed by the company.

Description:

The company will study each activity separately in order to decide on the economic feasibility. Moreover, it will study competitive relationships to other companies in order to promote a healthy private sector in the agriculture industry. It is important to note that agricultural services aimed at helping small farmers should be provided for a certain period by the company.

The company would need a sizable government subsidy in the early stages. In accordance with the goals of MAF to achieve success in

operating the company, it is proposed that the government grants R.O. 3 million to the company in either the form of subsidy.

Responsibility:

The newly established company will be responsible for its own activities. The agencies relevant to the company, including MAF, will support and facilitate its operation.

Timing:

The necessary study to elaborate on the appropriate activities of the company will be conducted in 1991. After evaluating the results of the study, the company will be established in 1992 and required construction work will be done from 1992-1993. The operation will start at the beginning of 1994.

Budget:

The necessary funds for establishing the company are R.O. 10.0 million, of which R.O. 3 million will be provided by the government through a subsidy. The capital of the company will be shared by:

| | |
|------------------------|-----|
| Government | 20% |
| Public share holder | 50% |
| Founder of the Company | 30% |

The government will commit to purchasing all the shares that are not bought publicly. The government can sell some of its shares to any private company owned by Omani citizens. A rough cost estimate is shown in Table 3.5.1.

Table 3.5.1 Cost Estimation of NP-1 Project (10-Year Plan)

NP-1 Establishment of Private Company for Agro-Industry and Supply of Agricultural Inputs and Services

| Item | Unit | Volume | Unit Price | Amount (R.O.) | Government Share |
|-----------------------|------|--------|------------|---------------|------------------|
| 1) Capital | set | 1 | 7,000,000 | 7,000,000 | 2,000,000 |
| 2) Government Subsidy | set | 1 | 3,000,000 | 3,000,000 | 3,000,000 |
| 3) F/S and D/D | set | 1 | 100,000 | 100,000 | 100,000 |
| Total | | | | 10,100,000 | 5,100,000 |

[NP-2] Establishment of an Agro-Industrial Complex for Processing
of Dates, Limes and Tomatoes

Objective:

This project aims to establish a processing industry for the most promising Omani agricultural produce - dates, limes and tomatoes - in order to diversify the industrial structure and to raise farmers' income levels in the Sultanate.

Description:

This complex is divided into 3 parts: date processing, lime processing and tomato processing. The respective parts are described independently below.

1. Dates Processing

One of the greatest assets that Oman has is its date palm trees. They will continue to be productive after exhaustion of oil resources and they will continue to feed people and animals all year round with a wide variety of nutritious foods and drinks. The JICA team estimated the area covered by dates to be 24,170 ha for 1988 and it should remain the same for 2000 on the premise that little expansion will occur since date cultivation is not profitable. The productivity of the crop, however, will be promoted from 99,097 tons in 1988 to 145,020 tons in 2000 by replacing unproductive trees with new high-yielding varieties, through a government support program.

Since date production exceeds domestic demand at present, the promotion of export should be considered for the future. In order to raise the value added to dates, utilize surplus product efficiently and export it at a higher value, a date-processing industry should be established.

Possible products from a date processing plant are:

1) Natural products

- fresh whole dates (selecting and packaging)
- fresh pitted dates (selecting and packaging)
- chopped dates (selecting and packaging)
- dried dates (selecting and packaging)
- cold stored Rutab Dates

2) Semi-processed products

- date syrup
- date paste
- date bars
- date pickles, etc.

3) Date-based products

- confections and baked goods (biscuits, cakes, sweets, etc.)
- milk-related products (ice cream, yogurt, flavored milk drinks)
- miscellaneous desserts, etc.

4) Further processed products

- sweeteners (fructose, glucose)
- vinegar
- alcohol, etc.

One method of date processing promotion is to utilize and expand existing date factories and private plants. Existing confectionery companies could cover the date-based confection production like date bars, date chip cookies, date creams, date sugar cookies, etc., although research for further diversification of products is needed. The existing date factories should aim to supply private company needs at a profit.

There are a number of things to study and examine before establishing a new date processing plant, e.g. marketing survey, trend of consumer's preference, and sales potential. Under the 10-year Master Plan, the establishment of date processing plants is proposed on the assumption that a detailed feasibility study which will be conducted in the near future will conclude that the project is viable. Details

of the proposed new plant are described below:

A complex which can produce both semi-processed products and date-based products mentioned above is advisable because of its flexibility to correspond to internal and external demand fluctuations. In the present stage without a detailed study, it would be suggested that the plants not be too large, and as an alternative for establishing new plants, governmental assistance for promoting and expanding existing private confectionery factories should be examined.

The two existing government-owned date factories in Nizwa and Rustaq should be components of this complex. Accordingly, the government is to transfer the ownership of these factories to the company to be established which will be responsible for this complex.

The following must be considered before beginning the project:

- 1) Quantifying the local market is extremely difficult as the data is either outdated or in the process of being assembled. Sufficient marketing research is thus essential.
- 2) Plenty of substitute products for dates are generally found in the market.
- 3) Although a factory must purchase high-yielding, meaty dates that are free of insect infestation and low in waste, such are not readily available in Oman due to low date quality.

2. Lime Processing

The JICA team estimated that in 1988 the production area of lime was 2,400 ha and its production volume was 30,960 tons. The production will continue at this level and the estimated production for 2000 will reach 31,265 tons. Traditionally, fresh limes are processed as dried limes, although wide seasonal fluctuations in supply have frequently occurred in the drying process. Oman has exported dried limes to Iran, Iraq and Saudi Arabia. They are considered to be the best dried limes available.

The following is a list of products that could be produced through the activities of the Agro-Industrial Complex.

- 1) clear lime juice
- 2) carbonated lime drink
- 3) lime pickles
- 4) others

Limes have a surplus of about 2,000 tons per year. It seems practical to make approximately 100 tons/year of lime juice concentrate.

It is desirable for the factory to produce one or two products - the juice and possibly oils and essence from the skin. Encouraging the farmer to maximize his juice yield/kg of fruit will be of prime importance, and should start with some basic research in Oman. Maximizing oils and essence yield relies mainly on careful treatment of limes at the farm level.

PAMAP has a plant near Marwala to make lime tea bags. The capacity is 300 tons/year, but so far only 30 tons/year have been made and most of that remains in storage. At present, the lime tea bag production is not promising.

Under the 10-year Master Plan, the establishment of a lime processing plant is proposed on the assumption that a detailed feasibility study to be conducted in the near future will conclude that the project is viable. Part of the capital area is appropriate as a site for the plant because of market and export accessibility.

3. Tomato Processing

Tomatoes are eaten fresh or cooked, pureed to add taste and color to food, canned whole or in part, juiced, and made into ketchup, sauce or paste. Tomatoes are an increasingly important part of the Omani diet. The JICA team estimated that in 1988 the production area was 1,212 ha and the production volume was 26,906 tons. The production will increase in 2000 to 35,520 tons by productivity improvement, despite a

decreasing trend in cultivation area. The self-sufficiency rate of tomatoes in Oman was 74.4% in 1988 and the rate will reach 95% in 1995. In order to control seasonal surpluses and ensure farmers' revenues, the establishment of a tomato processing industry is proposed.

The following processed products can be made:

- tomato juice
- tomato juice concentrate
- tomato ketchup
- canned whole tomatoes
- tomato paste
- tomato puree
- other

In spite of the importance of the produce, a pre-feasibility study has revealed that tomato processing is not viable unless the following problems are solved.

1) Financial

Concentrated tomato paste, the main processed product, is made in Turkey and exported to many countries. Comparative analysis regarding price differences between Turkey and Oman shows that the price in Oman is as much as 6 to 7 times higher than that in Turkey. To compete with the Turkish tomato paste industry, the Omani farmer must be subsidized heavily.

2) Cropping

The main problem facing Omani farmers is the high incidence of the tomato leaf curl virus, which is spread very quickly by whiteflies. Moreover, the quality of Omani tomatoes still leaves a lot to be desired, especially processed tomatoes. There is a high incidence of pin worm and nitidulid beetles, and various other types of damage can be seen on even the finest looking tomatoes. Late tomatoes are often soft and suffer from sun scorch.

3) Processing

The processing factory requires a long stable operation period. To ensure the necessary requirements, it is essential for tomato production to be organized adequately. There is not a continuous supply of the right type of tomato in large enough quantities to justify a plant. There is usually a surplus of tomatoes in the January/February period.

Further study for confirming the feasibility of a tomato processing industry is of prime importance. Under the 10-year Master Plan, the establishment of a tomato processing plant is proposed on the assumption that the proposed feasibility study will conclude that the project is viable. Part of the capital area is appropriate as a site for the plant because of market and export accessibility.

Responsibility:

The newly established private company for agro-industry and supply of agricultural inputs and services will be responsible for all the plant activities (refer to NP-1).

Timing:

The feasibility study and detailed design for date processing plants in 3 sites, namely Nizwa, Rustaq and the capital, will be conducted in 1991. The priority is put on a Nizwa plant followed by Rustaq and the capital in that order. The construction schedule of the plants is:

- Nizwa in 1992
- Rustaq in 1993
- capital in 1994

The feasibility of lime processing and tomato processing plants will be confirmed in the second half of the 10-year Master Plan from the results of the studies that will be conducted in 1996 on lime processing and in 1998 on tomato processing. After appraising the studies, the construction of a lime plant will begin in 1997, followed

by a tomato plant in 1999.

Budget:

In the same way as NP-1, the capital for establishing plants will be shared by:

| | |
|----------------------|-----|
| Government | 20% |
| Founder | 30% |
| Public share holders | 50% |

A cost estimate is shown in Table 3.5.2.

Table 3.5.2 Cost Estimation of NP-2 Project (10-Year Plan)

NP-2 Establishment of Private Company for Agro-Industry and Supply of Agricultural Inputs and Services

| Item | Unit | Volume | Unit Price | Amount (R.O.) | Government Share |
|---|------|--------|------------|---------------|------------------|
| 1. Date Processing Plant | | | | | |
| New Processing Plant | | | | | |
| (1)Nizwa | set | 1 | 2,150,379 | 2,150,379 | 430,076 |
| (2)Rustaq | set | 1 | 2,028,148 | 2,028,148 | 405,630 |
| (3)Capital | set | 1 | 750,000 | 750,000 | 150,000 |
| Subtotal | | | | 4,928,527 | 985,705 |
| 2. Limes Processing Plant (Capital) | set | 1 | 600,000 | 600,000 | 120,000 |
| 3. Tomato Processing Plant (Capital) | set | 1 | 600,000 | 600,000 | 120,000 |
| 4. Consulting Service (F/S, D/D. Supervision) | % | 15 | 6,128,527 | 919,279 | 183,856 |
| 5. Grand Total | | | | 7,047,806 | 1,409,561 |
| Rounded Total | | | | 7,048,000 | 1,410,000 |

[NP-3] Establishment of Pickling and Vinegar-Processing Plant

Objective:

This project aims to promote resource availability by the efficient usage of agricultural product wastage and non-standardized agricultural products, by establishing pickling processing plants.

Description:

MAF carried out a pre-feasibility study in 1988 and concluded that around 23,500 tons of vegetables and fruits were wasted due to lack of demand or other reasons. Out of this, around 15,400 tons could be used for pickling in oil and vinegar for which a definite market exists. Conclusions derived from the study suggested the establishment of 12 pickling plants, each with a 250 tons annual capacity in 12 different places, namely:

Phase I Quriat, Samail, Sohar, Khaburah, Barka, Bahla

Phase II Seeb, Shinas, Suwaiq, Izki, Ibra, Salalah

MAF conducted a detailed feasibility study and design of a pilot pickling plant in 1989-1990. The study revealed that a definite market for pickles exists because the average annual import of pickles was around 4,493 tons from 1981-1986. On the basis of apparent demand only, 9 plants of a 500 tons/year capacity will be required to be established. From the results of the study, it is clear that a pilot plant for pickling (500 tons/year) is suitable for the initial stage. Since vinegar would be the major requirement for pickling and also direct market needs, a vinegar production plant has also been examined. In the detailed feasibility study, it was also mentioned that a vinegar plant with a capacity of 350 tons/year is suitable in combination with the pickling plant. Since the vinegar market demand is around 239 tons, additional demand for vinegar will be created if pickling plants are established. Since fruits and vegetables for pickling and vinegar are readily available, establishing a pilot plant is a step in the right direction. Experimental results show that

omsila dates (low-quality dates presently being fed to animals) can economically be utilized for vinegar production.

Two pilot pickling plants including vinegar production lines are suggested to be established during the 5-year Agricultural Development Plan (1991-1995).

One should be constructed in the Rusayl Industrial Estate since the necessary infrastructure is readily available and PAMAP collection and distribution centers are also located in the vicinity. Moreover, the capital area markets will provide a ready outlet for the products. Another pilot pickling plant is suggested to be constructed in Barka. Employment opportunities will be created for 74 personnel at each pickling plant (see Figure 3.5.1).

Based on an evaluation of achievement in the pilot plants, two more pickling plants should be constructed after 1996. The sites of these plants are to be Bahra and Sohar according to the suggestions of the pre-feasibility study. It should be noted that the financial viability of establishing vinegar plants in Oman on a commercial scale is suspect. It will be essential, therefore, to consider a tariff review for imported vinegar to make such a plant financially viable. The above study concludes that domestic demand of vinegar is not enough to justify large scale commercial operations.

Responsibility:

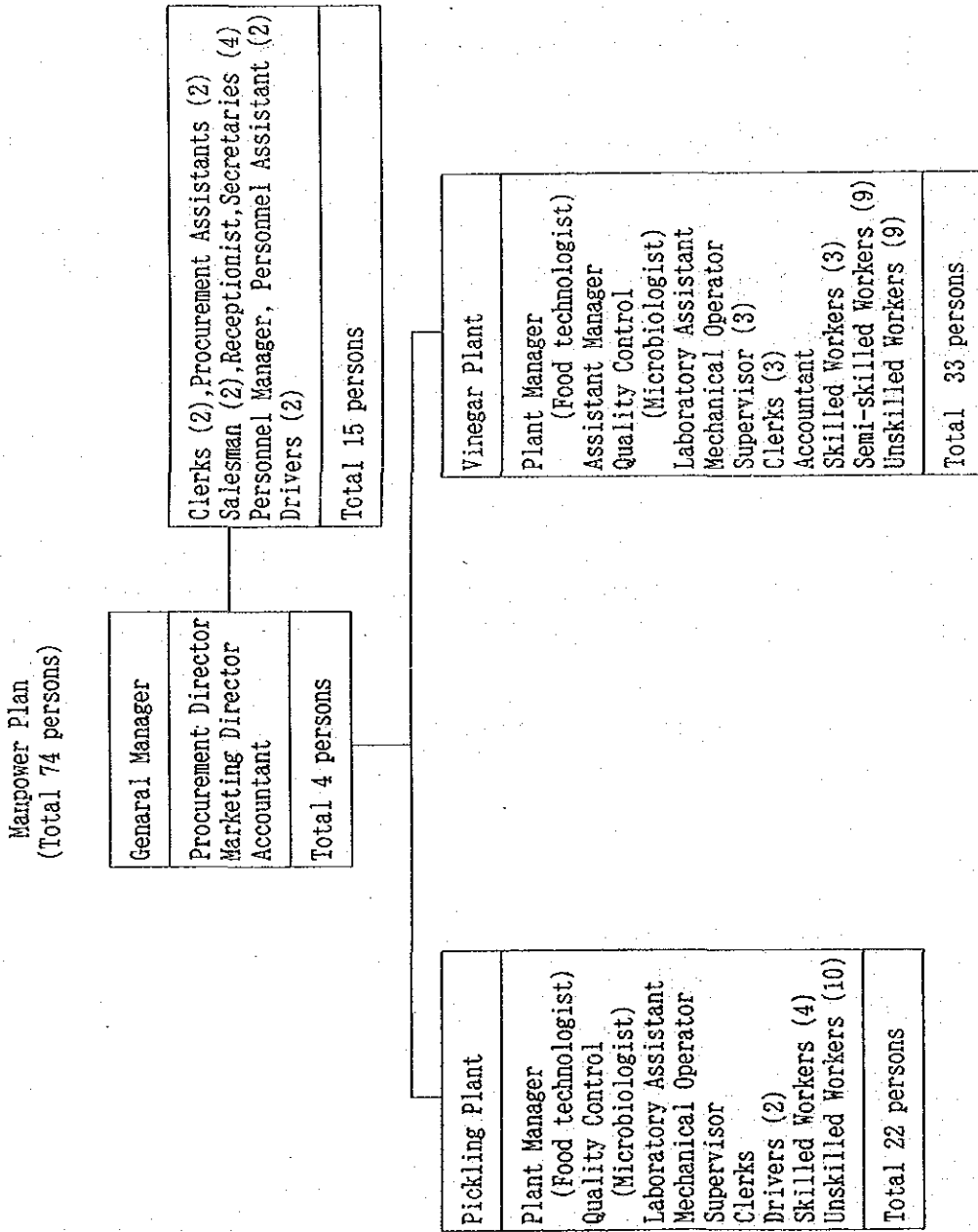
The private company to be established will manage all the plant activities.

Timing:

After completing a detailed design in 1991, the construction of two pilot pickling plants combined with a vinegar plant will start in 1992. The operation will begin in 1993.

The two pickling plants will be constructed in 1997 after completing

Figure 3.5.1 PICKLING AND VINEGAR-PROCESSING PLANT ESTABLISHMENT PROJECT



feasibility studies and detailed designs in 1996 on the basis of a scrutinized assessment of pilot plants achievement.

Budget:

Government will be responsible totally for the capital necessary for establishing two pilot pickling plants including vinegar production line.

The capital necessary for establishing the pickling plants during the latter half of the 10-year Master Plan (1996-2000) will be shared by:

| | |
|----------------------|-----|
| Government | 20% |
| Founder | 30% |
| Public share holders | 50% |

A cost estimate is shown in Table 3.5.3.

Table 3.5.3 Cost Estimation of NP-3 Project (10-Year Plan)

NP-3 Establishment of Pickling and Vinegar-Processing Plant

1. Pickling Plant including Vinegar Production Line

| Item | Unit | Volume | Unit Price | Amount (R.O.) | Government Share |
|---------------------------------------|------|--------|------------|---------------|------------------|
| 1) Fixed Cost | | | | | |
| Land | set | 1 | 4,225 | 4,225 | |
| Civil Works, Land Development | set | 1 | 297,000 | 297,000 | |
| Plant and Machinery | set | 1 | 173,000 | 173,000 | |
| Duties and Taxes | set | 1 | 8,650 | 8,650 | |
| Transportation of Machinery | set | 1 | 17,300 | 17,300 | |
| Utilities Connection | set | 1 | 8,000 | 8,000 | |
| Erection/Installation | set | 1 | 51,900 | 51,900 | |
| Financial Charges | set | 1 | 12,604 | 12,604 | |
| Furniture and Fixture | set | 1 | 10,000 | 10,000 | |
| Vehicles | set | 1 | 12,000 | 12,000 | |
| Pre-operating Expenditure | set | 1 | 6,000 | 6,000 | |
| Contingency | % | 10 | 600,679 | 60,068 | |
| Subtotal | | | | 660,747 | 660,747 |
| 2) Net Initial Working Capital | | | | | |
| | set | 1 | 146,030 | 146,030 | 146,030 |
| | | | | 806,777 | 806,777 |
| Total | | | | 806,777 | 806,777 |
| Rounded Total | | | | 807,000 | 807,000 |

2. Pickling Plant

| Item | Unit | Volume | Unit Price | Amount (R.O.) | Government Share |
|-----------------------------------|------|--------|------------|---------------|------------------|
| 1) Fixed Cost | | | | | |
| Land | set | 1 | 2,250 | 2,250 | |
| Civil Works, Land Development | set | 1 | 151,000 | 151,000 | |
| Plant and Machinery | set | 1 | 72,000 | 72,000 | |
| Duties and Taxes | set | 1 | 3,600 | 3,600 | |
| Transportation of Machinery | set | 1 | 7,200 | 7,200 | |
| Utilities Connection | set | 1 | 5,000 | 5,000 | |
| Erection/Installation | set | 1 | 21,600 | 21,600 | |
| Financial Charges | set | 1 | 6,621 | 6,621 | |
| Furniture and Fixture | set | 1 | 4,000 | 4,000 | |
| Vehicles | set | 1 | 8,000 | 8,000 | |
| Pre-operating Expenditure | set | 1 | 3,000 | 3,000 | |
| Contingency | % | 10 | 284,271 | 28,427 | |
| Subtotal | | | | 312,698 | 62,540 |
| 2) Initial Working Capital | | | | | |
| | set | 1 | 106,212 | 106,212 | 21,242 |
| | | | | 418,910 | 83,782 |
| Total | | | | 418,910 | 83,782 |
| Rounded Total | | | | 419,000 | 84,000 |

3. Grand Total

| Item | Unit | Volume | Unit Price | Amount (R.O.) | Government Share |
|--|------|--------|------------|---------------|------------------|
| 1. Pickling Plant including Vinegar Production Line | | | | | |
| Pilot Plant (Capital) | set | 1 | 807,000 | 807,000 | |
| Pilot Plant (Batinah(Barka)) | set | 1 | 807,000 | 807,000 | |
| Subtotal | | | | 1,614,000 | 1,614,000 |
| 2. Pickling Plant | | | | | |
| Dakhliya (Bahra), Batinah (Sohar) | set | 2 | 419,000 | 838,000 | 168,000 |
| Grand Total | | | | 2,452,000 | 1,782,000 |

4. Financial Analysis

| Item | Value |
|---|---------|
| 1. Pickling Plant (with Vinegar Production Line) | |
| Pickles 500tons/year | |
| Vinegar 4.5% Acidity, 350tons/year | |
| FIRR (%) | 14.30 |
| Payback Period | 7 years |
| 2. Pickling Plant | |
| Plant Capacity 500tons/year | |
| FIRR (%) | 18.98 |
| Payback Period | 5 years |

[NP-4] Establishment of Coconut-Processing Plant

Objective:

This project aims to diversify crop production and to increase the value added to coconuts in the Southern Region through establishing a processing plant for coconuts which are a promising tree crop in the region.

Description:

Coconuts have been grown in the Salalah area for a considerable period of time. Where palm roots are able to reach the fresh groundwater table, they grow well, but supplementary irrigation is essential to achieve a good yield. The Department of Agricultural Statistics of MAF estimates that the area cultivated for coconut in 1988 was approximately 328 ha. Up to three-quarters of the coconuts are harvested and sold as green nuts for drinking.

MAF conducted a feasibility study on the establishment of a viable coconut industry in the Salalah Plain from 1988-1989. The study indicated that in the near future it should be possible for a processing industry to obtain at least 1 million nuts per year from recently planted trees. However, to ensure reliability of supply for any processing plant, it is considered essential that new trees be planted with the specific objective of providing raw material to the processing plant. In the study, one area along the Salalah coast was selected as the most appropriate place from a number of different areas. 300 ha could be planted here.

The most promising products of the coconut plant would be:

- Ice cream ingredient (for use in the manufacture of dairy ice creams)
- Rubberized coil (for use in the manufacture of mattresses, upholstered furniture and car seats)
- Charcoal (for baking)

By fully utilizing all the components of the whole coconut, this product mix will maximize the value added from the processing.

The proposed ice cream ingredient would form about 25% of the final ice cream product for sale to consumers. The total Omani market for ice cream, of all flavors, is estimated at 2.6 million liters/year, and the GCC market totals 30 million liters. The greatest part of this is manufactured by local dairy product firms. It is recommended that in the first phase of development, the production scale for ice cream ingredient be 400-500 tons/year with a single daily sift operation. This would be equivalent to 1.6-2.0 million liters of ice cream, or 5-6% of the Gulf market. This scale of production would require an input of 1 million coconuts/year.

Rubberized coil would be produced primarily for sale to mattress and upholstery manufacturers in Oman and the Gulf. The minimum viable scale of production of rubberized coil is 800 tons/year, requiring an input of 3 million coconuts. Production at this level is estimated to be equivalent to under 7% of the GCC market of mattress materials.

Charcoal could be produced from the shells of the coconuts which would be a by-product of the other processing plants. Charcoal for cooking purposes is imported to Oman and other GCC countries. The sale of limited quantities which could be manufactured in Oman would present no problems.

The proposed factory is to be an integrated process whereby the whole nut is collected from the farmer or estate and processed into a number of products. Three main products to be made from coconuts are:

- Coconut-flavored ice cream ingredient at 430 tons/year from the meat of coconut
- Coil fiber and rubberized coil at 800 tons/year from the husk
- Charcoal at 390 tons/year from the shell

The plant is expected to require 60,000kwh of electricity per year, 10,000cu.m of water, and 100,000 liters of fuel oil when working at

full capacity.

The factory complex will be managed by a central board who will be responsible for group transport, accounts and marketing. The complex is expected to provide 143 jobs ranging from management to labor (see Figure 3.5.2).

The factory will be located near Salalah township.

The proposed planting of 300ha of coconuts to ensure supply for processing should be undertaken as an integral part of the processing plant investment. The FIRR of 300ha of coconut planting, assuming a sales price for coconuts of R.O. 0.175 per piece, would be only 4%. Combining the planting program and the processing plant, the FIRR for the full investment project would be about 7%.

Responsibility:

A private stock company which will manage all the activities of plants and coconut estates is to be established.

MAF is responsible for the development and operation of the coconut farm.

Timing:

A detailed design will be completed in 1992. Construction of the whole complex takes 2 years (1993 and 1994). The operation will begin in 1995.

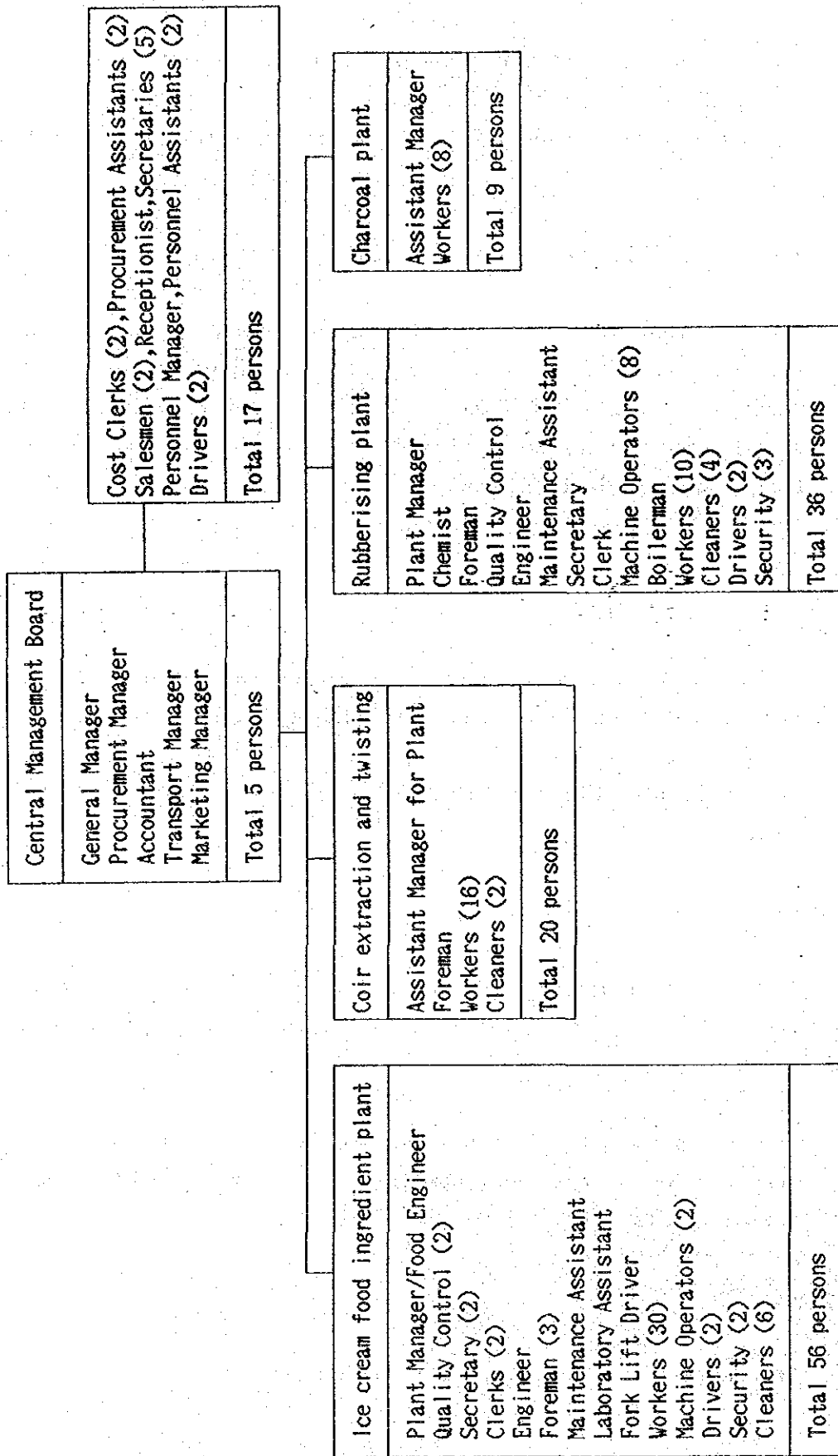
The coconut farm construction should be implemented before the construction of the plant complex in order to stabilize the supply of raw materials. It will be from 1991-1995.

Budget:

The capital of the company will be shared by:

Figure 3.5.2 Manpower Plan for Coconut-Processing Plant

Manpower Plan
(Total 143 persons)



| | |
|----------------------|-----|
| Government | 20% |
| Founder | 30% |
| Public share holders | 50% |

The government will be responsible for all the shares that are not purchased by the public by providing soft loans of OBAF or ODB. The costs for the development and operation of coconut farm will be borne by MAF. A cost estimate is shown in Table 3.5.4.

Table 3.5.4 Cost Estimation of NP-4 Project (10-Year Plan)

1. Project Cost

| Item | Unit | Volume | Unit Price | Amount (R.O.) | Government Share |
|--|------|--------|------------|---------------|------------------|
| 1) Civil Works | | | | | |
| Site Preparation | sq.m | 25,500 | 2.5 | 63,750 | |
| Factory Buildings | sq.m | 3,350 | 110.0 | 368,500 | |
| Reception/Storage | sq.m | 8,000 | 60.0 | 480,000 | |
| Offices | sq.m | 500 | 125.0 | 62,500 | |
| Hard Standing | sq.m | 900 | 17.5 | 15,750 | |
| Contingency | % | 10 | 990,500 | 99,050 | |
| Subtotal | | | | 1,089,550 | 217,910 |
| 2) Plant & Equipment | | | | | |
| Ice Cream Ingredients | set | 1 | 352,050 | 352,050 | |
| Coir Extraction | set | 1 | 207,090 | 207,090 | |
| Coir Rubberizing | set | 1 | 414,180 | 414,180 | |
| Charcoal | set | 1 | 103,600 | 103,600 | |
| Primary Tools & Spares | % | 5 | 1,076,920 | 53,846 | |
| Engineering Design | % | 5 | 1,076,920 | 53,846 | |
| Contingency | % | 10 | 1,076,920 | 107,692 | |
| Subtotal | | | | 1,292,304 | 258,461 |
| 3) Working Capital | | | | | |
| Imported Raw Materials (3 months) | set | 1 | 38,500 | 38,500 | |
| Local Raw Materials (1 month) | set | 1 | 49,410 | 49,410 | |
| Accounts Receivable | set | 1 | 51,010 | 51,010 | |
| Subtotal | | | | 138,920 | 27,784 |
| 4) Consultancy Services (D/D, Supervision) | % | 10 | 1,089,550 | 108,955 | 21,791 |
| Grand Total | | | | 2,629,729 | 525,946 |
| Rounded Total | | | | 2,630,000 | 526,000 |

2. Financial Analysis

| Item | Value |
|---------------------------|---------|
| 1. Production | |
| Ice Cream Mix 1,300t/year | |
| Rubberized Coir 800t/year | |
| Charcoal 360t/year | |
| 2. Financial Analysis | |
| FIRR (%) | 11.53 |
| Payback Period | 8 years |

(continued)

3. Cost for Development of Coconut Farm

| ITEMS | 1ST YEAR (1000R.O.) | 2ND YEAR (1000R.O.) | 3RD YEAR (1000R.O.) | 4TH YEAR (1000R.O.) | 5TH YEAR (1000R.O.) | TOTAL COST (1000R.O.) |
|-------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|--------------------------|
| INVESTMENT COST | | | | | | |
| 1. LABOUR | 101 | 51 | 51 | 50 | 41 | 294 |
| 2. MACHINERY | 135 | 9 | 9 | 9 | 9 | 171 |
| 3. PLANTING MATERIAL | 150 | 8 | 8 | 7 | | 173 |
| 4. FERTILIZER | 4 | 8 | 15 | 30 | 30 | 87 |
| 5. PESTICIDE | 18 | 2 | 1 | 1 | | 22 |
| 6. PEST/WEED CONTROL | | 8 | 8 | 7 | 7 | 30 |
| 7. TOP SOIL/MANURE | 330 | | | | | 330 |
| 8. IRRIGATION EQUIPMENT | 365 | | | | | 365 |
| 9. IRRIGATION (PUMPING) | 9 | 19 | 36 | 72 | 73 | 209 |
| OVERHEADS AND MISC. | 278 | 25 | 32 | 44 | 40 | 419 |
| TOTAL | 1390 | 130 | 160 | 220 | 200 | 2100 |

4. Operation Cost for Coconut Farm

OPERATING COST PER ANNUM

| ITEMS | NUMBERS | UNIT PRICE (R.O.) | TOTAL COST (R.O.) |
|-------------------------|---------|----------------------|----------------------|
| OPERATING COST | | | |
| 1. LABOUR | 300 ha | 200 | 60,000 |
| 2. MACHINERY | 300 ha | 60 | 18,000 |
| 3. FERTILIZER | 300 ha | 100 | 30,000 |
| 4. PEST/WEED CONTROL | 300 ha | 25 | 7,500 |
| 5. IRRIGATION (PUMPING) | 300 ha | 245 | 73,500 |
| OVERHEADS & MISC. | 300 ha | 157 | 47,000 |
| TOTAL | | | 236,000 |

3.6 Inter-Sectoral Projects

[NI-1] Integrated Agricultural Development Project in Nejd

Objective:

This project aims to increase agricultural production in the Nejd area, where a high potential for underground water development has been confirmed. The project will be implemented by integrating irrigation water development, irrigation facilities construction, extension activities, staff training, groundwater monitoring, and natural condition observation.

Description:

In the Salalah Plain, the core city of the South, little room is left for additional large-scale agricultural development because there has been a rapid utilization of land and water resources through population increases and urbanization. In this regard, the agricultural development in Nejd, which has high potential for large-scale development, is essential for the promotion of agricultural production in the Janubiya.

The agricultural development in Nejd started at the beginning of the 1980's with the development of hand-dug and flowing wells by the local people. Major crops cultivated are fodder grass, fruits and vegetables. Besides these small-scale farms, a PDO farm with an area of 100ha irrigated by the center pivot system was established in 1985 under the by directive of H.M. Sultan Qaboos. In the PDO farm, 95% of the total farm land is covered with Rhodes grass.

According to the feasibility study conducted by JICA from 1987-1989, the lower UER (Umm Er Radhuma formation) aquifer bears pressurized groundwater of low level EC (electric conductivity) -- around 1,500 micro.s/cm. The aquifer has a formation range from 270 to 310+ m below groundlevel. It is notable that the Nejd groundwater is disconnected from the present hydrologic cycle and is believed to be

finite.

Based on the results of the JICA study, the following was pointed out.

- For a development area of 300-500 ha, the life time could be in the order of thousands of years.
- Initial drawdown of underground water level limits the scale of reclamation to 1,000 ha.

In order to optimize the utilization of limited water resources, the following phased development scheme is proposed:

(1) Phase 1

- Establishment of a pilot farm, through which data collection and experimental activities are made.

(2) Phase 2

- Development of up to 500ha based on the results of Phase 1.

(3) Phase 3

- Further development based on the results of Phase 2.

Based on soil conditions, static groundwater levels and socio-economic conditions, the following sites are recommended for agricultural development:

- Nagha area
- Dauka area
- Shasr area

Among them, both the Nagha and Dauka areas are selected as development areas, and the Nagha area is also selected as a pilot farm site.

The outline of the development project is shown below.

- (1) Groundwater development and construction of irrigation facilities

Well digging up to 300m in depth is necessary. Although the target groundwater is highly pressurized, the economical groundwater level is 100m maximum from the surface. Irrigation facilities connected with wells will be constructed along with roads, windbreaks and houses. The necessary equipment and machinery also will be introduced.

(2) Farm arrangement

The intensive type of farm will be constructed because of its benefit in forming communities, using machinery effectively and economy of scale in infrastructure development.

(3) Settlement

From the phase 2 development stage, a suitable farming group of local people should be selected to settle in the area to maintain the new developed farm. They will take full responsibility for farm management.

The pilot farm will be constructed prior to full-scale agricultural development. In the pilot farm, there will be an extension office and training unit, as well as production facilities and equipment. The size of the pilot farm is to be 50 ha consisting of:

- Experimental farm 5 ha
- Small-scale verification farm 15 ha
- Large-scale verification farm 30 ha

The activities on the pilot farm will be as follows:

- Soil improvement by cultivating fodder grass
- Experimental cultivation of other crops
- Training of extension staff and farmers
- Extension work such as guidance in appropriate farming

- techniques, publicizing technical information and investigating and collecting information
- Continuous observation of groundwater levels and meteorological and soil conditions
 - Verification of irrigation methods such as center pivot type, rain gun, side wheel sprinkler and drip irrigation system

The required staff for the operation of the pilot farm is shown in Table 3.6.1.

Responsibility:

The Directorate General of Agriculture of MAF is responsible for the project. The construction work and operation of the project will be performed in coordination with other concerned MAF departments.

Timing:

The pilot farm will be constructed in 1991 and it will begin operation at the beginning of 1992. Phase 2 of agricultural development which targets 450ha of beneficial area will be implemented in the order shown below:

- 50ha in 1992
- 50ha in 1993
- 100ha in 1994
- 150ha in 1995
- 100ha in 1996

Budget:

MAF will establish and maintain the pilot farm by bearing the whole cost. Personnel required for the smooth implementation of activities in the pilot farm will also be deployed. Based on the results of the pilot farm operation, further development will follow. Since FIRR of full-scale development is only 1.1%, the whole construction cost of the subsequent project should be borne by MAF.

The budget needed for both the pilot farm and full-scale agricultural development is:

- Pilot project: R.O. 1.655 million
- Agricultural development project: R.O. 14.898 million

A cost estimate is shown in Table 3.6.2.

The operation cost of the pilot project (recurrent budget) is estimated to be approximately R.O. 175,000 per annum as shown in Table 3.6.3.

Table 3.6.1 Manpower Plan of Pilot Farm in Nejd Development Project

NI-1 Integrated Agricultural Development Project in Nejd

Manpower Plan in the Pilot Project

| Speciality | Number | Remarks |
|--|--------|--|
| 1. Project Manager | 1 | Management of all the activities |
| 2. Agronomist | 2 | Cropping experiment |
| 3. Irrigation engineer | 2 | Irrigation |
| 4. Extension engineer | 2 | Extension |
| 5. Engineer specialized in observation | 4 | Monitoring of groundwater level, meteorology, soil, etc. |
| 6. Mechanics | 2 | Maintenance and repair for machinery |
| 7. Machine operator | 2 | Machinery operating |
| 8. Administrator | 1 | |
| 9. Clerk | 1 | |
| 10. Secretary | 1 | |
| 11. Laborer | 3 | Farming |
| 12. Cook | 1 | |
| Total | 22 | |

Table 3.6.2 Cost Estimation of NI-1 Project (10-Year Plan)

NI-1 Integrated Agricultural Development Project in Nejd

1. Pilot Farm (50ha)

| Item | Unit | Volume | Unit Price | Amount (R.O.) |
|-----------------------------|------|--------|------------|---------------|
| 1. Civil Works | | | | |
| 1)Preparation work | set | 1 | 7,500 | 7,500 |
| 2)Land reclamation | set | 1 | 500 | 500 |
| 3)Intake facility | set | 1 | 100,000 | 100,000 |
| 4)Irrigation facility | set | 1 | 455,000 | 455,000 |
| 5)Drainage system | set | 1 | 14,000 | 14,000 |
| 6)Road works | set | 1 | 79,000 | 79,000 |
| 7)Windbreaks | set | 1 | 250,000 | 250,000 |
| 8)Water supply | set | 1 | 11,000 | 11,000 |
| 9)Buildings | set | 1 | 210,000 | 210,000 |
| Subtotal | | | | 1,127,000 |
| 2. Equipments | | | | |
| 1)Generator | set | 1 | 40,000 | 40,000 |
| 2)Machinery | set | 1 | 93,000 | 93,000 |
| 3)Meteorological Equipments | set | 1 | 4,000 | 4,000 |
| 4)Vehicle | set | 1 | 35,000 | 35,000 |
| 5)Office equipment | set | 1 | 12,000 | 12,000 |
| Subtotal | | | | 184,000 |
| 3. Project facilities | set | 1 | 9,000 | 9,000 |
| 4. Administration | set | 1 | 5,000 | 5,000 |
| 5. Consulting Service | set | 1 | 180,000 | 180,000 |
| 6. Contingency | set | 1 | 150,000 | 150,000 |
| 7. Grand Total | | | | 1,655,000 |

2. Main Development Project (450ha)

| Item | Unit | Volume | Unit Price | Amount (R.O.) |
|------------------------------|-------|--------|------------|---------------|
| A. Cost per 50ha | | | | |
| 1. Construction cost | set | 1 | 1,296,500 | 1,296,500 |
| 2. Machinery cost | set | 1 | 84,500 | 84,500 |
| 3. Project facilities cost | set | 1 | 7,400 | 7,400 |
| 4. Administration cost | set | 1 | 5,700 | 5,700 |
| 5. Consultation service cost | set | 1 | 110,700 | 110,700 |
| 6. Physical contingency | set | 1 | 150,500 | 150,500 |
| Total | | | | 1,655,300 |
| B. Project Cost for 450 ha | Block | 9 | 1,655,300 | 14,897,700 |

Source: The Study on Agriculture Development Project in the Nejd Region, Final Report (JICA, October 1989)

Table 3.6.3 Recurrent Budget for Pilot Farm in Nejd Development Project

NI-1 Integrated Agricultural Development Project in Nejd

1. Recurrent Budget for Pilot Farm

| Item | Unit | Volume | Unit Price | Amount (R.O.) |
|--|------|--------|------------|---------------|
| 1. Project Office | | | | |
| 1)Salaries | set | 1 | 18,000 | 18,000 |
| 2)Fuels | set | 1 | 2,803 | 2,803 |
| 3)Maintenance and repair | set | 1 | 6,375 | 6,375 |
| Subtotal | | | | 27,178 |
| 2. Experiment and Verification Farm | | | | |
| 1)Laborers | set | 1 | 75,120 | 75,120 |
| 2)Maintenance and repair | | | | |
| (1)Water intake facilities | set | 1 | 601 | 601 |
| (2)Irrigation facilities | set | 1 | 7,533 | 7,533 |
| (3)Drainage facilities | set | 1 | 14 | 14 |
| (4)Roads | set | 1 | 79 | 79 |
| (5)Windbreaks | set | 1 | 2,035 | 2,035 |
| (6)Water supply | set | 1 | 56 | 56 |
| (7)Buildings | set | 1 | 219 | 219 |
| (8)Generator | set | 1 | 50,372 | 50,372 |
| (9)Machinery | set | 1 | 11,457 | 11,457 |
| (10)Meteorological equipments | set | 1 | 112 | 112 |
| Subtotal | | | | 147,598 |
| Total | | | | 174,776 |
| Rounded Total | | | | 175,000 |

[NI-2] Improvement and Maintenance of MAF Facilities

Objective:

The objective of this project is to construct and improve the building and facilities of the ministry headquarters as well as regional offices in order to correspond with the expansion of ministerial functions and technical modernization.

Description:

This project has three components:

- Ministry building
- Office building for Directorate General of Agriculture in 6 regions
- Separate consolidated allocation for all consultancies

The outline of each project component is as follows:

(1) Ministry building

This component includes the construction of additional office space, refurbishment and maintenance of existing facilities and the establishment of central library facilities in MAF headquarters. Necessary equipment and materials such as furniture, books, office machines and so forth will be introduced. Tender documents will also be prepared.

(2) Office building for Directorate General of Agriculture in 6 regions

This component includes the transfer and new development of regional offices in 6 regions, namely: Batinah (Sohar), Sharqiya (Ibra), Dakhliya (Nizwa), Dhahira (Ibri), Janubiya (Salalah), and Musandam (Khasab). Equipment and furniture, as well as computer terminals connected with the host computer in the headquarters are

included. The study for the construction was completed in 1985 and the sites for new offices have been secured.

(3) Separate consolidated allocation for all consultancies

This component covers the additional consulting services by foreign experts or consultants who are required temporarily to respond to specific technical needs that can not be dealt with by annually contracted expatriate experts. The field requiring experts are citrus, grapes, mangoes, pineapples, whitefly, leaf minors, plant nematoda and plant virus. Work conducted by those experts and consultants will not exceed a time period of 3 months.

Responsibility:

The Planning Unit of MAF is in charge of this project.

Timing:

The timing of each component is:

(1) Ministry building

Construction: 1991 and 1992

(2) Office building for Directorate General of Agriculture in 6 regions

Construction: Batinah, Sharqiya in 1991

Dakhliya, Dhahira in 1992

Janubiya, Musandam in 1993

(3) Separate consolidated allocation for all consultancies

Annual activity

Budget:

A cost estimate is shown in Table 3.6.4.

Table 3.6.4 Cost Estimation of NI-2 Project (10-Year Plan)

NI-2 Improvement and Maintenance of MAF Facilities

| Item | Unit | Volume | Unit Price | Amount (R.O.) |
|---|------|--------|------------|-------------------|
| 1. Ministry Building | | | | |
| 1) Ministry Building | set | 1 | 2,266,000 | 2,266,000 |
| 2) Refurnishment and Maintenance | set | 1 | 2,000,000 | 2,000,000 |
| 3) Central Library Facilities for Ministry Headquarters | set | 1 | 925,000 | 925,000 |
| Subtotal | | | | 5,191,000 |
| 2. Office Building for Directorate General of Agriculture in 6 Regions | | | | |
| 1) Batinah | set | 1 | 1,200,000 | 1,200,000 |
| 2) Sharqiya | set | 1 | 1,200,000 | 1,200,000 |
| 3) Dakhliya | set | 1 | 1,200,000 | 1,200,000 |
| 4) Dhahira | set | 1 | 1,200,000 | 1,200,000 |
| 5) Janubiya | set | 1 | 1,500,000 | 1,500,000 |
| 6) Musandam | set | 1 | 1,200,000 | 1,200,000 |
| 7) Computer system (terminal) | set | 6 | 50,000 | 300,000 |
| Subtotal | | | | 7,800,000 |
| 3. Separate Consolidated Allocation for All Consultancies | | | | |
| | set | 1 | 8,000,000 | 8,000,000 |
| Total | | | | 20,991,000 |

[NI-3] Artificial Rainfall Project

Objective:

The objective of the project is to verify the possibility of artificial rainmaking technology in order to enhance the amount of precipitation in the Southern Region where a clear monsoon period is recognized.

Description:

The Thai expert team, consisting of government engineers from the Royal Rainmaking Research and Development Institute and the Ministry of Agriculture and Cooperatives, proposed the project after a reconnaissance survey in the Southern Region in 1987 and 1988. The project is deemed to be possible on the basis of successful achievements in Thailand implemented by concerned government agencies.

The mechanism of rainmaking is that scattered seeding agents from aircraft will produce micro-physical and dynamic effects in warm clouds to stimulate the precipitation process. The recommended seeding agents in Dhofar Jabal and the Salalah plain are sodium chloride powder, urea, ammonium nitrate, dry ice, etc. The proper implementation of the seeding depends not only on the scattering intensity and the size of the particles, but also on the time and place in the clouds.

The outline of the project to be classified as a pilot project is shown below:

(1) During monsoon period (June-September)

Airborne seeding technique will be adapted over the Jabal and plain area of Mirbat. Mountain top to cloud base seeding technique by high pressured dispersal machines installed on selected high mountain tops of Jabal and Mirbat area will be tested.

(2) During dry period (October-November)

A pre-investigative study and observation will be conducted to examine the possibility of introducing Thai seeding techniques in the following year.

(3) Training

The Omani team of scientists will be trained at the field operation site in Thailand to familiarize them with artificial rainmaking technology.

Full-scale implementation of rainmaking will follow if the project is sufficiently effective, both technologically and economically.

Responsibility:

The Planning Unit of MAF and Directorate General of Agriculture in the Southern Region is responsible for the implementation of the project.

Timing:

The project will be implemented in 1996 and 1997 after further study on artificial rainmaking processes in the Southern Region.

Budget:

Approximately R.O. 2.5 million is required.

[OI-1] Citizen's Compensation against Natural Crisis

Objective:

This project aims to compensate farmers who suffer from natural disasters such as floods, droughts, landslides, etc.

Description:

This project is one of the on-going projects from the Third Five-year Development Plan and should continue since the necessary budget should be secured as an emergency fund to cope with natural crises and to help sufferers.

Responsibility:

The Directorate General of Agriculture of MAF is responsible for the project.

Timing:

Annual activity.

Budget:

The budget should be prepared annually. The necessary annual budget is approximately R.O. 300,000.

[OI-2] Master Plan for Development of Date Palm Cultivation

Objective:

The project intendeds to increase date production, improve quality, reduce waste and losses and cost of production, increase returns on investment, and improve national capabilities in date production, processing and utilization.

Description:

The project was agreed upon by MAF, FAO and UNDP in December, 1988. The activities of the project focus on:

- (1) Date palm production
- (2) Date palm protection
- (3) Date handling, processing and industrialization

The project consists of recruiting international experts, assigning Omani national counterparts and training of counterparts in order to achieve the objectives mentioned above. Experts in the following areas are required:

- (1) Date production
- (2) Date processing and industrialization
- (3) Date palm protection
- (4) UN volunteer (UNV) specialists
 - Food technology
 - Horticulture date palm
 - Plant protection

Omani national counterparts for all the above international experts and UNV specialists are also required. International experts and UNV specialists are recruited after government clearance. The project is coordinated by an international project coordinator and by a national project coordinator to be selected and appointed by the government. The project is also coordinated by a project coordination

committee to be organized by MAF.

The expected outputs from the project are:

- (1) Intensification of date palm production
 - Definition of improved management practices, namely manuals, guidelines and advanced technology leading to improved yield, reduced waste and low cost of production
 - Introduction of improved management practices
 - Utilization of the existing pollen extraction station in Ghala
- (2) Improvement of existing methods for better management of pests and disease control
- (3) Development of an industrial date-processing capacity
- (4) Upgrading and development of technical staff in date palm improvement programs through appropriate training
 - Establishment of a program for local training including courses, seminars and workshops, teaching material and operating manuals for ten nationals
 - Three nationals to be trained abroad

Responsibility:

The Directorate General of Agriculture of MAF is responsible for the implementation of the project.

Timing:

The project was started in 1988 and will be completed in 1991.

Budget:

Approximately R.O. 600,000 is needed and the cost is to be shared by MAF, FAO and UNDP.

CHAPTER 4

*IMPROVEMENT PLAN FOR
CULTIVATION AND FARMING*

CHAPTER 4 IMPROVEMENT PLAN FOR CULTIVATION AND FARMING

4.1 Cultivation

(1) Selection of major crops in the 10-Year Master Plan for Agricultural Development

An overall evaluation of the importance of agricultural crops presently cultivated in Oman for promotion of the 10-year Master Plan for Agricultural Development was done after investigating --through grading and weighing -- various conditions such as agricultural importance (major production region, production area, total yield, unit yield, unit price, net profit, import or export-weight, PAMAP sales-weight), political importance (recommendation by MAF, tolerance to drought, tolerance to salinity, self-sufficiency rate) and economic importance (net profit, benefits per cubic meter of water consumption).

The results of the evaluation are indicated in Table 4.1. Ranks are assigned to the 15 most important major crops. These are potatoes, tomatoes, Rhodes grass, citrus fruits such as orange, grape, wheat, alfalfa, sweet potato, chili peppers, carrots, date palms, watermelons, sweet-melon, cucumbers and mangoes. Furthermore, though their ranking in the grading table is lower than the major crops mentioned above, some crops necessary for farming improvement models in different regions have been ranked as sub-main crops.

The sub-main crops have characteristics as indicated below. Bananas, coconuts and papayas are extensively cultivated, particularly in Salalah, and these have the outstanding merits of resisting drought and salinity, as well as excellent profitability. Barley, sorghum and onions are mostly cultivated in Interior Regions. They have low self-sufficiency rates but excellent profitability. Also eggplants, cabbage and okra are extensively cultivated, particularly in Batinah. Either the self-sufficiency rate is low, or since cultivation is easy and production can be realized in a short period of time, these are widely cultivated.

Table 4.1 Selection Criteria and Prioritization of the Major Crops Proposed in the Master Plan for the Agricultural Development in the Sultanate of Oman

| Crop | Major production region | | Production | | | Price RO/ton | Net profit RO/ha | Import or Export ton (1988) | PAMAP Sales ton (1988) | Benefits per cubic meter of water (RO) | Recommendation by IMAF | Tolerance | | Self-sufficiency rate (%) | Total | Order |
|---------------|-------------------------|----|------------|---------|-------------------|--------------|------------------|-----------------------------|------------------------|--|------------------------|-------------------|---------|---------------------------|-------|-------|
| | Ba | In | So | Area ha | Product 1,000 ton | | | | | | | Unit yield ton/ha | Drought | | | |
| Dates | ⊗ | | | 5 | 4 | 2 | 0 | 4 | 0 | 1 | 1 | 5 | 5 | 0 | 41 | 11 |
| Mango | ⊗ | | | 3 | 2 | 1 | 0 | 3 | 1 | 3 | 1 | 3 | 1 | (3) | 40 | 15 |
| Citrus(Lime) | ⊗ | | | 3 | 3 | 2 | 0 | 4 | 3 | 2 | 1 | 3 | 1 | 0-(5) | 32-47 | 4-26 |
| Banana | ⊗ | | ⊗ | 2 | 3 | 2 | 2 | 3 | 5 | 2 | 1 | 1 | 1 | 1 | 36 | 19 |
| Coconut | ⊗ | | ⊗ | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 5 | 5 | 1 | 35 | 21 |
| Papaya | ⊗ | | ⊗ | 1 | 1 | 2 | 3 | 2 | 2 | (3) | 1 | 1 | 1 | 1 | 31 | 29 |
| Pomegranate | ⊗ | | ⊗ | (0) | (0) | (2) | 0 | (1) | (0) | (2) | 1 | 3 | 3 | (3) | 27 | 31 |
| Guava | ⊗ | | ⊗ | (0) | (0) | 2 | 0 | 1 | (0) | (2) | 1 | 3 | 3 | (3) | 26 | 32 |
| Grape | ⊗ | | ⊗ | 1 | 6 | 2 | 4 | 4 | (0) | 2 | 1 | 3 | 3 | 5 | 47 | 5 |
| Wheat | ⊗ | | ⊗ | 2 | 0 | 1 | 0 | 5 | 0 | (1) | 5 | 3 | 1 | 5 | 46 | 6 |
| Barley | ⊗ | | ⊗ | 1 | 0 | 1 | 0 | 5 | 0 | (1) | 1 | 3 | 1 | 5 | 35 | 22 |
| Rhodes grass | ⊗ | | ⊗ | (1) | (3) | 4 | 3 | (1) | 0 | (4) | 5 | 5 | 5 | (1) | 48 | 3 |
| Alfalfa | ⊗ | | ⊗ | 4 | 5 | 3 | 3 | (1) | 0 | (4) | 1 | 3 | 1 | (1) | 44 | 7 |
| Sorghum | ⊗ | | ⊗ | 2 | 1 | 4 | 3 | (2) | 0 | (5) | 1 | 4 | 1 | (1) | 35 | 23 |
| Tobacco | ⊗ | | ⊗ | 1 | 1 | 2 | 5 | 1 | 0 | (5) | -5 | 3 | 1 | 2 | 32 | 27 |
| Frankincense | ⊗ | | ⊗ | (0) | (0) | (0) | ? | (0) | 0 | (5) | 3 | 5 | 1 | (0) | 12 | 33 |
| Tomato | ⊗ | | ⊗ | 2 | 3 | 3 | 4 | 5 | 4 | 4 | 1 | 1 | 1 | 2 | 49 | 2 |
| Chilli pepper | ⊗ | | ⊗ | 2 | 2 | 2 | 3 | 1 | 2 | (4) | 1 | 1 | 1 | 1 | 43 | 9 |
| Egg plant | ⊗ | | ⊗ | 1 | 2 | 3 | 0 | (2) | 3 | 3 | 1 | 1 | 1 | (3) | 22 | 28 |
| Potato | ⊗ | | ⊗ | 1 | 2 | 3 | 4 | 5 | 3 | 1 | 5 | 1 | 1 | 4 | 51 | 1 |
| Onion | ⊗ | | ⊗ | 2 | 2 | 2 | 0 | 4 | 2 | 2 | 1 | 1 | 1 | 3 | 34 | 24 |
| Garlic | ⊗ | | ⊗ | 1 | 1 | 2 | 4 | 1 | 1 | 3 | 1 | 1 | 1 | 2 | 38 | 17 |
| Water melon | ⊗ | | ⊗ | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 1 | 1 | 1 | 1 | 41 | 12 |
| Sweet melon | ⊗ | | ⊗ | 2 | 2 | 2 | 4 | 4 | 3 | 3 | 1 | 1 | 1 | 1 | 41 | 13 |
| Cucumber | ⊗ | | ⊗ | 2 | 2 | 2 | 4 | 2 | 2 | 5 | 1 | 1 | 1 | 1 | 41 | 14 |
| Squash | ⊗ | | ⊗ | 1 | 1 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | (3) | 37 | 18 |
| Cauliflower | ⊗ | | ⊗ | 1 | 1 | 2 | 0 | 3 | 1 | 2 | 1 | 1 | 1 | (3) | 29 | 30 |
| Cabbage | ⊗ | | ⊗ | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 36 | 20 |
| Lettuce | ⊗ | | ⊗ | 0 | (1) | 3 | 4 | 1 | 2 | 4 | 1 | 1 | 1 | (3) | 39 | 16 |
| Carrot | ⊗ | | ⊗ | 1 | 2 | 3 | 5 | 2 | 1 | 3 | 1 | 1 | 1 | (3) | 42 | 10 |
| Okra | ⊗ | | ⊗ | 0 | 1 | 2 | 4 | (2) | (1) | 3 | 1 | 1 | 1 | (3) | 34 | 25 |
| Sweet potato | ⊗ | | ⊗ | 1 | 1 | 3 | 4 | (1) | 2 | (4) | 1 | 5 | 3 | (2) | 44 | 8 |
| Note | | | | 10,000 | 20,000 | 10,000 | 3,000 | 8,000 | 3,000 | 2,000 | Strong | Strong | Strong | < 20 | | |
| Ba : Batinah | | | | 5,000 | 5,000 | 500 | 1,500 | 4,000 | 1,500 | 1,000 | Medium | Medium | Medium | < 40 | | |
| In : Interior | | | | 1,700 | 1,250 | 170 | 500 | 1,333 | 500 | 0.333 | Medium | Medium | Medium | < 60 | | |
| So : Southern | | | | 430 | 313 | 43 | 125 | 333 | 125 | 0.083 | Week | Week | Week | < 80 | | |
| Weight | | | | 86 | 0.78 | 0.8 | 25 | 67 | 25 | 0.017 | Week | Week | Week | < 100 | | |
| | | | | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 3 | | |

Notes: 1. Figures in parenthesis () were estimated by the JICA Study Team.
 Figures in parenthesis { } were obtained from the figures shown in the "Others" column in the Statistics Table.

2. Weight: Each factor can be evaluated from all aspects and from 1 to 3 in order of importance.

(2) Improvement in Cultivation Methods of Major Crops

Due to the lack of water for irrigation, the area for horizontal expansion is confirmed at about 5,600 ha, as mentioned before. This is quite small. To achieve expansion in production to meet the targets of agricultural development, plans are necessary for expansion of production mainly in the existing cultivated areas.

The factors which contribute to steep increases in production of agricultural crops, or in other words, increase of production quantity per unit area are: kinds of crops, variety, cropping and crop rotation systems, cropping season, cultivation methods, countermeasures against crop pests. All of these are interrelated. Therefore, to achieve a high level of improvement in unit yield, these factors must be improved harmoniously from an overall point of view. The main items for which measures need to be taken in this 10-year Master Plan for Agricultural Development, are described below.

(a) Selection of kinds of crops

It need not be mentioned that, not only do production items vary depending on the kind of crop, but so do environmental adaptability and productivity. According to the kind of crop, the production costs, unit yield, selling price, and profitability vary considerably too. (See Table 4.15).

Therefore, with the aim of short-term improvement in productivity, crops which have high profitability under the present circumstances and for which there is no likelihood of poor profitability, must be selected after observing the trends of recent years. Also, when the target is a high degree of long-term stability in productivity, future profitability must be predicted by studying the supply-demand trends in the present circumstances and then crops which satisfy these targets must be selected. To increase greenery in the country, to improve the micro-climatic conditions in daily-life environments, and to create a beautiful environment it is better for each farm to cultivate fruits to a certain extent. Along with

economic development in future, an increased demand for temperate fruit, tropical fruit, flowers, ornamental plants, orchids, etc. is predicted.

(b) Variety selection

Depending on the variety, adaptability to the environment, productivity, quality, response to fertilizer, resistance to crop pests, and adaptability to mechanization of the crops, vary considerably. Even a 10% improvement in production profitability could be achieved due to improvement in variety.

Therefore, varieties which suit the farming aim are to be selected for cultivation. In other words, when high profitability is aimed for under intensive management, even if the resistance to crop pests is inferior, a variety which has high quality and high yield is selected. But, under circumstances where adequate control cannot be exercised, there are advantages of selecting varieties with a high degree of resistance to crop pests and which are easy to cultivate, even though the quality and yield is inferior.

It is also important to select varieties based on demand trends of the consumer market. Furthermore, varieties must be selected and cultivated with proper balance of flowering time and ripening time so that the working hours are more or less even.

(c) Investigation of plowing and land preparation methods

In cultivating one season crops like vegetables or field crops, the soil is plowed and prepared prior to sowing or planting seedlings. Since flood irrigation and border irrigation methods are widely used in Oman, in case of vegetables, cultivation is mostly done after piling up the soil to form furrows and built-up ridges. With the drip-type or sprinkler-type irrigation method, building ridges is not required, but even in these cases, examples of built-up ridges can be observed.

The system of cultivating by building ridges is commonly adopted in cases where the cultivated soil is too shallow or soil drainage conditions are poor. In Oman, even in regions where cultivation is suited for level rows, which does not pertain to either of these, there are cases where ridge culture is being used. Cultivation without building up ridges is considered to have the advantages of reducing the quantity of evaporated water from the soil surface and of reducing the range of rise in soil temperature, compared to the ridge build-up cultivation system. Also, when making use of the new technique of "plastic film mulching" system, which is mentioned later, the advantage of reduced material costs is recognized. This will be one of the topics in the extension works in future.

(d) Improvement of cropping systems

Cropping system is a factor which is extremely important in raising the level of production per unit area to a high level and in maintaining it continuously over a long period of time. Intercropping system, mixed cropping system, multiple cropping system and crop-rotation systems are described below.

(i) Intercropping system

Intercropping is a method by which the rate of horizontal and utilization is raised. In Oman, this system is very effective in raising the rate of land utilization of date palm orchards. In the period of time between when the trees are planted and when they grow till the crown of the trees are crowded, other crops are planted between the trees, and the rate of horizontal land utilization is increased. Also, by planting crops according to ascending order of heights, not only can the rate of horizontal land utilization be increased but the rate of standing space utilization can also be increased (Figure 4.1).

Alley farming, which was recommended by IITA (1988) as a result of research in recent years, is an example of this type

of system. Adoption of this system should be possible for Oman also. By making use of the intercropping system, it should be easy in future, to have sound cultivation of crops such as peppers, which prefer a certain amount of shade. Also, most of the vegetables which are cultivated in summer would be sheltered to some extent and protected from the fierce sunlight, and could be healthier, resulting in good quality production.

Furthermore, in winter, crops which are cultivated between trees or under them, are protected to some extent from the cold due to heat radiation at night. For instance, if the space between the date palm trees along the Batinah sea shore is used for orchids or ornamental plant production, a minimum amount of shadow nets may be sufficient. Plastic film used for conserving heat in winter may become unnecessary, or a small quantity of these films might suffice.

To effectively utilize intercropping and increase the land and space utilization rate, the planting interval of all the crops to be cultivated must be adjusted, and research from now on this topic is necessary.

(ii) Mixed cropping system

Similar to the intercropping system, this is a system for increasing the rate of horizontal land utilization and rate of standing-space utilization. By mixed cropping of fruit trees with varying heights and by planting fodder crops under these trees, the land and space can be effectively utilized. However, mechanical operations are almost impossible in this mixed cropping system, and it has the disadvantage of requiring manual labor.

The scope of operation in general in the agricultural households in Oman is about 0.1 - 1 ha, which is quite small. In agricultural households using a falaj for water, where the land partitions are small, and soil is mixed with gravel, the chances

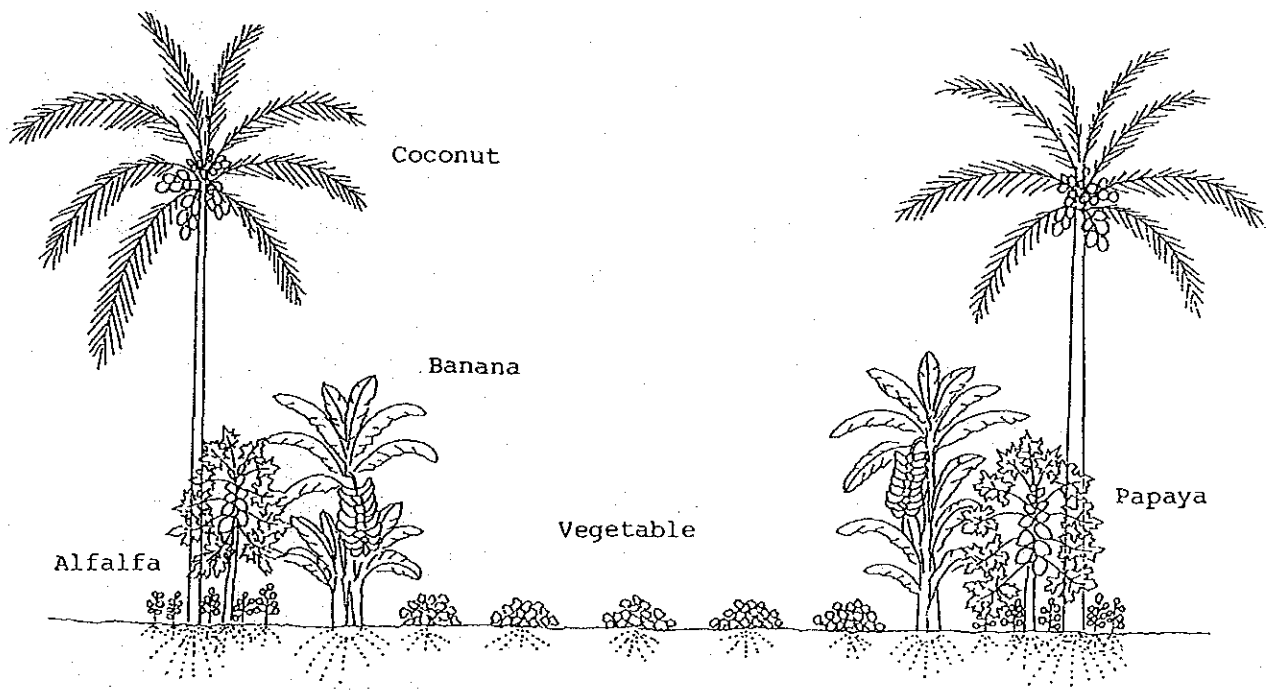


Figure 4.1 Example of Intercropping and Mixed Cropping for Raising Cropping Rate of Farms

of using large machines are minimal. For this reason, in places with such conditions, intercropping or mixed cropping systems are enforced as far as possible to increase the rate of horizontal land utilization and rate of standing-space utilization.

(iii) Multiple cropping system

Northern Oman generally uses a single cropping system, but in the traditional agricultural households of Salalah the utilization rate of land per year is as high as 110% to 135%, as mentioned later in the chapter on farming.

Increasing the rate of land utilization means reducing the fallow period and this is extremely important for increasing the production profits of crops per year or per unit area.

Crops can be broadly classified as summer crops and winter crops. In general, double cropping annually is possible, but since the weather conditions in the summer in northern Oman are severe, if cultivation is done at any period other than summer, it is difficult to have two crops in a year. Nevertheless, in Salalah, the weather conditions are comparatively favorable throughout the year, and since crop cultivation is possible throughout the year, double cropping can be easily carried out in a year. If not continuous, three crops a year are also possible.

As a method of increasing the introduction rate of multiple cropping, seedlings or sprouts are transplanted after they have grown to a certain extent in the nursery. Presently, since convenient seedling pots are available cheaply, cultivation by transplanting can be easily done. The planting period can be reduced by appropriate selection of varieties of crops such that the growth period is short. The possibility of multiple cropping can be increased thereby, and therefore, multiple cropping can be promoted using these methods, and the rate of

land utilization can be increased.

(iv) Crop-rotation system

As the rate of introduction of multiple cropping is increased and as the rate of land utilization, with respect to time, is improved, the fallow period of arable land becomes shorter. This is related to the impoverishment of soil and the reduction in soil fertility. Also, particular crops have special characteristics of absorbing large amounts of fertilizer components, and if the number of plantings is large, a deficiency in the particular fertilizer ingredient results, causing a hindrance to crop production. Also, it is said that continuous planting of special crops has a tendency to leave behind a special alleropathy (a kind of sick soil). Furthermore, in general, crop pests are common through the same family crops.

Therefore, if crops belonging to the same family are continuously cultivated, or if the fallow period of crops belonging to the same family is reduced, the population density of particular crop pests increases, and the damage caused to the crops also increases. Watermelon, sweet melon, chilli pepper, and tomato crops, etc. have particularly strong tendencies to be affected and continuous planting of these must be avoided at any cost.

If leguminous crops are cultivated, the nitrogen in the atmosphere is fixed due to the working of rhizobium bacteria, and crop dregs left behind have the effect of enriching the soil. Also, gramineous crops have the characteristic of cleaning up the soil. In particular, deep-rooted crops such as corn or sorghum are not only superior in this respect, but also play an important role in improving the deeper layers of soil.

After considering these characteristics, the cultivation of similar crops belonging to the same family, on principle, should

not be repeated within two years and leguminous crops and gramineous crops should be cultivated within a specified period of time. Measures have been devised for crop-rotation systems of the major crops mentioned previously. One example of a complete cycle in 6 years is indicated later in the chapter on farming, along with an estimate of farming profitability.

The regional characteristics for each of the main regions are considered here so that selections can be made in response to the varying farming aims of agricultural households. A number of menus of crop rotation systems with 1 cycle in 5 years are indicated in Figure 4.2 to 4.4.

There are four examples of mainly fodder crops combined with vegetables in the crop rotation system, to form a fodder crop type for Batinah region, 6 examples of mainly vegetables combined with field crops, to form a vegetable type and 3 examples of mainly field crops combined with vegetables to form a field-crop type. Similarly, in the interior regions, there are 4 examples of fodder-crop type, three examples of each vegetable type and field crop type, and in Salalah there are 5 examples of fodder crop type, 3 examples of vegetable type and 3 examples of type in response to the period of short supply of vegetables in northern Oman.

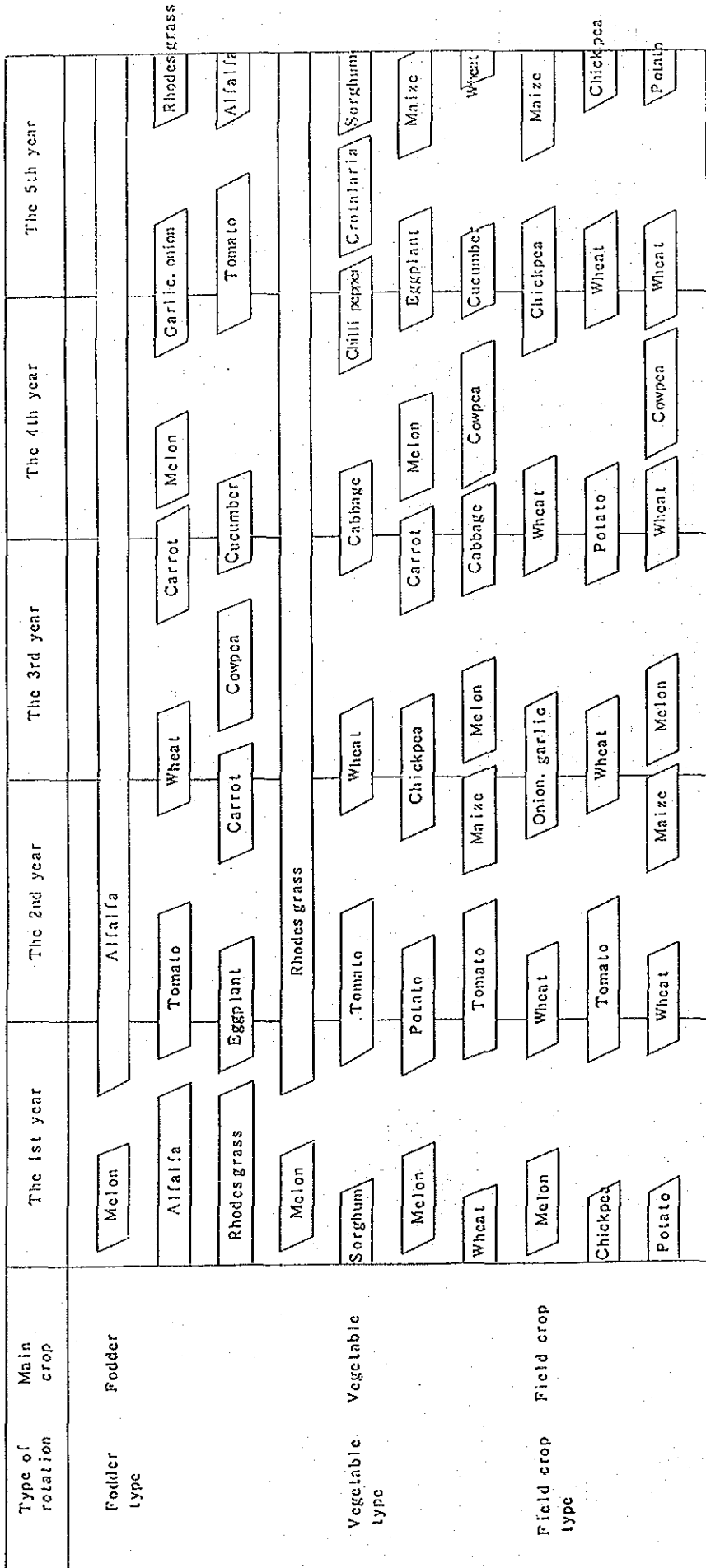
(e) Improvement in cropping season

Since crops have photoperiodic sensitivity and thermosensitivity, and since the summer of Oman is extremely severe, the sowing season in northern Oman is normally concentrated around September and October, and harvesting period is concentrated around February and March. For Salalah, since the weather condition is comparatively favorable, crop production is possible throughout the year. For this reason, in this 10-year Master Plan for Agricultural Development, plans are made so that the vegetable production in Salalah aims for the period of short supply in northern Oman. In the mountainous region (Jabal Akhdar) too, production of vegetables in

| Type of rotation | Main crop | The 1st year | The 2nd year | The 3rd year | The 4th year | The 5th year |
|------------------|--------------|--------------|--------------|--------------|---------------|---------------|
| Fodder type | Melon | Melon | Alfalfa | | | |
| | Alfalfa | Alfalfa | Tomato | Wheat | Chilli pepper | Onion |
| | Rhodes grass | Rhodes grass | Melon | Cowpea | Wheat | Onion |
| Vegetable type | Melon | Melon | Rhodes grass | | | |
| | Melon | Melon | Tomato | Onion | Melon | Chilli pepper |
| | Wheat | Wheat | Eggplant | Cucumber | Sweet potato | Cabbage |
| | Bean | Melon | Carrot | Cowpea | Sweet corn | Melon |
| | Melon | Melon | Wheat | Cucumber | Potato | Onion |
| | Sweet potato | Sweet potato | Cabbage | Tomato | Melon | Wheat |
| | Bean | Squash | Cabbage | Melon | Sorghum | Melon |
| | Wheat | Wheat | Wheat | Sorghum | Melon | Wheat |
| | Wheat | Wheat | Sorghum | Melon | Wheat | Cowpea |
| | Potato | Potato | Wheat | Sorghum | Melon | Wheat |
| Field-crop type | Wheat | Wheat | Wheat | Wheat | Wheat | Wheat |
| | Wheat | Wheat | Wheat | Wheat | Wheat | Wheat |
| | Potato | Potato | Wheat | Sorghum | Wheat | Wheat |
| | Potato | Potato | Wheat | Sorghum | Wheat | Wheat |

Note: Wheat (or Barley), Melon: Watermelon or Sweet melon, Chilli pepper (or sweet pepper), Cabbage (or Cauliflower, Lettuce), Onion (or Garlic), Cowpea (or Crotalaria).

Figure 4.2 Proposed 5-Year Crop Rotation Pattern for Basic Major Crop in the Batinah Region



Note: Wheat (or Barley), Melon: Water melon or Sweet melon, Chilli pepper (or sweet pepper), Chick pea (or fababean or mungbean), Cabbage (or Cauliflower), Lettuce, Cowpea (or Crotalaria), Onion (or Garlic).

Figure 4.3 Proposed 5-Year Crop Rotation Pattern for Basic Major Crop in the Interior Region

| Type of Rotation | The 1st year | The 2nd year | The 3rd year | The 4th year | The 5th year | | | | | | |
|--------------------------|--------------|---------------|--------------|--------------|--------------|----------|---------------|---------------|----------|---------------|---------|
| Fodder Type | Melon | Alfalfa | Sweet potato | Alfalfa | Alfalfa | Eggplant | | | | | |
| | Alfalfa | Chilli pepper | Alfalfa | Alfalfa | Tomato | Okra | Alfalfa | | | | |
| | Sweet potato | Alfalfa | Onion | Carrot | Alfalfa | Alfalfa | Sweet potato | | | | |
| Vegetable Type | Melon | Rhodes grass | Rhodes grass | Alfalfa | Alfalfa | Tomato | | | | | |
| | Beans | Melon | Rhodes grass | Rhodes grass | | Cabbage | Beans | | | | |
| | Melon | Onion | Carrot | Cowpea | Cabbage | Tomato | Okra | Cucumber | Eggplant | | |
| Supply-Compensation Type | Melon | Cabbage | Sweet potato | Cowpea | Okra | Tomato | Cucumber | Onion | Carrot | Chilli pepper | |
| | Melon | Onion | Potato | Sweet corn | Carrot | Tomato | Cucumber | Eggplant | Okra | Squash | |
| | Okra | Tomato | Sweet potato | Melon | Sweet corn | Potato | Cabbage | Chilli pepper | Beans | Cucumber | Okra |
| Crop in Salalah | Potato | Melon | Sweet potato | Beans | Cabbage | Tomato | Carrot | Melon | Onion | Eggplant | Potato |
| | Cabbage | Tomato | Potato | Melon | Cabbage | Carrot | Chilli pepper | Melon | Onion | Eggplant | Cabbage |

Note : Melon : Water melon or Sweet Melon, Chilli pepper, (or sweet pepper) , Cabbage (or coulflower, Lettuce) ,
Onion (or Garlic) , Cowpea (or Crotonaria) .

Figure 4.4 Proposed 5-Year Crop Rotation Pattern for Basic Major Crop in Salalah

summer with the same aim, is possible.

To break the production peak of crops and to extend the production period is very difficult in general in northern Oman, where the summer weather conditions are severe. But, by making use of seedlings or sprouts, and transplanting the grown seedlings early to the fields, and by using new methods such as plastic film mulching or plastic film tunnels in the fields, it should be comparatively easy to quicken the harvesting period.

Now, in the hottest regions, it is extremely difficult to shift production period or planting period, but cultivation in sheltered spaces under palm trees should be possible to some extent.

The possibility of utilizing new technology such as vernalization or illumination by electric lamps for early maturing of flower buds exists, and the progress of research in these fields is eagerly anticipated.

(f) Improvement in cultivation methods

Cultivation of most of the crops should start with the sowing of appropriate quantities of superior quality seeds, which germinate well and which are not infected by crop pests. For crops which are cultivated by growing seedlings and transplanting, healthy seedlings must be grown. The planting density has a profound relation to the fertilizer quantity but this must be appropriately decided and controlled. Weeds compete with the growth of crops for essential components (water, light, oxygen, carbon dioxide, fertilizer nutrient, space and others) and therefore, abundant growth of weeds and other plants which hinder the growth of crops must not be tolerated. To upgrade weeding, it is essential to use the minimum required quantity of herbicide effectively, after carefully investigating the growth characteristics of the weeds. Molding is also necessary to protect crops from lodging, for improving growth of crops and preventing the growth of weeds.

Fertilization is one of the main factors which influences growth and yield of crops. An increase in yield of about 30 % may be anticipated with a proportional increase in fertilizer quantity. MAF has published a manual for cultivation of main crops and fixed standards for fertilization of important crops. MAF has been offering guidance but at present, it is estimated that the farmers are applying less than half the quantity prescribed in the given standards. To obtain healthy growth and adequate production of crops, the fertilization standards are to be thoroughly implemented throughout the country, under the 10-year Master Plan for Agricultural Development.

Most of the cultivated land in Oman is composed of sandy soil with good water permeability, and the percentage of clay or organic components is remarkably low, therefore not only is the fertility deficient but the adsorption ability of fertilizer nutrients is also poor. For this reason, fertilizer should be frequently applied. The adoption of a modern irrigation system, where the fertilizer is dissolved in the irrigation water and supplied many times making use of irrigation equipment is possible. This is effective in improving fertilizer effect.

It is also important to maintain the balance of NPK-3 elements and care must be exercised to prevent the occurrence of hindrance to growth due to a micronutrient deficiency. The growth and yield of crops are not only influenced by chemical fertilizers but also by the fertility of soil. Organic fertilizers have the effect of nurturing the fertility of soil and of slowly releasing fertilizer nutrients. Since they are extremely effective in healthy growth of crops and good yield, though comparatively high-priced as a concentration of fertilizer component, they must be applied as indicated in the fertilization standards.

By grafting watermelon onto bottle gourd or pumpkin stock, the resistance against crop diseases increases, growth becomes excellent, and yield increases. This is one of the technologies to be implemented under the present development plan.

For date palms, appropriate distribution of pollination plants along with pollination for 3 times or more at suitable times improves the quality of fruit and increases the yield too. A considerable amount of labor is needed for pollination of tall trees, but by making use of the pollination machines developed by MAF, pollination work should be thoroughly implemented.

For harvesting wheat or barley, labor productivity can be increased by using small binders or small combines. Plans for spreading manual threshers or power threshers must be implemented. There are limitations on increasing productivity by promoting mechanization in the agriculture of Oman, where the farm scale is small and artificial irrigation is unavoidable. This is one of the most essential future research topics.

(g) Improvement of methods for control of crop pests

The damage due to crop pests and birds is quite severe even at present circumstances, but in the future superior varieties will be cultivated with a lot of fertilizers for a considerable period in a year, therefore the possibility of increased damage exists. To prevent the collapse of planned production targets of crops, measures for perfection of control of crop pests must be taken.

There are various control methods. The most common is the chemical method. MAF has prescribed applicable methods of effective pesticides for controlling each major crop pest. MAF has been offering guidance too but this has not been fully implemented at present. This implementation will be perfected through extension activities. There are plans for increasing the usage of pesticides for control of crop pests by 50% under the 10-year Master Plan for Agricultural Development. Thorough guidance for appropriate usage of control tools is essential to increase the control effect.

For pest control at appropriate times, the occurrence of crop pests must be predicted at an early stage and measures must be

devised to counter them. This is not a subject to be tackled personally, therefore it must be executed officially. There is already an organization for control of crop pests in MAF. It is hoped that a organization which predicts the occurrence of crop pests and the organization for plant and animal quarantines will combine with this organization and form an integrated plant and animal protection system.

As far as possible, control methods should be enforced without damaging after-effects. The chemical method is a double-edged sword, as along with key pests, natural enemies and other insects are also killed, ecosystems are destroyed, and other injurious effects like increase of totally different crop pests, may be caused. For this reason, chemical control methods will be appropriately implemented with the backing of substantial research. As far as possible, control by other methods which do not cause damaging effects will be implemented. Biological control is one of the methods which is yielding excellent results in Oman. With the development of a biological control method for the whitefly and utilization of bio-chemicals, further progress of biological control is anticipated.

By usage of sex pheromons, prediction of pest occurrence and pest control through communication disturbances, usage of growth pheromon inhibitors, usage of catch plants against soil nematodes (Marigolds, etc.), usage of a technology which weakens the activity of virus diseases by inoculating with other weak virus, and other new ecological control methods need to be studied for their future extension.

(h) Development of new cultivation methods

On the plateau of Dhofar, the mountainous range in the Southern Region, the maximum temperature in May and June is 24.7 °C on a monthly mean temperature (Medinat Al-Haq), which is not too hot. In winter too, the monthly mean minimum temperature here is 18.7 °C, which is comparatively moderate. The rainy season is in summer (from the middle of June to the middle of September), and the precipitation

is between 300 - 400 mm in these places, often with the formation of fogs. Here, cowpeas or traditional fodder and other crops are traditionally cultivated by small-scale rain-fed cultivation. Also, the soil of this plateau has abundant clay and organic compounds and is extremely fertile. For this reason, it is considered that many kinds of vegetables and field crops can be cultivated in this plateau. To convert the present pastures into large-scale cultivation fields means to infringe on the vested interests of people having the rights to these pastures. Therefore, there is a difficult political problem here. It would be most meaningful to try out crops with high profitability which can supplement the earnings of the households residing in this belt. The crops which are considered to be suitable for this area are upland rice, maize, sweet corn, sorghum, seed potato, etc. Results of experimental research in future is anticipated.

The cultivation of temperate fruit and potato seeds is possible in the mountainous area (Jabal Akhdar), making use of the cool climate of the summer season. Vegetable production is also possible aiming for the period of short supply of vegetables in northern Oman, and in addition strawberries can be cultivated for vernalization. In other words, in this cultivation method, the strawberry seedlings grown on level ground are transplanted to the fields in the mountainous area (around May and June). After lying dormant, the seedlings which have begun bud differentiation in autumn (around August) are re-transplanted and cultivated in the level ground (using electrical illumination if necessary). Strawberries are harvested in the winter period, which includes Christmas and New Year. This is one of the research topics for the future.

Since there is practically no rainfall in the summer season in northern Oman, there are possibilities of producing seeds of field crops or vegetables with comparative ease, making use of these climatic conditions. The crops are carrots, onions, chilli peppers, wheat, barley and others. After considering the superior characteristics of preservation and transportability of seeds, the dry climatic conditions of the Interior Regions and the fact that it

is far from the large consumption areas, making shipment of products difficult, it is considered that the Interior Regions would be most appropriate for production of seeds. In addition, seed production of other crops such as radishes, gourds, spinach and okra is considered feasible.

At present, cucumbers and tomatoes are cultivated by methods which do not use props, but in order to increase the efficient utilization of the environment, to easily control crop pests, and to upgrade the quality and yield of produce, it would be best to instigate the widespread use of cultivation methods which make use of prop materials. Naturally, there will be expenses for prop materials but it is estimated that the production profits will cover them.

There is the possibility of effectively utilizing the space between date palms or coconut trees for ornamental plants or orchids in future. Experimental research for selection of superior varieties is necessary.

Mulching by the usage of plastic film and the technology of tunnel cultivation for vegetables and fruits with high profitability, have considerable advantages to offer, too. Film mulching is effective for conserving the water content in soil for a long duration of time, in the prevention of weed growth, soil temperature control (transparent film raises the soil temperature, black film reduces the temperature), and in upgrading the quality of produce. Plastic tunnels increase the temperature within the tunnel and are effective in reducing the cultivation period of vegetables or other crops in low temperature regions. If necessary it may be combined with film mulching, and small tunnels within a large tunnel layer construction. An example of this type of construction is shown in Figure 4.5.

For the usage of brackish water which has been found as a by-product of oil field development in the desert area distributed over a part of the Interior Region and a part of Nejd, crops which have superior resistance to dry conditions, such as sisal (Agave sisalana).

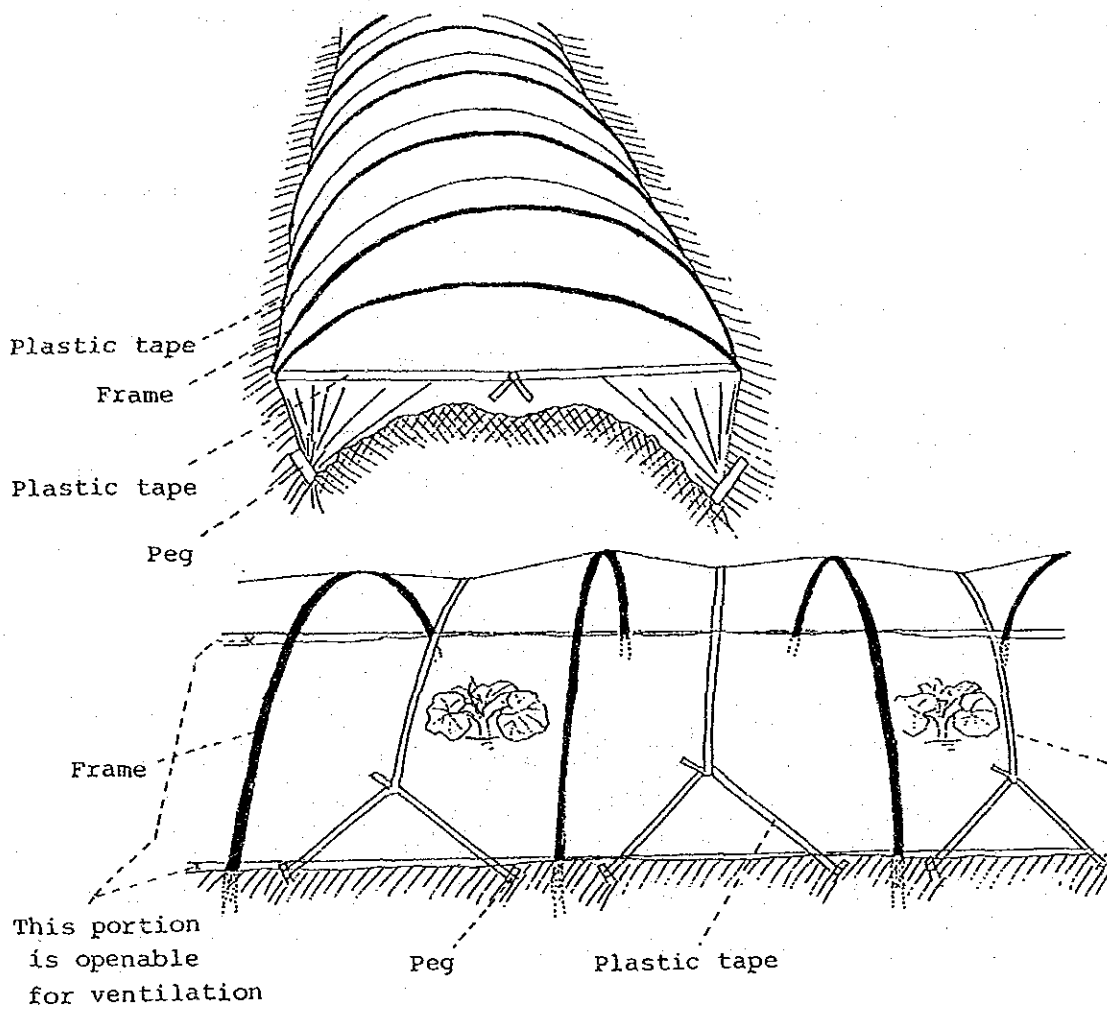


Figure 4.5 Sketch of Structure of Plastic Film Tunnel for Forced Culture of Field Melon and Watermelon

as a basic material for ropes or Burbank's Spineless (Opuntia ficus-indica), with high resistance to dry conditions or Atriplex nummularia, which has strong resistance to salinity, could be cultivated as fodder for livestock. It would be worth testing the viability of these.

(i) Introduction of modern irrigation methods

Introducing modern irrigation methods will have the following effects:

- o Improvement of yield and quality of produce with a proper quantity of timely irrigation water.
- o Improvement of yield by adoption of liquid fertilizers which improve fertilizing effects.
- o Reduction of fertilizer application amount by adoption of liquid fertilizers.
- o Improvement of yield by adoption of foliar spray fertilizers which improve fertilizing effects.
- o Improvement of cropping rate in a field by deletion of water course.
- o Saving of labor.
- o Saving of water resources.
- o Prevention of salt accumulation.

(3) Decision of Targeted Yield per Unit Area of Major Crops under the 10-Year Master Plan for Agricultural Development

The present yield per unit area for Oman is low and there is considerable scope for improvement in future. After considering the

present yield per unit area of Oman and other countries and the scope of technological improvements, the target yields to be achieved up to the end of the 10-year Master Plan for Agricultural Development have been decided. (Table 4.2).

According to the data collected in a program called "Annual Updates of Important Statistical Series" by the Department of Agricultural Statistics of MAF, the present yield per hectare (ton/ha) is as indicated in Table 4.2 and Table 4.15. Judging from the results of farm investigations conducted by the JICA team and concerned documents, it is estimated that the figures are slightly high for sweet potatoes, lettuce, potatoes, carrots, grapes and onions. On the other hand, the figures are estimated to be rather low for alfalfa. But since these are the most reliable data available in the present circumstances, they have been used as basic figures. This is attributed to the fact that MAF conducted the investigation for the entire country based on the above-mentioned annual program through widely spread organizations, and the number of samples was rather large. For Rhodes grass and sorghum, however, yields are indicated as weight in semi-dried matter in connection with selling price, and each unit yield is adjusted so as to be a little lower than their original data.

The present yield per unit area of the Oman Modern Farm and Al Raja Farm, which are commercial farms in Oman, and the yield per unit area of Middle East countries included in GCC, Israel, Zimbabwe, Austria, the USA and Japan indicated in the Production Yearbook (1987) of FAO, and the maximum level of yield per unit area or standard yield in main production regions of Japan indicated in the professional horticulture handbooks, are all indicated in the same table.

The reasons for varying yield per unit area according to the producer or producing country may be attributed to environmental (natural) factors and techniques, and man-made improvements are possible in the latter. The improvement rate (%) of yield had been estimated by predicting the improvement of each individual technique possible, up to the end of the 10-year Master Plan for Agricultural Development.

Table 4.2 Determination of Target Yield of Major Crops
in the Master Plan for Agricultural Development

| CROP | Actual unit yield (ton/ha) | | | | | | | | | | Possibility of improvement % | Target unit yield ton/ha % |
|---------------|----------------------------|----|----|----------------|--------|---------------|---------|-----|-------|---------|---------------------------------------|-------------------------------|
| | Oman | | | Middle East | Israel | Zimba- bwe | Austria | USA | Japan | | | |
| | 1) | 2) | 3) | 4)(5) | 6) | 7) | 8) | 9) | 10) | 11) | | |
| Date palm | 4.1 | | | | | | | | | | 50 | 6.0 46 |
| Mango | 2.0 | | | | | | | | | | 50 | 3.2 60 |
| Lime | 10.8 | | | | | | | | | | 50 | 15 39 |
| Lemon | 15.0 | | | | | | | | 18 | | 50 | 22 47 |
| Sweet lime | 11.0 | | | | | | | | | 30-40 | 50 | 16 45 |
| Orange | 11.0 | | | | | | | | 23 | | 50 | 16 45 |
| Banana | 13.6 | | | | | | | | 6 | 40-50 | 50 | 20 47 |
| Coconut | 16.8 | | | | | | | | | | 50 | 25 49 |
| Papaya | 12.0 | | | | | | | | 10 | | 65 | 19 58 |
| Grape | 15.0 | | | 11(15) | 15 | | 5.5 | 15 | 12 | | 50 | 19 27 |
| Wheat | 1.5 | | | 2.4(4.7) | 3.1 | 5.8 | 4.5 | 2.5 | 3.2 | 2.4-5.5 | 60 | 2.4 60 |
| Barley | 1.9 | | | 2.7 | 1.4 | 5.8 | 4.0 | 2.8 | 3.2 | 2.5-6.0 | 60 | 3.0 58 |
| Rhodes grass | 57.6 ¹⁴⁾ | | | | | | | | | | 40 | 120 ¹⁵⁾ 33 |
| Alfalfa | 38.4 ¹⁴⁾ | | | | | | | | | | 90 | 72 ¹⁵⁾ 20 |
| Sorghum | 53.3 ¹⁴⁾ | | | | | | | | | | 65 | 125 ¹⁵⁾ 50 |
| Tomato | 22.2 24 48 | | | 43 | 51 | | 28 | 53 | 52 | 50-130 | 80 | 40 80 |
| Chilli pepper | 9.0 | | | 17 | 39 | | 20 | 12 | 36 | 15-25 | 80 | 16 78 |
| Egg plant | 19.0 | | | | 33 | | | 22 | 31 | 30-150 | 80 | 32 68 |
| Potato | 25.0 | | | 20 | 38 | 16 | 26 | 34 | 29 | 30-40 | 70 | 30 20 |
| Onion | 13.7 | | | 18(51) | 23 | 17 | 35 | 41 | 43 | 40-75 | 65 | 18 31 |
| Garlic | 8.0 | | | 41 | 13 | | | 15 | | 15-20 | 70 | 14 75 |
| Water melon | 19.0 22 31 | | | 26 | 16 | | | 15 | 32 | 30-60 | 75 | 26 37 |
| Sweet melon | 13.1 16 28 | | | 24(57) | | | | | 19 | 20-40 | 80 | 23 76 |
| Cucumber | 14.9 | | | 29(121) | 29 | | 26 | 13 | 43 | 40-150 | 70 | 25 68 |
| Squash | 15.8 | | | | | | | | 17 | 25-40 | 70 | 25 58 |
| Cabbage | 23.2 | | | 31 | 23 | | 45 | 20 | 40 | 40-80 | 75 | 35 51 |
| Lettuce | 17.0 | | | | | | | | | 26-49 | 60 | 20 18 |
| Carrot | 23.8 | | | 26 | 49 | | 31 | 31 | 27 | 25-40 | 65 | 30 26 |
| Okra | 13.2 | | | | | | | | | 20-50 | 80 | 22 67 |
| Sweet potato | 23.8 | | | 25 | 39 | 24 | 13 | 15 | 23 | 30-40 | 40 | 25 5 |

Notes:

- 1) These values were obtained in 1989 from "the Annual Update of Important Statistical Series" which has been carried out by the DAS in MAF since 1982.
- 2) Oman Modern Farm. 3) AL Raja Farm.
- 4) The second highest yield from 1985 to 1987 in such countries as Egypt, Iran, Iraq, Jordan, Kuwait, Qatar, Saudi Arabia and UAE (FAO production year book 1987)
- 5) The highest value among those mentioned above.
- 6) - 10) FAO Production year book 1987.
- 11) Horticultural encyclopedia, Okinawa horticultural encyclopedia, Handbook for facilities horticultural.
- 12) Percentage estimated by JICA Study Team under the condition that growing elements are improved.
- 13) Target yield in the year 2000 and its percentage improved from the current yield.

14) Semi-dried Weight

15) Fresh-matter Weight

After these examinations, the improvement of the present yield per unit area was estimated to be from 5 % to 80 %, the target yields under the 10-year Master Plan for Agricultural Development have been decided.

(4) Countermeasures for Land with Salt Problems

In the belt along the seashore of Batinah, salt concentration in underground water is becoming high due to penetration of sea water and areas where salt accumulates and date palms wither away, are widespread. At present a study is being conducted by FAO, and methods for improvement are being investigated. Introduction of a one-season crop with a short growth period may be considered as an emergency measure. In practice, in the region of 0.5 - 3 km from the seashore of Barka, in the land where date palms died, a considerable number of farms have already started cultivation of fodder crops such as alfalfa or Rhodes grass, field crops such as wheat, barley and sorghum and vegetables such as tomatoes, chilli peppers, watermelons, sweet-melons, cucumbers, okra, potatoes, and others. Alfalfa withers considerably after the second year (withering rate 70% according to the example investigated by the JICA team), but no damage has been found in one-season crops.

The reason why one season crops avoid salt damage could be attributed to the fact that the growth period is only a few months long, and before the salt accumulates to induce plasmolysis of crop cells, the crops are harvested.

The essential techniques for cultivation of one-season crops in soil with salt accumulation are: (1) to measure the salt concentration of underground water, and to check the level of electric conductivity (preferably less than 10,000 mhos/cm): (2) to irrigate with the required quantity of water at frequent intervals, and if possible to irrigate continuously every day to generate a leaching effect against accumulated salt on the soil surface: (3) to supply a large amount of organic fertilizer (more than 10 tons/ha) to enable the healthy growth of crops. Overall research on actual conditions of damage due to salt, causes and countermeasures will be necessary in the future.

(5) Use of New Materials and New Facilities

Highly water-absorbant resins (Acry-hope and others) have the capacity to absorb almost 1000 times their own weight in water and can preserve it for a long period of time. Porous ceramics (such as Isolite) have a different construction but similar properties. Due to the properties of these materials, they are used in greenification of desert areas, reclamation of golf courses and civil constructions. On an experimental farm in a dry region of northern Egypt (Bustan region), highly water-absorbant resin made of high polymer and drip irrigation was combined, and in terms of rainfall conversion, 1 mm per day of irrigation was done in an experiment for cultivation of watermelons and sweet-melons resulting in a yield of more than two times the yield in areas which did not make use of these materials. Highly water-absorbant resins (acrylic high polymer) are decomposed by ultraviolet rays, heat and salt, and for practical application of these techniques a considerable amount of experiments and research is needed. Even so, it is felt that these are promising materials which are worth investigating in Oman.

Plastic films with various kinds of properties have been developed, and these are already being used in mulching for cultivation of vegetables or field crops and as temperature-conserving tunnels, as mentioned before. These materials are being extensively used as heat-conserving film houses or as leak-prevention materials in irrigation canals or water reservoirs, therefore the research of usage methods of these materials in future for Oman too, is worthwhile.

Shadow nets, greenhouses with air-conditioning equipment, hydroponic facilities, etc. have been realized in some commercial farms in Oman too, but for the establishment of profitable management of those modern facilities, further research is necessary.

(6) Apiculture

In the Sultanate of Oman, an apiculture has been created by rearing *Apis mellifera jamaicensis* introduced from Egypt and other countries and a domestic bee, *Apis florea*. Bee-keeping has been conducted in a

traditional method such that the beehive is placed inside a hole made by hollowing out a date palm trunk which is then put under the branches of a garden tree or a house. Honey is collected by smashing the hive.

Honey in Oman is of high quality, so its price is about three to four times higher than that of imported honey. Therefore, an apiculture is a profitable supplement for farmers. The number of bee-keeping farms, however, is not large and the scale is small. Also, there are some problems like a shortage of honey-production plants, an occurrence of the American foul-brood, and others.

MAF has put high priority on operating honey bee projects in the 5-year plan for agricultural development from the first year. Under the project, three apiculture research centers were constructed in Rustaq, Nizwa and Salalah, and a modern apiary complete with a hive, hive materials, a smoothing tool, a centrifugal separator, etc. is being promoted, through distribution by experts and extension workers.

At present, however, research center stock, the number of experts, quality and number of extension workers, the budget, etc. are not sufficient and more support is needed for the future.