SULTANATE OF OMAN

SOIL SURVEY AND LAND CLASSIFICATION PROJECT

OMA/87/011

SALALAH INTEGRATED STUDY

FARMING SYSTEMS SURVEY REPORT

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MINISTRY OF AGRICULTURE AND FISHERIES

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This field document is one of a series of reports prepared during the course of the Salalah integrated study. The conclusions and recommendations given are those considered appropriate at the time of its preparation.

The material produced by the study is comprised of 29 colour maps, also available in digital format, computer databases on soil and crop water requirements, a computerized land evaluation system and 6 inter-related reports:

- *The first report, which is the "Summary of Conclusions and Recommendations" is meant for decision makers.*

- *The second report is titled " Land Resources Report" and describes the soil and water resources. The land evaluation chapter of this report contains information on crops, including potential yields and profits that can be achieved under improved management. This chapter is also the basis of cropping pattern recommendations.*

- *The third report titled "Land Use Report" gives detailed statistics on land use and land cover. A very detailed analysis highlights the influence of farm size and water salinity on current cropping patterns. This information is used by most other reports.*

- *The fourth report is the "Irrigation Report" which analyses current irrigation practices and proposes alternatives for improved water management. Detailed specifications as well as well as costing are included.*

- *The fifth report is titled " Plant Production Report, Special Investigations". It contains analyses and recommendations on plant protection and weed control practices in Salalah. Similar information on micronutrients is also included. The last section of this report contains an analysis of the livestock sector by staff of the Directorate General of Agricultural Research. Monographs on the major crops of the area were also produced and published separately.*

- *The sixth report is the "Farming Systems Report" which contains a detailed analysis of the socio-economic constraints on the farm households. Marketing and credit are also dealt with in this report.*

ACKNOWLEDGEMENTS

This field document reports on a farming systems survey of the Salalah Plain carried out by the Soil Survey and Land Classification Project of the Ministry of Agriculture and Fisheries Resources from June 1991 to December 1992.

This report is an integral part of the integrated study of the Salalah Plain carried out by the project. Its main objective is to highlight the socio-economic and other constraints of the farming systems in the area.

This study is the first of its kind in the Sultanate of Oman and was carried out by a team of Omani staff of the MAF and United Nations scientists.

Thanks are due to all the individuals who directly or indirectly contributed in the preparation of this document by providing valuable information and support. Special aknowledgment is made of the valuable contribution of the staff of the Directorate General of Agriculture, Dhofar Region, the Directorate General of Agricultural Research and PAMAP.

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EXECUTIVE SUMMARY
&
CONCLUSIONS AND RECOMMENDATIONS

To propose viable changes in the existing farming systems a thorough understanding of farmer's as well as of Government objectives is required.

Development priorities are often perceived differently by farmers and Government. The main objectives of farmers in Salalah is to generate income from their land and to keep livestock for socio-cultural reasons. The main objectives of Government are to develop sustainable agriculture to diversify the economy, to increase domestic production and to achieve self-sufficiency in agricultural produce while conserving natural resources and the environment. Government wishes also to halt and if possible reverse migration from rural areas to urban settlements.

During the eighties Government has pursued a policy of expansion of the area under cultivation by distributing land free of charge and by supporting the establishment of new farms with an extensive package of subsidies to encourage new investments and to promote the use of modern techniques and inputs. Government has also protected the domestic market by a system of improt licensing and has improved agricultural services (extension, research, credit and marketing) and invested heavily in the country's infrastructure.

Farmers have taken the opportunity to benefit from all these measures. As a result the cultivated area has expanded and agricultural production has increased although there is still scope for much improvement in productivity and sustainability.

In Salalah plain Government policies of price support and subsidies to the livestock sector have induced changes in the land use. These policies have encouraged the expansion of area under Banana and grasses which have high water requirements thus further deteriorating the aquifer water balance.

Among the physical constraints in the study area climate, soils and water quality (salinity) are the most important.

The monsoon type of climatic conditions (high humidity) prevailing during the khareef is ideal for the development of all sorts of pests and diseases.

The soils of Salalah plain are highly calcareous and have a low fertility status. Deficiencies in micronutrients affect nearly all crops.

The study has shown that about 34 percent of the cultivated area is irrigated with brackish water having an electrical conductivity between 3 and 15 dS/m.

Equally if not more important several sociological and institutional constraints hamper production and profitability in agriculture.

In both agricultural production, services and marketing nearly all the labour force is expatriate. Expatriates are often involved in the management of the farms hence rendering the decision making process more complicated. They are also more interested in immediate profit and therefore little motivated for long term investment and conservation of natural resources.

It was found that extension services do not function properly for the following reasons:

- There is no testing of research results in farmers conditions to make the information directly usable by the extensionsists to advise farmers. As a result extensionists are mostly involved in supplying tractor and spraying services as well as distributing inputs to the farmers.

- Farms are not considered as a single enterprise and extension is rather based on a crop by crop approach.

- Ideally the target of extension should be the person who is carrying out production activities and not the farm owner. However, in Salalah this would mean that extension should be more oriented toward the expatriate labourer. Besides social and political reluctance this would pose the problem of communications as all extensionists except one are arabic speaking.

- Some Omani absentee farmers complain about the fact that extensionists are not available during weekends when they are themselves available.

Although it has achieved some good results, agricultural research suffers from a number of problems of which the most important are:

- The site of the research station is not representative of farmers environmental conditions. Indeed water is of the best quality and soils are of a type which is not representative. Since the research station is large and does not have a dense network of windbreaks, it is open to wind influence. In contrast most farms are small and are densely planted therefore little affected by wind.

- Research programmes are not oriented enough towards farmers' needs. No research has been carried out to identify vegetable varieties that are resistant to

  salinity although salinity affects more than a third of the cultivated area. Tall grasses, banana, papaya and coconut have not received attention in proportion with their economical importance whereas coffee has been studies in several trials.

- With some exceptions fertility trials on macro-nutrients have received little attention and micro-nutrients none.

- Research suffers from a general lack of resources, whether it be personnel, equipment or premises.

Though inputs are generally in good supply, they are often inadequate. Certified seeds and chemicals are not all tested before being marketed. There is no systematic checking of active ingredient content of pesticides. Some big farms import their own pesticides hence escaping control.

Labour is not in short supply though nearly all expatriate. However this labour force is often not familiar with agriculture. It is not uncommon to find former tailors or drivers working as agricultural labourers.

Marketing of agricultural produce, especially vegetable, is a major problem for farmers. In peak production periods farmers are often obliged to sell their production at very low prices or throw it away. Storage facilities are inappropriate and losses are high. The Public Authority for Marketing Agricultural Produce (PAMAP) is trying to improve the situation but faces problems of excess supply alternating with periods of shortage.

Credit is available but farmers are not well informed about it. There is also often a reluctance to take loans and mistrust towards banking institutitons. However, the practices of leniency followed by the credit institutions endanger their very existence as real credit organisations.

Given the present physical, institutional and socio-cultural setting higher production and productivity could be achieved through a package of measures.

1) Government should start a programme of on-farm trials in about a dozen farms selected through the maps produced by the project. These farms should be rented (maybe from Awqaf) on a long term lease agreement or purchased. These farms will serve to test any new technology to be disseminated by the extensionists. These as well as the research staff should be closely involved in the management of the trials. The farms should also be used as demonstration plots.

2) The programme of the Directorate of Research should be directed more towards the crops relevant to the area. Vegetable, banana and grasses should be the main focus. Trials should be conducted to select varieties that are resistant to salinity. Trials should be conducted to determine the potential of the main vegetable at different planting dates (off-season).

3) On-farm fertiliser trials should be carried out in order to determine optimum application rates. Micro-nutrients should be part of these trials.

4) An integrated pest management unit should be set up with proper staffing and facilities. This measure should be supplemented by tighter quarantine controls.

5) Government should encourage vegetable production by regulating the market through future trading by PAMAP. Contracts should be made with farmers to supply vegetable in the framework of a calendar to avoid over supply.

6) An irrigation subsidy programme can be started in Salalah plain in optimal conditions since all the information is available. The study has shown that modern irrigation systems will be highly profitable.

7) All agricultural expansion should be avoided in the sweet water area and the big Rhodes grass farms should be relocated in brackish water areas in the plain or in the Nejd.

8) Extension services should also be addressed to the expatriate workers to increase their effieicency.

9) Monitoring of changes in the agricultural landuse and water quality should be a permanent activity. The computerised databases established by the project should be maintained and updated.

10) The proposed cropping pattern should not be imposed but rather be made attractive by demonstrating their profitability to the farmers through the on-farm trials.

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INTRODUCTION

1.1 BACKGROUND OF THE FARMING SYSTEMS STUDY

1.1.1 Project background

The Soil Survey and Land Classification Project (OMA/87/011) commenced in the beginning of 1989. The project document was approved by the Government of the Sultanate of Oman in November 1988 and subsequently signed by the Government and the United Nations Development Programme (UNDP) and the Food and Agriculture Organization of the United Nations (FAO) who was designated as the executing agency, while the Directorate General of the Ministry of Agriculture and Fisheries was designated as the implementing agency. The project is scheduled to be terminated by the end of June 1992. A second Phase is presently under consideration by the Government.

1.1.2 Project objectives and outputs

The original project objectives were limited to providing direct support to the Ministry of Agriculture and Fisheries for the implementation of its soil survey programme. A major output of the project is the preparation of a soil atlas containing reconnaissance soil and land suitability maps (1 : 250,000) of the whole country. In addition detailed maps (1 : 10,000) are to be prepared containing soil, water quality and land cover information on 50,000 hectares of presently cultivated lands. Out of these 4000 hectares are located in the Salalah plain and 46000 hectares in the Batinah. To date about 40000 hectares have been completed. In December 1989 a revision of the project document led to the inclusion of supervision activities of the Government Subsidy Operation to Irrigation. This operation was designed to install modern irrigation systems on about 800 farms in the Batinah. In a second revision the project was also requested to take the responsibility of all design activities while supervision continued to cover all activities necessary to achieve the successful on-farm installation of modern irrigation systems. A third revision of the project document expanded the objectives of the project to include an integrated or farming systems analysis of the study areas (50,000 ha). The necessity of this study emanates from the observation of recent developments in agriculture. These developments are

characterized by an expansion of the cultivated areas in the Batinah due to the fast expansion of the overall economy since the early seventies, allowing to invest and further develop the agricultural sector. The actual expansion is now leading to seawater intrusion and saline upconing. Severe salinization of irrigation water and soils adversely affects an ever growing portion of the Batinah farm lands. Abandoned datepalm groves, invaded by salt, have become a permanent feature of desolation in the Batinah landscape. Project studies in the Salalah plain have revealed that this area is also under the threat of seawater intrusion, due to a growing demand for water. It has now been recognized that the root causes of this general deterioration are complex and that technical solutions, taken in isolation, are not expected to solve these complex problems in a sustainable way. Consequently, an integrated approach was selected to describe and analyze the physical, socio-cultural and the policy/institutional environments to have a better insight in the causes, and to identify ways and means to overcome the identified constraints.

1.1.3 Farming systems survey

It was decided to firstly select the Salalah Plain as a pilot area since this area covers only about 4000 ha. The overall study comprises the following primary data collection in the study area: a detailed soil survey, a detailed land cover survey and an inventory of the wells, including the determination of the water quality. In addition a farming systems survey was carried out in the Salalah Plain amongst 50 farm households. Apart from the primary data collection extensive secondary information has been collected on relevant issues. Also studies were carried out in the field of specific problem areas such as the control of pests and diseases in crops, the issue of the limited availability of micro nutrients, while also the livestock issue has been specifically addressed.

The present report focuses on the farming systems survey while incorporating in brief the preliminary conclusions and recommendations of other activities carried out within the framework of the farming systems analysis.

Chapter 2

PRESURVEY AND FARMING SYSTEMS METHODOLOGY

2.1 OBJECTIVES OF THE FARMING SYSTEMS SURVEY

Previous studies in the Salalah Plain have shown that the area is increasingly confronted with salinization problems. The root cause can be found in the recent economic developments in the country, which have led to a general increase in the demand for water, including in the Salalah Plain. Current reserve estimates indicate that the aquifer contains about 340 million cubic metres of fresh water (Dames & Moore, 1991). An analysis of the fresh water balance showed that the system is losing an estimated seven to nine million cubic meters every year. Consequently, a decline in the water table and the migration of adjacent saline groundwater has been observed. The demand for water is, and will further outstrip supply, if adequate measures are not taken. Since agriculture is using about 75 percent of the total output from the aquifer, it has to contribute to the long term conservation of the aquifer, Consequentially, this will lead to an intervention in the present agricultural practices, in one way or another.

It is now commonly accepted that when major interventions are thought necessary to change the course of an agricultural production system, a Farming Systems Development Approach (FSD) is to be preferred. The Soil Survey and Land Classification Project has adopted such an integrated methodology to achieve the following objectives:

- To understand the ways and means by which farm-household systems in the Salalah Plain operate and to analyze their interlinkages with other systems.

- To identify all major constraints to the farm-household systems, whether they occur in the physical, socio-cultural or in the policy/institutional environments.

- To identify development potentials and priorities which fit the farming system and which are, or are expected to be, socially acceptable and which are technically, economically and financially feasible.

The integrated approach should provide the basis for a sustainable land use.

2.2 METHODOLOGY

2.2.1 General

The FSD approach is well described in several of FAO's publications. The methodology followed in the present study is the one described in "Farming Systems Development; Guidelines for the conduct of a training course in FSD" published by the Farm Management and Production Economics Service (AGSP) of the Agricultural Services Division of FAO in 1990.

FSD starts with the understanding of the whole farm-household system, analyses all constraints and potentials, identifies appropriate research priorities and necessary institutional and policy changes, tests these on-farm, or simulates its effects by modelling in case of policy changes.

The present report mainly describes the results of the Farming Systems Survey. It also presents the outcome of the group interviews which were carried out to establish the common cultural practices, as well as the inputs used in the present situation. Further, extensive use has been made of all secondary information and data collected by the project such as soil and water quality information, land cover, farm size, and separate studies on specific issues, however detailed reports on these subjects are separately published, and only the conclusions and recommendations are either summarized or taken into account in this document to avoid duplication. The main report to be published by the end of the project will integrate all aspects of the study area.

2.2.2 Pre-survey activities

The pre-survey activities started in July 1991 with a one week visit to the Salalah study area to carry out a Rapid Rural Appraisal. This visit was organized to familiarize the survey team with the prevailing farming- and other interlinked systems, and to identify major issues to be addressed in the survey. Secondary information was also collected and interpreted, to facilitate the design of the farm household questionnaire.

Interviews were carried out with various people including Government personnel of relevant ministries, farmers, herdsmen in the jebel and those involved in the marketing of farm produce.

Group interviews were carried out during a second visit, which lasted for two weeks. The aim of the group interviews was to establish operational calendars and labour profiles, the number operation performed within season/year and labour standard rates for the major crop enterprises cultivated in Salalah. Detailed information on material inputs used for the production of the main crops was collected from the group interviews and from individual farmers during the survey. Four group interviews of labourers with three to five participants were carried out,

one in each extension centre. The involvement of the extension officers has been very useful in the identification of respondents for group interviews. It has also aided in the categorization of crops according to importance which are spread among the four extension centres, and in improving quality of data through their active participation in these group interviews.

On the basis of the collected information, a detailed questionnaire was designed to interview individual farm-households. The questionnaire was designed such, that the collected information could be processed with FAO's Farm Analysis Package (FARMAP), a set of computer programs specially designed for the processing of farm-household data. They were then tested on farms in the South Batinah and adjusted where necessary, before their reproduction in the final format as shown in Annex 1 (separate document). The training of enumerators in using these questionnaires for data collection, involved initial office training followed by field training in the Batinah, and a more intensive field training in the study area.

2.2.3 Sample design

The design of the sample is based on geophysical characteristics (soil type and salinity of irrigation water), on the land use pattern, and on the geographical location. Aerial photos, soil and salinity overlays were used in the initial stages of the sample design. Parcels were first numbered on the land use map in an ascending order, starting from Dahariz extension centre in the east of the plain and ending with Awqadeen in the west. The soil maps originally covered 39 types of soils which were re-grouped by the soil surveyors into 25 groups. Salinity of irrigation water was divided into six groups giving a total of 150 soil/water salinity combinations. The three maps (landuse, soil and salinity) were superimposed on each other to divide the Salalah farm-households into homogeneous groups on the basis of "the dominant" soil type on each farm and on the level of water salinity. Fifty major combinations were specified while 100 soil/salinity combinations were either empty (65), had one (20), two (6) or three parcels(9). Three parcels were then selected at random from each of the 50 major combinations resulting in 150 parcels (about 20 % of the total population). The final selection covered almost all soil types, in the Salalah Plain.

The sample size for the survey was fixed, taking into consideration the time and means available, as well as the level of detail and precision required for the analysis. The presurvey investigation showed, that one team could not survey more than five farms per week. With two teams to carry out the field work and the postcoding of the questionnaires within a period of five weeks, a sample size of fifty farms had been determined.

The 150 farms were arranged in an ascending order and at random, fifty farms were selected in a systematic way. The

systematic selection ensured the geographical spread of the sample and the proportionate representation of the four extension centres. Only one farm has been selected from the new development areas of

Table 1

DISTRIBUTION OF NUMBER OF FARM-HOUSEHOLDS
BY SOIL TYPE AND WATER SALINITY

Ec / Soil Type	<2.0	2-3	3-5	5-7	7-10	>10.0	Total
1, 2, 4	1	-	-	1	-	-	2
3, 18	1	-	-	1	-	-	2
3 bis, 8	-	-	8	15	5	15	43
7, 10	74	15	22	13	17	-	141
9, 11	9	13	6	7	3	-	38
14	-	-	-	2	7	2	11
15	-	-	1	-	-	-	1
15 bis	-	-	8	-	-	-	8
16, 26	6	16	33	10	1	-	66
17	4	-	3	-	-	-	7
19, 30	48	8	11	19	13	-	99
20,29,29 bis	8	3	-	-	-	-	11
21, 28	10	1	6	8	1	4	30
22	6	-	10	5	-	-	21
23	3	9	13	-	-	-	25
23 bis	-	-	-	-	4	1	5
31, 6	15	4	3	6	1	3	32
27	28	23	71	37	7	-	166
32, 33	1	-	3	1	-	-	5
34	-	-	3	1	-	4	8
35	10	-	2	1	-	-	13
36, 39	2	2	18	18	3	10	53
36 bis	-	-	-	1	-	-	1
37	1	-	-	1	-	-	1
38	2	8	1	1	-	1	11
Total	228	102	221	147	62	40	800

west Awqadeen and Sahanowt (in the east). Both areas have limited agricultural potential due to the poor soils and the

high salinity of water. Because of possible absenteeism, difficulty of tracing landowners, prevalence of enclosed farms, and abandoned parcels (particularly old coconut parcels near the sea), a reserve list of fifty parcels was kept. During the survey, the reserve list served as a safeguard against refusal and other forms of non-response. Few large commercial farms were excluded and five farms discarded due to bad response. The fifty farms interviewed are divided between the extension centres as follows:

Table 2

Extension centre	No. of farms
1. Dahariz	14
2. Hafa & Qarrad	13
3. Salalah	12
4. Awqadeen	11
Total	50

2.2.4 Organization of the field work

Two teams were used for the enumeration of farmers and permanent labourers. Each team consisted of two United Nations Volunteers (UNV's) - one conversant in Arabic and the other in Hindi - and two technicians. The UNV's supervised the interviews. The technicians counted the number of fruit trees (mature/young) on each plot before attending the interviews for training and to acquaint themselves with the conditions on the farm. The technicians remained for one day on the farm, to carry out the following activities:

(a) To keep timely record of the frequently performed operations like irrigation, weeding, fodder harvesting, feeding animals, etc...

(b) To measure the areas harvested - particularly of fodders and weigh the production of fruits, grasses, milk etc. as well as weigh quantities of animal feeds.

(c) To measure electric conductivity (salinity) of irrigation water.

(d) To observe and report on farm marketing arrangements.

An animal production specialist was employed to collect all data on livestock. He was assisted by technicians and by a Hindi

speaking UNV when required.

Arrangements were made to meet the owners of the selected farms. Although Salalah is a small place and most of the farm labourers know the residence/place of work of their sponsors, making appointments consumed more time than anticipated.

The landuse maps were enlarged four times and plots were marked and numbered prior to the interviewing. First, the permanent labour(s) of a selected farm were interviewed. Data obtained from those interviews were checked with the farmers and questionnaires were completed. Filled questionnaires were checked by the survey supervisor on the same day of interviewing. Information collected by technicians was incorporated and gaps noted, were filled the following day.

Very few farmers know the exact area of their holdings, and parcels are often divided into a number of small plots. This necessitated the use of a planimeter for the measurement in feddans of the parcel and the plots within the parcel. It was essential to carry out this activity in the field, to check the planted areas and spot and correct out-of range parameters.

All data were post-coded in the Salalah field-office. This helped in filling gaps and omissions, specially with regard to price/value of on-farm transfers of planting materials, manure, milk...etc, and of family consumed products like fruits, milk...etc.

All product prices were recorded at the farm level. Marketing margins for some crops like coconut and grasses were established by interviewing those involved in marketing, both at farm level and at scattered market places.

Full information on quantities of fertilizers by type, vegetable seeds, tractor hire and crop protection services, provided by the Government to the farmers in the sample, were obtained from the extension centres. Information on quantities of banana sold to PAMAP were obtained from the banana ripening factory. All this information was used to check the data collected during the survey.

None of the selected farmers refused to be interviewed and bad response during the survey was minimal. A number of factors helped in achieving this. Arrangements made prior to the investigation included a clear explanation of the purpose of the survey, the use that would be made of the data and how the farm-households were selected. The respondents were also made aware of the data collection procedures and the relatively long duration of the interview. All interviews were performed in the field in absolute privacy. The formal nature of the enquiry, the structure of the format, the agricultural background and experience of interviewers, all helped in achieving a good response. Nevertheless, two questionnaires were discarded after the interviews were completed due to inconsistency in the data and other serious discrepancies.

2.3 DATA PROCESSING

In view of the fact that surveys were to be carried out in both Salalah and in the Batinah, computerized data processing was chosen to process the survey information. Survey questionnaires were post-coded mostly by the enumerators themselves on the same day or the day following the interview. Data checking was carried out in the study area by the survey supervisor. Data entry was carried out in the project offices in Muscat and took about two weeks, using two computers full time and two operators per computer. The FARMAP package was then used to check and correct the data where necessary. Data checking and correction took most of the time, about 70 to 80 percent.

Thereafter, data were tabulated and a great number of tables have been produced of which only a few are incorporated in this report. The most powerful aspect of computerized processing is the capability of regrouping the data according to one or more variables. The regrouping facility was extensively used to detect or confirm possible relations between certain farming systems variables. All tables are kept by the project and can be consulted when required.

The questionnaire is presented in a separated volume published earlier.

Chapter 3

GENERAL BACKGROUND INFORMATION OF THE STUDY AREA

The Salalah plain , in Southern Province of Dhofar, is a broadflat coastal plain extending for about 300 km along the coast and 8 km in land from the sea. The plain is bounded by the mountain (Jebel) on the North and by the Arabian Sea on the South.

Salalah has a climate distinct from the rest of the Arabian Peninsula and is affected by the monsoon (khareef) providing precipitation in the form of drizzle, rain, mist & fog between June - September, and by its topography (the Jebel 700 - 1000 metres). Annual rainfall averages 260 mm in the Jebel and 110 mm in the plain.

The main agricultural area forms a narrow strip ranging from about one to two km in width and is running between the old residential area of Salalah town towards the stone and the new urban areas towards the airport. Few large Royal & Government farms are located in this strip. Domestic gardens around private houses are more common in Wadi (Salalah extension centre) and Saada (Dahariz extension centre).

The current total population in the plain is estimated at about 77,000 people divided in the ratio of 2 : 1 between nationals and expatriates. At present population grows at an estimated annual rate of 3.7 %, this rate is expected to increase to 4.7 % and the local population is expected to triple within 20 years.

The recent economic developments are leading to a steep increase in construction for private and tourist purposes. This in turn is leading to an expansion of the farm/garden area, thus increasing the demand for drinking and irrigation water.

The Government is the major employer, while also the establishment of new commercial enterprises is stimulated by increased income and savings. In short the development of Salalah is now under way at an increasing speed. Agriculture in this developing society is loosing its importance as income generating activity. Consequentially, agricultural development has to be approached in non-conventional way. Due to the high levels of

non-farm income and the exclusive use of expatriate labour, as well as the existence of all sorts of subsidy programs in both the agricultural and the non-agricultural sectors, land owners do not respond to price and non-price incentives as if they were still subsistence farmers. The mixture of traditional thinking and the newly acquired wealth demands better land use planning, stricter rules and regulations and above all better extension services and awareness activities.

The landuse pattern in Salalah Plain is reported in Table 3. It shows that 8436 feddan are put to agricultural use, out of which around 75 percent is used for the cultivation of various crops.

Table 3

Land use pattern in Salalah Plain (1991)

Type of use	Area (Feddan)	Percent
Net Cultivated Area	6371	75.52
Fallow (current & permanent)	645	7.65
Culturable waste land	850	10.08
Ornamental Plants and Parks	95	1.12
Farm buildings	388	4.60
Other non-agricultural use	87	1.03
Total land	8436	100.00

Source: Land Use Survey Report, Table 1

Table 4 gives details on the land distribution pattern in the area. It shows that the distribution of land is highly skewed. The four large farms own 41 percent of the total agricultural land, while 90.4 percent of farms are of less than ten feddan in size and own only 40.8 percent of the total area. The large farms are namely the Royal Farm, the Dhofar Cattlefeed Company, the Livestock Research Farm and one private farm.

Table 4

Land distribution pattern in Salalah Plain (1991)

Size of Holding	Number of Farms	Percent of Total	Total Area (feddan)	Percent	Average Size of Land (feddan)
< 3	253	31.8	417.0	5.9	1.7
3 - 6	306	38.5	1286.0	18.2	4.4
6 - 10	160	20.1	1182.7	16.7	7.7
10 - 20	55	6.9	628.8	8.9	12.0
20 - 50	13	1.6	341.8	4.8	23.1
50 - 100	5	0.6	306.1	4.4	61.3
> 100	4	0.5	2906.3	41.1	476.2
Total	796	100.00	7068.7	100.0	11.2

Source: Land Use Survey Report, Table 5

Table 5 shows the cropping pattern by size class of farms in Salalah for the year 1991. This information was generated by the landuse survey team in the project. It show that 46.9 percent of the area is under short and tall grasses, 36.2 percent various fruit plants, 7.9 percent vegetables and 9 percent is kept fallow. No cereals or pulses are grown in the area. This trend of high area of fodder is due to the existence of a traditional livestock based system. Also, the high area under fruit plants is related to the food habits of the people. Banana and coconut are the dominating fruit crops. The Salalah area produces surplus banana and other fruits. The area is picking up vegetable cultivation, mainly as intercrop between the fruit plants. Tomato is considered to be a good cash crop.

There are a large number of small farms and their cropping pattern is different than large farms. The large farms are specialised farms, mostly growing fodder crops. On the other hand, small farms are mixed farms, allocating 50 percent area under fruit trees and the remaining 50 percent under vegetable and fodder crops. Most farms keep livestock and therefore put 30 percent area under perennial fodder crops.

Table 5

CROPS GROWN AND AREA BY SIZE OF FARMS IN SALALAH (1991)

(Area in Feddans)

Type of crops	Farm Size Class (Feddan)					Over all
	Less than 3	3 - 6	6 - 10	Sub total upto 10	Above 10	
I Fodder Crop and grasses						
(i) Alfalfa	4.2	10.6	11.1	25.9	6.3	32.2
(ii) Short grasses	101.6	305.0	217.3	624.0	2368.3	2992.3
(iii) Tall grasses	26.0	114.0	94.3	234.3	56.1	290.3
Sub Total	131.8 (31.5)	429.6 (33.4)	322.7 (27.3)	884.2 (30.6)	2430.07 (58.1)	3314.8 (46.9)
II Fruit Crops						
(i) Banana	131.3	332.0	305.4	768.7	266.5	1035.2
(ii) Citrus	5.6	13.2	14.1	32.9	34.1	67.1
(iii) Coconut	64.0	223.5	247.5	535.0	544.4	1079.4
(iv) Papaya	15.6	28.2	39.7	83.5	68.3	151.8
(v) Other fruits	7.9	12.4	10.5	30.8	189.5	220.3
Sub Total	224.4 (53.7)	609.3 (47.4)	617.2 (52.2)	1450.9 (50.3)	1102.8 (26.4)	2553.8 (36.2)
III Vegetables						
(i) All vegetables	43.3 (10.4)	161.1 (12.5)	181.9 (15.6)	386.3 (13.4)	174.4 (4.2)	560.7 (7.9)
IV Fallow Land	18.4 (4.4)	86.5 (6.7)	61.0 (5.1)	165.9 (5.7)	472.0 (11.3)	637.9 (9.0)
Total	417.9 (100.0)	1286.6 (100.0)	1182.8 (100.0)	2887.3 (100.0)	4179.9 (100.0)	7067.2 (100.0)

Note: Figures in parenthesis are percentages

Source: Land Use Survey, Table 6

Chapter 4

THE RESOURCE BASE

4.1 LAND AND LAND TENURE

Land is the basic resource of production. Its distribution and ownership pattern determines its use and productivity. This chapter deals with the land ownership patterns and tenurial arrangements of the 48 sample farms. Table 6 give details of the size classwise distribution of sample farms, operated land and the average size of holding.

Table 6

DISTRIBUTION OF HOUSEHOLDS AND OPERATED AREA BY SIZE CLASS IN SALALAH

Size Class	No of sample farms	Percent of total number of farms	Operated area (Feddan)	Percent of total operated area (Fe)	Average operated area per farm (Fe)
0-3	17	35.42	37.42	17.93	2.20
3-6	22	45.83	99.15	47.51	4.51
6-7	6	12.50	39.41	18.88	6.57
above 7	3	6.25	32.71	15.67	10.90
Overall Total	48	100	208.69	100	4.35

It shows that 81 percent of sample farms are in the less than 6 feddan land size category, with an average size of farm of 3.55 feddan (or 1.5 hectares) and own 65 percent of operated land.

Basically, the area can be described as a small farm based agricultural system. This special feature of agriculture should be kept in mind when planning or framing agricultural policies

for the area. As the population pressure increase, there are chances of further subdivision of small lands, which will be detrimental to their economic viability.

Besides the small size of holdings, it is also important to know of the tenurial arrangements existing in the area, which have direct impact on the productivity of agricultural lands.

Table 7 provides details of the existing land tenurial system in the area.

Several land tenure arrangements can be distinguished. Most land is privately owned and operated by the owner. The practice in the area is that the owner carries out the supervision of the day to day work, while the actual work is performed by permanent expatriate labourers. Yet, sometimes important decisions like the procurement and use of inputs, and marketing are made by the permanent hired labourers. In the case of bananas and livestock however, there is frequently direct supervision by the owner. In an attempt to avoid being exploited, labourers tend to neglect other farm activities in areas where labour intensive crops are grown. About 73 percent of the farms are owned and self operated and 86 percent of them are of size less than 6 feddan. In terms of area, around 59 percent of area is under owned and self operated class. Leasing-out and leasing-in land is more practiced by land owners of size class 3 to 7 feddan. The leased-out land are given either on fixed rent or share cropping.

Sharecropping with expatriate labour is an increasing phenomenon. Sharecropping is foremost limited to annual/seasonal crops, especially vegetables, with the exclusion of fodder crops. There are two major reasons why sharecropping is practised. Firstly, a number of expatriate labourers are not paid a monthly salary in cash for their services. Their cash income is expected to arise from sharecropping. This is an incentive for the sharecropper to optimize the production of the shared crops, since his income depends on it. Secondly, in many cases, the sharecropper has to carry out in addition all other operations on the farm, which are not covered by the share arrangement. These activities mainly consist of irrigating permanent crops and feeding the animals. In principle the owner has lower costs and increased benefits. Several forms of share arrangements exist in Salalah. Sometimes all inputs other than labour, are provided and financed by the owner. In other cases the sharecropper pays 50 percent of the material inputs such as fertilizers, chemicals etc.. After the crop is sold, the total costs are deducted and the owner gets 50 percent of the net revenue as a reward for his land and the capital invested in the production. The expatriate's share covers the cost of his labour for all farm activities including those that are not covered like coconut, fodder and animals. He also implicitly pays for the cost of irrigating those enterprise (fuel and maintenance charges etc). It is evident, that it is in the interest of the sharecropper to increase his cash and kind income, as well as to reduce the volume of work on the non-shared enterprises. This arrangement may affect the

Table 7

LAND TENURE BY SIZE CLASS OF FARMS IN SALALAH

Size class (feddan)	Owned and self operated		LEASED-OUT LAND						LEASED-IN LAND						TOTAL	
	No of farms	Area (Fe)	No of farms	Area (Fe)	Terms of leased-out				No of farms	Area (Fe)	Terms of leased-in				No of farms	Operated area (Fe)
					Fixed Rent		Share cropping				Fixed Rent		Share cropping			
					No of farms	Area (Fe)	No of farms	Area (Fe)			No of farms	Area (Fe)	No of farms	Area (Fe)		
Less than 3	15 (88) (43)	33.2 (89) (27)	- - -	- - -	- - -	- - -	- - -	- - -	2 (12) (25)	4.3 (11) (12)	2 (12) (25)	4.3 (11) (12)	- - -	- - -	17 (100) (35)	37.5 (100) (18)
3.01 - 6.00	15 (68) (43)	53.6 (54) (44)	7 (32) (64)	29.1 (29) (57)	3 (14) (60)	13.9 (14) (57)	4 (18) (67)	15.2 (15) (58)	4 (18) (50)	16.5 (17) (46)	4 (18) (50)	16.5 (17) (46)	- - -	- - -	22 (100) (46)	99.2 (100) (48)
6.01 - 7.00	3 (50) (8)	11.3 (29) (9)	4 (67) (36)	21.7 (55) (43)	2 (33) (40)	10.5 (27) (43)	2 (33) (33)	11.2 (28) (42)	1 (17) (12)	6.4 (16) (18)	1 (17) (12)	6.4 (16) (18)	- - -	- - -	6 (100) (13)	39.4 (100) (19)
Above 7.00	2 (67) 6)	23.9 (73) (20)	- - -	- - -	- - -	- - -	- - -	- - -	1 (33) (13)	8.8 (27) (24)	1 (33) (13)	8.8 (27) (24)	- - -	- - -	3 (100) (6)	32.7 (100) (15)
Overall	35 (73) (100)	122.0 (59) (100)	11 (23) (100)	50.8 (24) (100)	5 (10) (100)	24.4 (12) (100	6 (13) (100)	26.4 (13) (100	8 (17) (100)	36.0 (17) (100)	8 (17) (100	36.0 (17) (100)	- - -	- - -	48 (100) (100)	208.8 (100) (100)

Note: Figures in parenthesis are percentages to column and row totals.

output of the non-shared enterprises. One example is that subsidised inputs like inorganic fertilisers and pesticides, intended for permanent crops, might be diverted to the shared crops. Another side effect is the overuse of pesticides on the shared crops, in an attempt to safeguard the production/income as much as possible. The relative low costs of pesticides certainly contribute to the extend of this malpractice.

The other form of tenure is contract farming. In contract farming, a monthly cash payment is made by the contractor to the owner of the land (or land use right) for the farm and in some cases for only part of the farm. The payment is made for renting the land, and for the use of existing irrigation facilities including the pump(s), as well as the available farm premises. Contract arrangements may cover all land including fruit trees or may be confined, as is often the case, to annual and seasonal crop land. The contractor is obliged to take care of the farmers' other enterprises (mainly fodder and livestock). Contract farming might occur both on owned as well as on Awqaf land. In the latter case, the holder of Awqaf land may contract the land out at a much higher rate than he pays to the Ministry.

Before the oil boom and influx of the expatriate labour force, contract arrangements used to be made with the landless members of the society, especially those of African origin. At present an active market for contract farming has been developed with expatriates, especially Pakistanis, offering relative high land rents. Locals who cannot afford or willing to pay comparable high rents are now often being expelled.

The contractor benefits from all the land owner entitlements with regard to subsidized inputs. Market limitations, risk aversion and the expatriate's desire for guaranteed and quick cash returns have enforced an intensive, highly diversified, exhaustive pattern of land use. Land owners as well as local agricultural authorities are aware of the adverse effects of this system on natural resources and the environment. About 12.5 percent of the farms have either a part or the whole farm contracted out to expatriates.

There is a form of land tenure called "Awqaf land". This land belongs to the Ministry of Justice, Awqaf & Islamic Affairs. Awqaf land was usually distributed among the poor people at a nominal fee. The usufruct (right of use) of this land is passed on to their heirs, regardless of the status of their income and well-being. However, to let benefit as many people as possible, only relatively small areas were distributed, resulting in an average farm size of less than three feddan. Of all farms in the survey, about 10 percent is Awqaf land.

During the survey, farmers were requested to value their land. As expected, land owners valued their land extremely high. A simple valuation of agricultural land can be carried out by dividing the annual net return to land by the long term interest rate. This is only valid, when the land is solely used for agricultural purposes and when the demand for land is exercised by farmers for this purpose. However, the land in Salalah is not primarily used for agricultural purposes, since it is located within the built-up area of the town. Therefore, land has a residential function at the same time. In fact the value of land is not governed by its agricultural value at all. In principle landowners do not sell their land.

Until now the Government has continued to distribute lands for the development of new farms. Agricultural loans are provided to develop these plots. The size of these plots is small and the "agricultural" development is carried out in anticipation of the likely conversion of this agricultural land into residential areas in the future. Calculation of the return to land in such a situation has lost its meaning.

Most of the agricultural land is under perennial fruit trees (bananas, coconut and papaya) and fodder crops (Rhodes grass and Elephant grass). Vegetables are mainly grown in the khareef season (June - December) with few crops like okra and melons cultivated in the winter season (January - June). The pattern of land use on small farms is influenced by geophysical features and by land tenure arrangements. On farms at the east and west edges of the plain mostly salinity tolerant crops like coconut and grasses are cultivated . While the effect of salinity on the pattern of land use may also be observed in other parts of the plain, land tenure appears to be the determining factor.

4.2 PERMANENT LABOUR

The availability of labour for productive work in smallholder agriculture is normally a function of the household composition. In the Sultanate of Oman, however, the availability of labour is a function of whether expatriate labour can be profitably employed and whether labour can earn/save more than it can do in the home country. Only in cases where the off-farm income component of the land owner by far outstrips the income from agriculture labour might be employed in agriculture even if it is not profitable. In other words off-farm income is transferred to agriculture to keep the farm going. In such a situation farming becomes a kind of hobby or leisure activity.

The Omani family provides the management either direct or indirect to any activity that requires expatriate labour. However, to become a sponsor of one or more labourers a

justification is required. Farming is considered by the Government as a productive activity that justifies the sponsorship of expatriate labour. Besides, many Omani families who own farm land in Salalah are engaged in other productive activities which also justifies the use of expatriate labour in a number of cases. Therefore, as long as labour can earn/save more in Oman than in the home country, labour will be in plenty supply. All smallholder farming depends entirely on this cheap migrant labour, while also migrant labour is employed in the agricultural service sector, including marketing and retailing. Most of the expatriate labour force are young males whose prime objective is to send money home as much as they can.

In the sample more than 50 percent of the permanent labourers are Pakistani and about one third are Indians, while the remaining labourers are coming from Bangladesh and Egypt. The quality of this labour force is rather diverse. Some were previously poor city dwellers without any agricultural background, while others had an agricultural background. However, in several cases labourers were originally sponsored to carry out a complete different job and were later employed in agriculture. It is therefore not surprising that their technical performance leaves much to be desired.

Table 8

NUMBER OF PERMANENT LABOURERS
EMPLOYED BY SAMPLE FARMERS BY COUNTRY OF ORIGIN

	Total Number	Average per farm	Percentage
Pakistan	46	.96	53.49
India	29	.60	33.72
Bangladesh	9	.19	10.47
Egypt	2	.04	2.33
Total	86	1.79	100.00

To be able to communicate the language knowledge of the labour force is important. The survey clearly confirms that there is a severe communication problem since the majority does neither speak arabic nor english (see Table 9). Since most of them can neither read these languages, problems occur in reading the instructions on pesticides and other chemicals, used in agriculture.

Table 10 provide details on mode of payment to the permanent labourers employed by the landowners. It show that 18 percent of the labourers are paid cash, while about 57 percent receives accommodation in addition, and another three to four percent is also provided with food. Important is that about 20 percent does not receive any cash payment. These are mainly sharecroppers and contractors. This group usually has a better agricultural knowledge and is able to make money in agriculture, especially in the cultivation of vegetables. Of the non-livestock keepers in the sample almost 40 percent of the labourers do not receive any cash payment. This underscores the relationship between vegetable growing, land tenure and labour. Any proposed development intervention should take this into account. Improved vegetable production may induce an increase in sharecropping and contract farming. Consequently, Omani tenants might face difficulties in renting in land from other Omani's unless they are prepared to pay competitive rents.

Due to the convertibility of Omani Rial savings can be easily transferred to the home country.

In all cases the sponsor has to cover the travel costs from their home country and back every two years, in addition to a month's paid leave during this period.

Table 9

PERMANENT LABOURERS
EMPLOYED ON SAMPLE FARMS AND THEIR
LANGUAGE SKILLS

	Total Number	Percentage
Spoken arabic		
Fluent	6	6.98
Little	58	67.44
None	22	25.58
Total	86	100.00
Spoken english		
Little	5	5.81
None	81	94.19
Total	86	100.00

Table 10

MODE OF PAYMENT TO PERMANENT LABOURERS
BY SIZE CLASS OF FARMER
(PERCENTAGES)

	Land Size Class (Feddan)				
Mode of payment	0-3	3-6	6-7	Above 7	Overall
Cash only	13.04	17.95	15.38	36.36	18.60
Cash + Lodging	86.96	53.85	23.08	45.45	56.98
Cash + Lodging + Food		2.56		18.18	3.49
Share Cropping		15.38	7.69		8.14
As Contractor of farm		10.26	53.85		12.79
Total (percent)	100.00	100.00	100.00	100.00	100.00

Table 11 shows that a labourer costs his employer on average 980 OR per year or about 82 OR per month. In this calculation sharecroppers and contractors have been excluded. From the table it can be deducted that a sharecropper must earn about 75 OR per month or 900 OR per year to break even with other paid labourers, the other costs are paid by the land owner. Based on a peak labour requirement of about 75 hours per month one labourer can cultivate about three feddan with vegetables. Assuming a cropping intensity of 150 percent during the khareef season, about four and a half feddan of vegetables can be cultivated. To earn 900 OR from four and a half feddan of vegetables, the sharecropper must make a net profit of about 200 OR to break even (i.e. earning the same income from sharecropping in the khareef season only). If a higher crop intensity can be achieved the sharecropper requires less than 200 OR per feddan.

Table 11
AVERAGE COST OF HIRING PERMANENT LABOUR
BY SIZE CLASS OF FARMS IN SALALAH
(PER LABOUR IN OR)

	Size class of farms (feddan)				
Item	0-3	3-6	6-7	Above 7	Overall
Cash wage per month	62.61	69.48	66.00	68.18	66.69
Kind wage per month	8.04	11.24	4.00	7.27	8.99
Total wage per month	70.65	80.72	70.00	75.45	75.68
Other costs per month	0.09	0.07	2.00	6.36	1.24
Other costs per year	70.65	53.97	72.50	61.82	56.91
Total cost per month	76.63	85.29	72.00	86.97	81.65
Total cost per year	919.52	1023.48	936.50	1043.64	979.85

Note: Share croppers and contractors are excluded

4.3 FEMALE LABOUR

The role of women in agriculture in the Salalah Plain is practically zero. Women do not work on the fields since this is done by expatriate labour. In the past women and children were attending livestock and carried out some other agricultural jobs. However, most of the livestock is now stallfed and agriculture as source of income has diminished in importance. In the remainder of this report no special attention is therefore paid to the role of women. It is very unlikely that any change in the present farming system will require again the involvement of women in any significant way. Family income and status prevent the involvement of women in agriculture in the future.

Management decisions on the farm are taken solely by the owner in about 60 percent of the cases. In 12.5 percent of the cases the management decisions are taken completely by the expatriate labourers. This is quite high and it should be taken into account when any proposals are made to improve agriculture.

Table 12

FARM MANAGEMENT DECISION MAKING ON SAMPLE FARMS

	Number of farms	Percentage
Solely by farmer	29	60.42
Farmer and expatriate	7	14.58
Solely expatriate	6	12.50
Tenant	5	10.42
Total	48	100.00

4.4 FAMILY SIZE, OCCUPATION AND INCOME

In most smallholder agriculture off-income activities are dealt with under the heading of resource use. However, in the study area, it is appropriate to deal with off-farm income under the chapter resource base. The reason is that practically no household is entirely depending on agriculture for their income nor is their own labour input a limiting factor in quantitative terms.

In most households the major source of income is generated outside agriculture. Therefore, money earned outside agriculture may find its way to agriculture when it cannot serve as a basis for living.

So the off-farm income component is more related to the household composition than the agricultural income is. Table 13 below presents the household composition. The average family size is just over ten persons. This is quite large and the off-farm income is mainly earned by the head of household and his sons.

Table 13

HOUSEHOLD COMPOSITION
OF SAMPLE FARMS (ALL FARMS)

	Male	Female	Total
Head of household	1.00	.00	1.00
Wives	.00	1.23	1.23
Children	4.00	3.04	7.04
Relatives	.52	.90	1.42
Total family size	5.52	5.17	10.69
Domestic servants	.44	.63	1.06

In the sample 94 percent of the farm households had off-farm income. The average off-farm income amounted to 10,000 OR per year or 834 OR per month. About 60 percent is in earned in government jobs while almost 35 percent is earned in business. The remainder is received from pension and social security funds and the army. Over 95 percent of the off-farm income was earned in cash and the rest in kind. There exists a considerable difference in off-farm income between the different extension centres. In the Salalah extension area off-farm income amounted to 15,590 OR per year, while in Awqadeen only 6,708 OR per year was earned. A clear explanation for this difference could not be identified. One possible reason is that the Salalah extension area together with Hafa & Qarad are the oldest cultivated areas.

A comparison of off-farm income along farm size classes showed that there is no direct relationship between farm size and off-farm income. If farming would be a major source of income and it would compete for farm household labour one would expect that the larger farms would have less off-farm income. In Salalah this is not the case.

In order to judge the relative importance of the off-farm income component, a comparison is already made here between the net cash income from agriculture and that earned from off-farm activities. The total annual agricultural cash inflow in the sample is estimated at about 4,063 OR and the total annual net cash outflow at 3,920 OR, resulting in a net cash inflow of only 143 OR per year. In this figure rent paid and rent received are not included. In anticipation of the conclusions one could determine that the role of agriculture as a cash income

generating activity is only marginal. However, it should be borne in mind that the kind inflow resulting from the livestock activities is relatively significant.

Another way to show the relative importance of agriculture is to look at the assets acquired by the sample households. It was decided on the basis of the rapid appraisal not to try to collect the value of premises, saloon cars, etc., because this could tricker suspicion and would deviate the attention of the land owners from the agricultural issues. The table below shows that 48 farms had 55 residential houses, 14 multi-story buildings, 38 building plots, 23 small shops, 53 saloon cars, 22 pick-ups, 13 trucks, and five large trucks.

Table 14

ASSETS OWNED BY THE SAMPLE FARMERS (ALL FARMS)

	Total Number	Average per farm
Residential house	55	1.15
Multi-story building	14	.29
Building plot	38	.79
Small shop	23	.48
Large shop	1	.02
Saloon car	53	1.10
Pick-up	22	.46
Small trucks	13	.27
Large truck	5	.10
Workshop	20	.42
Dental clinic	1	.02

It is obvious that farming cannot have laid the foundation for this wealth. Nevertheless, despite the minimal importance of agriculture in terms of income, 33 percent of the interviewed head of households claimed that agriculture is their first source of income. There are several possible reasons for this response. Firstly, most of them still feel that they are farmers, and secondly, it is not uncommon to overemphasize the importance of agriculture in such an interview, to minimize the chance that the Government would reduce their assistance to agriculture in the form of less projects or lower subsidies. In any case the figures do not support the farmers' claim. Table 15 show total off-farm income by size class of sample farms in Salalah.

Table 15

TOTAL OFF-FARM (NON AGRICULTURAL) INCOME BY SIZE OF FARMS

	Size of farm (feddan)						
Source of Income	0-3	3-6	6-7	Above 7	Over all	Livestock keepers	Non Livestock keepers
Civil service	4341.18	6874.86	1920.00	8920.00	5613.60	5269.66	6237.00
Commerce/business/rent	4817.65	2912.38	500.00	1720.00	3338.22	4046.21	2055.00
Pension	208.94	991.43			541.60	761.79	142.50
Social Security		63.43			29.60	45.93	
Military	211.76		2700.00		320.00	496.55	
Others	105.88				40.00	62.07	
Total	9685.41	10842.09	5120.00	10640.00	9883.02	10682.21	8434.50
No of farms	17	21	4	3	45	29	16
Average Size of farm (feddan)	2.20	4.44	6.57	10.90	4.21	4.40	3.88

It can be safely concluded that farming is not a major source of income and that the involvement of the family in farming is rather limited. Even the day to day management is left in quite a few cases to expatriate labour. It appears that the objective of farming is primarily to keep ties with the past. The ownership of farm land and cattle raises the status of the family in the community. Consequently, there could be a conflict between the objectives of the Government to increase agricultural output and the objectives of the individual farm households. Making agriculture more profitable requires new investments, better management and higher (and appropriate) levels of inputs. It seems that many are prepared to transfer money from their off-farm income to agriculture when a negative cash flows occur. However, it is doubtful whether high new investments will be made by farmers unless significant subsidies are given or when they are convinced of high net returns. The policy of the Government to subsidize agricultural investments and inputs and the continuous price support has given the farmers the feeling of an inalienable right to continuous Government support.

4.5 CAPITAL AND CREDIT

4.5.1 Buildings, machinery and equipment

The average capital invested in structures and buildings amounted to 6009 OR per farm or 1428 OR per feddan. This figure does not include farm houses and villas. Forty percent of has been invested in irrigation facilities. These include pump houses, water tanks and concrete canals. About one third was invested in fencing.

Table 16

INVESTMENTS IN STRUCTURES AND BUILDINGS
BY SAMPLE FARMS

Farm size class: All farms

Operated land (Fe) 4.21
No of farms 45

	Total number	Estimated total present value at market prices	Estimated average present value at market prices
Irrigation facilities	56	111500.00	2477.78
Fencing	27	87120.00	1936.00
Labour house	21	37950.00	843.33
Livestock shed	33	28325.00	629.44
Storage facilities	4	1800.00	40.00
Poultry house	8	3700.00	82.22
Bee hives	1	50.00	1.11
Total		270445.00	6009.88

Note: Irrigation facilities comprise pumps, pump houses, water tanks and concrete canals. Farm house/villa excluded. Three farms have been excluded.

The investment in irrigation facilities varies considerably per farm size class. The larger the farm the smaller the investment per feddan. This a logical consequence of the fact that the investment in field channels and structures is not systematic and not a prerequisite for basin irrigation when water is pumped from private (or shared) wells. The investment costs in wells, the pump house and pumps are not proportionate with the area irrigated. In the smallest farm size class (0 - 3 feddan) about 1,021 OR are invested in irrigation facilities, while the farms between three and six feddan have only 554 OR invested per feddan. In the largest farm size classes the amount invested has dropped to 340 - 400 OR per feddan. If modern irrigation systems are considered amongst the improvement proposals, it should be realized that the costs of these systems are more proportionate with the size of the farm, because of the larger share of investments per feddan (pipes, fittings, outlets etc. in every feddan). Since the total household income is not related to the farm size (larger farms higher total

income) only the absolute level of off-farm income and the value of total new investments are relevant parameters.

Another factor that could play a role is the involvement of the owner in the management of the farm. If an overall package can be offered that really would improve the net profits of agriculture, more owners could become more interested in farming as a source of income. This could have consequences for the tenants, the sharecroppers and the contractors.

At present a considerable amount of the investments in agriculture is subsidized. The table below shows that about 30 percent of the original investment costs have been received as subsidies.

Table 17

INVESTMENTS IN STRUCTURES AND BUILDINGS
AND SUBSIDIES ON SAMPLE FARMS

Farm size class: All farms

Operated land (Fe) 4.21
No of farms 45

	Average original amount invested at market prices	Average amount paid by farmer at market prices	Average amount of subsidy received	Subsidy as percentage of original cost
Irrigation facilities	3178.89	1152.22	2060.00	64.80
Fencing	2348.89	2257.78	91.11	3.88
Labour house	1022.22	1022.22	.00	.00
Livestock shed	886.67	748.89	137.78	15.54
Storage facilities	83.33	83.33	.00	.00
Poultry house	103.33	50.00	53.33	51.61
Bee hives	3.33	3.33	.00	.00
Total	7626.66	5317.77	2342.22	30.71

Note: Irrigation facilities comprises pump houses, water tanks and concrete canals. Farm house/villa excluded. Three farms excluded.

Almost 65 percent of the original costs of irrigation facilities was subsidized. Farmers received the subsidy in cash on the basis of simple designs for pump houses, well improvements etc. However, farmers were able to have these being built at lower costs, so increasing the relative amount of the subsidy.

Farmers had invested about 1,330 OR (original costs) in mainly diesel and electric pumps and several kinds of sprayers. About eighty six percent of the original investment costs went into pumps. Nearly 400 OR or 30 percent of the total costs was received as subsidy. The present value of these investments is estimated at about 820 OR.

Table 18

INVESTMENTS IN MACHINERY AND EQUIPMENT

Farm size class: All farms

Operated land (Fe) 4.35
No of farms 48

	Total number	Estimated total present value at market prices	Estimated average present value at market prices
Electric pumps	30	20700.00	431.25
Diesel pump	48	11990.00	249.79
Engine driven sprayers	27	2070.00	43.13
Manual sprayers	8	245.00	5.10
Electric fodder chopper	4	750.00	15.63
Generator	1	3500.00	72.92
Total	118	39255.00	817.81

Table 19

INVESTMENTS IN MACHINERY AND EQUIPMENT
BY SUBSIDIES

Farm size class: All farms

Operated land (Fe) 4.35
No of farms 48

	Average original amount invested at market prices	Average amount paid by farmer at market prices	Average amount of subsidy received	Subsidy as percentage of original cost
Electric pumps	568.02	443.02	125.00	22.01
Diesel pump	581.56	338.60	242.96	41.78
Engine driven sprayers	69.79	47.71	22.08	31.64
Manual sprayers	13.33	6.56	6.77	50.78
Electric fodder chopper	26.04	26.04	.00	.00
Generator	72.92	72.92	.00	.00
Total	1331.67	934.85	396.81	29.80

4.5.2 Livestock

Livestock plays an important role in the farming system of Salalah Plain. Two third of the farm-households keep stall-fed animals. About 40 percent keep dairy cattle, 50 percent keep sheep and goats, while 17 percent keep mixed cattle (local & crossbred) and 25 percent keep chickens. Only few households (two) are still keeping camels. The presence of cattle, sheep and goats is the main reason why so much of the cultivated area is covered with short and tall grasses in the plain. The survey tried to detect whether there exists any relationship between the animals kept in the jebel and those kept on the farm. Initially, it was assumed that the production of grasses, especially Rhodes grass and Buffalo grass, was in surplus in the plain and that the surplus was sold to the

livestock keepers in the jebel. However, the survey showed that there are more animals kept in the plain than anticipated. The monthly fodder balance (Appendix 2, Table A2.40) shows a deficit, therefore the hypothesis that grasses are cultivated for the livestock keepers in the jebel must be rejected. This is important when assessing the relative high price of grasses.

Valuing livestock is often a difficult problem since livestock keepers tend to overvalue their herds. In the survey animals have been determined by the livestock expert and the farmer together to avoid overvaluation. The total value of all livestock is equal to the sum of the opening value and closing value divided by two. In the sample the value of the average dairy herd of 20 farms (i.e. 42% of the farms) was estimated at 5,086 OR. This is equal to 2,120 OR for the whole sample (total value divided by 48 farms). The value of the average herd of mixed cattle of eight farms (i.e. 17% of the farms) amounted to 1,847 OR, which is equal to 308 OR for the whole sample. The average flock of sheep and goats of 24 farms consisted of about 42 animals with an estimated average value of 1,721 OR or 860 OR for the whole sample. Excluding chickens and camels the total average capital invested in livestock amounted to 3,288 OR for the whole sample. The amount invested in livestock is almost 1.7 times the amount invested in irrigation facilities.

Livestock produces milk, meat and dung, but animals are not used for draught power. Dung is extensively used as a soil conditioner to increase the organic matter and the water holding capacity of the rather poor soils. From a nutritional point of view the addition of dried dung is very limited.

Considering the relatively large number of stall-fed animals and the considerable area under ley and grasses one would expect that livestock is a profitable enterprise. The returns of the livestock enterprises are discussed in Chapter 5. The following tables present the inventory and inventory changes of all livestock enterprises except camels.

Table 20

PER FARM LIVESTOCK INVENTORY AND INVENTORY CHANGES
CROSSBRED DAIRY CATTLE

No of farmers	20							
	Opening	Purchased	Born	Given Away	Sold	Slaughtered	Died	Closing
Dairy cows	7.85	3.25	.00	.10	4.15	.35	.30	6.50
Calves	3.25	.00	2.15	.00	.90	.00	.00	3.50
Heifers	.85	.00	.00	.00	.00	.00	.15	1.40
Mature males	.50	.00	.00	.10	.05	.00	.10	.25
Total number of animals	12.45	3.25	2.15	.20	5.10	.35	.55	11.65

Table 21

PER FARM LIVESTOCK INVENTORY AND INVENTORY CHANGES
CATTLE MIXED

No of farmers	8							
	Opening	Purchased	Born	Gifted-in	Sold	Slaughtered	Died	Closing
Mature females	4.75	.00	.00	.00	.00	.25	.50	2.75
Mature males	.38	.00	.00	.00	.25	.00	.00	.13
Heifers	1.88	.13	.00	.13	.38	.00	.00	1.63
Calves	2.38	.13	1.13	.00	.00	.25	.00	2.75
Mixed animals	.00	.00	.00	.00	.88	.88	.00	.00
Total number of animals	9.38	.25	1.13	.13	1.50	1.38	.50	7.25

Table 22

PER FARM LIVESTOCK INVENTORY AND INVENTORY CHANGES
SHEEP & GOATS

No of farmers	24							
	Opening	Purchased	Born	Given Away	Sold	Slaughtered	Died	Closing
Total number of animals	44.38	4.00	9.00	.29	6.17	8.04	4.13	38.75

Table 23

PER FARM LIVESTOCK INVENTORY AND INVENTORY CHANGES
CHICKEN

No of farmers	12							
	Opening	Purchased	Hatched	Gifted-out	Sold	Slaughtered	Died	Closing
Mixed animals	41.00	.42	16.33	.00	.00	4.50	8.00	46.08
Total number of animals	41.00	.42	16.33	.00	.00	4.50	8.00	46.08

4.5.3. Credit

Improvements in the financial situation of the local population, through the development of the private and Government sector since the early seventies, have mostly eliminated the need for informal and short term credit. The farm fixed capital is supported mainly through equity financing. Institutional agricultural credit is only provided by the Oman Bank for Agriculture and Fisheries.

The Oman bank for Agriculture and Fisheries was established in May 1981 and commenced its operations in November the same year. The legislation for its establishment permitted the bank to grant loans or provide loan facilities for agriculture development and modernization or any other business as long as it has some connections with agriculture.

As a specialized financial institution, OBAF is a closed joint stock company fully owned by the Government of Sultanate of Oman. The share capital of the bank comprises of 3,8 million shares of five OR each (1990). To this year, the paid up share capital was a little less than 17 million (OR) out of the 19 million authorized.

Apart from the capital provided to the establishment of the bank, the main financial sources since inception have been interest on loans, advances and interest compensation and interest on short term deposits.

The interest rates charged by OBAF to borrowers are subject to the financial policy of the Government of the Sultanate and it conforms with its development goals. Borrowers are charged interest at a concessionary rate which is compensated by the Government.

OBAF provides three types of loans; short term, medium term as well as long term to individual operators and to private companies. Duration of loans range from two years for short term, two to seven years for medium term loans, and over seven years for long term loans.

The bank,s lending activities were for a long period concentrated on medium term loans intended to meet the costs incurred for the establishment of new farms, existing farm development, both agriculture and fishery equipments, fishery transportation, livestock and fishery marketing.

Some long term loans have been granted mainly to large projects with long life span. Financing of these projects depends on factors such as the cost of the project, life span and its significance.

The provision of short term loan was previously insignificant and its share in the overall lending portfolio of the bank was less than ten per cent (Appendix 3 Table A3.1). It seems the bank had started (1990) divesting itself of financing

medium and long term loans, resources are being channelled to finance short term loans.

Before 1990 the credit policy of the bank focused on capital financing. Almost 99% of the funds were extended on medium and long term basis, while short term loans are confined to marketing agricultural products and fish. The bank loans are specifically extended for the following:

- Farm Improvements: including wells, irrigation systems, pump houses, pumps, etc.
- New farms: includes expenditure to establish new farms (standard size of 10 feddan) such as land reclamation, land dwelling, fencing, housing for labour, modern irrigation systems etc.
- Farm mechanisation: includes various machines used for agriculture, depending on the project, but water pumps and tractors are dominant.
- Agro-industries, marketing and related activities: including freezers (mainly for fish) finance of small trading, small facilities like green houses etc.
- Large projects: defined as projects of more than 100 feddan or total cost of more than 100,000 OR.

The lending conditions of the bank are as follows:

Size of loans

Farmers:	90% of project cost
Non-farmers:	80% of project cost
Companies:	40% to 60% of project cost

Rate of interest per annum

Farmers:	2%
Non-farmers:	3% to 5%
Companies:	4% to 6%

Duration of the loan

Mechanisation:	2 years for water pumps 4 years for tractors
Large projects:	Variable depending on project life
Others:	Variable within a maximum of 12 years
Grace period:	Variable according to feasibility study
Security:	Collateral

The share of Dhofar region in institutional credit reached a weighted average of 3% of the bank's lending activities during 1985 - 1988 and most of it (74% in 1987 and 62% in 1988) has been extended to fisheries as shown in Appendix 3 Tables A3.3.

Repayment of agricultural loans is not done according to rules which normally apply to agricultural credit institutions. Remission of debts were granted several times. This is removing the fundamental characteristics of credit and undermines the actual repayment and repayments in the future.

It is therefore recommended that the bank's lending procedures should be changed in such a way that one can speak again of credit. This means real interest rates should be charged, an active policy regarding the mobilization of savings should be pursued, and an active policy to recover debts should be followed. Unnecessary arrears are not acceptable, certainly in a situation where other sources of income are as high as in Salalah. Should the Government wish to continue the present policy, then it is better not to use the word credit at all.

The credit policy has certainly contributed to the expansion of the cultivated area, which was one of the original objectives of the Government. In view of the salinity problems the Government should terminate the credit program for the establishment of new farms in endangered areas. In close collaboration with the Planning Committee areas for exclusion should be determined.

4.5.4 AGRICULTURAL SUBSIDIES

Government subsidies to agriculture play an important role in Oman. The subsidy programme has been launched to promote economic diversification, food self-sufficiency and higher incomes. The programme provides subsidies in four main categories:

a) Recurrent inputs including most of the seasonal production inputs like seeds, fertilizers, pesticides, etc.

b) Durable inputs such as tractors, sprayers and pumps. The subsidy is reflected in the preferentially low interest loan to purchase them from Oman Bank for Agriculture and Fisheries.

c) Government services including extension, veterinary services, chemical spraying and tractor hire services.

d) Price support to agricultural produce.

In fact the programme is contributing to the financing of the most important inputs (except labour), outputs and investments on a more or less permanent basis. However, the total

amount of subsidies fluctuates considerably over the years. In addition other subsidy programmes are implemented on an ad hoc basis. These include subsidies to livestock purchases. In several cases subsidies were given after the Government was put under pressure by interest groups. Recently, a subsidy programme is being implemented to install modern irrigation systems in the Batinah (5 million OR) and further a programme (7 million OR) to cover areas outside the Batinah.

The distribution of the subsidies nation-wide for 1988, 1989 and for 1990 are shown in Tables A4.1 and A4.2 respectively. The subsidy programme for 1988 amounted to 2.5 million OR, for 1989 and 1990 1.6 million OR has been budgeted. About 30 percent of the subsidies are used to subsidise pesticides.

About 30% of the value of imported seeds was financed by the MAF in 1986. The purchased seeds are supplied to the smallholder farmer, who is given priority over commercial farmers for allocation of these supplies. Varieties are selected after they are tested at the Rumais Research Station. The experience of the extension service as well as farmer's preferences are taken into account. Without the positive endorsement of this selection system, seed varieties are not considered for purchase by MAF and cannot be made available to the farmers at subsidised prices. Nevertheless a wide range of cultivars are available in the market at unsubsidised retail prices. Appendix 4, Table A4.4 shows that seeds are mostly subsidised for about 50 percent.

Until the relevant GCC body has framed the forthcoming pan-regional regulations, there continues to be no established Omani law governing seed quality, seed phytosanitary regulations, or selection and testing procedures. The private sector is free to import any seed varieties supplied by reputable, international seed producers for distribution and sale through their retail outlets.

Large quantities of vegetable seeds are provided by the government at 50% of their market price. The total subsidy however, declined over the years and quantities dropped by nearly 50% as is shown in Appendix 4, Table A4.3.

The vegetable seeds subsidy scheme in Salalah Plain has been designed to encourage vegetable production where geophysical conditions permit. About 41% of the subsidised vegetable seeds were distributed to farmers in Hafa and Qarad extension centre because of soil and water suitability and because of the large number of farmers (Appendix 4, Table A4.5).

The fertiliser subsidy scheme was designed to encourage the use of inorganic fertilisers. The programme started with a subsidy level of 100%. With the higher adoption rate, the level of the subsidy has progressively been reduced. At present inorganic fertilisers are distributed by the government at 75% of their market price as shown in Appendix 4, Table A4.6.

The fertiliser subsidy scheme is being used to stimulate the

use of fertilizers. Nitrogen fertilizers are by far the most important. Nevertheless the total amount of bags sold at subsidised prices is far from sufficient. Besides, the composition and quantities vary widely over the years.

All tractor services for small farmers in Salalah plain are provided by the government at a subsidised cost of 1.000 OR per hour. Higher (2.000 OR per hour) unofficial rates are sometimes charged at the peak season to cover the driver's overtime rate. About 13 tractors are available and distributed between the four extension centres as shown in Appendix 4, Table A4.8. Despite the higher rates during the peak period, no shortage of tractor services has been observed during the survey.

Considering the small number of farmers in Salalah the overall subsidy programme is considerable. To answer the question whether subsidies should be abolished or not, is not easy to answer. In international fora the pressure to abolish agricultural subsidies is increasing. However, since Oman is a net importer of agricultural products, domestic arguments in favour or against subsidies are the most important. To assure a certain degree of food selfsufficiency (for strategic reasons) through subsidy programmes seems to be internationally accepted. Locally produced fruits and vegetables are protected against cheap imports by a system of import permits on the one hand and the subsidy programmes for investments and inputs on the other. Without this protection local production would not have a chance to compete with imported agricultural products. As long as the objective of the agricultural policies is to reach a higher degree of selfsufficiency in food production and as long as the burden on the Government budget is not too large, there is no immediate reason to propose a serious reduction or even a total abolishment of agricultural subsidies. The whole system of subsidies and import permits is geared to keep consumer prices reasonable.

It is very doubtful whether more expensive pesticides will lead to a better more responsible use of pesticides. The high non-farm incomes make the price mechanism almost powerless.

Chapter 5

THE RESOURCE USE

5.1 INTRODUCTION

In this Chapter the resource use of the small farms in Salalah is discussed. Gross margins of crops and livestock enterprises are discussed in section 5.3 and the farm cash flow analysis is presented in section 5.4. The cultural practices of the most important crops are presented in Appendix 5. In Appendix 5 the interest on working capital as well as the fixed cost of labour and pumping have been included.

5.2 DETAILED LAND USE

The land cover survey, executed by the project, provided for the first time a full detailed land use map of the Salalah plain. In this section the sample data are presented.

In the sample most different mixes were originally recorded as separate types of crop mixes. However, due to the great variety of crops, some crop mixtures were later during the survey, classified as mixed vegetables or mixed fruits. These mixtures can hardly be compared with each other, because the percentages of each crop in the same mixture varied widely over the farms.

In Appendix 2 three cropping pattern tables (Tables A2.20 A2.22) are presented, one showing the crops that were present during the whole year, the second showing the crops during the winter season, and finally the crops that were planted during the khareef season. As around 60 percent of operated land is put under perinial fruit trees and grasses only 40 percent is available for cultivation during Khareef and Rabi season. Mostly vegetables are grown in these lands. The cropping pattern by size class is presented in Table 24.

Table 24

CROPPING PATTERN BY SIZE CLASS OF FARMS IN SALALAH

Crops	Percent crop area by size class (feddan)				All Farms
	less than 3	3-6	6-7	above 7	
A. FRUIT CROPS					
(i) Banana	12.8	8.8	8.3	7.9	9.6
(ii) Banana & Papaya	15.0	5.8	1.8	23.2	8.9
(iii) Coconut	6.1	9.7	4.8	-	6.6
(iv) Mixed fruit trees	1.9	2.6	2.4	8.6	3.0
(v) Other fruits	0.5	-	0.4	-	0.2
Sub total fruits	36.3	26.9	17.7	39.7	28.3
B. FODDER AND GRASSES					
(i) Alfalfa	3.6	1.4	-	-	1.5
(ii) Elephant grass	9.8	6.4	1.2	-	5.3
(iii) Rodes grasses	14.0	15.6	8.1	7.5	12.5
(iv) Sorghum for fodder	2.4	2.5	-	-	1.6
Sub total grasses	29.8	25.9	9.3	7.5	20.9
C. VEGETABLES					
(i) Pepper & Chillies	4.0	2.1	1.1	-	2.1
(ii) Tomatoes	3.0	7.8	9.8	-	6.3
(iii) Cucumbers	1.3	2.2	2.7	-	1.9
(iv) Mixed vegetables	2.6	5.5	31.7	10.0	11.7
(v) Other vegetables	6.5	4.8	8.2	-	5.7
Sub total vegetables	17.4	22.4	53.5	10.0	27.7
D. MIXED CROPS					
(i) Fruit & grasses	6.1	11.3	0.7	4.3	6.7
(ii) Fruit & vegetables	0.9	2.6	-	16.4	3.0
Sub total mixed crops	7.0	13.9	0.7	20.7	9.7
E. FALLOW LAND	9.5	9.8	18.8	22.1	13.3
GRAND TOTAL	100.0	100.0	100.0	100.0	100.0

The table show that about 13 percent of the operated land was kept fallow. The extent of fallow land increased with the size of land holding. It was 9.5 percent for farms less than 3 feddan and increased to 22.1 percent on farms of size above 7 feddans. The fallow was more during winter season than the summer. In fact, quite a few farmers let certain vegetables, such as peppers, chilies and egg plant planted during the khareef season, continue to grow till the main vegetable season commences again in June. They uproot them just before the khareef season, and replant the plots. Yields of these crops during this period are extremely low, but they still produce something, and since there is no real alternative for the winter season apart from some gourds, the farmers let them grow.

Apart from the four main categories - grasses, bananas, coconut and vegetables, hardly any system can be detected in the cultivation of other crops. The variety of vegetables is so great that the number of observations per species is, in almost all cases, too small to draw firm conclusions. Besides, the planted areas are very small, which in turn increases the chance to introduce errors. Only tomatoes are planted during the khareef season by about one third of the farmers, covering about eight percent of the total operated land.

There existed a marked difference in cropping pattern between different size class of farms. The marginal farms of size of holding less than 3 feddan had put more area under fruit trees (36.3 percent) and annual grasses (29.8 percent) while the farms of size group 6 to 7 had more area under vegetables (53.5 percent). Cultivation of grasses and vegetables as an inter-crop with fruit trees, particularly during the early years of tree plantations, was the common practice.

In the category of fruit crops, banana was the major crop followed by cocnut. But it was observed that farmers try to grow all kinds of fruit trees, the number may be even 3 to 5 plants, basically for self consumption.

As livestock is an important component of the farm household system, fodder and grasses got importance in allocation of area on marginal and small farms. Among the fodder and grasses, farmers prefer to grow Rhodes grasses and Elephant grass which require less attention and give higher output.

In Salalah plains, a large number of vegetables are grown and farmers try to grow them in very small plots - so small that sometimes it is difficult to measure the area under them. Such plots are shown either in the category of mixed vegetables or clubbed together and put as other vegetables. Among the vegetables, tomatoes were the most popular, followed by pepper and chillies. Tomatoes can be called the main vegetable crop of the area and is being supplied to other parts of Oman.

A comparison of land uses by tenure reveals that the area

under vegetables increases significantly when more share croppers and contractors are using the land. Besides, livestock keepers are cultivating more grasses while the non-livestock keepers are cultivating more vegetables. A comparison of land uses by salinity classes clearly shows that bananas practically disappear when the salinity is above 5 millimho's per cm, while also grasses are becoming more important (see Table 8 of Land Use Survey Report). This underscores that farmers are fully aware of the problems associated with salinity and that they adjust their land use accordingly.

Table 25 shows water salinity level by size of farm for the whole of Salalah: The area has attained a critical limit of salinity because only 30 percent of the area has safe water quality and 50 percent is in the critical zone of 3 to 7 ds/m. Any negligence on the part of farmers will lead to a reduction in crop yields and will limit the cropping pattern to very few crops. This is a very important constraint of the area and needs immediate attention in planning the future agriculture in the area. Any recommendation on cropping pattern in the area has to be matched with the water quality. More research is required to look into this issue in the area.

Table 25

WATER SALINITY LEVEL BY SIZE OF FARM IN SALALAH
(area in feddans)

Water Salinity	Size of Farm (feddans)			
	Less than 3	3 - 6	6 - 10	Total less than 20
< 2	77.11 (18.5)	260.85 (20.3)	353.09 (29.9)	691.05 (23.9)
2 - 3	103.37 (24.7)	135.42 (10.5)	107.22 (9.1)	346.01 (12.0)
3 - 5	152.71 (36.5)	467.20 (36.3)	389.98 (33.0)	1009.89 (35.0)
5 - 7	52.57 (12.6)	222.51 (17.3)	195.75 (16.6)	470.83 (16.3)
7 - 10	21.70 (5.2)	116.52 (9.1)	92.63 (7.8)	230.85 (8.0)
> 10	7.87 (1.9)	71.27 (5.5)	30.47 (2.6)	109.61 (3.8)
Mixed	2.55 (0.6)	12.81 (1.0)	13.46 (1.1)	28.82 (1.0)
Total	417.88 (100.0)	1286.58 (100.0)	1182.60 (100.0)	2887.06 (100.0)

Source: Land Use Survey, Table 8 and Appendix tables 4 and 5

5.3 GROSS MARGIN ANALYSES

5.3.1 Crops

Gross margin analyses are prepared to compare the relative advantages of one crop versus other crops on the basis of the monetary values of inputs and outputs. In fact the gross margin measures the contribution of an enterprise towards the fixed costs. In Salalah the labour costs are relatively fixed per farm, because a farm employs one, two or more labourers for the whole year, depending on the size of the farm, and as mentioned above, sometimes labour is alternatively used when other businesses would require additional labour. Further the investment costs in structures, buildings and equipment are fixed. Only the material inputs and the tractor costs as well as the pumping costs are variable. Especially the last category of inputs is highly

correlated with the potential of a certain crop in one particular area. Since soil and water quality are varying over relative short distances, average gross margin figures might be misleading. Another factor that greatly affects the gross margin is the incidence of pests and diseases. These often vary per year, thus affecting the long term average gross margins. Average gross margins, calculated over a number of years better reflect, the risks involved in cultivating certain crops. Finally, the objectives of the farm households also determine the combination of enterprises. In Salalah all these factors play an important role. Since thirty percent of the cultivated area is planted with short and tall grasses livestock is a determining factor in the whole farming system of Salalah. It is however difficult to determine whether the wish to keep livestock (or its profitability) is the driving force or that the agro-technical potential of soils and water are the decisive factors to cultivate grasses at such a large extent.

Before analyzing the survey gross margins of a number of important crops, it is useful to get an idea of what the farmers themselves, rightly or wrongly, perceive as to which enterprises are profitable and which result in losses.

Bananas lead the list of profitable enterprises (29 cases), with coconut second (27 cases) on the list (Table 26). Thirdly short and tall grasses are mentioned as profitable crops. It is interesting to see that except for alfalfa, no farmers listed grasses under the non-profitable enterprises (Table 27). Equally, coconut was never mentioned as a loss making activity. Only banana has been mentioned in three cases as non-profitable, versus 29 cases as profit making. Livestock, although kept by about 63 percent of the farmers was only mentioned six times as profitable and three times as non-profitable. This suggests that livestock is rated as a reasonable enterprise, but not outstanding either positively or negatively.

Table 26

PROFITABLE ACTIVITIES ACCORDING TO THE FARMERS

Average operated land (Fe) 4.35
No of farms 48

	Ranks							
	1	2	3	4	5	6	7	Total
Sweet potatoes	0.	1.	1.	0.	1.	0.	0.	3.
Legumes & beans	0.	0.	1.	1.	0.	0.	0.	2.
Pepper & chilies	1.	1.	4.	0.	0.	0.	0.	6.
Cabbages	0.	0.	0.	1.	0.	0.	0.	1.
Eggplant	0.	0.	1.	1.	1.	0.	0.	3.
Okra	0.	0.	1.	0.	0.	0.	0.	1.
Cucumbers	0.	0.	1.	1.	0.	1.	0.	3.
Squash & pumpkins	0.	0.	0.	1.	0.	0.	0.	1.
Tomatoes	1.	5.	2.	0.	0.	0.	0.	8.
Sweet melons	0.	0.	1.	0.	0.	0.	0.	1.
Radishes	1.	0.	0.	1.	0.	0.	0.	2.
Cauliflower	0.	1.	0.	0.	0.	0.	0.	1.
Alfalfa	2.	1.	0.	1.	1.	1.	0.	6.
Elephant grass	0.	1.	1.	1.	0.	1.	0.	4.
Rhodes grass	5.	1.	4.	2.	2.	0.	1.	15.
Maize for fodder	0.	1.	0.	0.	0.	0.	0.	1.
Curcubites	1.	0.	2.	0.	0.	2.	0.	5.
Coconut	10.	14.	1.	1.	1.	0.	0.	27.
Banana	19.	8.	1.	1.	0.	0.	0.	29.
Papaya	0.	3.	2.	1.	0.	0.	0.	6.
Citrus	0.	0.	2.	0.	0.	0.	0.	2.
Mixed vegetables	3.	3.	3.	0.	1.	0.	0.	10.
Fodder unspecified	0.	1.	0.	0.	0.	0.	0.	1.
Livestock in general	4.	1.	1.	0.	0.	0.	0.	6.
Total	47.	42.	29.	13.	7.	5.	1.	144.

Table 27

NON-PROFITABLE ACTIVITIES ACCORDING TO THE FARMERS

Farm size class: All farms

Average operated land 4.35
No of farms 48.00

	Ranks				
	1	2	3	4	Total
Sweet potatoes	2.	0.	0.	0.	2.
Pepper & chilies	2.	3.	0.	0.	5.
Cabbages	0.	1.	0.	0.	1.
Eggplant	0.	1.	0.	0.	1.
Gourds	1.	1.	0.	0.	2.
Okra	1.	0.	0.	0.	1.
Cucumbers	0.	0.	1.	1.	2.
Squash & pumpkins	0.	1.	0.	0.	1.
Tomatoes	5.	4.	1.	0.	10.
Sweet melons	2.	2.	3.	0.	7.
Alfalfa	1.	0.	0.	0.	1.
Banana	2.	1.	0.	0.	3.
Citrus	2.	0.	1.	0.	3.
Pomegranates	1.	0.	0.	0.	1.
Mixed vegetables	11.	0.	1.	0.	12.
Livestock in general	1.	2.	0.	0.	3.
Total	31.	16.	7.	1.	55.

The most interesting answers are related to the cultivation of vegetables. Tomatoes, the most important single vegetable, was listed eight times as profitable and ten times as non-profitable. Similarly, peppers and chilies were listed six times as profitable and five times against. Mixed vegetables scored ten times on the profitable list and 12 times as non profitable. This is a clear sign of the high risks involved in the cultivation of vegetables. More importantly however, knowing that quite a number of vegetables are grown by sharecroppers and contractors, it is likely that the management practices of vegetables are to a certain extent decisive for their profitability. Sharecroppers and contractors would stop growing vegetables unless they can make a profit. To obtain a profit all efforts are made to safeguard the production by using excessive amounts of pesticides, which due to the subsidies are relatively cheap. Nevertheless, despite the use of pesticides, the possibilities of crop failure still remain.

Cropwise gross margins per feddan for sample farms in Salalah are presented in Table 28. The production value of bananas, coconut and vegetables is calculated by multiplying the total quantity of production with the farm gate price. The prices of bananas (Government price) and vegetables (market price) are the real market prices minus the costs of marketing, when the produce is collected at the farm gate by middlemen. The price of coconut is the price which private contractors offer to the farmer for the coconuts on the tree. The contractor brings his own specialized labour and transport. He then selects trees and offers a price for the whole tree. Bananas and vegetables are harvested by the farmer's permanent labourers and marketed mostly by the farmer.

The variable costs consist of planting materials, farm yard manure, compost, sahib soil, chemical fertilizers, plant protection chemicals and tractor hire costs. Because of the existence of a market for manure, actual and imputed prices have been used in the gross margin analysis. The imputed price was applied when the farm yard manure was produced on the farm. Labour costs are excluded because they are in fact fixed costs for the farm as a whole. However, based on the group interviews and data collected during the survey, monthly labour profiles have been prepared to estimate the labour costs per crop. Water requirements have been separately estimated to calculate the cost of water per crop and to calculate the cost of pumping. It is difficult to allocate the real pumping costs to the different crops, because some crops are definitely over-irrigated. This complicates the analysis because the return to water and some other efficiency indicators should be used to optimize the land use.

Table 28

CROPWISE GROSS MARGIN PER FEDDAN FOR SALALAH SAMPLE FARMS

	Expenditure on Crops and value of output in OR							
Item	Banana	Coconut *	Rhodes Grass	Alfalfa	Elephant Grass	Tomato Kherif	Pepper and Chillies Kherif	Mixed Vegetables in Kherif
Total Production Value (OR)	1023.73	471.38	651.31	777.19	1111.09	651.07	421.71	427.30
Material costs								
Planting materials	13.74		50.77	190.14		4.27	2.20	3.73
Compost			1.40	5.63		2.71		0.53
Farm yard manure	94.21	6.26	33.31	23.18	44.19	28.12	42.10	10.95
Urea		3.48	26.82	149.58	31.40	1.39	1.03	3.04
Ammonium Sulphate		0.48						
Potassium Sulphate		0.48						
Super Phospate		0.48						
NPK compound		5.32	0.91	1.97	11.76	18.75	21.99	7.71
Other chemic fert	2.13		15.33	5.07	9.97	1.63	2.58	0.94
Plant protection	3.36	1.67	2.27	8.59	20.29	27.03	28.99	11.92
Sahib soil (jebel)	111.94	4.84	12.57	28.17	27.90	21.89	4.81	11.29
Total Material Costs	225.37	23.02	143.38	412.34	145.52	105.78	103.70	50.11
Other costs								
Tractor hire	6.40		4.86	5.35	4.04	9.27	5.84	8.47
Casual hired lab.						0.18	3.44	
Transportation	5.41		0.06		5.09	7.22		
Total Other Costs	11.80		4.92	5.35	9.13	16.68	9.28	8.47
Total Variable Costs 1/	237.17	23.02	148.3	417.69	154.65	122.46	112.98	58.59
Gross Margin	786.56	448.37	503.02	359.50	956.44	528.61	308.73	368.71

* Per 100 Trees

Note: 1/ Labour and pumping costs are excluded.

Most grasses are produced for on-farm use and the production is therefore valued at imputed prices. Since there is an active market in hay in Oman, imputed prices are based on the market prices. Salalah including the jebel is a deficit area and hay is transported from the Batinah to Salalah over more than a thousand kilometres. However, the deficit in the Salalah plain alone is not very large. Despite cutting and weighing, the yields of grasses, and especially those of the tall grasses, seem to be overestimated, thus increasing the gross margins. This overestimation also affects the gross margins of the livestock enterprises. In the livestock analysis the cost of on-farm produced feeds are also valued at market prices. The livestock gross margins are therefore underestimated.

The crop labour requirements are based on the total production, the cultural practices, and the amounts of inputs used, as observed during the survey and is reported in Table 29.

The total labour requirements per farm size class for the category other crops and the category unidentified intercrops are based on the average labour requirements per feddan of the specified crops in each farm size class. The monthly labour requirements for the most important crops are presented in Appendix 2, Tables A2.13 - A2.17. The total labour requirements per farm size class are presented in Appendix 2, Tables A2.18 - A2.21.

Due to the use of permanent labourers, the cost of labour per day varies with the farm size class. In the smallest farm size class (0 - 3 feddan) 17 farmers employ 23 labourers and none of them use any sharecropper or contractor. To carry out all farm activities about 1335 hours are required per year or about 990 hours per labourer on average. For calculation purposes it is more appropriate to assume that the majority of the farmers have only one labourer and that only five farms employ two labourers. The peak labour requirement occurs in June and amounts to 134 hours. One labourer can easily carry out all activities during the peak period. As mentioned before farmers with two labourers are using them also for other (non-farm) activities. The cost per hour amounts therefore to about 0.690 OR in the farm size class 0 - 3 feddan.

TABLE 29

CROPWISE, OPERATIONWISE PER FEDDAN TOTAL HUMAN LABOUR

(human labour hours)

	CROPS				
Agricultural Operations	Banana	Rhodes Grass	Coconut	Elephant Grass	Tomatoes
Adding Sahib soil	30				
Nursery operations					28
Plot preparation					24
Furrow preparation					16
Transplanting					35
Manuring	60				
Irrigation	185	60	96	72	125
Fertilizing		12	24	12	4
Weeding/basin repair	198				
Basin maintenance		60			
Plant protection					30
Harvesting	72	465		78	75
Sub total	545	597	120	162	337
Miscellaneous 10%	54.50	59.70	12.00	16.80	33.70
Grand Total	599.50	656.70	132.00	178.80	370.70

The farmers (22) in the farm size class 3 - 6 feddan employ 39 labourers of which 29 are permanent labourers, while six are employed as sharecroppers and four as contractors. In total about 2350 hours are required to carry out all farm activities. Assuming that most of the vegetables are cultivated by sharecroppers and contractors than 2085 hours of other farm work has to be done by an average of 1.3 labourers. The peak labour requirement occurs in June and amounts to 247 hours. Excluding the labour required by vegetables reduces the peak labour requirement to about 200 hours in June. One labourer will just be able to take care of all the work in the peak season. It is obvious that those farmers who wish to cultivate more vegetables, either employ a second permanent labourer or use sharecroppers or contractors. Since vegetables are mainly grown during a short period of the year the use of sharecroppers and contractors is more cost effective than the employment of an additional permanent labourer who cannot be fully used during the rest of the year. Those farmers in this farm size class who employ two permanent labourers will have very likely more livestock, thus increasing the work load during the whole year. The labour cost per hour is estimated at about 0.500 OR in the farm size class 3 - 6 feddan.

The six farmers in the farm size class 6 to 7 feddan employ only five permanent labourers and employ one sharecropper and seven contractors. One farmer had contracted the whole farm out, while the other farmers make extensive use of contractors to cultivate vegetables. The peak labour requirement amounts to almost 400 hours in June and it is obvious that one permanent labourer cannot carry out the necessary operations on his own. Removing the vegetables and some of the intercrops and by shifting some operations to the next or previous month will reduce the labour peak to about 250 hours in June. One labourer may just be able to carry out the remaining operations during June. In total about 3470 hours of work are required to carry out all farm activities. However, the use of sharecroppers and contractors may reduce the work load for one permanent labourer to about 2300 hours per year, resulting in a cost of about 0.400 OR per hour.

Although only three farms in the sample had more than seven feddan of operated land, it is clear that in this farm size class a different approach is followed regarding the employment of permanent labourers and sharecroppers. None of the farmers employed either sharecroppers or contractors. The peak labour requirement in June amounts to 608 hours. With three to four labourers the work load per labourer amounts to about 1500 hours per man per year. This results in a cost of about 0.700 OR per hour. However, it is likely that this labour is also used to carry out other (non-farm) activities.

For calculation purposes 0.500 OR has been chosen as the average cost of labour per hour, or four OR per day. In Appendix 6 this cost has been included in the cost of production figures.

Table 30

SUMMARY GROSS MARGINS OF MAJOR CROPS
PER LABOUR DAY

Enterprise	Gross margin per feddan	Labour days	Labour cost	Gross margin (labour included)
Bananas	786.56	75	300.00	486.56
Coconut	448.37	17	68.00	380.37
Short grasses	503.02	82	328.00	175.00
Tall grasses 3/	956.44	22	88.00	868.44
	Khareef season			
Tomatoes	528.61	46	184.00	344.61
Mixed vegetables	368.71	45	180.00	188.71

Notes: 1/ Labour estimates based on group interviews.
2/ Labour day based on eight hours/day
3/ Yield is overestimated.

When bananas, coconut, tomatoes and mixed vegetables are compared, bananas have the highest gross margin, while coconut and tomatoes have similar, lower gross margins. However, due to the high incidence of a great variety of pests and diseases in vegetables, coconut has a more stable gross margin. When pests and diseases in vegetables can be controlled, the gross margin of vegetables will certainly be higher. Another important difference between coconut and vegetables is that coconuts hardly require any inputs except irrigation water, while the production over the years is also quite stable. The gross margin analyses confirm the farmer's opinion regarding the profitability of the crops grown.

Considerable differences in the use of material inputs are observed between the major crops. In bananas 85 percent of the costs are spent on farm yard manure and sahib soil from the jebel. The inclusion of the costs of adding sahib soil is somewhat exaggerated, since the farmers do not add sahib soil every year. Chemical fertilizers are hardly used, while also the amount spent on plant protection is very small. The land cover map confirms that bananas are grown mostly, in the best area when soil and water characteristics are taken into account. In the centre of the plain the soil characteristics have been changed by adding soil and manure over a long period of time.

Coconuts require little attention and very few inputs are used. Less than two bags of fertilizers (average) are used per year, most plant protection is carried out free of charge by the extension service. Harvesting is done by contractors while only irrigating and the application of fertilizers are carried out by the permanent labourers. In fact, many do not apply any fertilizers at all.

Rhodes grass, buffalo grass and elephant grass are fertilized with manure during establishment, and chemical fertilizers are applied after each cut (between 500 and 600 kg per feddan per year). Rhodes and buffalo grass are cut about eight to nine times per year, while elephant grass is only cut about three times per year (harvesting the same spot). But in practice every day small areas are cut and directly fed to the livestock. Only a few farmers use choppers to cut the (short) grasses and bale them. Ensilage is not practised at all. Replanting is done only after several years. Often the grass is cut too late. This results in a lower digestibility and reduces the nutritional value. Farmers who sell Rhodes grass as hay often do not dry the grass properly.

Many different types of vegetables are grown in the Salalah Plain. Tomatoes are the most important. Other vegetables that are grown are peppers/chilies, egg plant, cucumbers, okra, cauliflower, cabbage, sweet melon, and a variety of gourds. Apparently tomatoes, are less affected by uncontrollable pests and diseases. However, also tomatoes suffer from pests and diseases resulting in relative low yields. The climatic conditions in Salalah during the khareef season are ideal for the development of all kinds of pests and diseases. Farmers spray at least once a week and sometimes up to three times per week. There are clear indications that often the wrong types of pesticides are applied. The sharecroppers and contractors especially spray heavily and it seems that most sprays are applied as preventive sprays. Despite the spraying, many crops are badly affected. Quality control of pesticides is lacking and in many cases chemicals are mixed in the wrong dosages. Fertilizer and manure are applied in relatively low quantities ranging from 100 to 150 kg per feddan. Field observations indicate, that the soils lack in many cases essential micro-nutrients which in turn affects the vigour of the plants and makes them even more susceptible to pests and diseases. Other alternative control methods such as cultural practices, the use of certified seeds, resistant varieties and biological control measures are not used. Weed control is mostly done by hand. Due to the lack of quarantine measures and the transport of sahib soil from the jebel, pests and diseases, as well as new weeds freely enter the Salalah Plain, thus increasing the problems. Further details on pests and diseases are elaborated upon in other project publications.

No pumping costs are included in the tables above. During the survey the number of hours of pumping per day was recorded. The capacity of the pumps was measured by irrigation specialists. The

total amount of water pumped is derived from this information. It is obvious that the multiplication of the daily hours with 365 days leads to an overestimation of the total amount of water pumped. All actual costs related to pumping were recorded as well. The net water requirements below are taken from a separate project publication. The gross water requirements are based on the cropping pattern of the full land cover by farm size class applying an efficiency of 60 percent. It is however known that many crops are overirrigated.

Table 31

WATER REQUIREMENTS IN M3 PER CROP PER YEAR
PER FEDDAN

	Net	Gross
Banana	6445	10740
Short grasses	6445	10740
Tall grasses	6678	11128
Coconut	4122	6869
Vegetables	2300	3833
Others	6000	10000
Unknown intercrops	4000	6666

Table 32

GROSS WATER CONSUMPTION PER YEAR
IN M3 BY FARM SIZE CLASS

Farm size classes	0 - 3	3 - 6	6 - 7	>> 7
Banana	4833	10633	17077	27172
Short grasses	3007	8699	10096	25883
Tall grasses	890	3450	4562	6120
Coconut	1511	3228	7075	8174
Vegetables	498	1572	3296	5136
Others (mono crops)	900	1700	10200	10400
Unknown Intercrops	1067	2133	2533	1200
Total	12706	31415	54839	84085

Note: Based on cropping pattern of full land cover.

Table 33
AVERAGE PER FEDDAN PER YEAR QUANTITY AND COST OF PUMPING BY SIZE OF CLASS FARMS IN SALALAH

	Size of Farms				
Items	0-3	3-6	6-7	Above 7	All farms
Number of Pumps	24	33	9	6	72
Capacity in m3 per hour	28.0732	17.4231	12.0345	12.4427	17.5345
Quantity of water Pumped					
a) Hours of pumping/day	1.6740	1.2801	1.3153	1.0027	1.3139
b) Water Pumped m3/year	27055.3300	24075.7900	26971.2400	24714.0900	25256.8900
c) Water mm/day	17.3451	15.4349	17.2912	15.8441	16.1921
Average Costs					
Energy cost per year	58.4354	67.4656	58.8033	30.7319	58.4529
Energy cost per m3	0.0022	0.0028	0.0022	0.0012	0.0023
Other variable cost/year	6.1197	11.8205	9.7437	1.8343	8.8409
Other variable cost/m3	0.0002	0.0005	0.0004	0.0001	0.0004
Total fixed cost/year	15.0989	13.9939	5.2017		10.3383
Total pumping costs	79.6540	93.2800	73.7488	32.5662	77.6321
Total cost per m3	0.0029	0.0039	0.0027	0.0013	0.0031

Though gross margin analysis supports that banana is the most profitable crop, followed by coconut and tomatoes, other studies in the project show that the cropping pattern is mainly determined by the quality of water for irrigation. Therefore, any recommendation on cropping patterns has to be integrated with the findings on water quality.

The present practice of growing various kinds of vegetables on all types of farms can be strengthened by government intervention in marketing. The profitability of these crops can be increased manyfold by proper price support policy of PAMAP.

5.3.2 Livestock

In contrast with bananas, coconut and vegetables, which are all mostly produced for the market, livestock and the cultivation of grasses are less market oriented and the gross margins have to be analyzed in conjunction with the cash and kind flows.

The production of dairy (crossbred) and mixed cattle consists

of milk, sour milk, ghee and manure. The turnover (sales minus purchases) and the closing value minus the opening value of all animals, have been added to arrive at the gross value of production. In the gross margin analysis all production is valued at market prices, whether it is sold or consumed. The variable costs consist of all purchased green and dry fodders, and other feeds such as on-farm produced fodders, flour, concentrates, fish meal, and mineral salts. Labour costs are not included in the tables. All on-farm produced fodders are valued at market prices. Veterinary services are provided free of charge by the Government. The costs of raising livestock, mainly consists of feeding costs and contain therefore a hidden subsidy (fertilizers, pesticides etc. used in the production of fodders).

Dairy cattle shows a positive gross margin while mixed cattle and sheep & goats show negative gross margins (see Table 34). Crossbred dairy cattle produce about eight litres of milk per day while mixed cattle produce only three to four litres per day. Detailed gross margin tables are presented in Appendix 2, Tables A2.49 A2.52. Even when the labour costs would be added the dairy enterprise would give a positive result. If on-farm produced Rhodes grass would be included in the gross margin at the cost of production (and not at market prices), the gross margin of dairy cattle would further increase. Mixed cattle and sheep and goats would not show a positive gross margin when Rhodes grass would be included at production costs.

Table 34

SUMMARY GROSS MARGINS OF LIVESTOCK ACTIVITIES

Enterprise	Production Value	Variable Costs	Gross margin
Dairy cattle	4003.25	2309.14	1694.14
Mixed cattle	1846.88	1158.59	-550.85
Sheep & goats	105.34	1136.42	-1031.09
Chicken	367.01	179.56	187.45

Notes: 1/ Labour costs are excluded.

The cash plus kind inflow of the dairy enterprise amounts to about 7000 OR, of which 52 percent (3649 OR) consists of milk and milk products and 43 percent (3064 OR) of animal sales and animals slaughtered. The total cash plus kind outflow amounts to 3166 OR of which 30 percent (951 OR) is spent on feeding. About 56 percent is spent on the purchase of animals, while about 428 OR is lost due to mortality. The difference between the total cash plus kind inflow

and outflow amounts to a positive balance of 3834 OR. About 86 percent (3281 OR) of the net positive balance, is received in kind.

Of the total milk production 88 percent is used on the farm by the family or is fed to calves. The total cash inflow amounts to 3292 OR of which 87 percent is due to the sale of animals. However, the overall cash balance amounts to only 553 OR and the overall kind balance amounts to 3281 OR.

The marketing of milk seems to be a serious constraint since no milk collection system exists. Should all milk be marketed, the dairy enterprise could significantly add to the cash income of the farm.

Mixed cattle shows a marginal positive cash balance of only 48 OR. The total cash plus kind balance amounts to 1090 OR. The overall kind balance amounts to 1042 OR.

The sheep and goats enterprise shows a negative cash balance of about 479 OR. The total cash plus kind balance amounts 71 OR only, while the kind balance is about 550 OR.

It is concluded that the dairy enterprise in Salalah is profitable at the present high price of milk, and that if more milk could be marketed a significant additional income could be earned. Mixed cattle is not profitable but does not result in a negative cash flow. Sheep and goats are not profitable and are mainly kept for home consumption. There seems to be a preference for meat of Omani sheep and goats, however, despite the price premium, this enterprise is not profitable and cannot compete with cheap imported mutton.

Table 35

CASH AND KIND INFLOWS AND OUTFLOWS
LIVESTOCK

Operated land	4.35		
No of farms	48.00		
	Cash	Kind	Total
Inflows			
Milk	133.83	1532.21	1666.05
Sour milk	.00	137.25	137.25
Ghee	41.42	1.75	43.17
Animal sales	1431.04	.00	1431.04
Animals slaughtered	.00	316.00	316.00
Manure disposal	6.75	178.82	185.57
Other sales (eggs)	34.74	48.06	82.79
Total Inflow	1647.78	2214.09	3861.87
Outflows			
Dry fodder	289.92	.00	289.92
Green fodder	33.04	.00	33.04
Concentrates	466.70	.00	466.70
Fish meal (sardines)	37.40	.00	37.40
Other expenses (inputs)	65.10	.00	65.10
Animals acquired	825.49	10.94	836.43
Animals died	.00	285.48	285.48
Total Outflow	1717.64	296.42	2014.06
Balance	-69.87	1917.67	1847.81

Note: On-farm produced fodder is not included under kind outflows.

Table 36

CASH AND KIND INFLOWS AND OUTFLOWS
DAIRY CATTLE

Operated land	4.22
No of farms	20.00

	Cash	Kind	Total
Inflows			
Milk	321.20	2894.39	3215.59
Sour milk	.00	329.40	329.40
Ghee	99.40	4.20	103.60
Animal sales	2856.00	.00	2856.00
Animals slaughtered	.00	207.50	207.50
Manure disposal	15.00	273.16	288.16
Total Inflow	3291.60	3708.65	7000.25
Outflows			
Dry fodder	287.27	.00	287.27
Green fodder	32.13	.00	32.13
Concentrates	531.90	.00	531.90
Fish meal (sardines)	86.16	.00	86.16
Other expenses (inputs)	13.60	.00	13.60
Animals acquired	1787.50	.00	1787.50
Animals died	.00	427.50	427.50
Total Outflow	2738.56	427.50	3166.06
Balance	553.04	3281.15	3834.19

Note: On-farm produced fodder is not included under kind outflows.

Table 37

CASH AND KIND INFLOWS AND OUTFLOWS
MIXED CATTLE

Operated land	3.70
No of farms	8.00

	Cash	Kind	Total
Inflows			
Milk	.00	700.34	700.34
Animal sales	468.75	.00	468.75
Animals slaughtered	.00	337.50	337.50
Manure disposal	.00	154.90	154.90
Total Inflow	468.75	1192.74	1661.49
Outflows			
Green fodder	82.27	.00	82.27
Concentrates	237.67	.00	237.67
Fish meal (sardines)	4.50	.00	4.50
Other expenses (inputs)	23.60	.00	23.60
Animals acquired	72.50	.00	72.50
Animals died	.00	150.00	150.00
Total Outflow	420.55	150.00	570.55
Balance	48.20	1042.74	1090.94

Note: On-farm produced fodder is not included under kind outflows.

Table 38

CASH AND KIND INFLOWS AND OUTFLOWS
SHEEP & GOATS

Operated land	4.61		
No of farms	24.00		
	Cash	Kind	Total
Inflows			
Milk	.00	323.18	323.18
Animal sales	305.00	.00	305.00
Animals slaughtered	.00	342.71	342.71
Manure disposal	1.00	65.20	66.20
Total Inflow	306.00	731.09	1037.09
Outflows			
Dry fodder	290.94	.00	290.94
Green fodder	11.88	.00	11.88
Concentrates	286.84	.00	286.84
Fish meal (sardines)	1.50	.00	1.50
Other expenses (inputs)	58.30	.00	58.30
Animals acquired	135.42	21.88	157.29
Animals died	.00	159.38	159.38
Total Outflow	784.87	181.25	966.12
Balance	-478.87	549.84	70.97

Note: On-farm produced fodder is not included under kind outflows.

5.4 CASH FLOW ANALYSIS

The cash flow tables contain the sources of all cash inflows and only the destination of cash outflows related to farming, therefore excluding household expenditures. The total cash balance is the disposable income of the households. Detailed monthly whole farm cash flow tables are presented in Appendix 2, Tables A2.53 - A2.57.

As much as possible, all inflows and outflows are presented on a monthly basis. However, in some cases it was not possible to allocate expenditures to a particular month. These amounts are included in the total.

No negative net cash flows occur in any farm size class, in any month. Consequently, it is sufficient to analyze the total annual cash flows. The table below summarizes the results.

Table 39
WHOLE FARM CASH FLOW ANALYSIS

Farm size classes	0 - 3	3 - 6	6 - 7	>> 7
Cash inflows				
Off-farm income	8415	11287	8413	10240
Rent received	0	136	160	0
Crops	1552	2218	4958	3674
Livestock	438	2850	542	1900
Total cash inflow	10405	16491	14073	15814
Cash outflows				
Expenses crops	476	770	696	504
Expenses livestock	839	2772	460	1451
Permanent labour	1018	1100	680	3280
Machinery costs	289	393	789	434
Rent paid	43	215	1004	400
Total cash outflow	2666	5251	3629	6070
Total cash balance	7738	11240	10444	9744

The cash inflows stemming from vegetables are correct but do not all accrue to the owner of the land, since a part of it has to be paid to the sharecropper, when applicable. Similarly, not all expenses on vegetables are paid by the owner, when a sharecropper is employed.

The off-farm income in practically all farm size classes, is almost equal to the total net cash balance. This means that the cash earned from farming is small.

Some years the farmers will earn cash from farming, while in other years they may have to transfer money from their off-farm income to sustain the farm operations. As has been discussed, in the previous section dairy cattle could add quite some cash income if milk could be marketed on a larger and a systematic scale.

It is very likely, that the recorded off-farm income is underestimated. The wealth indicators as presented in Chapter four show that households are in general, very wealthy.

The cash income from livestock fluctuates among the farm size classes, because the major source of cash comes from the sale of animals. The sale of dairy and mixed cattle is not an aim in itself and therefore, sales vary considerably.

The cash expenses on crops do not show a consistent pattern

which indicates the high variability in the use of inputs.

The relatively low expenses on permanent labour in the farm size class 6 to 7 feddan, is explained by the employment of permanent labourers who are not paid in cash but who have to earn their income from vegetables. This coincides with the relatively high income from crops in this farm size class. This proves that the use of sharecroppers and contractors is beneficial, both to the labourer and to the farm owner.

Considering that the owners also have income in kind from the farm, and that most of them still consider themselves as farmers, it is important to improve farming systems sustainable.

Chapter 6

AGRICULTURAL SERVICES AND MARKETING

6.1 EXTENSION

In the Ministry of Agriculture and Fisheries, the Director of Agricultural Affairs and the Director General of Agriculture are responsible for the extension services. In the whole country there are nine regional offices and 45 extension centres. Five extension centres are located in the Governorate of Dhofar. The regional office is headed by one supervisor, under his direction six extension officers render services to the farmers. In the whole country there only ten subject matter specialists. Of these, none are stationed in Salalah. Plant protection activities are carried out by one engineer who is aided by two plant protection assistants. In total, there are 12 teams in Dhofar for the spraying of insecticides and one statistician assisted by four enumerators. Fifty percent of the extension officers in Dhofar are expatriates.

With only 796 smallholders in the Salalah Plain the extension officer/farmer ratio is relatively high when compared with other parts of the country.

Farmers are visited regularly by the extension officers. In theory, about five to seven farmers can be visited in a day. Farmers also visit the extension centre themselves, for advice. Due to the location of the centre, a researcher can easily be consulted by an extension officer whenever necessary. Group meetings are also organized in which audio-visual techniques are increasingly used.

On-farm demonstrations are carried out by the extension service.

The extension service plays an important role in assisting new farmers in establishing their five to ten feddan new farms. In 1987 the Government launched a program to establish 2,500 new farms in the country.

The extension officers are in charge of the distribution of seeds, fertilizers and pesticides, while they also carry out spraying programs after field inspection. The farmer does not pay for the labour costs, while the pesticides are provided at 50 percent of the real cost.

In most cases, the farm is visited after the farmer has made a request for the supply of inputs. After substantiation, the farmer receives a voucher and can collect the approved inputs at reduced rates from certain companies.

All farm mechanization activities are performed by the tractor fleet of the extension centres at a subsidised rate of OR 1 per hour. At peak periods, the rate is unofficially raised to OR 2 per hour to cover payment of overtime to the drivers. The standard rates for mechanization as obtained from extension centres are shown in Table 22. Real costs are in the order of 6 to 7 OR per feddan.

Table 40

STANDARD RATE (HOURS/FEDDANS)
FOR MECHANISED OPERATIONS BY
MAJOR CROP TYPES

Operation	Vegetables	Fodder	Banana	Other fruits
Ploughing - chissed	3	3	3	3
Harrowing	2	2	2	2
Levelling	3	3	4	
Ridging - Furrowing	2	-		1
Light Ploughing	-	2	2	
Plate Levelling	-	-	4	3
Drilling Holes for new Plants				2

The following constraints hamper the efficient functioning of the extension service. Firstly, different types of services are rendered by the same person in various fields, whether it be vegetables, perennial crops or livestock. Secondly, despite the relatively good links between the extension service and the research stations, research results are seldom translated into practical guidelines for the extension officers. Often the results are only presented in typical research format, while little attention is paid to the whole socio-economic environment of the target group. There are too many research exercises and these focus on maximum rather than optimal results, leaving the

extension service with unsolved problems. Thirdly, the large number of expatriates prevents the transfer of knowledge to Omani counterparts, since this is not in the long term interest of the expatriate. This phenomenon is not only limited to the extension service, but can be observed in many other areas in Oman.

6.2 MARKETING

Apart from consultant reports on activities of the Public Authority for Marketing Agricultural Produce (PAMAP) and an earlier study by The Netherlands Economic Institute (1981), detailed studies on agricultural marketing in Oman are lacking. The analysis of agricultural marketing is further obscured by absence of regular information on supplies and by the non-existence of systematic registration of market prices. Despite these limitations, an attempt is made to present some basic indicators on the present marketing situation. This is based on available secondary data and on information collected by the study team, through field investigations at farm, wholesale and retail level, and through discussions with other dealers. Additional information has also been gathered from meetings with PAMAP personnel and with officials in related government agencies.

Firstly, an overview of the total agricultural production in Oman is presented. Secondly, the present agricultural marketing system in Oman is broadly reviewed. Thirdly, the marketing of agricultural produce in the Salalah is discussed.

Supporting tables are presented in Appendix 5.

6.2.1 Agricultural production in Oman

An overview of the agricultural production in Oman and its trend over the period 1985-89, shows an increase in the total agricultural production. This has largely been the consequence of an expansion of the cultivated area, resulting from free land distribution and an extensive input subsidy scheme. The area under cultivation increased by 17% from nearly 48,000 ha to about 56,000 ha and total production increased by 65% from 510,000 tons to 840,000 tons during the same period. The planted area under vegetables increased substantially (34%), while the production more than doubled (123%). The cultivated area under fruit trees increased 11% while production increased by 17% over the same period (1985-89).

Table 41

DISTRIBUTION OF THE CULTIVATED AREA AND PRODUCTION
IN PERCENTAGES IN OMAN (1989)
BETWEEN REGIONS

District	Area under				Total Area	Total Prod.
	Fruits Crops %	Field Crops %	Vegetables %	Other Crops %	%	%
North Batinah	28	16	22.5	37	27	22.5
South Batinah	35	19.5	28	26	30	24
Sharqiya	15	22	16.4	11	16	18.6
Wousta	3	5	5	5	4	4.4
Dakahlia	8	19	13	7.5	10	14
Dahira	9	15	12.6	8	10	12
Dhofar	2	3.5	2.5	5.5	3	4.5
Total	100	100	100	100	100	100
Percent of total area	60	16	11	13	100	100

The figures in Table 41 above clearly demonstrate the importance of fruit production in Oman (60 % of the total area). Almost three out of every four hectares are cultivated with dates, mangoes occupy 12%, followed by lime 11%, banana 5% and coconut 1%. The area under field crops is dominated by fodders, namely alfalfa, rhodes grass and elephant/napier grass. Among vegetables, melons occupy one third of the area, tomato 20%, cabbage 13% and cucumber, chili and onions each occupy 10% of the total area planted with vegetables.

The Governorate of Dhofar cultivates only about three percent of the total farmed area in Oman, fruit trees occupy about 44 percent, field crops 20 percent, vegetables ten percent and other crops about 26 percent. Dhofar produces only two percent of the national production of fruits, three and a half percent of the field crops, two and a half percent of all vegetables and five and a half percent of other crops.

Salalah produces about 7.5 percent of the total vegetable production of Oman, on ten percent of the total area planted with vegetables. The South Batinah produces 20 percent, on only ten percent of the total area planted with vegetables. Although the composition of vegetables is not presented, it can safely be concluded that there are significant differences in productivity between Dhofar and the South Batinah.

6.2.2 Marketing channels in Oman

Consumption and market flow of fruits and vegetables and their trend over the period 1985-89 are estimated and presented in Table 42. The total market activity in dealing with fruits and vegetables is constantly on the increase. It reached about 272 thousand tons in 1989 (an increase of about 20% compared to

1985). Domestic production accounts for about 70% only (on-farm retention estimated at about 30% of domestic production). The deficit (i.e. 30%) is met by imports. This underscores the potential market for increased domestic production. These prospects are however, somewhat mitigated by seasonal constraints in the local markets and by little availability of information on current marketing conditions. Consequently, several crops are excessively produced in a short periods. This results in a fall in the selling prices (low commercial rate) and hence diminishes the incentive for farmers to improve the quality of their crops or to introduce new crops and advanced production techniques. Imports are often of higher quality than local production, while prices are often even lower. [1]

Table 42

CONSUMPTION AND MARKET FLOWS OF FRUITS AND VEGETABLES (1985 - 1989)

Unit: (1000 tons)

Year / Particular	1985	1986	1987	1988	1989
Domestic production	216.40	228.10	246.05	266.66	273.95
Marketable	151.48	159.67	172.24	186.66	191.77
Less exports	10.70	12.01	10.01	12.97	15.10
Marketable domestically	140.78	147.66	162.23	173.69	176.67
Plus imports	86.90	84.80	65.30	93.20	95.20
Total marketed	227.68	232.46	227.53	266.89	271.87
Plus retention	43.28	45.62	49.21	53.33	54.79
Total consumption	270.96	278.08	276.74	320.22	326.66
Self sufficiency %	80.00	82.00	89.00	83.00	84.00

Notes: Marketable = Domestic Production minus 20% on-farm retention minus 10% waste.

6.2.3 Traditional marketing channels

The major market flow of fruits and vegetables is directed towards the capital area and big cities. The traditional channels through which produce flows include wholesalers, retailers, supermarkets, importers and other intermediate dealers. All channels combine the marketing of domestic as well as imported farm produce.

Although it plays an important role for local produce, the wholesale market deals more significantly with imported products. Wholesalers buy directly or through intermediary suppliers from

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[1] Source: N. Gergely and E. Rousse (1990): Mission for the preparation of PAMAP's Five Year Development Plan. Final report. UNDP Muscat, 1990.

the farmers (mainly commercial farmers) at competitive Dubai prices and also from the Dubai market. High income Omani groups prefer to buy directly from wholesalers because of the large quantities and the low prices. Nonetheless, the main activity of wholesalers is the distribution through retailers and supermarkets in the residential areas. Wholesalers also provide PAMAP with imported fruits and vegetables.

The small producers often do not market their own perishable produce directly due to time constraints. They sell in most cases to specialized middlemen, who collect the produce at the farm. However, when they are close to the market, farmers may sell their produce (or part of it) directly at the market to retailers and consumers. Often farmers are using pick-ups individually or jointly or they use three-ton trucks. The common philosophy among small producers is the quick sale of small quantities of a great variety of products at relatively high prices to avoid full dependency on the large suppliers. Small producers use PAMAP as a last resort during glut-periods when selling becomes a problem.

Large producers sell most of their crops to wholesalers and some make contractual arrangements with PAMAP. Preference for PAMAP by commercial farms have accelerated their growth and detrimentally reduced market space for the majority of small farmers' marketable surplus. Many of the large farmers transport their crops using their own trucks and some practice cash and carry selling ex-truck at market places.

Imports are usually done by small merchants, transporting produce from Dubai market and exporting domestic produce when the market is favourable for export. Limited number of large operators with refrigerated vans are also involved in this business. The imported produce is usually sold, specially at wholesale level, in its original pack and the incidence of marketing losses is very high.

Retailers (small specialised agents or supermarkets) are well spread over the country. They purchase agricultural produce from wholesalers (especially imported products) and from local producers at local markets. Few retailers purchase directly from PAMAP distribution centres. They mostly purchase from middlemen who make their purchases at PAMAP distribution centres and in turn sell to scattered small retail shops.

Various marketing functions are performed at these channels. Transport from local farms or import market to local markets is provided by some wholesalers, import dealers and large commercial farms. Some small farmers - as mentioned earlier - also transport their own produce. Refrigerated vans, large and small trucks and pick-ups are involved in the distribution network of farm products. Storage is the main marketing problem and losses due to wastage and shrinkage, specially for imported products, are very high. Only PAMAP and a handful of private large agents have cold stores. Storage facilities at the retail level are not available. Sorting and grading of local products at farm level are not done. PAMAP performs limited sorting of local produce at

its collection centres. Retailers sort and grade local produce and some remove waste, and sort and repack imported products into smaller volumes and weights.

Prices and distribution efficiency at local markets are directly influenced by Dubai market (due to non-existence of a central market for farm products in Oman) and by the distinct seasonality of local production. A comparison of prices of 1990/91 in the markets of Barka, Seeb and Ruwi (Table 43) reveals wide variations in prices between the winter and summer seasons. Price differences between vegetables produced in the summer and those produced in the winter reached 175% for onions and 176% for Okra. The price differences for winter crops like eggplants, pepper, tomato and cucumber may exceed 150%. Vegetables which do not show great seasonal variation in prices such as potato and carrots are mainly imported. Seasonal variation in prices of fruits is very limited because fruits are either imported (oranges, grapes, apples) or are of regular local production (coconut, papaya) or their marketing is controlled by PAMAP like banana. Local seasonal fruits such as lime and dates exhibit wide seasonal variations in prices.

Table 43

SEASONAL PRICE FLUCTUATIONS OF VEGETABLES AND FRUITS
IN LOCAL MARKETS
(in OR)

	Summer Season Local Markets of				Winter Season 1/ Local Markets of			
Product	Barka	Seeb	Ruwi	Average	Barka	Seeb	Ruwi	Average
Onion	0.125	0.128	0.125	0.126	0.265	0.131	0.265	0.220
Garlic	1.233	1.100	0.850	1.028	1.000	0.700	0.783	0.828
Tomato	0.325	0.416	0.250	0.330	0.175	0.266	0.225	0.222
Eggplant	0.212	0.250	0.175	0.212	0.133	0.125	0.113	0.124
Potato	0.350	0.255	0.217	0.274	0.250	0.225	0.328	0.268
Pepper	0.500	0.450	0.500	0.483	0.250	0.350	0.333	0.311
Carrots	0.383	0.375	0.387	0.382	0.266	0.312	0.287	0.288
Okra	0.300	0.316	0.250	0.289	0.500	0.550	0.500	0.517
Cabbage	0.200	0.250	0.200	0.217	0.150	0.200	0.150	0.167
Cucumber	0.450	0.425	0.416	0.430	0.275	0.300	0.250	0.275
Squash	0.250	0.350	0.300	0.300	0.200	0.250	0.250	0.233
Lettuce	0.550	0.600	0.600	0.583	0.400	0.550	0.400	0.450
Banana	0.350	0.350	0.325	0.342	0.325	0.350	0.350	0.342
Oranges	0.400	0.400	0.383	0.394	0.300	0.350	0.425	0.350
Mango	1.167	0.633	1.100	0.967	1.500	1.233	1.300	1.344
Grapes	1.417	0.725	0.800	0.981	1.033	0.833	1.167	1.011
W/Melon	0.150	0.150	0.100	0.133	0.150	0.100	0.100	0.117
S/Melon	0.250	0.250	0.250	0.250	0.225	0.270	0.200	0.232
Lime	0.150	0.150	0.175	0.158	0.900	0.850	0.700	0.817
Apple	0.425	0.375	0.450	0.416	0.250	0.283	0.300	0.278
Poms	-	-	-	0.000	0.143	0.143	0.297	0.194
Coconut	0.275	0.250	0.275	0.267	0.275	0.250	0.275	0.267
Papaya	0.250	0.250	0.300	0.267	0.250	0.250	0.300	0.267

Source: Local Markets Survey (1991)
Note: 1/ Khareef season is winter season in Salalah.

6.2.4 Public Authority for Marketing Agricultural Produce

PAMAP was legally established by Royal decree No. 97/81 in November 1981 and commenced operation in October 1985. The decision to establish PAMAP and hence for direct intervention in the local produce marketing system has been taken in view of expanding agricultural production, seasonal marketing problems and high losses. PAMAP was seen as a means to minimize time and handling produce from harvesting point to consumer through its presence in the field. It was also mandated to be involved in the distribution of agricultural inputs, mainly fertilizers, and is therefore directly involved in the production system.

The establishment of PAMAP costed 10 millions OR and its annual expense budget reaches about 2.5 millions OR. PAMAP has an extensive network of 12 collection centres and six distribution centres and a large fleet of refrigerated vans and trucks. It also fully operates (since 1986) the banana ripening factory in Salalah, and markets the entire production of the factory, in addition to operating the dates packing factory in Rustaq.

The purchases record of PAMAP shows a clear preference for large commercial producers. Occasionally, PAMAP enters into forward contracts with large producers. Small producers often only sell their produce to PAMAP in case of oversupply or low local market prices. This phenomenon often results in excessive stocks, when PAMAP prices are slightly above the local market price. With a time-lag PAMAP has to further reduce its prices.

In addition to the handling and marketing of local produce, PAMAP also retails imported produce as a service towards its buyer clients. Losses made in the marketing of local produce is partly compensated by this more profitable activity. The higher profitability of imported produce is explained by the quick marketing at the main consumer market in and around Muscat. The marketing of imported agricultural products has increased over the last three years, as shown in Table 27. Imported vegetables, as a weighted average of the last three years, represent more than one third (41%) of PAMAP marketing activities, while imported fruits represent about 12% of the total PAMAP fruit sales during 1988-1990.

Table 44

PAMAP SALES OF LOCALLY PRODUCED AND IMPORTED VEGETABLES AND FRUITS DURING THE PERIOD 1988-1990

Unit: 1000 Kg

Year	Vegetables			Fruits		
	Local	Import	Import % of (L+I)	Local	Import	Import % of (L+I)
1988	5924	3454	37	6462	753	10
1989	6936	4113	37	7832	875	10
1990	4287	4401	51	6726	1196	16
Average	5716	3989	41	7007	941	12

Note: L + I is Local plus imports

Direct importation of fruits and vegetables by PAMAP is not permitted as the government policies adhere to non-interference in the well established private sector activities.

Imports of fruits and vegetables are only organized by PAMAP which is authorised by the Ministry of Commerce and Industry to issue import permits for farm products which are not locally grown or periodically unavailable, as shown in Appendix 5 Table A5.1. PAMAP carries out local market surveys and, based on demand forecasts and anticipated local supply, it estimates quantities of different crops to be imported for the coming period (by issuing import licenses). Generally, PAMAP overestimates quantities to be imported. Comparison of quantities licensed and quantities actually imported (Appendix 5 Table A5.2) shows that licensed quantities are four to five times larger than actual imports.

The low quality of its forecasts results firstly in fixing too high prices for local produce, the local market price drops quicker than it anticipates, and secondly while still expecting too high prices, it releases too many import licences to induce lower consumer prices. The commercial traders (importers) are apparently better informed about the lower prices and do not use their licenses to import, the prices have dropped already too much to make a profit. Consequently, PAMAP is paying too much for their purchases and receives too low prices when they sell their produce.

Due to bad management the quality of its produce diminishes so much (wastage and shrinkage) that it receives lower prices as is shown in Table 45.

Table 45

COMPARISON OF PAMAP AND LOCAL MARKET RETAIL PRICES IN 1990

Product	Local market	PAMAP	PAMAP price as % of local market prices
Tomato	0.276	0.230	83
Eggplant	0.168	0.141	84
Pepper	0.397	0.274	69
Potato	0.271	0.174	64
Cucumber	0.353	0.278	79
Onion	0.173	0.122	71
Okra	0.403	0.340	84
Carrots	0.335	0.260	78
Garlic	0.778	0.734	94
Banana	0.342	0.223	65
Papaya	0.267	0.176	66
Mango	1.155	0.449	38
Lime	0.488	0.416	85
Coconut	0.267	0.247	93

The main import season is the summer (Appendix 5, Table A5.3) which compares quantities (imported and local) of selected products purchased by PAMAP during 1988 on monthly basis.

PAMAP's marketing capacity was based on a potential turnover of 43,000 tons annually. The actual turnover remains as low as 37% of its capacity as shown in Table 46.

Table 46

PAMAP PURCHASES OF LOCAL AND IMPORTED FRUITS AND VEGETABLES 1988-90

Unit: 1000 Kg

Year	Vegetables	Fruits	Total	As % of installed capacity
1988	8235	8258	16493	38
1989	8363	9936	18299	43
1990	7224	6086	13310	31
Average	7941	8093	16034	37

Note: Installed turnover capacity equals about 43,000 tons

Working at a capacity of only 40 percent results in a high overhead costs, which PAMAP cannot charge to the consumers in a competitive market. In the whole marketing process losses are excessive as a result of overcapacity and inappropriate stock management (high stocking rate and low turnover) and slow distribution resulting in low quality and low prices.

The gross losses for 1988, 1989 and 1990 are shown in Table 47. Gross losses are defined as the difference between the total value purchased and the total value of sold produce.

Table 47

PAMAP MARKETING LOSSES OF FRUITS AND VEGETABLES
1988, 1989 AND 1990
(PERCENTAGE)

	Product	1988	1989	1990
Vegetables	Tomato	33	16	42
	Eggplant	38	24	5
	Pepper	30	17	41
	Potato	9	9	-
	Cabbage	29	23	23
	Cucumber	22	20	41
	Onion	21	14	31
	Peas	28	24	31
	Okra	22	15	61
	Cucurbites	41	19	48
	Garlic	56	13	-
Fruits :	Banana	11	11	-
	Dates	29	10	27
	Papaya	35	46	53
	Mango	52	35	25
	Lime	53	44	72
	Guava	80	39	47
	Coconut	30	9	46
	Melons	20	21	36

Notes: 1/ Losses are calculated as follows:

$$\frac{\text{Total purchases - Total sale}}{\text{Total purchases}} \times 100$$

As a result annual losses of PAMAP are estimated at about 2.0 million OR (excluding interest and depreciation). Interest and depreciation costs are estimated at about 0.1 million OR per year.

Results achieved by PAMAP, so far, are disappointing in

terms of low trading results and an accumulated deficit. PAMAP faces an extreme imbalance between costs and trading profits as a result of over investment and an oversized organization and bad management.

6.2.5 Agricultural Marketing in Salalah

The marketing system for locally produced and imported farm products in Salalah is more or less similar as discussed in the previous section. The main differences include:

The very limited absorptive capacity of the Salalah market for local produce especially during the main "khareef" season and the small scale of operations with few wholesalers and one PAMAP store.

A high level of integration between agricultural production and marketing. Both areas have significantly been influenced by the behaviour of the dominant expatriate labour force and their desire for guaranteed and quick cash returns. On the production side, the contractual (renting out) and sharecropping arrangements with expatriate labour force (due to absentee farms) resulted in a more divided decision-making process, hence complicating the relationship between agricultural production, maintenance of natural resources and environment and may probably have damaging effect on agriculture. On the marketing side, the behaviour of the expatriate farm labour force resulted in a very competitive market (low margins and fast turnover) for farm products and may have influenced the input market as well.

The marketing of imported farm products in Salalah follows a similar pattern as described in the previous section. The discussion in this section therefore is devoted to the marketing of the major locally produced farm produce.

6.2.5.1 Fruits

Bananas

Banana marketing is controlled by PAMAP which is obliged to purchase all quantities offered to it at the fixed price of 170 Baiza per kg. The produce is transported to the factory (established in 1982) at farmers' cost. One-tenth of the weight is deducted for the stalk. The total value is then computed and immediately paid out to the farmer. Bananas are washed, treated with chemicals and packed into 10 kg. cartons to be distributed in PAMAP centres in other parts of the country. Some farmers prefer to sell at the farm gate to expatriates who load their pick-ups with banana and sell to the factory.

The performance of the factory in terms of quantities handled and losses can be seen from figures in Table 31. During the period ending 1986 (when factory changed hands from MAF to PAMAP) the level of activity declined and losses reached a weighted average of 15% per annum. Thereafter quantities handled more than doubled and losses were knocked down to a weighted average of 5.7% per annum. PAMAP has been able to improve its banana marketing. Some expatriate collectors sell bananas either ripe or raw to expatriate retailers. The quantities marketed in this manner are very limited.

The factory does not deal with the dwarf slightly bitter local variety of banana. This is sold at almost double price, either to PAMAP collection centre or to local traditional merchants.

The secured market outlets (and the relative high price) have had a profound effect on the banana production. The area under the crop considerably expanded in recent years. However, with the high water requirement of banana and the scarce fresh water resources of Salalah, the expanded production contributes to increased saline water intrusion. Banana is not a food security item and the country, therefore, pays a high price for the continuation of its banana production. The cultivation of banana and certainly its possible expansion, should be reconsidered in view of its high water requirements, the economic justification, and possible alternatives as well as in view of the farmer's and the government's objectives of farming in Salalah. The Government is now considering to move the commercial rhodes grass farms out of the Salalah Plain. This cost should partly be attributed to the expansion of the banana production.

Table 48

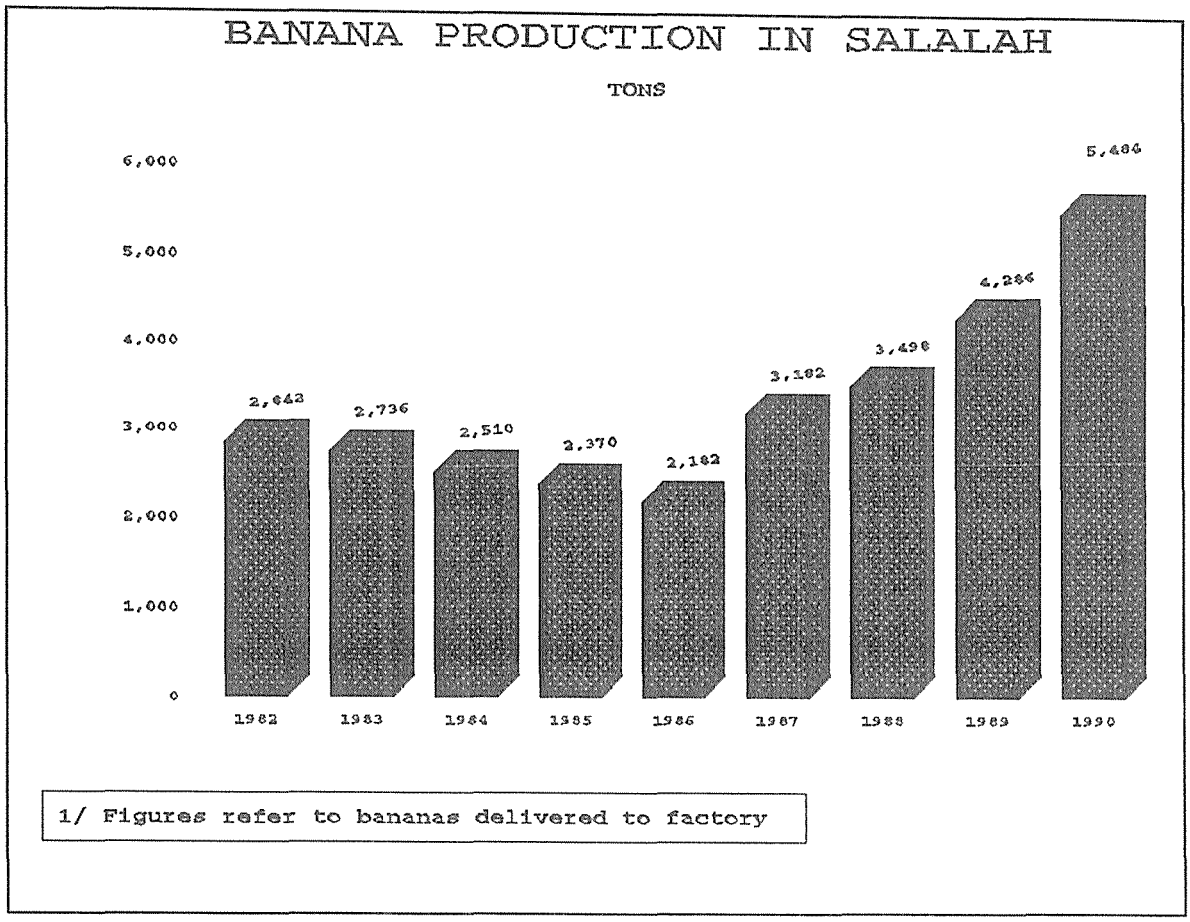
QUANTITIES OF BANANA EXCHANGED BY THE FACTORY AND PROCESSING LOSSES 1982 - 1990

Unit: Kg

Year	Quantity received	Quantity Produced	Processing losses	Losses as % of total quantity received
1982	2,841,725	1,768,718	1,073,007	37.8
1983	2,735,935	2,382,452	353,483	12.9
1984	2,510,237	2,295,226	215,011	8.9
1985	2,369,647	2,228,230	141,417	6.0
1986	2,181,637	2,092,118	89,519	4.0
Weighted average	2,527,836	2,153,349	374,487	14.80
1987	3,181,676	2,975,728	205,948	6.0
1988	3,497,853	3,258,400	239,453	7.0
1989	4,286,490	4,059,160	227,330	5.0
1990	5,483,575	5,220,260	263,315	4.8
Weighted average	4,112,399	3,878,387	234,012	5.7

Figure 1

BANANA PRODUCTION



- Coconuts

The coconut market is dominated by expatriates from the Indian Peninsula. The common practice is that a group of expatriates (3-5) moves around with a pick-up to identify coconut palms ready for harvesting and to approach the farmer to conclude a contract for harvesting. The group may be running the business jointly or working as hired labour for the pick-up owner who could also be an expatriate. Coconuts are purchased from farmers at 140 Baiza per nut on the tree. The crop is harvested by the group and sold at 170 Baiza per nut. Losses, as estimated by these merchants, are apparently less than 2%. The collected produce is sold to various expatriate agents including:

1. Sales agents are selling coconuts at the road sides as a drink at a price of 250 Baiza each. Losses at this channel are minimal. The agents either work for themselves and pay a rent to the owner of the land and pay a monthly fee to their sponsor or, work for him at a regular salary plus a percentage of the sales value as an incentive.

2. Export agents transport the crop to other local markets or to the United Arab Emirates.

3. Little produce finds its way to PAMAP.

- Papaya

Papaya is usually grown in a scattered manner mixed with banana or other crops. Much of the production is not marketed, and is either consumed at the farm or left to rot. Due to its high perishability papaya is hardly marketed by the expatriate merchants. Wherever papaya is grown as a commercial crop in a more organised form, the produce is sold to PAMAP and on the local market. Losses to PAMAP are very high, averaging 50%.

6.2.5.2 Vegetables

- Tomatoes

Salalah has a domestic comparative advantage in vegetable production. Vegetables can be cultivated in Salalah during the khareef season (summer in other parts of the country). During this period few vegetables are grown elsewhere in the Sultanate. Tomatoes in particular, represent the main vegetable crop cultivated in Salalah during this season. Advantage has recently been taken of this feature and measures were adopted to encourage and protect local production. The MAF during 1991 khareef season, provided tomato growers with treated seeds, chemicals for treating nursery soils and supervised nursery preparation. Unlike

preceding years, no tomato import licences were issued at this time of this year and PAMAP was obliged to purchase all the crop. As a result of PAMAP's high prices, and the limited size of the local market for tomatoes and their high perishability, almost all the tomato crop was sold to PAMAP. As has been mentioned before, PAMAP could not make a profit on its tomato marketing activities.

- Other vegetables

A number of other vegetable crops are cultivated in Salalah during the winter and khareef season. The most important are chilies, melon, okra, egg plant and a variety of curcurbites. In addition some vegetables are cultivated which are almost solely consumed by expatriates from the Indian peninsula . The total production of these specific vegetables is rather limited. Vegetable production and marketing is mostly controlled by expatriates. Due to the small size of the local market and to the necessity to avoid risk, diversification in vegetable production is extremely high. Vegetables are normally sold at the farm gate to expatriate merchants who collect small quantities from different farmers and distribute them to retailers. Little produce, especially chilies and melons find their way to markets in other towns.

While tomatoes are clearly grown on a scale that requires proper marketing outside the local market in Salalah, most other vegetables are grown for local (Salalah) consumption. This characteristic is important when assessing the potential of vegetable production in Salalah.

6.2.5.3 Fodders

Fodders are cultivated both on small farms as well as on a few large commercial farms. Small farmers as a whole do hardly produce sufficient fodders for their own use (Appendix 2, Table A2.40. However, due to the presence of large numbers of cattle, goats and sheep as well as camels in the jebel, an active hay market exists in Salalah. This market facilitates the purchase and sales of fodders.

Seasonal variations in the volume of fodder trade and in prices are enormous. During the dry period prices are almost double the khareef prices. The shortage of fodders in this period is obvious. The additional demand in this period comes from the jeballi livestock keepers who cannot produce irrigated fodders in the jebel. During the khareef season jeballi livestock keepers graze their animals in the then green jebel. Consequently, the demand for fresh and dry fodders by the jeballi livestock keepers is small in this period. However, the small farmers in the plain keep their livestock mainly stall-fed, requiring an almost constant supply of green and dry fodders throughout the year. Only very few farmers (living in the plain) move their animals to the jebel.

To assist the jeballi farmers MAF produces fodders which are distributed to farmers free of charge. Besides fodders are produced by large commercial farms and mainly sold to jeballi livestock keepers. Due to the short supply of hay in the dry period fodders are transported to Salalah from other production areas such as the Batinah and even from other gulf states.

Hay is directly purchased by livestock keepers and hay merchants, who buy the standing crop by area, harvest and transport it to feed either their own animals or sell it in the hay market at almost double the purchase price (to cover cost of harvesting, transport and a profit margin).

Some small farmers harvest their own crop and sell it by bundles to hay merchants who collect and transport it to the hay markets.

The Government is supporting the livestock keepers in the jebel through several subsidy programmes. Livestock is now and then purchased at prices far above the market price. Concentrates are subsidised. Watering points and wells are constructed with subsidies. This whole package of policies keeps the number of animals in the jebel beyond the carrying capacity. This poses an environmental threat to the jebel and at the same time provokes high fodder prices. The high prices are stimulating the production of fodders in the whole of the Sultanate. These policies are indirectly stimulating the pumping of groundwater in the whole of the Sultanate.

6.2.5.4 Livestock

Cattle (local, mixed and crossbred), goats and sheep are kept by the majority of the small farms out of tradition. The financial returns of livestock keeping is not the prime objective of this enterprise. Animals are mainly fed on green fodders, however, the subsidy on imported course grains has increased their use as animal feeds. At present the milk herd in Salalah produces more than the demand for fresh milk especially during the khareef season. Fresh milk in excess of the family needs is partly sold at the farm gate to regular buyers and partly fed to young animals due to lack of marketing facilities. Another part of surplus milk is processed into ghee for family use and or sale. The sour milk produced in this process has hardly a market and most of it is wasted.

Sales of live animals are rare and mainly occur during religious festivals and wedding occasions normally held during the khareef season.

Farm yard manure is extensively used in Salalah plain. The jebel remains the main source of farm yard manure. Farms producing more than their requirements sell the surplus to specialised merchants in bulk for the local market or packed into 50 kg bags for transportation to other markets such as the Batinah. The bags are often provided by the pick-up/truck driver.

As for other farm products, the marketing of farm yard manure is mostly an expatriates' activity.

Despite the subsidy on imported feed, the free medication and veterinary services, livestock production in Salalah remains financially unprofitable. The reasons for maintaining a financial unattractive enterprise find their roots in social and cultural factors such as the original way of living as nomads and is supported by the general affinity to livestock. Some owners still view livestock as a repository of wealth and a saving mechanism.

The marketing of milk is a major constraint for the development of the small stall-fed dairy herds.

6.3 MARKETING POTENTIAL AND CONSTRAINTS SALALAH PRODUCTION

Of the total amount of 272 thousand tons of fruit and vegetables marketed in 1989 in the whole country, PAMAP handled about 13 thousand tons or less than five percent. The majority is therefore marketed by traders and merchants. Out of the 272 thousand tons about 95 thousand tons was imported by private traders. In 1989 about 55 thousand tons consisted of imported fruits and 30 thousand tons of imported vegetables. Of the 30 thousand tons of imported vegetables about 20 thousand tons were imported during the second half of the year. This period is the khareef season in Salalah. Assuming that the harvesting period commences in September almost 60 percent of the imported vegetables could in theory come from Salalah. In the case of tomatoes almost 3 thousand tons of tomatoes (Appendix 5, Table A5.3) could come from Salalah in addition to the present production, assuming that the same quality (compared with imported tomatoes) can be produced. For okra an additional production of 1.6 thousand tons could be produced in addition, while these figures amount to 210 ton for chilies, 300 ton for cucumber, 285 ton for cabbages. There is also a considerable market for melons.

There are therefore enough possibilities to increase the production of a number of vegetables if the quality of the produce could be improved and if the production costs could be lowered.

The marketing of rhodes and buffalo grass is not a constraint in view of the large numbers of animals in the jebel.

Although a limited amount of bananas is imported additional production of bananas is not desirable from a water consumption point of view. There exists a huge difference in the import of bananas between the first half and the second half of 1989. This can most probably be explained by the different frequency of arrivals by boat. One boat more or less makes a big difference. Since bananas are produced the whole year round in Salalah, a fluctuation in the production can not have caused this difference. To reduce the area under bananas, the profitability of vegetables has to increase through increased yields and better

pest management, while lower prices offered by PAMAP for bananas could also move the cropping pattern in a more desirable direction.

The market for coconuts seems to be limited and a considerable expansion of the production of coconut does not seem to be possible.

However, the marketing figures presented in this report do not seem to be very consistent, which might be due to illegal imports, bad statistics, and a malfunction of the flow marketing information in general. The import licence system used by PAMAP clearly shows that the number and quantities of licenses issued is much higher in most cases than the actual imports. In other cases apparently more is imported than actually is licensed. The effectiveness of the license system should therefore be doubted. A second problem is that PAMAP pays sometimes higher prices to the farmers than the actual market price, which causes losses to PAMAP.

The marketing of milk is a serious constraint in Salalah. Almost 90 percent of the milk is used on the farm for human and animal consumption. Should the marketing of milk be enhanced then dairy cattle on a small scale results in positive net cash flow. All other livestock activities are not profitable in terms of cash returns.

Due to the continuously introduction of new fruits on an experimental scale, Salalah becomes a kind of test-garden. Little can be said about the marketing potential. Should the Salalah plain, however, be considered as source of agricultural produce, then these experiments should be better controlled by the research. Too many species are distributed free to farmers, thus endangering the phytosanitary situation.

Chapter 7

CONSTRAINTS AND RECOMMENDATIONS IN THE SALALAH PLAIN

7.1 SUMMARY OF EXISTING CONSTRAINTS TO AGRICULTURE

A major concern of development planners concerning agricultural development in the Salalah plain is the intensification of agricultural production to increase farm income under the restriction of a substantial deficit in the fresh water system. Shifting some of the four large rhodes grass farms from the Salalah plain to the Nejd would help restore the balance of the aquifer. A thorough understanding of the farmer's objectives is required to propose viable changes in the existing farming systems.

Development priorities are often perceived differently by farmers and Government. The main objectives of farmers in Salalah is to generate income from their land and to keep livestock for socio-cultural reasons. The main objectives of Government are to develop sustainable agriculture to diversify the economy, to increase domestic production and to achieve self-sufficiency in agricultural produce while conserving natural resources and the environment. Government wishes also to halt and if possible reverse migration from rural areas to urban settlements.

During the eighties Government has pursued a policy of expansion of the area under cultivation by distributing land free of charge and by supporting the establishment of new farms with an extensive package of subsidies to encourage new investments and to promote the use of modern techniques and inputs. Government has also protected the domestic market by a system of improt licensing and has improved agricultural services (extension, research, credit and marketing) and invested heavily in the country's infrastructure.

Farmers have taken the opportunity to benefit from all these measures. As a result the cultivated area has expanded and agricultural production has increased although there is still scope for much improvement in productivity and sustainability.

In Salalah plain Government policies of price support and subsidies to the livestock sector have induced changes in the land use. These policies have encouraged the expansion of area under Banana and grasses which have high water requirements thus further deteriorating the aquifer water balance. Among the physical constraints in the study area climate, soils and water quality (salinity) are the most important.

The monsoon type of climatic conditions (high humidity) prevailing during the khareef is ideal for the development of all sorts of pests and diseases.

The soils of Salalah plain are highly calcareous and have a low fertility status. Deficiencies in micronutrients affect nearly all crops.

The study has shown that about 34 percent of the cultivated area is irrigated with brackish water having an electrical conductivity between 3 and 15 dS/m.

Equally if not more important several sociological and institutional constraints hamper production and profitability in agriculture.

In both agricultural production, services and marketing nearly all the labour force is expatriate. Expatriates are often involved in the management of the farms hence rendering the decision making process more complicated. They are also more interested in immediate profit and therefore little motivated for long term investment and conservation of natural resources.

It was found that extension services do not function properly for the following reasons:

- There is no testing of research results in farmers conditions to make the information directly usable by the extensionsists to advise farmers. As a result extensionists are mostly involved in supplying tractor and spraying services as well as distributing inputs to the farmers.

- Extension is based on a crop approach, rather than sees the individual enterprises in the context of all activities of the whole farm.

- Ideally the target of extension should be the person who is carrying out production activities and not the farm owner. However, in Salalah this would mean that extension should be more oriented toward the expatriate labourer. Besides social and political reluctance this would pose the problem of communications as all extensionists except one are arabic speaking.

- Some Omani absentee farmers complain about the fact that extensionists are not available during weekends when they are themselves available.

Although it has achieved some good results, agricultural research suffers from a number of problems of which the most important are:

- The site of the research station is not representative of farmers environmental conditions. Indeed water is of the best quality and soils are of a type which is not representative. Since the research station is large and does not have a dense network of windbreaks, it is open to wind influence. In contrast most farms are small and are densely planted therefore little affected by wind.

- Research programmes are not oriented enough towards farmers' needs. No research has been carried out to identify vegetable varieties that are resistant to salinity although salinity affects more than a third of the cultivated area. Tall grasses, banana, papaya and coconut have not received attention in proportion with their economical importance whereas coffee has been studied in several trials.

- With some exceptions fertility trials on macro-nutrients have received little attention and micro-nutrients none.

- Research suffers from a general lack of resources, whether it be personnel, equipment or premises.

Though inputs are generally in good supply, they are often inadequate. Certified seeds and chemicals are not all tested before being marketed. Many of the subsidized pesticides are not suitable for the control of some occurring severe pests and diseases. There is no systematic control of active ingredient content of pesticides. Excessive application of pesticides however is a serious problem that urgently has to be addressed. Some big farms import their own pesticides hence escaping control.

Labour is not in short supply though nearly all expatriate. However this labour force is often not familiar with agriculture. It is not uncommon to find former tailors or drivers working as agricultural labourers.

Marketing of agricultural produce, especially vegetable, is a major problem for farmers. In peak production periods farmers are often obliged to sell their production at very low prices or throw it away. Storage facilities are inappropriate and losses are high. The Public Authority for Marketing Agricultural Produce (PAMAP) is trying to improve the situation but faces problems of excess supply alternating with periods of shortage.

Credit is available but farmers are not well informed about it. There is also often a reluctance to take loans and mistrust towards banking institutitons. However, the practices of leniency followed by the credit institutions endanger their very existence as real credit organisations.

7.2 CONCLUSIONS AND RECOMMENDATIONS FOR THE DEVELOPMENT OF SALALAH PLAIN

Given the present physical, institutional and socio-cultural setting higher production and productivity could be achieved through a package of measures. These measures require efforts from both the Government and its institutions, the land owners and the farm labour force. The increase in production and productivity should be achieved in a sustainable way. The fast increase in incomes has led to certain imbalances and agricultural systems which are not sustainable in their current form. Water consumption has risen too fast and present levels cannot be sustained unless the cultivated area is reduced or practices are changed. As discussed in the Plant and Animal Production Report, the increase

in the use of pesticides has reached levels which threaten the people and the physical resources such as soils and groundwater. Some of the present Government policies should be modified to discourage these undesirable trends.

It is recommended to develop the Salalah Plain for the exploitation of the existing market for vegetables. The potential for yield increases in vegetables is large and a considerable expansion of the area under vegetables is feasible. This option has two advantages. The water requirements of vegetables are the lowest of all crops, and vegetable production shows a high potential gross margin (see chapter 4 of Land Resources Report). The problem of the misuse of pesticides, which occurs mainly in vegetable cultivation, must be tackled in the process of promotion of these crops.

Production related activities

Vegetable cultivation would be the main focus of on-farm trials for which Government should select several plots selected through the maps produced by the project. These plots should be rented (maybe from Awqaf) on a long term lease agreement or purchased. They will serve to test any new technology to be disseminated by the extensionists. These as well as the research staff should be closely involved in the management of the trials, which also should be used for demonstration purposes.

Whole farm analyses should be prepared for several farms to be selected. The individual constraints and potentials, the preparation of farm development plans with the focus on improved vegetable production is recommended. The land owners and the farm labourers should be actively involved in this process.

On-station by the researchers and extensionists and on-farm, managed with the assistance of land owners and labourers, the following should be done:

- Testing of seeds, optimal planting time, application of fertilizers including micro-nutrients, salinization resistance, integrated pest management, cultural practices, and irrigation practices, as well as post-harvest methods.

Extension related activities

Through participation of the land owners and permanent labourers a whole farm approach should be followed. Farm labourers should actively participate, to ensure that feasible farm development plans are developed.

Training materials should be prepared in Arabic and in other languages, according to the needs of the people involved. They should not only cover technical aspects of cultivation but also farm management issues like cost of production estimates, labour requirements, physical input requirements and time and way of allocation. Also irrigation schedules should be prepared.

The extension service should be addressed to the land owners as well as to the expatriate workers.

Marketing related activities

The marketing of vegetables will arise as a problem with the increase in supply. Market regulation through future trading by PAMAP should attempt to solve this potential problem. Contracts should be made with farmers to supply vegetables in the framework of a calendar to avoid over supply.

Monitoring

It should be continued to monitor prices, subsidies and marketing of important crops. The monitoring of Government policies and their effects on farmers' behaviour (including credit) should result in the preparation of recommendations regarding Government policies which affect the production and productivity of vegetables.

As well the changes in the agricultural landuse and water quality should be a permanent activity. the computerized databases established by the project should be maintained and updated.

Other activities at Salalah Plain level

An irrigation subsidy programme can be started on the basis of the results of the previous whole farm analyses, which showed the needs and requirements of the land owners and labourers.

An integrated pest management unit should be set up with proper staffing and facilities. This measure should be supplemented by tighter quarantine controls.

The Government should reconsider the policies regarding the expansion of the agricultural area in the Salalah plain. This is one of the most sensitive issues. The continuous increase in income has given many Omani families the opportunity to buy land and built new houses (with cheap loans) and to invest in garden farming. The Government has stimulated this development through an extensive credit programme supported by large subsidies for investment and subsidies on agricultural inputs.

It is, however, questionable whether a reduction or abolishment of the subsidy programme (including credit) would be enough to redirect the magnitude and way of expansion. The high incomes, combined with the desire of most Omani families to have all modern comforts and to satisfy their traditional needs of having a farm, will most likely seriously reduce the effects which normally could be expected from a reduction or abolishment of subsidies.

It is therefore recommended to use laws and regulations which are based on sound land use planning. As soon as the land use plans are adopted implementation should be enforced. In principle no expansion of agricultural area should be allowed.

Appendix 1

SUMMARY OF COUNTRY CHARACTERISTICS

A1.1 GEOGRAPHY

A1.1.1 LOCATION

The Sultanate of Oman is located in the South Eastern tip of the Arabian Peninsula. Its land borders with Saudi Arabia and the United Arab Emirates in the West and by the Republic of Yemen in the South. The eastern side of the Sultanate borders on the Gulf of Oman and the Indian Ocean with a coastline of nearly 1690 kilometres. Oman's territory also includes the tip of the strategically important Musandam Peninsular, which is separated by the United Arab Emirates from the rest of Oman. Oman's geography also encompasses the Island of Masirah, off the eastern coast. Oman has an approximate area of 300,000 sq.km. Northern Oman has a mountain chain with heights up to 3000 m. The Jebel Al Quara in Dhofar in the South divides the Coastal Plains of Salalah from the interior plains of the Nejd.

A1.1.2 POPULATION

Due to the absence of a population census, only population estimates are available. By the end of 1989 the population was estimated at 1.5 million with an estimated annual growth rate of 3.5 percent. The coastal plains of the Batinah to the North East of the mountains (including the capital Muscat) is inhabited by nearly half the total population. In important feature is the number of immigrant workers in the Sultanate. Estimates vary considerably, it is assumed that on average there are about 400,000 immigrants in the country. Most of them are guestworkers from India, Pakistan, Bangladesh, Sri Lanka, Egypt, Jordan and the Philippines. Official figures show that out of the total labour force of 529,000 workers in 1990 about 60.8 percent are Omani's and the remainder of 207,000 (or 39.2 percent) are foreigners. This underscores the importance of expatriate labour in the development process.

Table A1.1

DISTRIBUTION OF THE POPULATION BY REGION

Region	Total population	Percentage
Muscat	333 352	22
Batinah	436 476	29
Sharqiyah	218 089	14
Dakhliyah	190 263	13
Dhahira	135 585	9
Dhofar	164 410	11
Musandam	23 825	2
Total	1 500 000	100

A1.1.3 CLIMATE

With the exception of the mountains of the Southern Region, which has a tropical monsoon climate, Oman is a sub-tropical desert. In the summer the coastal areas are hot and humid and the interior parts hot and dry, while the winters are comparatively cool. The climate is influenced by the prevailing winds, the up-welling of coastal water and cyclones, and is temperate at high level.

Annual mean temperature varies between 17.8 C. and 28.9 C. The hottest period is June and July and the coldest month is January.

Except for the Dhofar and the Hajar mountains, the rainfall is low and irregular. Mean annual rainfall is below 50 mm in the interior, the major part of the country, and about 100 mm in the coastal area. The Hajar mountains receive 100 to 300 mm and the Dhofar mountains which are influenced by the monsoon, having 200 to 260 mm of rainfall. Mist is common in this area, adding important amounts of moisture to the vegetation. In the period from September to November there is practically no rainfall in Oman.

A1.2 ECONOMY

Oman's economy was profoundly changed by the exportation of oil, starting in 1967. Until then principal exports consisted of dates, limes and fish, and principal imports of basic foodstuffs and cotton goods. Oil immediately accounted for over 99 percent

of all exports, a position it held until the fall in oil prices during 1986. Its share of GDP had been falling for some time before then, as other sources of GDP (dependent on oil) grew, and since 1983 it has remained below 50 percent of the total (at present about 45 percent).

The economy is centrally managed by virtue of the dominant role played by oil revenue, which all accrues to the Government. But private enterprise is actively encouraged in agriculture, fisheries and manufacturing as well as banking and other financial services. All the new economic and social infrastructure has been Government funded, and private sector economic activity is subsidized in various ways.

The Omani Rial is pegged to the US dollar since 1974 at US$1 = 0.3454 OR, but was devaluated in January 1986 to US$1 = 0.3845 OR in response to the fall in the price of oil.

The GDP at current prices is estimated at 3,522 million Omani Rials in 1990. The nominal growth rate for 1990 is estimated at nine percent. Due to fluctuating oil prices and the high share of the oil and gas sector in the GDP, annual growth figures have fluctuated significantly from minus 18.9 percent in 1986 to plus 10.4 percent in 1989. Over the last five years the average annual growth rate has slowed down to 4.7 percent. Inflation is estimated at three percent resulting in a real growth figure of six percent in 1990. The growth rate of the economy surpassed the population growth rate (estimated at 3.5% per annum) resulting in increased GDP per capita and considerable improvement in the standard of living.

Oman's trade balance showed a considerable surplus amounting to an estimated 1930 million OR in 1990. Despite Oman's trade surplus, there is a sizable net outflow on the invisible account which has left the country with a much reduced current account surplus since 1982 and a deficit in 1986 and 1988. This is mainly due to the net imports of services and the net outflow of transfers (mainly remittances of expatriate labourers).

The total external debt amounted to 2850 million OR in 1990. A considerable amount which has mainly been built up to finance the development of the infrastructure and the oil and gas sector. The debt service ratio is rapidly increasing from 3.6 percent in 1983 to almost 17 percent in 1988.

The fast growth in civilian and defence expenditure led to a Government budget deficit for the first time in 1982. From 1984 onwards the gap widened further, peaking at 666 million OR in 1986 before dropping to 97 million in 1987. Despite cuts in expenditure, the deficit widened again to reach 238 million OR in 1988, largely due to a 20 percent drop in oil revenues. The 1989 deficit, at 275 million OR, was lower than budgeted, thanks to the recovery in oil revenues.

As a result of the recurrent deficits, the Government had to draw on its reserves in the State General Reserve Fund.

A1.3 THE AGRICULTURAL SECTOR

A1.3.1 GENERAL

The contribution of agriculture to the GDP is modest, but the sector has been growing at an average rate of 9.6% (reached 20% during the "agriculture year" in 1988).

Table A1.2

CONTRIBUTION OF AGRICULTURE TO THE GDP
AT CURRENT PRICES (MILLION OMANI RIAL)

Year	Total Gross Domestic Product	Contribution of agriculture at market prices	
		Total agriculture	Percentage
1979	1289.9	40.3	3.1
1980	2063.5	52.6	2.6
1981	2490.5	62.1	2.5
1982	2613.6	66.1	2.5
1983	2739.9	80.6	3.0
1984	3046.7	89.0	3.0
1985	3453.8	93.7	2.7
1986	2800.4	95.9	3.5
1987	3002.6	105.4	3.5
1988	2919.3	123.6	4.3
1989	3231.0	117.1	3.6
1990	3522.0	n.a	n.a.

The increased demand for food generated a negative agricultural trade balance which in 1988 reached 115 million OR (imports = 144 million OR). The share of agriculture and fisheries in non-oil exports dropped from 100% in 1980 to 46% in 1988 while its share in imports increased from 12% to 17% over the same period.

The Gross Domestic Expenditure (on consumption and investment) depended heavily on the public sector. The contribution of the government to investment financing reached 70%. About 27% of government funds for investment were expended on the commodity production sectors. Agriculture's share in the investment reached 4.5% as shown in Table A1.3.

Despite its relative low contribution to the national economy, agriculture remains the most important sector in terms of employment. Traditionally Oman community life is based on farming and fishing. The development of urban life is a recent phenomenon. At present nearly half the Omani population live in rural areas including over 85,000 farm families engaged in agriculture (including livestock) helped by about 20,000 expatriate agricultural labourers and about 18,500 fishermen.

A high priority has been given by the government to the agricultural sector. An agricultural policy based on free land distribution and a large subsidy scheme has been adopted to further encourage development of agriculture and promote its contribution to:

- diversification of the national economy
- improvement of rural incomes and welfare
- increase domestic production and improve agricultural trade balance
- reverse the current rural/urban population drift
- preserve national resources and environment

As a result, agricultural production and its trend over the last decade showed an expanding intensity. The area under cultivation increased by 17% from 48,000 hectares in 1985 to 56,000 hectares in 1989, and total production by 65% from 510,000 tonnes to 840,000 tonnes during the same period. The planted with vegetables increased substantially (34%) while production more than doubled (123%), and the area under fruit trees expanded by 11% with production increasing by 17% over the same period (1985 - 1989).

Due to climatic conditions the season suitable for agricultural production is limited and short. Farmers are therefore forced to cultivate the same crops almost at the same time every year. High temperatures and very dry summers impose a single crop system.

With the current restrictions on agricultural development as imposed by soil, water, climate, human resources and social factors only land which is fully suitable for agriculture should be used for crop and animal production. Land distribution for small farmers (less than 4 ha.) was halted in 1987 so that soil survey work should determine appropriate areas. Distribution continued for commercial farming (over 4 ha. except in Salalah Plain where the limit is 2 ha.) based on feasibility studies. The total area approved for distribution between 1981 - 1989 amounted to 10,054 as shown in Table A1.4.

Table A1.3

AGRICULTURE SHARE IN TOTAL GOVERNMENT INVESTMENT
1979 - 1988

Unit: million OR

Year	Government investment			Share of agriculture in government investment expenditure as % to	
	Total	Commodity production sectors	Agriculture and fisheries	Total	Commodity production sectors
1979	215.7	71.5	3.6	1.7	5.0
1980	305.8	105.3	4.3	1.4	4.0
1981	389.6	142.2	5.2	1.3	3.7
1982	482.1	167.3	6.0	1.2	3.9
1983	529.9	120.2	5.0	0.9	4.2
1984	652.5	118.1	8.4	1.3	7.1
1985	701.7	132.3	9.4	1.3	7.1
1986	653.9	203.6	7.4	1.1	3.6
1987	399.7	114.5	3.5	0.9	3.1
1988	332.9	103.0	4.4	1.3	4.3

Table A1.4

LAND DISTRIBUTED TO FARMERS (1981 - 1989)

Unit: Feddan

Year	Total area	Area under cultiv ation	%	Distribution of area cultivated by major crop category					
				Vegetables	%	Fruits	%	Other	%
1981	70	56	80	28	50	15	26.8	13	23.2
1982	429	340	79.3	153	45	113	33.2	74	21.8
1983	1079	982	91	363	37	477	48.6	142	14.4
1984	538	435	80.9	142	32.6	212	48.8	81	18.6
1985	683	524	76.7	128	24.4	293	55.9	103	19.7
1986	454	365	80.4	87	23.8	236	64.7	42	11.5
1987	842	720	85.5	140	19.4	385	53.5	195	27.1
1988	2155	1693	78.6	355	21	827	48.8	511	30.2
1989	3804	3055	80.3	704	23	1600	52.4	751	24.6
Total	10054	8170	81.3	2100	25.70	4158	50.9	1912	23.40

A1.3.2 AGRICULTURAL RESOURCES AVAILABLE AT THE END OF THE THIRD FIVE YEAR PLAN 1985 - 1990

- Water

With exception of the monsoon rains and mist in Dhofar, groundwater is the main source of water for both domestic and agricultural use. Most groundwater resource are recharged by water run off which is irregular and mainly appears as flash floods. The most important water resources are the coastal aquifers in the Batinah and Salalah, and the shallow alluvial aquifers tapped by traditional aflaj. The Nejd has significant sources of artesian and non-artesian fossil water. Because these sources are not recharged, no sustainable development can be based on these water resources. Other resources are springs, brackish coastal lagoons. Desalinization of seawater is on the increase and is becoming a major source of drinking water in the capital area. In addition waste water treatment could become important. Both options are now under study in Salalah. Nevertheless, improved agricultural use of water should contribute to a sustainable development of all water resources.

At present water is the main constraint to development. Until the mid seventies water demand and supply was relatively well balanced. The recent rapid economic development has led to a drastic increase in the demand for water. In a number of areas, water demand highly exceeds the supply. A serious and partly irreversible deterioration of water and soils is occurring through overpumping and the manmade interception of water run-off causing reduced flood flows, which in turn results in a lower recharge.

The currently utilised water resources of Oman includes:

- A total of 2000 aflaj, irrigating about 26% of the cultivated land.
- A total of 116,000 wells and boreholes of which 30,000 are shallow, hand dug wells. About 67% of the agricultural land depends on wells for irrigation.
- Recharge dams with three pilot dams constructed at Al Khawd, Hilti-Salahi and Wadi Duiyat. Three more dams have been completed at Wadi Al Jizzi, Wadi Ghul and Wadi Tanuf and three more dams are under construction, including the Sanahout dam in Salalah.
- About 100 springs have been developed mainly for rural and livestock supplies in the Dhofar jebel with some major springs developed for domestic and irrigation supplies (0.2 feddan cultivated area).
- About 5.8% of the cultivated land in Oman is irrigated from more than one source.

- Land

The recently completed soil atlas of the country (under UNDP/FAO Project OMA/87/011) established that 93% of Oman land area is unsuitable for agriculture. Most of this area is bare of vegetation, rocky, sandy and unproductive. An expansion of agriculture in terms of area is possible since land is not the constraining factor. In fact the area under cultivation increased by 17% from nearly 48,000 ha to about 56,000 ha and total production increased by 65% from 510,000 tons to 840,000 tons in the period 1985 - 1989. Rainfall and groundwater resources (of good quality) are the main constraints to agriculture rather than available land, although the soils in general are of low quality. However, the soil fertility can be improved through improved cultural practices, including the use of farm yard manure.

The size of the small farm averages about 2 ha and is subject to land fragmentation resulting in various socio-economic problems. Most of the small farms are privately owned and some belong to Awqaf (in Ministry of Religious Affairs). Awqaf lands are usually distributed to the poor at a nominal fee but can be passed on to their descendants regardless of the well being of these ancestors.

- Vegetation

From a vegetation point of view only the natural woodlands are important. Almost all the natural woodlands of Oman are in the Dhofar Region in three major ecological formations depending on latitude and climate (mainly moisture availability):

- The coastal plain known as Sahel.
- The southern slopes of the Dhofar range (jebel).
- The desert and semi desert of central and northern Dhafar (Badiyah).

There is great diversity in tree and shrub species on the southern slopes of the Dhofar range. This is under the influence of monsoon rains and mist. The vegetation on the slopes is almost similar to that of the African tropical savannah. In Northern Oman woodland vegetation is very sparse due to the low rainfall. It is mainly restricted to wadi beds and depends on flash floods.

Despite the limited area, woodlands are an important ecosystem with great significance for the natural environment. The woodlands provide animal feed and shade to cattle, camels and goats, which are a major source of income for the rural communities in the region. The woodlands form an important source of animal feed when the grass production on the range lands comes to a halt in the dry period. Besides, these woodlands are a source of wood, honey, wild fruits and herbs.

Other important benefits of the woodlands comprise its role

in soil and water conservation, mist trapping, groundwater recharge, control of desertification, while the rich fauna and flora make it an attractive place for tourists. The forests play a crucial role in the livelihood of the Region. They belong to the invaluable national heritage of Oman and the Arabian Peninsula, being unique with respect to species diversity and ecological variability.

The woodlands are degenerating at an alarming rate, due to increased grazing pressure and some areas are now completely deforested.

A1.3.3 LIVESTOCK

More than 60% of the livestock in Sultanate is kept in the Batinah plains and in the Dhofar region. About 12,000 ha of alfalfa and 1,500 ha of Rhodes grass are under irrigation in the coastal plains with around 70,000 ha of range land in the Jebel.

Animal production in the north is based on large commercial dairy and poultry farms and also small livestock with mixed animal husbandry and agriculture. Shortage of feed is a major constraint to production. The Southern Region has the larger share of livestock with around 171,000, 70,000 and 125,000 heads of cattle, camels and goats respectively. In the traditional grazing patterns the herds were kept on the plains before and during the monsoon period and in the Jebel for the remaining period of the year.

The livestock feed resources are composed of about 200,000 ha of rangelands, some 21,000 tons of irrigated fodder and compound feed as well as and estimated 8,000 tons of dried fish.

Livestock in Oman is kept in the following ways:

- Domestic: Households that keep chickens, goats and sheep for home consumption.
- Agricultural: livestock (about 45% of total livestock); owners are engaged in cultivation and livestock and stock is fed with by-products;
- Nomads (about 15% of total livestock); the numbers of owners and stock are decreasing;
- commercial dairy and poultry farms.

Current and planned subsidies in the sub-sector include support for small dairy producers and fattening units and also price support to farmers and for stocking feed and sheds for small poultry farms. There is planned support for sheep farms, goat raising and honeybee farming.

The target of the current Five-year Plan (1991-1995) is to increase the self-sufficiency rate for animal products to 65% and

to overcome main constraints from lack of feed resources, limited breeding and disease control programmes and poor extension and marketing facilities.

The Plan strategy is to improve the conditions for livestock owners by enhanced integration of livestock and agriculture husbandry and improved utilisation of range land. Livestock production will be extended through the development of small scale farms for poultry, dairy and beef fattening.

Appendix 2

SELECTION OF DETAILED FARM SURVEY TABLES

Table A2.1

FARMING SYSTEMS SURVEY CHARACTERISTICS
ELECTRICAL CONDUCTIVITY BY SOIL SERIES

Electrical conductivity in millimho's/cm	Size of Farm (Feddan) 0 - 2	2 - 3	3 - 5	5 - 7	7 - 10	> 10	Total	Percent
Soil series								
Strongly saline soils	.00	.00	.00	.00	1.00	2.00	3.00	6.25
Loamy skeletal deep	.00	.00	2.00	.00	.00	.00	2.00	4.17
Gleyed (50 - 150 cm)	.00	.00	1.00	1.00	.00	.00	2.00	4.17
Sandy deep soils	2.00	.00	1.00	1.00	.00	.00	4.00	8.33
Fine loamy deep soils	2.00	3.00	10.00	.00	2.00	.00	17.00	35.42
Coarse loamy deep soils	2.00	.00	5.00	1.00	1.00	.00	9.00	18.75
Coarse loamy moderately deep	1.00	1.00	5.00	1.00	.00	.00	8.00	16.67
Sandy skeletal deep soil	1.00	1.00	1.00	.00	.00	.00	3.00	6.25
Total number of farms	8.00	5.00	25.00	4.00	4.00	2.00	48.00	100.00
Percent	16.67	10.42	52.08	8.33	8.33	4.17	100.00	100.00

Table A2.2

CROPPING PATTERN IN SALALAH
CROPS PRESENT DURING THE WHOLE YEAR

Operated land 4.35
No of farms 48

	No of farms	No of farms as percentage of all farms	Total area in feddans	Average area per farm	Planted area as percentage of operated land
Pepper & chillies	4	8.33	1.00	.02	.48
Eggplant	2	4.17	.90	.02	.43
Alfalfa	7	14.58	3.55	.07	1.70
Elephant grass	16	33.33	13.60	.28	6.52
Guinea grass	1	2.08	.66	.01	.32
Rhodes grass	27	56.25	32.93	.69	15.78
Curcubites	2	4.17	.91	.02	.44
Coconut	27	56.25	17.40	.36	8.34
Banana	22	45.83	22.20	.46	10.64
Papaya	1	2.08	.26	.01	.12
Citrus	1	2.08	.25	.01	.12
Guava/pomgranates/figs	1	2.08	1.28	.03	.61
Coconut/vegetables	1	2.08	1.02	.02	.49
Banana/papaya	13	27.08	23.64	.49	11.33
Custard apple/guava	1	2.08	.76	.02	.36
Banana/coconut	3	6.25	1.16	.02	.56
Citrus/papaya/grass	2	4.17	1.56	.03	.75
Mixed fruit trees	6	12.50	4.82	.10	2.31
Coconut/rhodes grass	8	16.67	12.63	.26	6.05
Sorghum/rhodes grass	1	2.08	2.21	.05	1.06
Fruit trees/fodders	1	2.08	1.96	.04	.94
Fruit/vegetables	1	2.08	.07	.00	.03
Total	48	100.00	145.29	3.03	69.62

Table A2.3

CROPPING PATTERN IN SALALAH
CROPS AND FALLOW DURING WINTER SEASON

Operated land 4.35
No of farms 48

	No of farms	No of farms as percentage of all farms	Total area in feddans	Average area per farm	Planted area as percentage of operated land
Sorghum for fodder	2	4.17	2.00	.04	.96
Sweet potatoes	1	2.08	.68	.01	.33
Pepper & chillies	2	4.17	1.65	.03	.79
Eggplant	1	2.08	.23	.00	.11
Gourds	2	4.17	3.33	.07	1.60
Okra	2	4.17	.85	.02	.41
Cucumbers	3	6.25	3.67	.08	1.76
Sweet melons	2	4.17	1.94	.04	.93
Radishes	2	4.17	.43	.01	.21
Curcubites	1	2.08	.31	.01	.15
Coconut	2	4.17	3.26	.07	1.56
Banana	3	6.25	6.38	.13	3.06
Fallow	24	50.00	31.31	.65	15.00
Mixed vegetables	4	8.33	6.17	.13	2.96
Mixed fruit trees	1	2.08	.40	.01	.19
Coconut/millet	1	2.08	.36	.01	.17
Total	48	100.00	62.97	1.31	30.17

Table A2.4

CROPPING PATTERN IN SALALAH
CROPS AND FALLOW DURING KHAREEF SEASON

Operated land 4.35
No of farms 48

	No of farms	No of farms as percentage of all farms	Total area in feddans	Average area per farm	Planted area as percentage of operated land
Legumes & beans	2	4.17	.40	.01	.19
Pepper & chillies	6	12.50	2.91	.06	1.39
Cabbages	1	2.08	.19	.00	.09
Spinach	1	2.08	.42	.01	.20
Eggplant	4	8.33	1.07	.02	.51
Gourds	1	2.08	.56	.01	.27
Cucumbers	2	4.17	1.26	.03	.60
Tomatoes	16	33.33	16.61	.35	7.96
Cauliflower	1	2.08	1.24	.03	.59
Alfalfa	1	2.08	.31	.01	.15
Elephant grass	1	2.08	.38	.01	.18
Curcubites	4	8.33	1.66	.03	.80
Banana	1	2.08	2.20	.05	1.05
Coconut/vegetables	2	4.17	3.26	.07	1.56
Fallow	10	20.83	8.69	.18	4.16
Mixed vegetables	9	18.75	15.93	.33	7.63
Coconut/millet	1	2.08	.36	.01	.17
Banana/maize	1	2.08	1.20	.03	.58
Fruit/vegetables	2	4.17	4.60	.10	2.20
Coriander	1	2.08	.07	.00	.03
Total	48	100.00	63.32	1.32	30.34

Table A2.5

GROSS MARGIN PER FEDDAN
BANANAS

Total planted area	22.20			
Season	12.00			
	Quantity	Unit	Price per unit	Value
Total Production	6828.83	2	.150	1023.73
Material costs				
Planting materials	39.64	1	.347	13.74
Farm yard manure	16283.79	2	.006	94.21
Other chemical fertil.	20.27	2	.105	2.13
Plant protection	10.20	8	.329	3.36
Sahib soil (jebel)	18986.49	2	.006	111.94
Total Material Costs				225.37
Other costs				
Tractor hire	6.40	3	1.000	6.40
Casual hired labour	10.81	3	.500	5.41
Total Other Costs				11.80
Total Variable Costs 1/				237.17
Gross Margin				786.56

Notes: Units: 1 = Number, 2 = Kg, 8 = Liters
Season codes: 12 = Whole year, 1 = Winter, 2 = Khareef.
1/ Permanent labour and pumping costs are excluded.

Table A2.6

GROSS MARGIN PER 100 TREES
COCONUTS

Number of trees	3494.00			
No of productive trees	2068.00			
Season	12.00			
	Quantity	Unit	Price per unit	Value
Total Production	3240.81	1	.145	471.38
Material costs				
Farm yard manure	964.70	2	.006	6.26
Urea	58.03	2	.060	3.48
Ammonium sulphate	4.84	2	.100	.48
Potassium sulphate	4.84	2	.100	.48
Super posphate	4.84	2	.100	.48
NPK compound	29.01	2	.183	5.32
Plant protection	.19	8	8.625	1.67
Sahib soil (jebel)	918.76	2	.005	4.84
Total Material Costs				23.02
Total Variable Costs 1/				23.02
Gross Margin				448.37

Notes: Units: 1 = Number, 2 = Kg, 8 = Liters
Season codes: 12 = Whole year, 1 = Winter, 2 = Khareef.
1/ Permanent labour and pumping costs are excluded.

Table A2.7

GROSS MARGIN PER FEDDAN
RHODES GRASS

Total planted area	32.93			
Season	12.00			
	Quantity	Unit	Price per unit	Value
Total Production	40166.88	2	.016	651.31
Material costs				
Planting materials	5.94	2	8.551	50.77
Compost	12.15	2	.115	1.40
Farm yard manure	4820.53	2	.007	33.31
Urea	356.06	2	.075	26.82
NPK compound	6.07	2	.150	.91
Other chemical fertil.	171.58	2	.089	15.33
Plant protection	.58	8	3.937	2.27
Sahib soil (jebel)	2095.35	2	.006	12.57
Total Material Costs				143.38
Other costs				
Tractor hire	4.56	3	1.067	4.86
Transportation	.00	0	.000	.06
Total Other Costs				4.92
Total Variable Costs 1/				148.30
Gross Margin				503.02

Notes: Units: 1 = Number, 2 = Kg, 8 = Liters
Season codes: 12 = Whole year, 1 = Winter, 2 = Khareef.
1/ Permanent labour and pumping costs are excluded.

Table A2.8

GROSS MARGIN PER FEDDAN
ALFALFA

Total planted area	3.55			
Season	12.00			
	Quantity	Unit	Price per unit	Value
Total Production	19429.86	2.0	.040	777.19
Material costs				
Planting materials	61.97	2.0	3.068	190.14
Compost	56.34	2.0	.100	5.63
Farm yard manure	4360.56	2.0	.005	23.18
Urea	633.80	2.0	.236	149.58
NPK compound	14.08	2.0	.140	1.97
Other chemical fertil.	84.51	2.0	.060	5.07
Plant protection	.99	8.0	8.714	8.59
Sahib soil (jebel)	4225.35	2.0	.007	28.17
Total Material Costs				412.34
Other costs				
Tractor hire	5.35	3.0	1.000	5.35
Total Other Costs				5.35
Total Variable Costs 1/				417.69
Gross Margin				359.50

Notes: Units: 1 = Number, 2 = Kg, 8 = Liters
Season codes: 12 = Whole year, 1 = Winter, 2 = Khareef.
1/ Permanent labour and pumping costs are excluded.

Table A2.9

GROSS MARGIN PER FEDDAN
ELEPHANT GRASS

Total planted area	13.60			
Season	12.00			
	Quantity	Unit	Price per unit	Value
Total Production	69485.88	2.0	.016	1111.09
Material costs				
Planting materials	36.76	2.0	.000	.00
Farm yard manure	6316.18	2.0	.007	44.19
Urea	415.44	2.0	.076	31.40
NPK compound	77.21	2.0	.152	11.76
Other chemical fertil.	143.38	2.0	.070	9.97
Plant protection	2.50	8.0	8.118	20.29
Sahib soil (jebel)	4213.24	2.0	.007	27.90
Total Material Costs				145.52
Other costs				
Tractor hire	4.04	3.0	1.000	4.04
Casual hired labour	9.41	3.0	.541	5.09
Total Other Costs				9.13
Total Variable Costs 1/				154.65
Gross Margin				956.44

Notes: Units: 1 = Number, 2 = Kg, 8 = Liters
Season codes: 12 = Whole year, 1 = Winter, 2 = Khareef.
1/ Permanent labour and pumping costs are excluded.

Table A2.10

GROSS MARGIN PER FEDDAN
TOMATOES IN KHAREEF

Total planted area	16.61			
Season	2.00			
	Quantity	Unit	Price per unit	Value
Total Production	2895.95	2.0	.225	651.07
Material costs				
Planting materials	.33	2.0	13.012	4.27
Compost	18.06	2.0	.150	2.71
Farm yard manure	4352.20	2.0	.006	28.12
Urea	17.76	2.0	.078	1.39
NPK compound	126.43	2.0	.148	18.75
Other chemical fertil.	18.06	2.0	.090	1.63
Plant protection	4.58	8.0	5.907	27.03
Sahib soil (jebel)	3671.88	2.0	.006	21.89
Total Material Costs				105.78
Other costs				
Tractor hire	7.47	3.0	1.242	9.27
Casual hired labour	1.81	***	4.000	7.22
Transportation	.00	.0	.000	.18
Total Other Costs				16.68
Total Variable Costs 1/				122.46
Gross Margin				528.61

Notes: Units: 2 = Kg, 8 = Liters
Season 12 = Whole year, Season 1 = Winter, Season 2 = Kharif.
1/ Permanent labour costs and pumping costs are excluded.

Table A2.11

GROSS MARGIN PER FEDDAN
PEPPER & CHILLIES IN KHAREEF

Total planted area	2.91			
Season	2.00			
	Quantity	Unit	Price per unit	Value
Total Production	1099.31	2.0	.384	421.71
Material costs				
Planting materials	.88	2.0	2.513	2.20
Farm yard manure	5979.38	2.0	.007	42.10
Urea	17.18	2.0	.060	1.03
NPK compound	137.46	2.0	.160	21.99
Other chemical fertil.	17.18	2.0	.150	2.58
Plant protection	6.27	8.0	4.622	28.99
Sahib soil (jebel)	1546.39	2.0	.003	4.81
Total Material Costs				103.70
Other costs				
Tractor hire	4.47	3.0	1.308	5.84
Casual hired labour	4.81	3.0	.715	3.44
Total Other Costs				9.28
Total Variable Costs 1/				112.98
Gross Margin				308.73

Notes: Units: 2 = Kg, 8 = Liters
Season 12 = Whole year, Season 1 = Winter, Season 2 = Kharif.
1/ Permanent labour costs and pumping costs are excluded.

Table A2.12

GROSS MARGIN PER FEDDAN
MIXED VEGETABLES IN KHAREEF

Total planted area	15.93			
Season	2.00			
	Quantity	Unit	Price per unit	Value
Total Production	1428.57	2.0	.299	427.30
Material costs				
Planting materials	13.59	2.0	.275	3.73
Compost	3.14	2.0	.170	.53
Farm yard manure	1679.85	2.0	.007	10.95
Urea	32.96	2.0	.092	3.04
NPK compound	56.81	2.0	.136	7.71
Other chemical fertil.	9.42	2.0	.100	.94
Plant protection	2.04	8.0	5.842	11.92
Sahib soil (jebel)	2005.65	2.0	.006	11.29
Total Material Costs				50.11
Other costs				
Tractor hire	4.46	3.0	1.901	8.47
Total Other Costs				8.47
Total Variable Costs 1/				58.59
Gross Margin				368.71

Notes: Units: 2 = Kg, 8 = Liters
Season 12 = Whole year, Season 1 = Winter, Season 2 = Kharif.
1/ Permanent labour costs and pumping costs are excluded.

Table A2.13

PRESENT LABOUR REQUIREMENTS OF BANANAS
PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Adding sahib soil	30.0												30.00
Adding farm yard manure	30.0					30.0							60.00
Weeding/basin repairs		18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	198.00
Irrigation		20.0	20.0	20.0	20.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	185.00
Harvesting (10 hrs/ton)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	72.00
Subtotal	66.0	44.0	44.0	44.0	44.0	69.0	39.0	39.0	39.0	39.0	39.0	39.0	545.00
Miscellaneous 10%	6.6	4.4	4.4	4.4	4.4	6.9	3.9	3.9	3.9	3.9	3.9	3.9	54.50
Grand total	72.6	48.4	48.4	48.4	48.4	75.9	42.9	42.9	42.9	42.9	42.9	42.9	599.50

Note: Assumptions: Yield 7 tons/feddan. Source: Group interviews.

Table A2.14

PRESENT LABOUR REQUIREMENTS OF RHODES GRASS
PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Irrigation	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	60.00
Fertilizing	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.00
Basis maintenance	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	60.00
Harvesting	30.0	30.0	30.0	30.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	30.0	465.00
Subtotal	41.0	41.0	41.0	41.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	41.0	597.00
Miscellaneous 10%	4.1	4.1	4.1	4.1	5.6	5.6	5.6	5.6	5.6	5.6	5.6	4.1	59.70
Grand total	45.1	45.1	45.1	45.1	61.6	61.1	61.1	61.1	61.1	61.1	61.1	45.1	656.70

Note: Source group interviews.

Table A2.15

PRESENT LABOUR REQUIREMENTS OF COCONUT PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Irrigation	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	96.00
Fertilizing	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	24.00
Subtotal	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	120.00
Miscellaneous 10%	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.00
Grand total	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	132.00

Note: Harvesting is done by contractors. Source group interviews.

Table A2.16

PRESENT LABOUR REQUIREMENTS OF ELEPHANT GRASS PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Irrigation	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	72.00
Fertilizing	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.00
Harvesting	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	78.00
Subtotal	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	162.00
Miscellaneous 10%	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	16.80
Grand total	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	178.80

Note: Harvesting is done by contractors. Source group interviews.

Table A2.17

PRESENT LABOUR REQUIREMENTS OF TOMATOES
PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Nursery operations					14.0	14.0							28.00
Plot preparation						24.0							24.00
Furrow preparation						16.0							16.00
Transplanting							35.0						35.00
Irrigation/weeding							25.0	25.0	25.0	25.0	25.0		125.00
Fertilizing							1.0	1.0	1.0	1.0			4.00
Plant protection							7.5	7.5	7.5	7.5			30.00
Harvesting									15.0	30.0	30.0		75.00
Subtotal					14.0	54.0	68.5	33.5	48.5	63.5	55.0		337.00
Miscellaneous 10%					1.4	5.4	6.8	3.3	4.8	6.3	5.5		33.50
Grand total					15.4	59.4	75.3	36.8	53.3	69.8	60.5		370.50

Note: Plant protection based on 4.5 liters chemicals, power sprayer 200 liters of solution requires two hours.
Yield assumption 3 tons per feddan. Source group interviews.

Table A2.18

ESTIMATED TOTAL LABOUR REQUIREMENTS
FARM SIZE CLASS 0 - 3 FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Banana	32.67	21.78	21.78	21.78	21.78	34.16	19.31	19.31	19.31	19.31	19.31	19.31	269.81
Short grasses	12.63	12.63	12.63	12.63	17.25	17.25	17.25	17.25	17.25	17.25	17.25	12.63	183.90
Coconut	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	29.04
Vegetables	-	-	-	-	2.00	7.72	9.79	4.78	6.93	9.07	7.87	-	48.16
Tall grasses	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	14.40
Sub total	48.92	38.03	38.03	38.03	44.65	62.75	47.97	44.96	47.11	49.25	48.05	35.56	543.31
Other + Intercrops	11.43	8.89	8.89	8.89	10.43	14.66	11.21	10.50	11.00	11.51	11.23	8.31	126.95
Livestock	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	600.00
Sub total	110.35	96.92	96.92	96.92	105.08	127.41	109.18	105.46	108.11	110.76	109.28	93.87	1270.26
Grand total (including 5%)	116	102	102	102	110	134	115	111	114	116	115	99	1334

Table A2.19

ESTIMATED TOTAL LABOUR REQUIREMENTS
FARM SIZE CLASS 3 - 6 FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Banana	71.87	48.00	48.00	48.00	48.00	75.14	42.47	42.47	42.47	42.47	42.47	42.47	593.83
Short grasses	36.53	36.53	36.53	36.53	49.90	49.90	49.90	49.90	49.90	49.90	49.90	49.90	545.32
Coconut	5.17	5.17	5.17	5.17	5.17	5.17	5.17	5.17	5.17	5.17	5.17	5.17	62.04
Vegetables	-	-	-	-	6.31	24.36	30.87	15.09	21.85	28.62	24.81	-	151.86
Tall grasses	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	55.44
Sub total	118.19	94.32	94.32	94.32	114.00	159.19	133.03	117.25	124.01	130.78	126.97	102.16	1408.49
Other + Intercrops	19.37	15.46	15.46	15.46	18.68	26.09	21.80	19.21	20.32	21.43	20.81	16.74	230.83
Livestock	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	600.00
Sub total	187.56	159.78	159.78	159.78	182.68	235.28	204.83	186.46	194.33	202.21	197.78	168.9	2239.32
Grand total (including 5%)	197	168	168	168	192	247	215	196	204	212	208	177	2351

Table A2.20

ESTIMATED TOTAL LABOUR REQUIREMENTS
FARM SIZE CLASS 6 - 7 FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Banana	115.43	76.96	76.96	76.96	76.96	120.68	68.21	68.21	68.21	68.21	68.21	68.21	953.21
Short grasses	42.39	42.39	42.39	42.39	42.39	57.90	57.90	57.90	57.90	57.90	57.90	42.39	617.25
Coconut	11.33	11.33	11.33	11.33	11.33	11.33	11.33	11.33	11.33	11.33	11.33	11.33	135.96
Vegetables	-	-	-	-	13.24	51.08	64.76	31.65	45.84	60.03	52.03	-	318.63
Tall grasses	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	73.32
Sub total	175.26	136.79	136.79	136.79	165.54	247.10	208.31	169.09	189.39	203.58	195.58	128.04	2098.37
Other + Intercrops	50.80	39.65	39.65	39.65	47.98	71.62	60.38	49.01	54.89	59.01	56.69	37.11	606.44
Livestock	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	600.00
Sub total	276.06	226.44	226.44	226.44	263.52	368.72	318.69	268.10	294.28	312.59	302.27	215.15	3304.81
Grand total	290	238	238	238	277	387	335	282	309	328	317	226	3470

Table A2.21

ESTIMATED TOTAL LABOUR REQUIREMENTS
FARM SIZE CLASS >> 7 FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Banana	183.68	122.45	122.45	122.45	122.45	192.3	108.54	108.54	108.54	108.54	108.54	108.54	1517.02
Short grasses	108.70	108.70	108.70	108.70	148.46	148.46	148.46	148.46	148.46	148.46	148.46	108.70	1582.72
Coconut	13.09	13.09	13.09	13.09	13.09	13.09	13.09	13.09	13.09	13.09	13.09	13.09	157.08
Vegetables	-	-	-	-	20.64	75.60	100.90	49.31	71.42	93.53	81.07	-	492.47
Tall grasses	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	98.40
Sub total	313.67	252.44	252.44	252.44	312.84	437.65	379.19	327.6	349.71	371.82	359.36	238.53	3847.69
Other + Intercrops	47.72	38.40	38.40	38.40	45.59	66.57	57.68	49.83	53.20	56.56	54.67	36.29	585.31
Livestock	75	75	75	75	75	75	75	75	75	75	75	75	900.00
Sub total	436.39	365.84	365.84	365.84	435.43	579.22	511.87	452.43	477.91	503.38	489.03	349.82	5333.00
Grand total	458	384	384	384	457	608	537	475	502	529	513	367	5500

Table A2.22

MONTHLY FODDER BALANCE

Farm size class: All farms

Operated land	4.35
No of farms	48.00

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
On-farm production													
Rhodes grass	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.06	3.06	3.06	3.06	37.02
Elephant grass	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.63	1.63	1.63	1.63	20.29
Alfalfa	.13	.13	.15	.14	.14	.14	.14	.12	.09	.09	.09	.09	1.44
Other fodders	.09	.09	.12	.12	.09	.13	.09	.09	.09	.09	.09	.09	1.18
Total production 'green'	5.04	5.04	5.09	5.08	5.05	5.09	5.05	5.03	4.86	4.86	4.86	4.86	59.93
Purchased fodders													
Green fodder	.11	.11	.11	.11	.00	.00	.13	.00	.00	.11	.11	.11	2.06
Dry fodder	.10	.10	1.26	.11	.10	.10	.10	.10	.10	.10	.10	.10	2.58
Total purchased 'green'	.51	.51	5.16	.56	.40	.40	.53	.40	.40	.51	.51	.51	12.37
Total sold	.79	.93	.97	.97	.93	.83	.79	.79	.79	.79	.79	.79	10.15
Total available 'green'	4.77	4.62	9.29	4.67	4.52	4.66	4.79	4.64	4.47	4.59	4.59	4.59	62.15
Fodders fed													
Green fodder	4.64	4.64	4.64	4.64	4.64	4.98	4.98	4.98	4.98	4.98	4.98	5.08	58.20
Dry fodder	.25	.25	.22	.25	.25	.19	.14	.14	.26	.26	.21	.22	2.65
Total fed 'green'	5.66	5.66	5.51	5.63	5.63	5.76	5.54	5.54	6.04	6.04	5.82	5.97	68.81
Overall balance 'green'	-.89	-1.04	3.78	-.95	-1.11	-1.09	-.76	-.90	-1.57	-1.46	-1.23	-1.38	-6.66

Table A2.23

DIESEL PUMPS

Operated land	4.35
No of farms	48
	Amount/value
Number of pumps	42
Average per pump	
Capacity in m3 per hour	53.7024
Average use	
M3 of water pumped/year	72836.9700
Hours of pumping/day	3.58
MM of water per day	9.3977
Average energy costs	
Price per liter diesel	.1160
Diesel cost per m3	.0028
Other variable costs/m3	.0006
Total fixed cost/m3	.0005
Total cost per m3 water	.0039

Table A2.24

ELECTRIC PUMPS

Farm size class: All farms

Operated land	4.35
No of farms	48

	Amount/value
Number of pumps	30
Average per pump	
Capacity in m3 per hour	46.79
Average use	
Hours used/month	127.65
M3 of water pumped/month	6143.6330
M3 of water pumped/year	73723.6000
Hours of pumping/day	4.11
MM of water per day	6.7944
Average energy costs	
Price per kilowatt-hrs	.1160
Electricity costs per m3	.0016
Other variable costs/m3	.0000
Total fixed cost/m3	.0003
Total cost per m3 water	.0020

Table A2.25

QUANTITY AND COST OF PUMPING

Farm size class: All farms

Operated land	4.35	
No of farms	48.00	
	Average per farm per year	Average per feddan per year
Number of pumps	72.0000	72.0000
Capacity in M3 per hour	76.2350	17.5345
Quantity of water pumped		
Hours of pumping/day	5.7124	1.3139
M3 of water pumped/year	109809.6000	25256.8900
MM of water per day	16.1921	16.1921
Average costs		
Energy cost per year	254.1363	58.4529
Energy cost per m3	.0023	.0023
Other variable costs/year	38.4375	8.8409
Other variable costs/m3	.0004	.0004
Total fixed cost/year	44.9479	10.3383
Total fixed cost/m3	.0004	.0004
Total pumping costs	337.5217	77.6321
Total cost per m3 water	.0031	.0031

Table A2.26

QUANTITY AND COST OF PUMPING

Farm size class: 0 - 3 feddan

Operated land	2.20	
No of farms	17.00	
	Average per farm per year	Average per feddan per year
Number of pumps	24.0000	24.0000
Capacity in M3 per hour	61.7941	28.0732
Quantity of water pumped		
Hours of pumping/day	3.6848	1.6740
M3 of water pumped/year	59553.5600	27055.3300
MM of water per day	17.3451	17.3451
Average costs		
Energy cost per year	128.6266	58.4354
Energy cost per m3	.0022	.0022
Other variable cost/year	13.4706	6.1197
Other variable costs/m3	.0002	.0002
Total fixed cost/year	33.2353	15.0989
Total fixed cost/m3	.0006	.0006
Total pumping costs	175.3325	79.6540
Total cost per m3 water	.0029	.0029

Table A2.27

QUANTITY AND COST OF PUMPING

Farm size class: 3 - 6 feddan

Operated land	4.51
No of farms	22.00

	Average per farm per year	Average per feddan per year
Number of pumps	33.0000	33.0000
Capacity in M3 per hour	78.5227	17.4231
Quantity of water pumped		
Hours of pumping/day	5.7691	1.2801
M3 of water pumped/year	108505.3000	24075.7900
MM of water per day	15.4349	15.4349
Average costs		
Energy cost per year	304.0550	67.4656
Energy cost per m3	.0028	.0028
Other variable cost/year	53.2727	11.8205
Other variable costs/m3	.0005	.0005
Total fixed cost/year	63.0682	13.9939
Total fixed cost/m3	.0006	.0006
Total pumping costs	420.3960	93.2800
Total cost per m3 water	.0039	.0039

Table A2.28

QUANTITY AND COST OF PUMPING

Farm size class: 6 - 7 feddan

Operated land	6.57
No of farms	6.00

	Average per farm per year	Average per feddan per year
Number of pumps	9.0000	9.0000
Capacity in M3 per hour	79.0467	12.0345
Quantity of water pumped		
Hours of pumping/day	8.6393	1.3153
M3 of water pumped/year	177156.1000	26971.2400
MM of water per day	17.2912	17.2912
Average costs		
Energy cost per year	386.2400	58.8033
Energy cost per m3	.0022	.0022
Other variable cost/year	64.0000	9.7437
Other variable costs/m3	.0004	.0004
Total fixed cost/year	34.1667	5.2017
Total fixed cost/m3	.0002	.0002
Total pumping costs	484.4066	73.7488
Total cost per m3 water	.0027	.0027

Table A2.29

QUANTITY AND COST OF PUMPING

Farm size class: >> 7 feddan

Operated land	10.90
No of farms	3

	Average per farm per year	Average per feddan per year
Number of pumps	6	6
Capacity in M3 per hour	135.6667	12.4427
Quantity of water pumped		
Hours of pumping/day	10.9328	1.0027
M3 of water pumped/year	269466.0000	24714.0900
MM of water per day	15.8441	15.8441
Average costs		
Energy cost per year	335.0800	30.7319
Energy cost per m3	.0012	.0012
Other variable cost/year	20.0000	1.8343
Other variable costs/m3	.0001	.0001
Total pumping costs	355.0800	32.5662
Total cost per m3 water	.0013	.0013

Table A2.30

CHEMICAL SPRAYERS

Operated land	4.35
No of farms	48

	Amount/value
Number of sprayers	24
Average use	
Hours used/month	13.382
Average energy costs	
Liters of fuel/hour	.245
Price per liter of fuel	.125
Fuel costs per hour	.029
Variable costs/year	7.485
Variable costs/hrs	.047
Maintenance/year	2.083
Total fixed cost/year	2.083
Total fixed cost/hour	.013
Total cost per hour	.060
Total cost per year	9.568

Table A2.31

GROSS MARGIN DAIRY CATTLE

Farm size class: All farms

Operated land	4.22			
No of farms	20			
Average number of animals present during the year	Quantity	Unit	Price per unit	Value
Dairy cows	7.18	1.00	570.70	4094.75
Calves	3.38	1.00	133.26	449.75
Heifers	1.13	1.00	275.78	310.25
Mature males	.38	1.00	616.67	231.25
Total number of animals	12.05	1.00	422.07	5086.00
Production				
Closing minus opening				-1002.00
Sales minus purchases				1068.50
Milk	9344.00	8.0	.344	3215.59
Sour milk	1006.75	8.0	.327	329.40
Ghee	26.05	8.0	3.977	103.60
Manure	33366.88	2.0	.009	288.16
Gross Production Value				4003.25
Purchased Material Inputs				
Green fodder	2100.00	2.0	.015	32.13
Dry fodder	2602.50	2.0	.110	287.27
Flour (cereals)	80.00	2.0	.123	9.80
Fish meal (sardines)	715.00	2.0	.121	86.16
Concentrates	5757.50	2.0	.092	531.90
Drinking water	2500.00	2.0	.001	1.50
Mineral salts	20.50	2.0	.112	2.30
Total Material Costs				951.06
On-farm produced & fed	81274.68	2.0	.017	1358.08
Total Variable Costs				2309.14
Gross Margin				1694.11
Key variables				
Milk (lt) per cow/day				4.05
Green fodder/animal/day				21.32

Notes: Units: 1 = Number, 2 = Kg, 8 = Litre
Labour costs and pumping costs are excluded. On-farm produced fodder is valued at market prices. All home consumed production is also valued at market prices.

Table A2.32

GROSS MARGIN SHEEP & GOATS

Farm size class: All farms

Operated land	4.61			
No of farms	24			
Average number of animals present during the year	Quantity	Unit	Price per unit	Value
Total number of animals	41.56	1.00	41.40	1720.77
Production				
Closing minus opening				-453.63
Sales minus purchases				169.58
Milk	958.13	8.0	.337	323.18
Manure	12024.79	8.0	.006	66.20
Gross Production Value				105.34
Purchased Material Inputs				
Green fodder	700.00	2.0	.017	11.88
Dry fodder	2535.42	2.0	.115	290.94
Flour (cereals)	154.17	2.0	.081	12.50
Dry bread	75.00	2.0	.100	7.50
Fish meal (sardines)	12.50	2.0	.120	1.50
Concentrates	3320.83	2.0	.086	286.84
Powdered milk	4.50	1.0	3.500	15.75
Drinking water	208.33	2.0	.108	22.50
Mineral salts	.50	2.0	.100	.05
Total Material Costs				649.45
On-farm produced & fed	29142.99	2.0	.017	486.97
Total Variable Costs				1136.42
Gross Margin				-1031.09
Key variables				
Milk (lt)/female/day				1.77
Green fodder/animal/day				2.64

Notes: Units: 1 = Number, 2 = Kg, 8 = Liter
Labour costs and pumping costs are excluded.

Table A2.33

GROSS MARGIN MIXED CATTLE

Farm size class: All farms

Operated land	3.70			
No of farms	8.00			
Average number of animals present during the year	Quantity	Unit	Price per unit	Value
Dairy cows	3.75	1.00	314.17	1178.13
Calves	2.56	1.00	101.71	260.63
Heifers	1.75	1.00	197.50	345.63
Mature males	.25	1.00	250.00	62.50
Total number of animals	8.31	1.00	222.18	1846.88
Production				
Closing minus opening				-643.75
Sales minus purchases				396.25
Milk	2098.75	8.0	.334	700.34
Manure	17441.15	2.0	.009	154.90
Gross Production Value				607.74
Purchased Material Inputs				
Green fodder	5015.63	2.0	.016	82.27
Fish meal (sardines)	37.50	2.0	.120	4.50
Concentrates	2712.50	2.0	.088	237.67
Drinking water	6500.00	8.0	.002	13.00
Mineral salts	12.50	2.0	.120	1.50
Chemicals/medicines	1.56	8.0	5.833	9.10
Total Material Costs				348.05
On-farm produced & fed	48507.13	2.0	.017	810.54
Total Variable Costs				1158.59
Gross Margin				-550.85
Key variables				
Milk (lt) per cow/day				1.53
Green fodder/animal/day				17.64

Notes: Units: 1 = Number, 2 = Kg, 8 = Liter
Labour costs and pumping costs are excluded. On-farm produced fodder and all home consumed production is valued at market prices.

Table A2.34

GROSS MARGIN CHICKEN

Farm size class: All farms

Operated land	3.87			
No of farms	12.00			
Average number of animals present during the year	Quantity	Unit	Price per unit	Value
Chicken (mixed)	28.96	1.00	1.67	48.31
Hens	14.58	1.00	1.07	15.67
Total number of animals	43.54	1.00	1.47	63.98
Production				
Closing minus opening				33.04
Sales minus purchases				-.29
Eggs	6365.08	1.0	.052	331.17
Manure	322.50	2.0	.010	3.09
Gross Production Value				367.01
Purchased Material Inputs				
Barley grain	366.67	2.0	.101	37.08
Bran	100.00	2.0	.130	13.00
Flour (cereals)	100.00	2.0	.103	10.30
Concentrates	1085.63	2.0	.110	119.18
Total Variable Costs				179.56
Gross Margin				187.45

Notes: Units: 1 = Number, 2 = Kg, 8 = Liter
Labour costs and pumping costs are excluded. On-farm produced fodder and all home consumed production is valued at market prices.

Table A2.35

MONTHLY CASH FLOW OF ALL CASH INFLOWS AND OUTFLOWS

Operated land	4.35
No of farms	48.00

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cash Inflows													
Off-farm income	818.78	818.78	818.78	818.78	818.78	823.78	823.78	823.78	823.78	818.78	818.78	818.78	9845.33
Rent received	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	6.88	82.50
Crops	143.92	141.56	140.03	172.03	206.99	202.79	203.68	180.82	260.83	290.85	272.38	199.41	2415.29
Livestock	26.39	965.97	36.81	34.72	28.89	37.64	20.14	38.89	18.06	18.06	18.06	18.06	1647.72
Total Cash Inflow	995.97	1933.19	1002.49	1032.41	1061.53	1071.08	1054.47	1050.36	1109.54	1134.56	1116.08	1043.12	13990.85
Cash Outflows													
Expenses crops	36.82	16.54	16.65	31.51	49.02	117.88	75.64	82.12	3.81	7.54	29.20	10.55	640.32
Expenses livestock	32.18	32.18	375.63	44.73	30.43	30.36	31.40	30.36	30.36	32.18	776.98	32.18	1716.27
Permanent labour	96.23	96.23	96.23	96.23	96.23	96.23	96.23	96.23	96.23	96.23	96.23	96.23	1154.75
Machinery Costs	29.75	29.75	29.75	29.75	29.75	29.75	29.75	29.75	29.75	29.75	29.75	29.75	408.17
Rent paid	21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88	21.88	264.26
Total Cash Outflow	216.86	196.58	540.13	224.09	227.31	296.10	254.90	260.33	182.03	187.58	954.04	190.59	4183.76
Total Cash Balance	779.10	1736.60	462.36	808.32	834.23	774.98	799.57	790.03	927.51	946.98	162.05	852.53	9807.09

Note: Machinery costs mainly consist of pumping and spraying costs.

Table A2.36

MONTHLY CASH FLOW OF ALL CASH INFLOWS AND OUTFLOWS

Farm size class: 0 - 3 feddan

Operated land	2.20
No of farms	17.00

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cash Inflows													
Off-farm income	701.24	701.24	701.24	701.24	701.24	701.24	701.24	701.24	701.24	701.24	701.24	701.24	8414.82
Crops	117.34	117.34	117.34	122.98	119.81	118.13	119.01	135.55	142.73	171.68	148.48	121.21	1551.59
Livestock	13.42	13.42	13.42	13.42	13.42	41.65	13.42	42.83	13.42	13.42	13.42	13.42	438.09
Total Cash Inflow	831.99	831.99	831.99	837.64	834.46	861.02	833.67	879.62	857.39	886.33	863.14	835.86	10404.50
Cash Outflows													
Expenses crops	57.65	6.47	4.18	.00	35.47	119.57	103.46	19.19	.53	.00	38.94	.12	476.38
Expenses livestock	31.70	31.70	100.04	66.41	31.91	31.70	31.70	31.70	31.70	31.70	31.70	31.70	839.42
Permanent labour	84.82	84.82	84.82	84.82	84.82	84.82	84.82	84.82	84.82	84.82	84.82	84.82	1017.88
Machinery Costs	20.59	20.59	20.59	20.59	20.59	20.59	20.59	20.59	20.59	20.59	20.59	20.59	288.85
Rent paid	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.53	3.53	43.24
Total Cash Outflow	198.29	147.11	213.16	175.35	176.32	260.22	244.11	159.84	141.17	140.64	179.58	140.76	2665.77
Total Cash Balance	633.70	684.88	618.83	662.29	658.14	600.80	589.56	719.78	716.21	745.69	683.55	695.10	7738.73

Table A2.37

MONTHLY CASH FLOW OF ALL CASH INFLOWS AND OUTFLOWS

Farm size class: 3 - 6 feddan

Operated land	4.51
No of farms	22.00

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cash Inflows													
Off-farm income	936.98	936.98	936.98	936.98	936.98	947.89	947.89	947.89	947.89	936.98	936.98	936.98	11287.46
Rent received	11.36	11.36	11.36	11.36	11.36	11.36	11.36	11.36	11.36	11.36	11.36	11.36	136.36
Crops	138.02	135.62	130.92	162.45	249.26	244.26	244.70	161.19	148.00	197.47	218.81	186.95	2217.65
Livestock	19.82	2088.00	60.73	56.18	43.45	40.73	24.36	42.55	19.82	19.82	19.82	19.82	2849.65
Total Cash Inflow	1106.19	3171.97	1139.99	1166.98	1241.07	1244.25	1228.32	1162.99	1127.07	1165.64	1186.98	1155.12	16491.11
Cash Outflows													
Expenses crops	27.76	27.52	27.33	67.73	45.85	114.47	64.59	139.52	7.91	16.45	33.62	22.92	770.33
Expenses livestock	27.82	27.82	724.33	28.36	23.83	23.83	26.11	23.83	23.83	27.82	1652.82	27.82	2772.48
Permanent labour	91.68	91.68	91.68	91.68	91.68	91.68	91.68	91.68	91.68	91.68	91.68	91.68	1100.18
Machinery Costs	27.10	27.10	27.10	27.10	27.10	27.10	27.10	27.10	27.10	27.10	27.10	27.10	393.02
Rent paid	17.73	17.73	17.73	17.73	17.73	17.73	17.73	17.73	17.73	17.73	17.73	17.73	214.75
Total Cash Outflow	192.08	191.84	888.17	232.59	206.19	274.81	227.21	299.86	168.25	180.78	1822.94	187.24	5250.76
Total Cash Balance	914.11	2980.13	251.82	934.38	1034.88	969.44	1001.11	863.13	958.83	984.86	-635.97	967.88	11240.35

Table A2.38

MONTHLY CASH FLOW OF ALL CASH INFLOWS AND OUTFLOWS

Farm size class: 6 - 7 feddan

Operated land	6.57
No of farms	6.00

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cash Inflows													
Off-farm income	701.11	701.11	701.11	701.11	701.11	701.11	701.11	701.11	701.11	701.11	701.11	701.11	8413.33
Rent received	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	13.33	160.00
Crops	174.32	174.32	179.32	303.76	274.09	263.54	266.59	310.44	950.94	941.14	727.19	392.07	4957.73
Livestock	100.43	33.76	33.76	33.76	33.76	33.76	33.76	33.76	33.76	33.76	33.76	33.76	541.82
Total Cash Inflow	989.20	922.53	927.53	1051.97	1022.30	1011.74	1014.80	1058.64	1699.14	1689.35	1475.39	1140.28	14072.88
Cash Outflows													
Expenses crops	28.45	9.57	21.13	3.75	69.68	119.76	47.17	90.97	.00	.00	.00	.00	695.76
Expenses livestock	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	34.62	460.40
Permanent labour	56.67	56.67	56.67	56.67	56.67	56.67	56.67	56.67	56.67	56.67	56.67	56.67	680.00
Machinery Costs	62.26	62.26	62.26	62.26	62.26	62.26	62.26	62.26	62.26	62.26	62.26	62.26	788.97
Rent paid	83.33	83.33	83.33	83.33	83.33	83.33	83.33	83.33	83.33	83.33	83.33	83.33	1004.17
Total Cash Outflow	265.33	246.44	258.01	240.63	306.55	356.64	284.04	327.84	236.88	236.88	236.88	236.88	3629.30
Total Cash Balance	723.87	676.09	669.52	811.34	715.74	655.11	730.75	730.80	1462.27	1452.47	1238.52	903.40	10443.59

Table A2.39

MONTHLY CASH FLOW OF ALL CASH INFLOWS AND OUTFLOWS

Farm size class: >> 7 feddan

Operated land	10.90
No of farms	3.00

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cash Inflows													
Off-farm income	853.33	853.33	853.33	853.33	853.33	853.33	853.33	853.33	853.33	853.33	853.33	853.33	10240.00
Crops	277.08	256.85	256.85	256.85	256.85	256.85	256.85	322.02	377.32	350.38	457.63	348.57	3674.12
Livestock	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	1900.00
Total Cash Inflow	1130.41	1110.19	1110.19	1110.19	1110.19	1110.19	1110.19	1175.35	1230.65	1203.71	1310.96	1201.91	15814.12
Cash Outflows													
Expenses crops	2.00	7.00	.00	.00	107.67	129.50	55.97	.00	.00	.00	.00	.00	504.99
Expenses livestock	62.10	62.10	62.10	62.10	62.10	62.10	62.10	62.10	62.10	62.10	62.10	62.10	1451.20
Permanent labour	273.33	273.33	273.33	273.33	273.33	273.33	273.33	273.33	273.33	273.33	273.33	273.33	3280.00
Machinery Costs	36.15	36.15	36.15	36.15	36.15	36.15	36.15	36.15	36.15	36.15	36.15	36.15	433.76
Rent paid	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	400.00
Total Cash Outflow	406.91	411.91	404.91	404.91	512.58	534.41	460.88	404.91	404.91	404.91	404.91	404.91	6069.95
Total Cash Balance	723.50	698.27	705.27	705.27	597.61	575.77	649.31	770.44	825.74	798.80	906.05	797.00	9744.17

Appendix 3

CREDIT SUPPORT TABLES

Table A3.1

DISTRIBUTION OF LOANS BY TYPE

Unit: 1000 OR

	Short Term		Medium Term		Long Term		Total	
Year	No:	Amount	No:	Amount	No:	Amount	No:	Amount
1986	10	56	147	1022	-	-	157	
1987	95	252	304	2363	6	577	405	3192
1988	156	96	913	3477	104	2540	1173	6113
1989	346	213	926	2391	68	1195	1340	3799
1990	428	1713	876	1972	4	998	1308	4683

Table A3.2

REGIONAL DISTRIBUTION OF APPROVED LOANS

Unit: 1000 OR

Region	1986		1987		1988		1989		1990	
	No:	Amount	No:	Amount	No:	Amount	No:	Amount	No:	Amount
South Batinah	61	599	105	1521	101	1567	214	624	125	756
North Batinah	17	83	66	839	217	1390	260	836	200	431
Sharqiya	54	206	99	349	289	1253	364	1006	395	1617
Interior	10	59	21	169	193	660	104	309	112	482
Mct,Qur,Masi	-	-	97	213	166	631	141	271	111	167
Dhahira	5	77	6	67	84	393	33	268	50	228
South Region	10	54	11	34	123	2190	116	376	190	882
Musandam	-	-	-	-	-	-	108	109	125	120
Total	157	1078	405	3192	1173	6113	1340	3799	1308	4683

Table A3.3

APPROVED LOANS DHOFAR REGION

Year	1987		1988		1989		1990	
Purpose	Numnber	Amount	Number	Amount	Number	Amount	Number	Amount
Establishment of new farms	-	-	2	36	-	-	-	-
Farm improvement	2	9	3	18	-	-	-	-
Seasonal loans	-	-	-	-	-	-	-	-
Livestock and poultry	-	-	1	10	3	55	-	-
Falaj maintenance	-	-	-	-	-	-	-	-
Goat improvement	-	-	-	-	-	-	-	-
Large projects	-	-	-	-	-	-	-	-
Irrigation pumps	-	-	-	-	2	2	-	-
Tractors	-	-	1	10	-	-	-	-
Fishery transportation	4	20	8	50	41	240	-	-
Boats and engines	5	5	98	92	66	77		
Fish equipment	-	-	10	3	4	2	-	-
Fish marketing	-	-	-	-	-	-	-	-
Fisheries large projects	-	-	-	-	-	-	-	-
Agricultural marketing	-	-	-	-	-	-	-	-
Agricultural loans	-	-	-	-	-	-	16	66
Agricultural equipment	-	-	-	-	-	-	4	15
Fishery loans	-	-	-	-	-	-	170	801
Total	11	34	123	219	116	376	190	882

Appendix 4

SUBSIDY PROGRAMME SUPPORT TABLES

Table A4.1

PROPOSED DISTRIBUTION OF THE FARMER'S SUBSIDY PROGRAMME ALLOCATION FOR THE YEAR 1988 AND 1989

	Item	Amount proposed for 1989	Amount allocated for 1988
1.	Insecticides	330,000	430,000
2.	Sprayers	20,000	140,000
3.	Aerial spraying	170,000	140,000
4.	Vegetable seeds	100,000	92,000
5.	Potato tuber	60,000	40,000
6.	Plants	30,000	260,000
7.	Chemical fertilisers	100,000	100,000
8.	Organic fertilisers	50,000	40,000
9.	Ploughs, threshers, implements	60,000	80,000
10.	Subsidy for modern irrigation systems	218,000	168,000
11.	Propagation of wheat seed	160,000	20,000
12.	Promotion of garlic cultivation	20,000	10,000
13.	Control of coconut disease	30,000	10,000
14.	Apiary inputs	50,000	40,000
15.	Animal feed	10,000	30,000
16.	Nurseries inputs and production farms	100,000	180,000
17.	Agricultural exhibition/competition	100,000	180,000
18.	Control of citrus disease	160,000	-
19.	Product farms input	included in 16 above	600,000
	Total	1,600,000	2,500,000

Source: Ministry of Agriculture and Fisheries

Table A4.2

PROPOSED DISTRIBUTION OF FARMER'S SUBSIDY PROGRAMME ALLOCATION FOR THE YEAR 1990

Item	Proposed amount in OR
Pesticides	250,000
Aerial spraying against dubas bug	170,000
Promotion of garlic cultivation	15,000
Control of coconut disease	10,000
Vegetable seeds	100,000
Chemical fertilisers	115,000
Organic fertilisers	20,000
Potato tuber	60,000
Extension programmes	35,000
Control of citrus disease	20,000
Propagation of wheat	15,000
Honey bee inputs	20,000
Nursery inputs	50,000
Subsidy for modern irrigation system	60,000
Plants	15,000
Pilot project at Jabreen and Jamah	595,000
Total	1,550,000

Source: Ministry of Agriculture and Fisheries

Table A4.3

DISTRIBUTED SEEDS AT SUBSIDISED PRICES
1985 - 1990
Unit: Kg

Year	Quantity
1985	1246.86
1986	1254.35
1987	945.39
1988	694.82
1989	823.4
1990	659.75

Table A4.4

SUBSIDISED AND MARKET PRICES
OF VEGETABLES AND SEEDS IN SALALAH PLAIN
DURING 1990 (R.O./KG)

Type	Subsidised price	Market price
Water melons	5.50	11.00
Sweet melons	4.38	8.75
Cucumber	5.45	10.90
Squash	1.87	3.74
Pumpkins	2.86	5.71
Turnip	3.40	6.80
Radish	2.32	4.65
Onion	4.14	8.28
Beetroot	2.53	5.05
Lettuce	5.50	11.00
Spinach	2.08	4.16
Parsley	3.30	6.60
Cabbage	3.83	7.66
Cauliflower	7.13	14.25
Okra	1.66	3.33
Egg plant	6.10	12.20
Pepper	7.33	14.65
Tomato	13.20	26.40
Large pumpkins	4.20	8.40

Table A4.5

DISTRIBUTION OF SUBSIDISED VEGETABLE SEEDS IN SALALAH
BY EXTENSION CENTRE
1985 - 1990

Extension Centre	Quantity (kg)	Percentage to Total %
Dhahariz	1154.21	21
Hafa and Qarad	2304.38	41
Salalah	1228.1	22
Awqadeen	939.9	16
TOTAL	56	100

Table A4.6

SUBSIDISED AND MARKET PRICES FOR CHEMICAL FERTILISERS IN 1990
(OR PER 15.KG)

Type	Subsidised price	Market price
Urea	2.95	3.93
Ammonium sulphate	3.16	4.21
Potassium sulphate	5.15	6.87
Super phosphate	4.80	6.40
Compound N P K	4.35	5.80

Table A4.7

DISTRIBUTION OF CHEMICAL FERTILIZERS
1985 - 1990

Unit: 50 kg bags

Year	Urea	Ammonium Sulphate	Potassium Sulphate	Super Phosphate	Compound NPK	Total
1985	-	855	162	-	7529	8546
1976	-	1000	-	-	3283	4285
1987	-	268	-	-	2338	2606
1988	-	409	-	-	2170	2579
1989	-	925	100	309	2046	4708
1990	-	853	225	482	-	4887
Total	4655	4157	649	791	21526	31777

Table A4.8

GOVERNMENT TRACTORS AND THEIR USE IN SALALAH PLAIN

Year	Dahariz		Hafa & Qarad		Salalah		Awqadeen		Total for Salalah plain	
	No. of Tractors	Hours worked	No. of Tractors	Hours worked	No. of Tractors	Hours worked	No. of Tractors	Hours worked	No. of Tractors	Hours worked
1985	3	2494	5	5090	2	2060	2	2536	12	12810
1986	3	2642	5	5568	2	2040	2	2779	12	13029
1987	2	3367	4	5106	3	2301	2	2437	11	13211
1988	2	3001	5	4637	3	2425	2	2651	12	12714
1989	2	2710	4	5126	2	2628	2	2891	10	13355
1990	2	2859	4	4479	2	2352	2	2840	10	12530
TOTAL	3	17073	5	30006	3	13806	2	13697	12	74582

Appendix 5

MARKETING SUPPORT TABLES

Table A5.1

IMPORT PERMITS ON PRODUCE

Category I	Category II	Category III
Produce which are restricted for import. These are produce which are available throughout the year in sufficient quantities. Dates Frankincense Lime Papaya Coconut Dry lime Note:On very special conditions, permits for the above items are considered and issued with writtent approval from H.E. The Executive President	Produce with fluctuating supplies during the season. Permits for these produce are issued depending on the demand and supply in the market. Tomato Eggplant Cucumber Sweet potato Okhra Squash Sweet Pepper Chilli Pepper Lettuce Cabbage Cauliflower Beetroot Karela (Bitter gourd) Pumpkins Green peas Radish Banana	Produce which are available during specific seasons and during the season they are obtainable in sufficient quantities. Permits for those produce are issued during off-season only. Onion Potato Carrots Garlic Mango Pomegranate Grapefruit Sweet melon Sweet lime Water melon

Table A5.2

COMPARISON OF QUANTITY OF FRUITS ACTUALLY IMPORTED WITH QUANTITY LICENCED TO BE IMPORTED DURING 1989
(IN KG)

	First half of 1989			Second half of 1989		
Product	Quantity licenced	Actual import	Marging of quantity licenced over import	Quantity licenced	Actual import	Margin of quantity licenced over import
Banana	3,881,845	2,173,650	1,708,195	585,808	411,733	174,075
Dates	90,950	21,796	69,154	8,500	6,925	1,575
Papaya		4,943	4,943		590	590
Mango	8,704,044	2,945,460	5,758,584	10,594,570	1,972,279	8,622,291
Lime	786,400	58,739	727,661	417,614	137,698	279,916
Coconut		229,422	229,422		76,758	76,758
Other citrus	396,066	144,494	251,572	241,468	110,664	130,804
Melons	13,860,016	1,967,931	11,892,085	46,282,786	10,329,603	35,953,183
Other fruits	6,150,938	-	6,150,938	10,329,603	35,953,183	11,620,537

Table A5.3

COMPARISON OF QUANTITY OF VEGETABLES ACTUALLY IMPORTED WITH QUANTITY LICENCED TO BE IMPORTED DURING 1989
(IN KG)

	First half of 1989			Second half of 1989		
Product	Quantity licenced	Actual import	Marging of quantity licenced over import	Quantity licenced	Actual import	Margin of quantity licenced over import
Tomato	3,717,950	750,248	2,967,702	22,554,681	4,762,895	17,791,786
Eggplant		5,212	5,212	419,696	11,072	408,624
Pepper	327,934	84,375	243,559		352,071	3,587,192
Cabbage	167,500	28,581	138,919		474,229	4,228,593
Cucumber	1,767,970	239,263	1,528,707		497,033	2,090,338
Onion	16,540,401	2,997,234	13,543,167	27,136,753	3,975,491	23,161,262
Sweet potato	35,900	4,891	31,009	313,550	127,456	186,094
Beans and peas	4,200	65,405	61,205	1,734,415	106,518	1,627,897
Potato	12,289,054	3,470,849	8,818,205	24,943,583	7,013,633	17,929950
Okra	69,275		69,275	49,600	2,716,102	2,666,502
Carrots	892,060	197,492	694,568	42,124,501	759,899	41,364,602
Garlic	952,500	190,365	762,135	4,058,177	685,579	3,372,598
Other curcubites	375,222	14,360	360,862	1,628,225	46,371	1,581,854

Table A5.4

PAMAP MONTHLY PURCHASES (LOCAL & IMPORTED)
SELECTED FARM PRODUCTS IN 1988
IN TONS

Month	Tomato		Potato		Onions	
	Local	Imports	Local	Imports	Local	Imports
January	788.56	50.33	11.44	1095.73	0.06	870.00
February	468.26	3.64	506.78	669.29	0.88	653.33
March	249.84	8.76	693.92	468.60	4.59	823.70
April	169.28	217.65	221.23	303.93	31.31	525.15
May	67.11	920.35	4.65	671.89	62.37	556.57
June	12.37	1120.71	0.00	792.06	41.30	521.11
July	1.28	1253.35	0.00	626.54	1.97	612.27
August	0.14	1274.86	0.17	708.36	0.70	28.59
September	8.03	1496.40	0.0	984.90	0.16	26.08
October	143.29	1180.56	0.0	1025.62	0.0	776.50
November	76.91	1192.21	0.01	914.74	0.0	757.41
December	507.78	587.39	0.01	1075.81	0.01	886.67

Appendix 6

INPUT OUTPUT INFORMATION OF SOME IMPORTANT CROPS IN SALALAH

A6.1 INTRODUCTION

This Appendix presents input output information on some important annual and perennial crops. During the farming systems survey in Salalah the cultural practises of both perennial and annual crops were recorded and observed. Below a descriptive summary of the most common cultivation practices as well as the input - output relations of the most important crops are presented.

Salalah is one of the regions in the Sultanate of Oman suitable for the cultivation of a variety of perennial and annual crops under irrigation. Presently, the most important perennial crops are bananas, grasses and coconut. These three crops account for about 72 percent of the total planted area. About eight percent is cultivated with a variety of perennial fruit trees of which papaya the most important is in terms of area and income. The remaining twenty percent is either fallow (about 7.5%) or cultivated with a great variety of vegetables during the khareef season which commences in June and lasts till December. Only some vegetables such as peppers and eggplant are planted as perennial crop by some farm-households. However, most are up-rooted just before the khareef season commences. The khareef season, when compared with other regions in the Sultanate, can be considered as an off-season for the cultivation of vegetables. This is important for the production and marketing of vegetables, since Salalah produces more than the local market can absorb. The main vegetables cultivated in Salalah are tomatoes, chilies, cauliflower, radish, spinach, eggplant, cucurbites, beans and okra. Tomatoes are by far the most important in terms of area. Most of the farm-households are cultivating vegetables with the help of expatriate labourers. In Chapter four extensive attention is paid to the different land tenure arrangements under which crops are cultivated.

The labour requirements were based on group interviews. However, during the survey it was noted that the labour actually spent was in many cases considerably lower than earlier reported. On the other hand a high variability has been observed. This is related to the land tenure arrangements. The allocation of labour to irrigation for example is very arbitrary. In practice several operations are carried out while irrigation water is running into the basins. Therefore the duration of the actual irrigation is not a yardstick for the labour actually spent on irrigation. The level of attention paid to particular crops is directly related to the interest of the labourers in the result (sharecropping, contract farming). Sharecropping in which the labourer has a direct interest receives more attention than permanent crops in which the labourer has no interest. The interest of the owner in farming and his management regime are likely the most decisive factors in the actual labour allocation within the farm.

The cost of labour can be calculated as follows. It can be deducted from the survey that one labourer can actually handle about three feddans. Since one labourer costs about 980 OR per year, the cost per average feddan amounts to about 325 OR per

year. If the farm size is slightly higher, the farmer can allocate more land to sharecropping to reduce the labour peak. Is the farm size smaller than three feddan, then the farmer can either contract the farm out as a whole, or accept that his labour cost is fixed at 980 OR per year. This reasoning is slightly artificial since the farmer has full control over the labourer and can consequently assign him any duty on the farm or outside the farm. Contracting out depends on the amount of non-farm income and the interest of the owner in farming. Small farms are hardly contracted out, because farms have also the function of entertainment location. Large farms employ more than one labourer where by one labourer per three feddans is required. In between farms, either use sharecropping or contract farming as a solution. There is no indication that the existing cropping patterns are much influenced by the availability of labour or its cost. In other words the return to labour has only a marginal influence on the overall cropping pattern. For calculation purposes one could use a cost per hour of 500 Baiza, this is based on the total cost of labour and the total productive hours worked on the surveyed farms (see Chapter 6).

The financial profitability per crop, combined with the physical potential and constraints seem to influence the cropping pattern more than any other factor. From the owner's point of view the long term net annual cash flow is the most important profitability indicator, given the other objectives of farming. In this connection livestock keeping should be mentioned. Still many land owners regard livestock keeping as an important socio-cultural activity. Only dairy farming appears to be an interesting opportunity when cash and kind flows are considered. Nevertheless a lot of fodders are cultivated to feed mixed cattle sheep and goats without any reasonable gross margin or cash/kind flows. This stipulates that not all farm activities are based on rational farm management principles only.

A6.2 PERENNIAL CROPS

A6.2.1 Introduction

Perennial crops consist of bananas, rhodes grass, buffalo grass, elephant grass, coconut and, to a minor extend, of papaya, lime, mango, and a wide variety of almost experimental crops like grapes, pineapple, custard apple etc. Of all these crops, bananas and grasses are cultivated in a more intensive way, due to their financial attractiveness directly or indirectly (fodders). Unfortunately, both bananas as well as grasses have high water requirements. The recent expansion of bananas and grasses is therefore contributing to the aggravating water salinity problem. Excessive irrigation is not the real problem, since most of the excess irrigation water returns to the aquifer, except for the losses due to direct open evaporation. The total increased planted area of bananas and other crops should be seen as the real cause of the problem, due to their high evapotranspiration.

A6.2.2 Banana

Banana occupies almost 28 percent of the total planted area in Salalah. The planted area has recently significantly increased due to a secured market outlet and its overall profitability. Bananas are practically always controlled by the owner and no sharecropping has been observed. Permanent labourers are taking care of the crop, while marketing and overall management supervision is done by the owner.

After establishment, bananas are in most cases continuously cultivated on the same farm and often on the same plot. Dwarf cavandish is the main variety cultivated in Salalah.

Banana suckers can be planted throughout the year. But the khareef season is the best period for planting. Correct spacing is seldom practised during establishment. In several cases intercropping with annual crops has been observed during the first year after planting. After two years spacing is more narrow and intercropping disappears.

The removal of suckers, dry leaves and pseudostems from which the fruits have been harvested, constitute the main after-care. But in Salalah the suckers are allowed to grow continuously, in many cases only the removal of dry leaves is practised. Weeding is regularly done on most farms. The excessive use of irrigation contributes to the control of weeds, but has other less positive effects such as pests and diseases. Although bananas have high water requirements, overirrigation is a general practise. Bananas are irrigated about five times per month during the first half of the year and four times during the second half of the year. However, higher irrigation frequencies have been observed. Stagnating water in the basins is common in many of the surveyed farms.

Material inputs

On average farmers apply eight tons of farm yard manure and eight tons of sahib as a basal dose. Manure and sahib are mixed in the pits before planting. A second dose of farm yard manure, and sometimes also sahib of about eight tons each, is often applied before flowering. The application of sahib soil is a regular practice in mature banana stands. Very small quantities of chemical fertilizers are applied (on average only 20 kgs per feddan). About 10 litres of chemicals are sprayed per year to control pests and diseases. The net water requirements are estimated at about 6500 m3 per feddan per year or 11,000 m3/feddan/year gross (efficiency 60%). However, gross water application rates seem to be rather in the order of 20,000 m3/feddan/year. Reducing pumping has only a minor effect on the cost of production.

Pests and diseases

The following diseases have been observed:

Fungal: Sigatoga diseases (Cercospora musae) Cigar end disease (Verticillium theobromae)

Bacterial: Moko diseases (Psendomonas solanauarum)

Viral: Mosaic virus

Nematodes: Root knot nematodes (Meloidogyne spp.)
Lesion nematode (Protylenchus musicola)
Burrowing nematode (Radopholus similis)

Non parasitic diseases:

Fruit cracks due to high temperatures and irregular irrigation. Root rot due to excessive irrigation. Deficiencies due to unbalanced manuring and fertilizer application. Salt damage due to soil and water salinity.

Yield

Bananas are harvested the whole year round after the plant crop has firmly been established. The average yield in the survey amounted to about seven tons per feddan (or 16.7 tons per ha). The average yield is slightly higher due to the incorporation of some young banana plantations. This yield is relatively high considering the limited use of fertilizers.

Labour requirements

The establishment of bananas requires about 385 hours per feddan excluding irrigation and pest management in the first year. A fully grown banana plantation requires about 640 hours per feddan (or 80 mandays/feddan). This is equal to about 190 mandays per ha. Compared with data from other countries in the region this seems to be on the high side. The allocation of labour to particular months for adding sahib and the application of fertilizers and manure is somehow arbitrary, since these operations can easily be shifted to other months. The actual time spent on weeding is highly variable and is correlated to the other duties arising from the individual cropping patterns. Several farm-households in the centre of Salalah cultivate bananas only. These farms undoubtly spend more time on weeding.

Cost of production

The production value of a feddan of mature bananas amount to about 1,050 OR. The main cash costs consist of sahib soil, farm yard manure and labour. Expenses on chemical fertilizers and plant protection chemicals are very low. Livestock farmers use their own farm yard manure, thus reducing the cash expenses (not the costs). The cost of labour depends on the way of payment. When farmers have to earn their own salary through sharecropping labour expenses are low. Based on a labour cost of 500 Baiza per hour, the labour costs of bananas would amount to 320 OR per

feddan. Based on an average cost of pumping of 3 Baiza per m3 and a gross water application of 20,000 m3 per year, the pumping costs would amount to 60 OR per year. Proper irrigation would reduce the pumping cost to about 30 OR per feddan. The total cost of production amounts to 605 OR, resulting in a net return of about 445 OR per feddan per year. The net return is the reward for land and management. The cash flow per feddan varies between the farm-households depending on the way of payment for labour and the source of farm yard manure.

It should be noted that the expenses on sahib soil are high. The total expenses on sahib soil i.e. 114 OR per feddan equals to about 1,425 Kg of urea. It is expected that a better balanced supply of macro and micro nutrients will have a positive effect on the yield, while also better pest management could contribute to better results in terms of quantity and quality. Table A6.1 reflects the cost of production of feddan of bananas. Input and output data are taken from the individual farm-household survey, while the labour requirements are based on the group interviews. Some labour requirements have been adjusted according to the farm-household survey. For easiness some figures have been rounded.

Table A6.1

COST OF PRODUCTION PER FEDDAN
BANANAS

	Quantity	Unit	Price per unit	Value
Total Production	7000.00	Kg	.150	1050.00
Material costs				
Farm yard manure	16000.00	Kg	.006	96.00
Other chemical fertil.	20.00	Kg	.105	2.10
Plant protection	10.00	Litres	.329	3.29
Sahib soil (jebel)	19000.00	Kg	.006	114.00
Interest working capital				9.68
Total Variable Costs				225.07
Gross Margin				824.93
Fixed costs				
Labour	640.00	Hrs	0.500	320.00
Pumping costs	20000.00	M3	0.003	60.00
Total Fixed Costs				380.00
Total Costs				605.07
Net Return				444.93

Notes: Planting costs excluded. Net return equals return to land and management.

Table A6.2

PRESENT LABOUR REQUIREMENTS OF FULLY ESTABLISHED BANANAS PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Adding sahib soil	30.0												30.00
Adding farm yard manure	30.0					30.0							60.00
Fertilizing			10.0					10.0					20.00
Weeding/basin repairs	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	180.00
Irrigation	20.0	20.0	20.0	20.0	20.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	205.00
Plant protection	8.0					8.0							16.00
Harvesting (10 hrs/ton)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	72.00
Subtotal	109.0	41.0	51.0	41.0	41.0	74.0	36.0	46.0	36.0	36.0	36.0	36.0	583.00
Miscellaneous 10%	10.9	4.1	5.1	4.1	4.1	7.4	3.6	4.6	3.6	3.6	3.6	3.6	58.30
Grand total	119.9	45.1	56.1	45.1	45.1	81.4	39.3	50.6	39.6	39.6	39.6	39.6	641.30

Note: Assumptions: Yield 7 tons/feddan. Source: Adjusted from group interviews.

Table A6.3

LABOUR REQUIREMENTS FOR THE ESTABLISHMENT OF BANANAS PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Ploughing					5.0								5.00
Basin preparation					120.0								120.00
Pit making & planting						75.0							75.00
Adding sahib soil						30.0							30.00
Adding farm yard manure						30.0							30.00
Weeding							15.0	15.0	15.0	15.0	15.0	15.0	90.00
Subtotal					125.0	135.0	15.0	15.0	15.0	15.0	15.0	15.0	350.00
Miscellaneous 10%					12.5	13.5	1.5	1.5	1.5	1.5	1.5	1.5	35.00
Grand total					137.5	48.5	42.9	42.9	42.9	42.9	42.9	42.9	385.00

Note: Assumptions: Yield 7 tons/feddan. Excluding irrigation and plant protection. Source: Adjusted from group interviews.

A6.2.2 Rhodes grass (Chloris gayana)

Rhodes grass is a fast growing perennial grass. It possess a profuse tillering habit, seven to eight cuttings can be taken in a year. Land is prepared by one or two deep ploughings. In general planting/sowing is done during the months of June - July. Rhodes grass is irrigated once a week, using basin irrigation. First cutting is usually done 80 days after planting. Subsequent cuts are done on a 35 to 40 days interval. Rhodes grass is replanted after four to five years. Despite the active market for grass and hay, most of the production is for on-farm use. This rejects the earlier assumption that grasses would be mainly produced for the livestock keepers in the jebel. Although there is some relation with the jebel keepers. Their main source of hay comes from the large commercial farms in Salalah and from the Batinah.

Material inputs

Approximately 40,000 rooted slips are required for the planting of one feddan. About four to five kgs of seeds are necessary for sowing. About five tons of farm yard manure and two tons of jebel soil are applied as basal dose during the time of land preparation. Most farmers apply chemical fertilizers after every cut. Relatively high amounts of fertilizer are applied. In the survey about 350 kgs of urea was used per feddan per year, in addition to about 175 of compound fertilizers. The net water requirements are estimated at about 6500 m3 per feddan per year or 11,000 m3/feddan/year gross (efficiency 60%). However, gross water application rates seem to be rather in the order of 15,000 m3/feddan/year. Here again the cost of irrigation is rather small and labourers are not inclined to reduce water application to optimum application rates. There is hardly any incentive to reduce pumping due to the low cost per m3 of water. Where pumping does not lead to depletion of the well, water is not regarded as a scarce good. The subsidies on pumps , pump houses and the low cost of energy do not stimulate the farmer/labourer to optimize pumping.

Pests and diseases

No specific list of pests and diseases has been prepared but it is well known that broadleaved weeds easily infest new established fields. After a few cuts weed competitions becomes less serious.

Yield

The yield of Rhodes grass is estimated at 40 tons per feddan of green material or about 10 tons of dry fodder. For one reason or another the yields seem to be systematically overestimated. Research claims even yields of 60 to 70 tons per feddan of green material. The reason is the way yields of small areas are extrapolated to per feddan figures. Even 10 tons of dry fodder per feddan per year seems to be rather high. In many fields gaps have been observed in the grass cover. This certainly contributes

to lower yields. Since the labourers have no direct benefit from higher yields, little attention is paid to obtain better grass stands.

Labour requirements

The labour requirements of Rhodes grass are estimated at about 660 hours per feddan per year. Cutting and irrigation are the most labour demanding activities. Only few farmers use choppers.

Cost of production

Assuming a yield of 40 tons per feddan the gross production value amounts to 640 OR per feddan per year. The total cost of production amounts to 480 OR, resulting in a net return of about 160 OR per feddan per year. The cost of production includes an imputed value for labour and includes also the pumping costs. The net return is the reward for land and management. The cost of production amounts to 12 Baiza per kg while the market price is about 16 Baiza per kg.

Table A6.4

COST OF PRODUCTION PER FEDDAN
RHODES GRASS

	Quantity	Unit	Price per unit	Value
Total Production Green	40000.00	Kg	.016	640.00
Material costs				
Planting materials 1/	1.00	Kg	8.500	8.50
Compost	12.15	Kg	.115	1.40
Farm yard manure	4820.53	Kg	.007	33.31
Urea	356.06	Kg	.075	26.82
NPK compound	6.07	Kg	.150	.91
Other chemical fertil.	171.58	Kg	.089	15.33
Plant protection	.58	Liters	3.937	2.27
Sahib soil (jebel)	2095.35	Kg	.006	12.57
Interest working capital				4.55
Total Material Costs				105.66
Other costs				
Tractor hire 2/	1.00		1.000	1.00
Total Other Costs				1.00
Total Variable Costs				106.66
Gross Margin				533.34
Fixed costs				
Labour	657.00	Hrs	0.500	328.50
Pumping costs	15000.00	M3	0.003	45.00
Total Fixed Costs				373.50
Total Costs				480.16
Net Return				159.84

Notes: 1/ Planting material divided by five to arrive at annual cost.
2/ Cost per year.
3/ Net return equals return to land and management.

Table A6.5

PRESENT LABOUR REQUIREMENTS OF RHODES GRASS
PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Irrigation	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	60.00
Fertilizing	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.00
Basis maintenance	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	60.00
Harvesting	30.0	30.0	30.0	30.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	30.0	465.00
Subtotal	41.0	41.0	41.0	41.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	41.0	597.00
Miscellaneous 10%	4.1	4.1	4.1	4.1	5.6	5.6	5.6	5.6	5.6	5.6	5.6	4.1	59.70
Grand total	45.1	45.1	45.1	45.1	61.6	61.1	61.1	61.1	61.1	61.1	61.1	45.1	656.70

Note: Source group interviews.

A6.2.3 Elephant grass (Pennisetum pupureum)

Elephant grass is a very tall (3 to 5 meters) erect, weakly rhizomatous and vigorous perennial grass that vegetatively is propagated. Approximately 8,00 rooted slips are used for the planting of one feddan. Cultural practises are almost the same as for Rhodes grass. However, since cutting is easy, less labour is required. A first cut can be taken after 80 to 90 days after planting. Subsequent cuts are done on a three to four months interval. About three to four can be realized under could management and proper fertilization. Elephant grass responses well to fertilizers. The yield is estimated at almost 70 tons of fresh material per feddan or 165 tons per ha. This would amount to almost 42 tons of hay per ha. This again seems to be high. In Salalah most elephant grass is grown in small patches and fed fresh to the animals on-farm. If elephant grass is cut too late digestibility will diminish. Depending on the combination of foodstuffs, effective yields may differ due to different times of cutting. In view of the cost of production elephant grass would surely replace Rhodes grass if feed ratios would not be taken into account. Secondly, the price of elephant grass has been fixed at the same level as Rhodes grass because little elephant grass hay reaches the market. If both the price and the yield are too high the overall result as presented in Table A6.7 would be much lower. It is more likely that elephant grass is grown as a supplement and not as the major source of animal feeding.

Table A6.6

COST OF PRODUCTION PER FEDDAN
ELEPHANT GRASS

	Quantity	Unit	Price per unit	Value
Total Production	69485.88	Kg	.016	1111.09
Material costs				
Farm yard manure	6316.18	Kg	.007	44.19
Urea	415.44	Kg	.076	31.40
NPK compound	77.21	Kg	.152	11.76
Other chemical fertil.	143.38	Kg	.070	9.97
Plant protection	2.50	Liters	8.118	20.29
Sahib soil (jebel)	4213.24	Kg	.007	27.90
Interest on working capital				6.55
Total Material Costs				152.06
Other costs				
Tractor hire 1/	2.00	feddan	1.000	2.00
Total Other Costs				2.00
Total Variable Costs				154.06
Gross Margin				957.03
Fixed costs				
Labour	179.00	Hrs	0.500	89.50
Pumping costs	20000.00	M3	0.003	60.00
Total Fixed Costs				149.50
Total Costs				301.56
Net Return				809.50

Notes: 1/ Annual cost based on establishment cost in year one.
2/ Yield and price are overestimated.

Table A6.7

PRESENT LABOUR REQUIREMENTS OF ELEPHANT GRASS PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Irrigation	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	72.00
Fertilizing	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.00
Harvesting	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	78.00
Subtotal	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	162.00
Miscellaneous 10%	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	16.80
Grand total	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	178.80

Source: Group interviews.

A6.2.4 Coconut (Cocos nucifera)

Coconut is one of the crops that requires very little attention to obtain acceptable returns. Coconut trees have long been growing in Salalah. Most of the nuts are harvested for drinking purposes. Only very small quantities are harvested for the coconut flesh. No oil extraction is practised. Coconut trees are often planted as fence, but also systematic small plantations are observed. Sometimes spacing is so wide that intercropping is practised. Harvesting and irrigation are the major operations observed during the survey. Tall varieties are most common in Salalah, although also dwarf orange and natural crossed dwarf varieties have been observed. Most of the crops are given out on a lease basis and the farmer receives a regular income whenever trees are harvested. Lot of insect attack like Rhinoceros beetle, coried bug and disease like bud rot (Phytophthora palmivora) were observed during survey. Coconuts are sprayed free of charge against some pests and diseases by the extension service. Material input use is minimal. The figures in the table, being an average, do not reflect that the majority of the farmers are hardly using any inputs at all, except irrigation water. This makes coconut an attractive crop. However the market is limited and an expansion of the area on any scale is not likely. Besides, the establishment period is rather long.

The net return per hundred trees is estimated at about 338 OR per year per 100 mature trees. In view of the low labour requirements coconut is an attractive side crop.

Table A6.8

COST OF PRODUCTION PER 100 MATURE TREES
COCONUTS

	Quantity	Unit	Price 1/ per unit	Value
Total Production	3240.81	Nuts	.145	471.38
Material costs				
Farm yard manure	964.70	Kg	.006	6.26
Urea	58.03	Kg	.060	3.48
Ammonium sulphate	4.84	Kg	.100	.48
Potassium sulphate	4.84	Kg	.100	.48
Super phosphate	4.84	Kg	.100	.48
NPK compound	29.01	Kg	.183	5.32
Plant protection	.19	Liters	8.625	1.67
Sahib soil (jebel)	918.76	Kg	.005	4.84
Interest on working capital				1.01
Total Material Costs				23.55
Total Variable Costs 1/				23.55
Gross Margin				447.83
Fixed costs				
Labour 2/	132.00	Hrs	0.500	66.00
Pumping costs	8000.00	M3	0.003	24.00
Total Fixed Costs				90.00
Total Costs				133.55
Net Return				337.83

Notes: 1/ Price per nut on the tree.
2/ Excludes labour for harvesting; harvesting done by contractors.

Table A6.9

PRESENT LABOUR REQUIREMENTS OF COCONUT
PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Irrigation	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	96.00
Fertilizing	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	24.00
Subtotal	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	120.00
Miscellaneous 10%	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.00
Grand total	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	132.00

Note: Harvesting is done by contractors. Source group interviews.

A6.3 VEGETABLES

A6.3.1 Introduction

The cultivation of vegetables under irrigation during the khareef season can be explained by a combination of physical and socio-economic factors. Firstly, there is a market for vegetables both locally and in the remainder of Oman during the harvesting period of most vegetables, cultivated in Salalah. The bulk of the production of vegetables in the Sultanate is produced in the winter season in other areas. The khareef season in Salalah coincides with the summer season in the rest of the Sultanate when the supply of crops is minimal from the Batinah and other regions. Secondly, the cultivation of vegetables is caused by the existing forms of land tenure and the way permanent expatriate labour receives their remuneration. Sharecropping of vegetables and contract farming (contracting the whole farm) is practised by a great number of Omani land owners to actually let the farm pay for the use of permanent expatriate labour, while at the same time the labourers have to undertake regular work of the non-shared farm activities. This arrangement is both beneficial for the farmer/owner and the sharecropper from an income point of view. The low yields of vegetables is caused by a wide variety of pests and diseases and the unbalanced supply of macro and micro nutrients, while in some areas also the high salinity of irrigation water and soil contributes to low yields. The end of December is in most years the end of the growing season due to high temperatures and hot winds coming from the desert areas. Only some farmers leave crops in the field to harvest only very some additional quantities.

The choice and extend of the cultivation of vegetables is influenced by two major factors. Firstly, the market i.e. the demand for particular vegetables and secondly by the net cash return. The net cash return is highly influenced by the expected yields. Tomatoes have a good market due to the dietary preference for this product. Yield expectations are mainly influenced by the possibility of controlling pests and diseases. The demand for certain vegetables stems from the expatriate community, it should however be realized that the purchasing power of this group is limited. Also the necessity to practice crop rotation contributes to the cropping pattern of vegetables.

Both yield fluctuations and the demand structure and as well as the necessity of crop rotation excludes the emerge of mono vegetable growing. Consequently, an one-time financial analysis of an individual vegetable should not lead to definite recommendations regarding a particular vegetable. A long-term risk analysis is carried out by the farmers themselves. Therefore one year one particular vegetable might be more profitable than another vegetable. The following year another vegetable might be more profitable. The figures below reflect the situation as met during the survey year.

In the remainder of this Appendix tomatoes is discussed in detail while some of the main cultural practices of the other

vegetables are reviewed. The number of observations of the other vegetables did not allow the presentation of reliable data.

It can be concluded from the analysis below that variety testing, and good plant protection advise, as well as good advise on the application of macro and micro nutrients essential elements are in furthering the success development of vegetable growing.

A6.3.2 Tomatoes (Lycopersicon esculentum)

Area wise as well as economically tomatoes is the most important vegetable cultivated during the khareef season. Normally, transplanting will commence in June and the growing season continues to the end of December.

Nursery operations commence in June. The Government usually provides soil treatment free of charge and sells treated seeds to farmers. Some farms are using their own seeds which are often brought into the country by labourers from their home country.

Land preparation starts in June with cleaning and ploughing. Most of the farmers buy soil "sahib" from the jebel and mix this soil with the top soil. Farmers believe that adding sahib soil improves the quality of the soil. However, most sahib soil is highly calcareous and poor in quality. It is more likely that this practice originates from areas with shallow soils. Most of the soils in the centre of the plain have been altered by farmers over the past. Despite the low quality, adding soil and manure over a considerable long period has most probably improved the overall soil condition in the centre of the plain.

After 15 to 20 days of sowing farmers use to transplant tomato to the main field. Irregular and close planting has been observed during the survey in Salalah. Normally 75 * 60 cm is suitable for autumn crop. Suitable spacing facilitates weeding, hoeing and fertilizer application. Regular weeding is the general practise in most of the farms in Salalah, but hoeing to loosen the soil is hardly practised. Tomato plants require frequent shallow cultivation, especially during their first week in the field. The surface soil is loosened by hand-hoeing as soon as it is dry enough after every irrigation or shower. Weeds should be removed to obtain high yields.

Often for early market the tomato plants are pruned to a single stem and tied to a stake. Various methods of pruning and training are followed. Single stem training is most common. In this system all the young shoots that grow in the axil of the leaves are removed.

Material inputs

High seed rates is a common practise among the farmers/labourers. A normal seed rate of 200 grams should be enough for one feddan, however on most farms 400 to 500 grams of

seeds is used for one feddan. On average about 4000 kg of sahib and 4000 kg of farm yard manure are used as a basal dose. If the jebel soil analysis shows negative results, it might be better to replace the jebel soil with farm yard manure because prices are almost same. In some farms proper mixing of the organic fertilizer and soil is not practised. This results in a lower production due to the lower availability of nutrients. Application of a starter solution (a dilute solution of nitrogen, phosphorous and potash) at the time transplanting will give good results. A yield of 16000 kg tomatoes removes for example 50 kg nitrogen, 16 kg phosphorous and 65 kg potash from the soil. Foliar application of nitrogen was observed in some farms. But concentrations higher than one percent may burn the leaves. The net water requirements are estimated at about 2030 m3 per feddan per year or 3,383 m3/feddan/year gross (efficiency 60%). However, gross water application rates seem to be rather in the order of 4,000 m3/feddan/year.

Pests and diseases

The following pests and diseases have been observed:

Fungal: Late blight (Phytophthora infestants), Early blight (Alternaria solani), Sooty molds (Capnodium, Fumago and other fungi), Powdry mildew (Leveillula taurica)

Viral: Leaf curl virus, transmitted by the white fly. Tobacco mosaic virus, transmitted by feeding of various insects and mechanically.

Nematodes: Root knot nematodes (Meloidogyne spp.)

Non parasitic diseases:

Sun scold; Blossom end rot, this disease is common on plants that had an excess of water in the early part of the season, followed by a period of drought, the disease is also caused by a deficiency of calcium which is needed for the synthesis of rigid cell walls of the tomato. Fruit cracks due to high temperatures and irregular irrigation. Some varieties are more susceptible than others. The variety Pearsum (widely used) is more susceptible than Pakmore. Deficiencies due to unbalanced manuring and fertilizer application.

As a consequence of the above mentioned pests and diseases high dosages of plant protection chemicals are applied. Most of the farmers are actually using higher dosages than the required quantities. But also the use of low dosages is observed in some of the farms resulting in an increase in the insect population. Usage of chemical with out proper mixing and use of systemic chemicals during the time of harvest were also observed during

survey. Mixing of the chemical with water before the use is an important factor. If the chemical is not properly mixed it will not give any result. The use of systemic chemicals just before harvesting is not advisable.

Yield

Harvesting starts in October and lasts up to December. The average yield in the survey amounted to about 3 tons per feddan. At this yield level tomatoes give a good return. However, yields do fluctuate a lot according to the level of pest and disease infestation.

Labour requirements

The total labour requirements amounted to about 370 hours per feddan or about 110 mandays per ha. The time spent on weeding and irrigation is relatively high.

Cost of production

Assuming a yield of 3 tons per feddan the gross production value amounts to 675 OR per feddan. The total cost of production amounts to 310 OR, resulting in a net return of about 365 OR per feddan. The cost of production includes an imputed value for labour and includes also the pumping costs. The net return is the reward for land and management. The cost of production amounts to 103 Baiza per kg.

Table A6.10

COST OF PRODUCTION PER FEDDAN
TOMATOES IN KHAREEF

	Quantity	Unit	Price per unit	Value
Total Production	3000.00	Kg	.225	675.00
Material costs				
Planting materials	.33	Kg	13.012	4.27
Compost	18.06	Kg	.150	2.71
Farm yard manure	4352.20	Kg	.006	28.12
Urea	17.76	Kg	.078	1.39
NPK compound	126.43	Kg	.148	18.75
Other chemical fertilizers	18.06	Kg	.090	1.63
Plant protection	4.58	Liters	5.907	27.03
Sahib soil (jebel)	3671.88	Kg	.006	21.89
Interest on working capital				4.76
Total Material Costs				110.55
Other costs				
Tractor hire	7.47	feddan	1.242	9.27
Total Other Costs				9.27
Total Variable Costs				119.82
Gross Margin				555.18
Fixed costs				
Labour	370.00	Hrs	0.500	185.00
Pumping costs	4000.00	M3	0.003	12.00
Total Fixed Costs				197.00
Total Costs				307.55
Net Return				367.45

Table A6.11

PRESENT LABOUR REQUIREMENTS OF TOMATOES PER FEDDAN

Unit: Hours

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Nursery operations					14.0	14.0							28.00
Plot preparation						24.0							24.00
Furrow preparation						16.0							16.00
Transplanting							35.0						35.00
Irrigation/weeding							25.0	25.0	25.0	25.0	25.0		125.00
Fertilizing							1.0	1.0	1.0	1.0			4.00
Plant protection							7.5	7.5	7.5	7.5			30.00
Harvesting									15.0	30.0	30.0		75.00
Subtotal					14.0	54.0	68.5	33.5	48.5	63.5	55.0		337.00
Miscellaneous 10%					1.4	5.4	6.8	3.3	4.8	6.3	5.5		33.50
Grand total					15.4	59.4	75.3	36.8	53.3	69.8	60.5		370.50

Note: Plant protection based on 4.5 liters chemicals, power sprayer 200 liters of solution requires two hours.
Yield assumption 3 tons per feddan. Source group interviews.

A6.3.3 Other vegetables

Cauliflower (Brassica oleracea; variety botrytis)

The cultivation of cauliflower commences in June to July and will last up to December. Most of the farmers are using early varieties. The climate in Salalah is suitable for early varieties which require a bit higher temperature and a longer day length than the other varieties.

Most of the farmers are purchasing seeds supplied by the Government. However, some expatriates are using there own seeds from their home country. Sowing time in Salalah starts in June. Nursery preparation for cauliflower may last up to August/September due to the possibility of repeated planting. The duration of crop in the main field is approximately 45 to 50 days, allowing several crops. A seed rate of 300 to 350 gram per feddan is recommended.

Land preparation commences in June with cleaning the main land followed by ploughing. Normally farmers are using 3000 kg of farm yard manure and the same amount of jebel soil "sahib" at the time of land preparation. Especially in Salalah, farmers are growing three to even four crops during the khareef season. In order to maintain the nutrient status of the soil sufficient amounts of organic manure and fertilizers are required. Fifteen tons of farm yard manure per hectare is a standard recommendation, but higher amounts might be required depending on the type of soil and the crop rotation practices.

The seedlings are transplanted after four to five weeks. Closer spacing is recommended for early varieties, 45 by 45 cm is the best spacing for early varieties. Leaving sufficient space between the plants facilitates proper weeding. Transplanting continues after each harvest.

Cauliflower requires high dosages of manure and/or fertilizers as it removes large quantities of macro nutrients from the soil. A yield of 25 tons per hectare, removes approximately 90 kg nitrogen, 40 kg phosphate and 100 kg potash from the soil. The application of nutrients is important in the cultivation of cauliflower, because of the repeated cultivation. Use of more manure and/or chemical fertilizers is essential to maintain the nutrients balance in the soil. Due to the lack of some essential micro nutrients cauliflower is susceptible to pests and diseases.

An early crop requires irrigation twice a week after transplanting. In the last stage it is better to minimise irrigation according to the availability of water in the soil. Frequent shallow hoeing should be practised to kill weeds and to provide soil mulch. Cauliflower is a shallow rooted crop, with most of its roots in the top 45 to 60 cm. Deep cultivation should, therefore, be avoided.

Proper blanching is not a common practise on most of the surveyed farms. This is one of the reasons why the quality of the produce is comparatively poor. A head of cauliflower should be white. To obtain a white head, blanching is required by excluding sun light. While the head is small, it is naturally protected by the inner leaves but later, when the leaves open, they are exposed to sun light. Usually blanching is carried by pulling the outer leaves up over the head and tie them with a twine or rubber band. By using different coloured twines or rubber bands each time, it is easy to select those tied earliest at the time of harvest.

Due to the limited number of observations in the survey only some pests and diseases are mentioned here. In general, gardens are affected by insects like diamond back moth (Plutellidae) and aphids. Fungal disease like leaf spot (Alternaria solani) were observed, while also nematodes such as root knot (Meloidogyne spp.) were spotted during the survey. Also chlorosis caused by various deficiencies was observed. Most fields were heavily damaged by pests and diseases despite the use of huge quantities of plant protection chemicals. As in other vegetables both the wrong chemicals as well as the wrong quantities, without proper dilution, are applied. Pest control is important in the cultivation of cauliflower because of its repeated cultivation. If insects and diseases are not properly controlled in the initial stage, they will affect the following cauliflower crop.

Harvesting starts about 45 days after transplanting. After completing the harvest, farmers will quickly prepare the land for the next crop. Normally this will be repeated two to three times up to December.

Chilies and peppers (Capsicum annuum)

Chilies are one of the more valuable crops in Salalah. Some of the farmers are growing the crop for more than one year. In most years chilies are profitable. The pungent type is more common than the non pungent type. Cultivation of the non pungent type is limited. The temperature regime in Salalah is suitable for the cultivation chilies and peppers. Normally the crop grows from May/June and continues production till December/January. Some crops remain for more than a year in the field. During the time of hot desert winds in January - February, the yield becomes very low.

Nursery preparations commences in May. A seed rate of 450 to 500 grams is required for one feddan, depending on the variety. Most of the farmers are using their own seeds for sowing.

Land preparation starts in May. Some of the farmers are using jebel soil mixed with farm yard manure. Chilies and peppers are grown on practically all soil types, except in saline areas.

Seedlings are transplanted after about four to five weeks.

Some farmers believe that one extra transplanting in second seed bed results in an early crop with a higher yield. Usual spacing is 45 cm in the rows and in between the rows. Experiments, however, have shown that closer spacings within the row ensures higher yields.

Eight to 15 tons of farm yard manure per feddan is giving good results. Farm yard manure should be incorporated in the soil at the time of land preparation. A fertilizer dose of 100 kg, 60 kg, 80 kg of N P K is the general recommendation for solanaceous vegetables like chilies, eggplant and tomato. Specific recommendations should be given on the basis of a proper soil analysis. Full doses of phosphate and potash and half dose of nitrogen should be applied at the time of transplanting and the remainder of the nitrogen should be given as top dressing.

Uniform moisture level in the soil is essential to prevent fruit drop. The number of irrigations is therefore depending on the soil type and the actual moisture content of the soil. Weeding and hoeing have to be carried after each irrigation. Chilies are sensitive to water and soil salinity.

During the survey symptoms of fungal disease wilt (inward rolling and yellowing of leaves) has been observed. Dropping of seedling in the nursery bed is also observed in some of the farms. Copper fungicide can prevent the spread of wilt disease. Fields affected by insect attacks (such as by thrips) were also found in some farms. Proper plant protection is a must to achieve good results. Treatment should be avoided at or just before the crop is harvested.

Harvesting commences in June and continues till December.

Egg plant (Solanum melongena)

This vegetable also belongs to the family solanaceae. The main variety grown in Salalah is the round or egg shaped which is grouped under the variety esculentum. The long slender type which belongs to the serpentinum variety serpentinum is also grown. Some farmers are keeping the egg plants as a perennial crop.

The government is supplying seeds on subsidized basis. Nevertheless, most farmers are using their own seeds. About 375 to 500 grams of seed is required for the cultivation of one hectare. In Salalah nursery operations start in May - June.

Land preparation commences in June with cleaning, ploughing, harrowing and mixing of jebel soil and farm yard manure in the main field. Eggplant is a hardy plant and can be grown on different kinds of soil but does best on silty loams or clay loam.

The seedlings are transplanted after three to four weeks. Proper spacing facilitates weeding and hoeing. The planting

distance depends on variety. The recommended spacing for the bushy, non-spreading type, is 50 by 60 cm between the rows and in between the rows.

Organic manures are mixed with the soil at the time of land preparation. Normally three tons of farm yard manure and three tons of jebel soil are used as a basal dose. Application of 20 tons of farm yard manure as a basal dose is the general recommendation. A fertilizer dose of 100 kg nitrogen, 60 kg phosphorous and 80 kg potash is the normal recommendation for solanaceous vegetables. Half dose of nitrogen and full dose of phosphorous & potash should be added at the time of transplanting and the remainder should be applied as top dressing after four weeks.

Excessive irrigation reduces the yield. Shallow cultivation with a top dressing of fertilizer will gives good result.

Like many other vegetables cauliflower is affected by leaf spot (Alternaria solani) and root knot, caused by nematodes (Meloidogyne spp.). Also chlorosis, caused by various deficiencies, has been observed.

Harvesting starts 45 to 50 days after transplanting.

Radish (Raphanus sativus)

Radish is cultivated as a main crop or as an intercrop between plants with a slower growth. Most of the farmers are using pure white, thin and tender varieties which mature within 30 days. Because of the short life span of the crop, some farmers cultivate two or three crops during the khareef season.

Land preparation starts in June. Some farmers are not giving sufficient attention to proper land preparation. They are used to sow directly on ridges as an intercrop without any soil preparation. The survey shows that the yield and quality of such crops are very poor. As a root crop radish need thorough channel preparation. Soil clods hamper the growth of roots and should be removed. Radish is sown on ridges, immediately after ridge making the seeds are sown. Approximately five kg of seed is recommended for one feddan.

Irregular and excess irrigation has been observed on most farms. On all farms in the survey weeding was practised once per month. Radish requires sufficient water from sowing time until the roots are large enough to harvest them. It is better to keep an even moisture level in the soil.

Most farmers are applying chemical fertilizers.

In some farms plants were severely affected by insects (diamond black moth, aphids). In some farms the degree of infestation was very high.

Harvesting starts 30 days after sowing.

Okra (Abelmoschus esculentus)

Okra is cultivated in both the khareef season as well as in the summer. The first crop is planted in January - February and the second crop in May - June.

Land preparation of the khareef crop starts in May - June. Only some farmers are using jebel soil mixed with farm yard manure. Approximately 1.5 tons of farm yard manure and two tons of jebel soil are applied as a basal dose. About five to eight kg of seeds are required per feddan. In khareef season a lower seed rate is the common practise. Most of the farmers are using their own seeds. For the summer season, seeds are soaked in water for 24 hours before sowing. Seeds are sown in rows.

According to the survey analysis, the application of chemical fertilizers is comparatively low. On average 30 kg of urea and about 55 kg of compound fertilizers (15-15-15) were applied.

The incorrect use of plant protection chemicals is very common in Salalah. Gardens affected by the insect attack like jassids, white fly and disease like yellow vein mosaic were observed during survey.

Okra fruits are continuously harvested every second or third day from the time the first pods are formed. The best time of picking begins 6 to 7 days after opening of the flowers. Plant growth and fruit bearing are adversely affected when the fruits are not harvested on time, i.e. when they are still young.

Beans and peas

Three types of beans are commonly cultivated in Salalah. They are cluster beans (Cyamopsis tetragonoloba), dolichos and cow pea (Vigna sinensis). Most of these are cultivated during khareef season, but some beans like cluster beans are also cultivated in the summer season.

Land preparation starts in June. Commonly, about 1.6 tons of farm yard manure and two tons of "sahib" soil are applied as base application.

Seed rates vary according to variety. Most of the farmers are using their own seeds. The seeds are sown on ridges. Inoculation of nitrogen fixing bacteria before sowing helps quick nodulation on the roots, which fix atmospheric nitrogen.

Hand-hoeing is the general practice for weed control.

Beans are shallow rooted and sensitive to overirrigation. No systematic irrigation practices are done in Salalah. In general

monthly three irrigations are given. Fertilizers are applied without proper soil analysis.

Curcubites

This includes cucumber (Cucumis sativus), bottle gourd (Lagenaria siceraria), bitter gourd (Momordica charantia), snake gourd (Trichosanthes anguina) and ash gourd (Benincasa hispida). The cultural requirements of all crops in this group are more or less similar.

Two types of methods of cultivation were observed during the survey. Seeds are either sown on hills or in furrows. In general 1.5 tons of farm yard manure and 2 tons of jebel soil are applied as basal dose at the time of land preparation. Weekly one irrigation is the general practise. Harvest will start 3 months after sowing.