JAMHUURIYADDA DIMOQRAADIGA SOMAALIYA
WASAARADDA BEERAHA
SOMALI DEMOCRATIC REPUBLIC
MINISTRY OF AGRICULTURE

GENALE-BULO MARERTA PROJECT

ANNEX IV
Existing Agriculture

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PLATE

Map 1E Present Land Use - Inside back cover

SUMMARY OF REPORT TITLES

Master Plan Report

Feasibility Study Report

Annex	I	Soils
Annex	II	Water Resources
Annex	III	Human Resources and Institutions
Annex	IV	Existing Agriculture
Annex	V	Livestock
Annex	VI	Potential Agricultural Development
Annex	VII	Engineering
Annex	VIII	Economic and Financial Analysis
Annex	IX	Management and Implementation
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PROJECT AREA AND STUDY AREA

This study contained two elements, a Master Plan covering 67 400 hectares and a feasibility study of 5 000 hectares.

Throughout the reports the term Study Area refers to the area covered by the Master Plan studies and the term Project Area is used for the feasibility study area.

ABBREVIATIONS USED IN THE REPORTS

ADB	African Development Bank
ADC	Agricultural Development Corporation
CARS	Central Agricultural Research Station - Afgooye
DAP	Diammonium phosphate
EDF	European Development Fund
ENB	National Banana Board
FAO	Food and Agriculture Organisation
FAO/PP	FAO Pilot Project (Afgooye - Mordiile Project)
HASA	Hides and Skins Agency
HTS	Hunting Technical Services Limited
HV	High volume (crop sprayer)
IBRD	International Bank for Reconstruction and Development (the World Bank)
ITCZ	Inter-tropical convergence zone
ITDG	Intermediate Technology Development Group (London)
JOSR	Jowhar Offstream Storage Reservoir
LDA	Livestock Development Agency
Libsoma	Libya-Somalia Agricultural Development Company
LSU	Livestock unit
LV	Low volume (crop sprayer)
MLFR	Ministry of Livestock, Forestry and Range
MMP	Sir M. MacDonald & Partners
NCA	Net cultivable area
NCB	National Commercial and Savings Bank (formerly National Commercial Bank)
ONAT	National Farm Machinery and Agricultural Supply Service
PLO	Palestine Liberation Organisation
SDB	Somali Development Bank
SNAI	Jowhar Sugar Estate
TDN	Total digestible nutrients
TDP	Total digestible protein
ULV	Ultra-low volume (crop sprayer)
UNDP	United Nations Development Programme
USBR	United States Bureau of Reclamation
USDA SCS	United States Department of Agriculture, Soil Conservation Service
WHO	World Health Organisation

SPELLINGS OF PLACE NAMES

Throughout the report Somali spellings have been used for place names with the exception of Mogadishu where the English spelling has been used. To avoid misunderstanding, we give below a selected list of Somali, English and Italian spellings where these differ.

Somali	English	Italian
Afgooye	Afgoi	Afgoi
Awdheegle	-	Audegle
Balcad	Balad	Balad
Baraawe	Brava	Brava
Buulo Mareerta	Bulo Marerta	Bulo Mererta
Falkeerow	-	Falcheiro
Gayweerow	-	Gaivero
Golweyn	-	Goluen
Hawaay	Avai	Avai
Hargeysa	Hargeisa	-
Janaale	Genale	Genale
Jelib	Gelib	Gelib
Jowhar	Johar	Giohar
Kismaayo	Kisimaio	Chisimaio
Marka	Merca	Merca
Muqdisho	Mogadishu	Mogadiscio
Qoryooley	-	Coriolei
Shabeelle	Shebelli	Scebeli
Shalambood	Shalambot	Scialambot

GLOSSARY OF SOMALI TERMS

Cambuulo	- Traditional dish of chopped boiled maize with cowpeas or green grams.
Chiko	- Chewing tobacco
Der	- Rainy season from October to December
Dharab	- Five jibals or approximately 0.31 ha
Gu	- Rainy season in April and May
Hafir	- Large reservoir on farms for storing water for use in dry periods
Hagai	- Climatic season June to September characterised by light scattered showers
Jibal	- Area of land approximately 25 m by 25 m or 0.0625 ha
Jilal	- Dry season from January to April
Kawawa	- Two man implement for forming irrigation ditches
Moos	- Measurement of land area equal to a quarter of a jibal
Quintal	- Unit of weight measurement equivalent to 100 kg
Uar	- See hafir
Yambo	- Small short-handled hoe
Zareebas	- Thorn cattle pen

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CHAPTER 1

THE STUDY AREA

1.1 Location

The Study Area is situated at the lower end of the Shabeelle river flood plain approximately 100 km south-west of Mogadishu between longitude 44°30' and 45°00' E and latitude 1°30' and 2°00' N (Figure 1.1). It comprises an area of 674 km^2 measuring approximately 40 km by 20 km and is bisected along its length by the Shabeelle river itself. The area is characterised by level terrain, fine-textured soils and a semi-arid climate.

The Study Area is demarcated by a line of coastal sand dunes along its south-east edge, an area of swamps to the south-west and, in part, old river channels in the sough and north. The remaining boundary sections link these natural limits such that the delineated area represents an area considered irrigable by the irrigation network established between 1925 and 1959.

1.2 Climate

The climate is tropical semi-arid with a mean annual precipitation of 471 mm which falls mainly during the gu and der seasons and due to the low altitude and coastal location of the Study Area, characterised by high temperatures and high relative humidity. Climatic data are summarised in Table 1.1. Four distinct seasons occur during the year, dominated by monsoon winds which blow from the north-east (jilal season) and the south-east (hagai season). The two major rainfall periods (gu and der seasons) correspond to the passing of the inter-tropical convergence zone (ITCZ) and the seasonal change in wind direction. Brief descriptions of the four seasons are given below:-

(a) jilal (December/January - March). A three month dry season with moderate north-east winds which can gust at high speeds for several days.

(b) gu (April - May/June). Generally a two month period of heaviest rainfall characterised by quite heavy storms rather than uniform precipitation.

(c) hagai (June/July - August/September). An intermediate rainy season with decreasing precipitation falling as a mixture of showers and isolated storms. The hagai is characterised by cooler, cloudier weather and persistent strong south to south-west winds.

(d) der (October/November - December). The final rainy season characterised by low winds and heavy storms. Unlike regions north of the Study Area, der rainfall is not significantly higher than during the hagai and is only distinguished by storm intensity.

TABLE 1.1

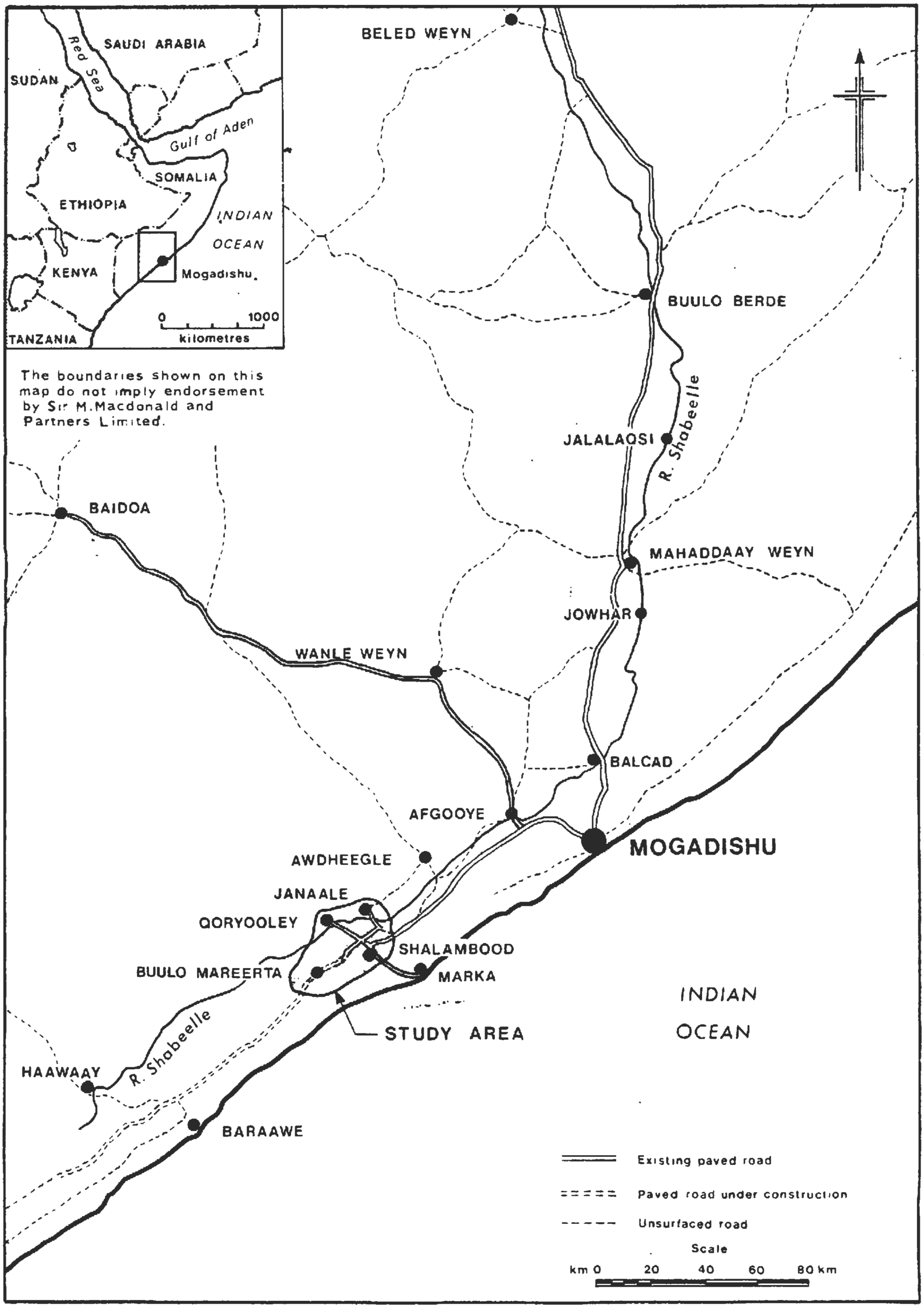
Study Area Climatic Data: Recorded at Janaale Agricultural Station

Data		Observed years	Unit	J	F	M	A	M	J	J	A	S	O	N	D	Year
Temperature:	mean monthly maximum	1930-39 1953-58	^0C	32.3	32.7	33.5	33.1	31.5	29.6	28.6	28.9	29.5	30.5	31.0	31.6	31.1
	mean monthly maximum	1930-39 1953-58	^0C	21.0	21.6	22.9	23.6	23.3	21.8	21.4	21.2	22.1	22.7	22.2	21.6	22.2
	monthly average	1930-39 1953-58	^0C	26.6	27.2	28.3	27.4	25.7	24.9	25.1	25.8	26.6	26.6	26.6	26.6	26.6
Relative humidity:	monthly mean	1930-39 1953-58	%	76	74	76	77	81	82	82	82	81	81	82	80	79
Wind speed:	monthly mean	1953-58	m/s	1.4	1.6	1.4	1.2	1.8	2.2	2.4	2.4	2.5	1.8	0.9	1.2	1.7
Cloud cover:	monthly mean	1930-39 1953-58	$\frac{1}{10}$ ths	2.2	2.2	2.6	3.8	4.4	5.0	5.3	4.3	3.7	4.3	3.9	3.0	3.7
Sunshine hours:	mean monthly total	1933-39 1953-58	hour	291	265	293	246	240	198	195	235	256	237	220	256	2 931
Rainfall:	monthly mean	1944-48 1951-58	mm	1.5	0.1	3.9	75.9	73.9	80.5	54.8	47.4	21.5	32.7	52.6	26.2	471.0
	75% reliable (1) monthly mean	1944-48 1951-58	mm	1.1	0.1	2.8	55.4	54.0	50.8	40.0	34.6	15.7	23.9	38.4	19.1	343.9
	mean number of rainy days	1944-48 1951-58	days	0.7	0.0	0.4	6.0	8.5	10.4	11.6	9.6	3.5	3.4	5.7	3.0	62.8

Note: (1) At 3 year out of 4 probability.

Source: Amilcare Fantoli; Contributo alla climatologia della Somalia (1965)

LOCATION OF THE STUDY AREA



Although the four seasons are distinct, annual variations in the sequential change between seasons are such that there is a large degree of unpredictability in the start, duration and rainfall of the gu, hagai and der rainy seasons. This reflects the marked variability in movement and strength of the ITCZ and, as rainfall is a predominant factor in the Study Area climate, this results in monthly variability of other factors such as temperature, cloudiness and wind speed. This variability can be seen in Table 1.2 and is discussed fully in Annex II (Chapter 1, Climate).

TABLE 1.2

Study Area Rainfall: Selected Monthly Rainfall 1951 - 1958(1)

Monthly rainfall (mm) (2)

Year	J	F	M	A	M	J	J	A	S	O	N	D	Total
1951	0	0	30	73	226	238	108	74	20	61	88	127	1 045
1952	0	0	0	53	31	106	5	0	0	36	69	0	300
1953	5	0	24	74	10	40	62	60	38	48	172	10	543
1954	0	0	0	77	60	76	20	40	12	10	61	33	387
1955	5	0	0	17	48	31	32	6	2	1	2	6	149
1956	0	0	0	112	31	66	72	8	1	6	108	0	404
1957	1	0	0	62	103	75	146	13	20	20	102	11	552
1958	1	0	0	142	119	84	40	64	1	1	39	12	500

Notes: (1) Recorded at Janaale agricultural station
(2) Rounded to nearest mm from actual records

Source: Fantoli (1965)

1.3 Water Resources

The hydrology of the Study Area is dominated by characteristics of the Shabeelle river, which has two annual high flow periods corresponding to the gu and der seasons.

The der high flow period is larger and more predictable than the gu period due to heavy der rains in the Ethiopian catchment of the river. The gu high flow period usually occurs in May and June and the der high flow period from August into December. However the onset and duration of both high flow periods, particularly the gu flow, are basically unpredictable, with subsequent influence on low flow periods and the frequency at which the river can dry up completely during the dry season (jilal). Consequently, although availability of river water for irrigation is generally considered to be between May and December, it can vary to cover the whole year or, during prolonged low flow periods, be restricted to the more predictable der high flow period.

River water quality is given in Table 1.3. The mean monthly salinity levels vary between 0.42 and 1.19 mmho/cm which is classified as being 'good' to 'permissible' quality for irrigation. The monthly variability indicates the importance of the der high flow period.

TABLE 1.3

Shabeelle River Mean Monthly Salinity Levels

	J	F	M	A	M	J	J	A	S	O	N	D
EC (mmho/cm)	0.97	1.19	1.08	0.92	1.19	0.96	0.81	0.54	0.42	0.45	0.82	0.85

Source: Annex II (Water Resources)

In years when the river dries up during the jilal season, salinity levels of the first part of the subsequent gu flow are high such that up to two weeks delay is necessary before irrigation can commence.

Groundwater resources in the Study Area are considered plentiful but of poor quality with salinity levels varying between 2 to 10 mmho/cm which is classified as being 'doubtful' to 'unsuitable' for irrigation. Consequently, pumped groundwater is only used for irrigation by banana growers during dry seasons when there is insufficient river water.

1.4 Soils

Study Area soils comprise fine-textured meander flood plain deposits divisible into old, semi-recent and recent alluvium. Eleven soil series were identified. The soils are classified as vertisols or their intergrades, being formed in expanding-lattice clays and exhibiting typical properties of deep-cracking and self-mulching. These properties are less predominant in some of the soils of the recent and semi-recent alluvium. Soil profiles are deep with moderate drainage. Terrain is level but areas of gilgai micro-relief occur locally and uneven topography is associated with channel remnants which traverse the area.

Soil physical properties are strongly influenced by moisture content. In the dry state, soils contract to form deep cracks, a friable surface mulch and discrete structural aggregates in the lower horizons. When soils are saturated, aggregates disintegrate and cracks close. This results in reduced flexibility of tillage operations under irrigation and retards moisture movement in saturated soils. Initial infiltration rates into dry cracked soils are rapid but rates are slow in moist soils (80 mm in eight hours), with moisture penetration generally limited to the upper 0.5 m except where perennial irrigation is practised. Total water available capacities are high (200 mm/m) but due to negligible stable porosity much of this is held outside the easily available range. Drainability of the soils is considered limited as slow hydraulic conductivities (0.23 m/d) were recorded in underlying clays of the old alluvium.

The soils are calcareous and base-saturated with very low proportions of sodium, indicating negligible alkalinisation hazard. Salinities are generally low with some increase with depth. Mean EC_e values are:-

(a) 0 to 0.50 m : 2.0 mmho/cm

(b) 0.50 to 1.00 m : 2.9 mmho/cm

Due to high reserves of soil calcium, leaching of salts should not cause deterioration of soil permeability.

Soils have moderate to low fertility, being deficient in nitrogen and phosphorus. The combination of moderately high soil pH and an imbalance in calcium and magnesium ions may reduce availability of some nutrients. Approximately 91% of the Study Area is rated as suitable or moderately suitable for irrigation. Soils of the recent and semi-recent alluvium, which comprise 57% of the Study Area, are classed as being more suitable than those of the old alluvium, due to more favourable profile and drainability characteristics.

1.5 Population and Infrastructure

There are about 112 310 people resident in the Study Area, comprising an estimated 18 940 household-families and living in 128 villages evenly distributed throughout the area. Twenty-two villages have an estimated population higher than 1 000 inhabitants and the average population density of $167/km^2$ is much greater than both the national average and other areas along the river.

The Study Area comprises part of both Marka and Qoryooley districts, which are two of the four administrative districts that compose Lower Shabeelle region. Good tarmac roads within the area link the four large towns and villages of Shalambood (pop. 5 000), Qoryooley (pop. 14 500), Janaale (pop. 8 000) and Golweyn (pop. 5 000). A large number of dirt roads and tracks links all remaining parts of the area but are often impassable to vehicles during isolated periods of heavy rain. Primary schools and health centres have been established in nearly all large villages. Government departments and organisations supplying agricultural infrastructural services to the Study Area all have regional offices or depots in the Study Area itself and, in the case of the grain marketing agency (ADC), sub-depots throughout the area.

1.6 Agricultural Significance

Lower Shabeelle region represents the most important crop producing region in Somalia. As can be seen in Table 1.4 it produces over 50% of the country's rice, maize and sesame as well as over 30% of the total annual crop production. Maize, sorghum and sesame represent the important staple food crops in Somalia. In 1976-1977, banana production represented, in value, 15 to 20% of national exports of which 46% of export production was from Lower Shabeelle region (Table 1.5).

TABLE 1.4

Estimated Annual Crop Production: Lower Shabeelle Region (1976/77)

Minimum estimated areas under production (ha) (2)

Crop	1976 der		1977 gu		Total		
	LSR(1)	National	LSR	National	LSR	National	% LSR
Sorghum	10 000	45 700	20 000	140 388	30 000	186 088	16
Maize	8 000	19 500	50 000	82 300	58 000	101 800	57
Rice	1 032	1 932	1 228	2 498	2 260	4 430	51
Sesame	31 964	51 660	7 220	18 800	39 184	70 460	56
Groundnuts	240	910	500	970	740	1 880	39
Cotton	300	2 343	-	2 293	300	4 636	6
Pulses	500	1 305	1 050	17 445	1 550	18 750	8
Vegetables	1 000	1 527	1 070	3 841	2 070	5 368	39
TOTAL	53 036	124 877	81 068	268 535	134 104	393 412	av.34

Notes: (1) Lower Shabeelle region (LSR)
(2) As most farming is by smallholders with low yields, areas are equivalent to production.

Source: Ministry of Agriculture (1977)

TABLE 1.5

National Banana Export Production: 1976

Area	Quintals	%	Hectares (net)	%
Lower Shabeelle region	338 737	46	3 897	53
Juba river	386 576	54	3 435	47
TOTAL	725 313	100	7 422	100

Source: National Banana Board (1977)

The agricultural significance of the Study Area lies in the large amount of irrigated agriculture in relation to remaining areas of the region. In terms of annual crop production within the region, Qoryooley district is the most productive for maize and sesame. Comparison of estimated Study Area production (extracted from Chapters 4 and 5) to regional production is given in Table 1.6. Due to the high proportion of smallholder agriculture, cultivated areas are assumed to be equivalent to production. In 1976, 3 897 ha were under banana production in the region of which an estimated 3 420 ha were in the Study Area, representing 88% of regional production (ENB, 1977). Consequently, the Study Area is a significant production zone within Lower Shabeelle region for maize, sesame and bananas, all of which are crops of major national importance.

TABLE 1.6

Study Area Annual Crop Production (1976/77)

Estimated areas in production (ha)

Crop	Lower Shabeelle region(1)	Study Area (2)	Percentage grown in Study Area
Maize	58 000	23 226	40
Sesame	39 184	10 954(3)	28
Rice	2 498	400	16
Vegetables	3 841	400(4)	10

Notes: (1) From Table 1.4

(2) Annex IV, Chapters 4 and 5 (net area)

(3) Includes hagai catch-cropping

(4) Mainly tomatoes

CHAPTER 2

METHODS OF ASSESSMENT

2.1 Introduction

During 1977, several comprehensive land use, agronomic and socio-agronomic surveys were undertaken in the Study Area to determine the extent of present crop production and land use, production methods, yields and present agronomic and related problems.

2.2 Previous Crop Production

A brief history of agricultural development in the Study Area was prepared using the following sources:-

(a) La Bananicoltura come fattore Economico - Sociale die primaria grandezza, La Rosa Filippo (1966)

(b) Water control of the Shebelli River, HTS Ltd. (1969)

(c) FAO/Lockwoods 1 : 30 000 scale aerial photography (1962/3)

(d) National Banana Board Statistical Report; 1950 - 1976 (1977)

(e) General field survey data and personal communications.

2.3 Present Land Use

Two land use surveys were undertaken:-

(a) a preliminary survey previously reported (Janaale - Buulo Mareerta Project; Inception Report, July 1977)

(b) a detailed survey carried out in October 1977. No recent aerial photography was available, so the study involved considerable fieldwork to demarcate areas of the major land use classes and assess net crop areas.

Following mapping of gross areas under crop production, estimated net cultivated areas were based on:-

(a) visual assessment of current land use intensity, particularly by smallholder agriculture;

(b) sample data of cropped areas from five large-scale farms of known mapped and measured gross areas;

(c) survey data obtained from village smallholder farmers, particularly for the demarcation of irrigation availability and cropping patterns. Data were collected in July - September 1977 and confirmed with short field visits up to and including December 1977;

(d) survey data collected by the Qoryooley district governor as part of the land re-allocation programme linked with village centralisation (see Annex III, Chapter 5 - Land Tenure). Gross and cultivated areas from nine villages in the Study Area had been collected during 1977;

(e) net cultivated area under banana production was obtained from National Banana Board (ENB), Shalambood.

All field data were mapped at 1 : 25 000 scale using base maps prepared from the 1962 FAO/Lockwoods 1 : 30 000 scale aerial photography. Final areas of each land use class and estimated net cultivated areas were calculated from planimeter measurement at 1 : 25 000 scale before final map preparation and presentation at 1 : 50 000 scale.

2.4 Annual Crop Production and Farming Systems

Data were collected through continuous survey work undertaken between July and September 1977 and included village smallholders, co-operative group farms, and large-scale private and state farms, involving:-

(a) crop monitoring - agronomic evaluation and assessment, throughout the Study Area, of methods, varieties, production problems, growth characteristics, pest and disease incidence and effectiveness of contol measures. The main crops assessed were maize, sesame, rice, groundnuts, chewing tobacco and tomatoes.

(b) yield assessment - mainly collected from survey work, but a separate maize yield assessment was undertaken on harvested gu crops, mainly of co-operative group farms, during August 1977. Forty-two harvest plots were selected. Full details are discussed in Chapter 6 (Maize).

(c) village smallholders, co-operative group farms and large-scale producers were surveyed and interviewed to determine production methods, labour requirements and availability, production problems, cropping patterns and yields. Twenty villages (15% of total villages in the Study Area) and 12 large-scale farms were covered by the survey.

(d) a village household survey to determine average holding sizes. 230 household-families in 16 villages were surveyed. This study was part of a land tenure and population survey (see Annex III).

Survey work that necessitated collection of reported information proved difficult such that, in order to obtain accurate information, the use of formal questionnaires was abandoned in favour of gathering information through separate discussion and interviews or during specific field and crop survey work. Follow-up fieldwork was undertaken in November and December 1977 to survey sesame crops and confirm reported information.

2.5 Perennial Crop Production

During September and October, 1977, a detailed study of banana production in the Study Area was undertaken. Agronomic evaluation of standing crops was made on 20 farms with particular reference to root depths, irrigation and drainage practices and nematode incidence (Radopholus similis), these being reported as the major constraints on banana production on the heavy soils in the Study Area. Twelve of these farms were also surveyed to assess production methods, labour requirements, inputs, costs, yields and crop duration. One major aim of the survey was to determine differences between good and bad management practices in order to determine likely benefits from introduction of improved methods to halt declining productivity of existing farms.

Supplementary technical information was supplied by ENB, Shalambood and two technical experts from Tropical Agriculture Research Services (SIATSA), Honduras who made a short technical survey of banana production in Somalia during 1977.

Basic information was also collected on management of the small areas of other perennial crops (grapefruit, coconuts etc). However, due to the low level of management and inputs, accurate information was not available.

CHAPTER 3

AGRICULTURAL HISTORY OF THE STUDY AREA

3.1 Pre-1925

Until the construction of Janaale barrage in 1925 and subsequent development of the present irrigation system, agricultural production in the Study Area was limited to small areas round the few long-established villages situated close to the river. Crop production was a mixture of rainfed cropping and irrigated production using short hand-dug canals offtaking directly from the river. As now, the major crops grown at that time were maize and sesame. Typical old villages in the Study Area are Qoryooley, Faraxaane, Janaale, Gayweerow and Haduuman.

3.2 1925 - 1939

Originally, following construction of the barrage, development of the irrigation network and concession areas was for intensive cotton production. A concession area of an estimated 30 000 ha (gross) was initially demarcated. It comprised 182 holdings varying in size from 40 to 621 ha situated along the Primo Secondario, Dhamme Yaasiin (Principale) and Asayle (Riva Destra) canals and including areas upstream of Janaale as far as Mubaarig. These holdings were allocated, originally, to Italians and after development of these areas as farms, title was established by the owners. Commercial production of cotton and bananas began in 1925/26 and by 1928/29 an estimated 3 000 ha was under cotton production before a decline due to economic and management problems, such as poor pest control. This decline continued steadily until production in the Janaale area ceased in 1939. Consequently, the expansion of banana production did not effectively start until after 1930. This followed an initial period of research at the Janaale station in 1927 to 1929 when the variety Juba was selected as being the most suitable for commercial export production out of 14 tested indigenous varieties. The subsequent development of banana production in the Janaale area, including the development from 1952 of a small area at Afgooye, is given in Table 3.1. Because the original canal system was designed for cotton production, the subsequent development of bananas resulted in production remaining close to the main canals as water supplies were insufficient to supply the entire length of the main secondary canals (second to fifth secondaries on the Dhamme Yaasiin canal). During this period, i.e. up to 1939, the Janaale research station continued its research programme. As development of the concession areas continued, smallholder agriculture expanded, mainly as the result of the Italian Administration establishing villages to serve the plantations. The resettlement of villagers was both forced and encouraged with this guaranteed labour force being given the inducement of smallholdings as part of each concession farm. An estimated 40 to 50 of these villages still exist in the Study Area. Natural expansion of the long-established villages has led to gradual expansion of their own annual crop production.

TABLE 3.1

Banana Production, Lower Shabeelle River: Areas in Production, 1927 - 1977

Year	Estimated net cultivated area (ha)
1927	53
1930	617
1932	2 130
1935	4 000
1939	4 500
1962	5 700(1)(2)
1969	3 031
1971	3 400
1972	3 917
1973	4 700
1974	4 694
1975	4 209
1976	3 897
1977	3 895

Notes: (1) Photo-interpretation of 1962 FAO/Lockwoods 1 : 30 000 aerial photography and reported by HTS (1969).

(2) 1962 onwards includes Afgooye area estimated at less than 10% of total area in Lower Shabeelle river.

3.3 1939 - 1950

From the onset of World War II in 1939 until the end of British Administration in 1948/49, marked changes in agricultural production occurred in the Janaale area, as elsewhere in Somalia. All research ceased and was not restarted until 1948. Many banana farms were either forcibly or voluntarily abandoned when British forces occupied Somalia in 1941, markedly altering the export trade. The effect of this period on banana production can be seen in Table 3.2. By 1950, the redevelopment of abandoned farms and previously unused concessions had commenced.

TABLE 3.2

Banana Production, Lower Shabeelle River: Exported Production, 1939 - 1977

Year	Exported fruit ('000 quintals)
1939	320.0
1949	61.0(1)
1950	121.6
1951	171.6
1952	253.0(2)
1953	178.2
1954	274.9
1955	325.8
1956	179.8
1957	276.9
1958	343.1
1959	332.5
1960	496.0
1961	486.7
1962	545.5
1963	603.7
1964	602.1
1965	606.7
1966	505.4
1967	413.7
1968	428.7
1969	422.7
1970	401.9
1971	367.1
1972	606.5
1973	467.2
1974	414.7
1975	349.9
1976	338.7
1977	288.1

Notes: (1) Includes small area on Juba river.

(2) From 1952, includes small area at Afgooye (see notes in Table 3.1)

Sources: National Banana Board (1978)
La Rosa Filippo (1966)

During the war, a limited area of castor and groundnuts was cultivated to provide industrial and vegetable oil for the war effort, with production declining from 1945 to an estimated 500 to 600 ha of each crop in 1950. Maize production was also encouraged by the British Administration as part of a general cereal production programme in Somalia (rice, for example, being developed on the Juba river), although no production figures were available.

3.4 1950 - 1960

In 1950, cotton production was reintroduced in Somalia as a result of the Korean War affecting the world market, boosting the price of cotton. Extensive research into annual crop production (cotton, castor, groundnuts and maize) from 1950 until closure of the research station in 1958, enabled 1 500 ha of cotton to be planted under irrigation in the Janaale area. Production was mainly by smallholders in areas away from the banana farms, such as Qoryooley, Buulo Mareerta and Uguunji. Production declined in 1957 and ceased entirely in 1958, again for economic and management reasons. The smallholders practised a rotation such that the residue of previous cotton crops was not destroyed and subsequent ratooning led to the build-up of large pest reservoirs which were difficult to control.

During the 1950 - 1960 period, a steady production of an estimated 500 ha of groundnuts, including confectionery nuts, continued before declining and the cessation of production in the early 1960's. Castor production also ceased during the 1950's. Uneconomic prices and harvesting problems of the tall, late varieties were the main reasons. Maize production had continued on the concession farms until 1957, using the local variety. However, it was reported that a hybrid variety had been developed at Janaale which gave yields of 60 to 80 q/ha under research conditions, but was never released to growers. Yields obtained from annual crops during this period are given in Table 3.3.

TABLE 3.3

Estimated Yields of Annual Crops in the Study Area: 1950 - 1960

Crop	Yield (q/ha)	Notes
Cotton	18	Yield of seed cotton; maximum with good pest control
	9	Average yield
Castor	15 - 20	Average yields of hulled seed. Yields greatly reduced with poor irrigation
Maize	18	Maximum yield from local variety
	10 - 15	Average yield, local variety
Groundnuts	13 - 14	Good, average yield (unshelled) Shelled = 10 q/ha

Source: Prof. F. Beccari (personal communication) - former cotton entomologist Janaale research station, 1950 - 55.

In 1955, the Italian administration started work on the Buulo Mareerta project, aimed at increasing the area under controlled irrigation by a further 25 000 ha. By 1959, Falkeerow and Qoryooley barrages and the Liibaan (Coriole), Wadajir (Fornari) and Bokore canals had been constructed, but resulted in a net increase of only 1 000 ha under controlled irrigation on 34 concession farms. These were all allocated and subsequently owned by Somalis, with most farms being used for banana production. It was during this period after the war that Somali ownership of around 22 other concession farms in the original Janaale area began. From 1950 to 1960, banana production increased steadily (see Table 3.2).

Smallholder agriculture also increased. Although the three new canals were not fully developed as concession areas, village smallholders were able to irrigate a larger area of land using the traditional basin-flood system. In 1960, this was estimated at 3 500 ha gross. The increase was also made possible as the result of floodbank construction, in 1960, on the left hand bank downstream of Falkeerow. Prior to this, regular flooding reached to within 1 to 2 km of Jeerow where villagers had used hand-dug canals to tap this flood and irrigate their fields. Furuqley, downstream of Falkeerow and on the Study Area boundary, was established in 1960, with villagers being able to cultivate the reclaimed area east of the village as far as the new Bokore canal. By 1960, it was estimated that the only unoccupied irrigable land in the Study Area was the unused concession area south of the Dhamme Yaasiin canal and old river channel that extends to the south of Golweyn.

By 1960, therefore, the pattern of present land use had been set:-

(a) uncultivated Acacia bush along the northern and southern margins of the area.

(b) smallholder maize/sesame production dominating the western 30% of the area downstream of the Wadajir canal.

(c) banana production concentrated along the Shabeelle river and continuing in a broad belt along the Dhamme Yaasiin and Primo Secondario canals.

(d) uncultivated irrigable land south of the Dhamme Yaasiin canal and parallel to the sand dune area adjacent to Shalambood.

3.5 1960 - 1976

The maximum area under banana production was considered to have been reached around 1962. From 1962, the net cropped area has fluctuated but generally declined to an estimated 3 900 ha in 1976 in the Afgooye - Janaale area, of which approximately 3 400 ha are in the Study Area (see Table 3.1). Maximum export production was reached in 1965, since which a steady decline has also taken place, despite fluctuations due to variability in irrigation supply and unusually high yields in 1972, which were attributed to large influxes of credit during that period (see Table 3.2). The agronomic reasons for the productivity decline are discussed fully in Chapter 11 (Banana Production), other main reasons being post-independence emigration of Italians as well as economic problems of export trade. For example preferential import duties given to Somali bananas exported to Italy were abolished in 1969 and from 1968, with closure of the Suez Canal, exportation was via the Cape, necessitating at least a further seven days sailing.

In 1962, the number of banana farms in production in the Study Area was estimated at between 130 and 140 farms, declining to the present 1977/78 total of 41 farms. Around 85 of the estimated 100 Italian-owned farms in production in 1960, were either amalgamated with other farms, sold, rented or, from 1972/3 onwards, acquired by the Government for co-operatives and production farms for annual crops. A few farms were abandoned for purely agronomic reasons, mainly due to poor irrigation supply and poor groundwater quality. Between 1970 and 1973, banana production ceased for the same reasons in the new area west of the Wadajir canal which had been developed since 1955. Only one farm (Tahliil) remains in production, off-taking from the Bokore canal. The other large farms changed to large-scale maize and sesame production.

Expansion of smallholder agriculture from 1960 onwards has been mainly through the encroachment onto old banana farms, particularly by the original labour force, as well as onto the uncultivated areas south of the Dhamme Yaasiin canal. The estimated net area under annual crops in 1962 on concession farms in use was 4 000 ha, which had been the result of photo-interpretation of the 1962/3 FAO/Lockwoods 1 : 30 000 scale aerial photography reported by HTS (1969). However, due to reported evidence gained during surveys in the Study Area, it is known that the total net area under annual crops was far greater than 4 000 ha at that time. Examination of the 1962/3 photography indicates a net area of around 8 000 to 10 000 ha to be more accurate. This then agrees with reported information and the present extent of annual crop production in the Study Area (see Chapter 4, Present Land Use).

In 1969, an estimated 300 ha south of the Mukoy Dumis secondary canal and south-west of Jeerow, was cleared and prepared for annual crop production but was abandoned due to poor irrigation supplies. Betwen 1970 - 1973, several private farmers opened an estimated area of 500 ha west of Jeerow by constructing their own canals offtaking directly from the Shabeelle river, just outside the Study Area boundary. A further large area of bush has been cleared in the north of the Study Area, north-west of Janaale, following the construction of a private secondary canal from the Asayle canal by one large-scale farmer. A small amount of bush clearance has steadily taken place up to the present day as a result of extending existing hand-dug canals, but irrigation supplies in these areas are very erratic.

The small area of other perennial crops (grapefruit, coconuts, limes etc.) presently in production were developed on banana farms and have fluctuated with the general fortunes of banana production during the past 52 years. Several original coconut plantations still stand. During development of the banana farms, substantial windbreaks were planted. Main species were Casuarina, Conocarpus, Eucalyptus, Delonix and Tamarindus. Many of these windbreaks remain as markers to where banana farms had once been in production and greatly enhance the aesthetic nature of the Study Area.

CHAPTER 4

PRESENT LAND USE

4.1 Introduction

The distribution of present land use in the Study Area is shown in Map 1E, while the total areas under each class are given in Table 4.1 and summarised in Table 4.2. Because recent aerial photographs were not available, the main method of land use assessment was by extensive field work. Although this produced an accurate general land use map, in places where access was limited some minor omissions and errors could have occurred. However, careful cross reference to the 1962/63 aerial photography enabled any omissions and errors to be kept to the minimum.

TABLE 4.1

Study Area: Present Land Use

Land use category	Gross area Hectares	Gross area %	Net cultivated area Hectares	Net cultivated area %
1. Uncultivated land				
1a Open woodland and scrub	12 950	19.2	-	-
1b Abandoned farm land	3 160	4.7	-	-
1c Sub-tropical riverine grassland and woodland vegetation	810	1.2	-	-
1d Permanently inundated land	530	0.8	-	-
Sub-total	17 450	25.9	-	-
2. Marginal annual crop production				
2a Rainfed cropping	640	1.0	198	0.9
2b 10 - 30% land use intensity(1)	9 185	13.6	2 484	11.9
2c 40 - 50% land use intensity(1)	5 395	8.0	2 162	10.3
2d 60 - 70% land use intensity(1)	345	0.5	234	1.1
Sub-total	15 565	23.1	5 078	24.2
3. Irrigated annual crop production				
3a 10 - 30% land use intensity	4 840	7.2	1 253	6.0
3b 40 - 50% land use intensity	16 745	24.8	6 959	33.2
3c 60 - 70% land use intensity	5 425	8.1	3 300	15.7
Sub-total	27 010	40.1	11 512	54.9
4. Irrigated perennial crops				
4a Bananas	6 870	10.2	4 067(2)	19.4
4b Other crops, mainly grapefruit and coconuts	515	0.7	305	1.5
Sub-total	7 385	10.9	4 372	20.9
TOTAL	67 410	100.0	20 962	100.0

Notes: (1) Land use intensity under marginal irrigation supply
(2) Includes 647 ha under development by ENB and two private farms during 1977/78. Estimated NCA in 1976 = 3 420 ha (ENB, 1977).

Source: Land use survey, October 1977

TABLE 4.2

Study Area: Summary of Present Land Use

Land use category	Gross area Hectares	Gross area %	Net cultivated area Hectares	Net cultivated area %	Land use intensity (%)
1. Uncultivated land	17 450	25.9	-	-	-
2. Marginal annual crop production (1)	15 565	23.1	5 078	24.2	33
3. Irrigated annual crop production	27 010	40.1	11 512	54.9	43
Annual crop production Sub-total	42 575	63.2	16 590	79.1	39
4. Irrigated perennial crop production	7 385	10.9	4 372(2)	20.9	60
TOTAL	67 410	100.0	20 962	100.0	-

Notes: (1) Includes rainfed cropping and marginally irrigated crops.
(2) Includes 647 ha under development in 1977/78 (see Table 4.1).

Source: Land use survey, October 1977

Four main categories of land use were identified:-

Class 1 - uncultivated land

Class 2 - marginal annual crop production

Class 3 - irrigated annual crop production

Class 4 - irrigated perennial crop production.

These categories indicate the dominant or most important land use. However, in each land use class, other types of land use may occur, but are of minor importance.

Descriptions of land use classes are given below.

4.2 Uncultivated Land (Land Use Class 1)

The permanently uncultivated land in the Study Area consists of four distinct types.

4.2.1 Open Woodland and Scrub (Class 1a)

This is the major type of uncultivated land in the area, comprising an estimated 74% of the whole land use class and 19% of the Study Area. It is dominated by Acacia species forming areas of dry thorn woodland and thicket mostly along the northern and southern borders of the Study Area. Other small, isolated thickets occur throughout the Study Area, with the larger thickets indicating topographically unsuitable land for irrigated agriculture. These thickets act as reservoirs for tsetse fly. Other major species include Commiphora, Salvadora, Cordia, Boscia, Dobera, Grewia, Euphorbia and Dicrostachys.

4.2.2 Abandoned Farm Land (Class 1b)

These are either recently abandoned farms or land found unsuitable after being cleared. For example the area of abandoned land to the north of Shalambood mainly comprises a low levee, indicating an old river course, and has proved a difficult area to irrigate. Most abandoned farm lands are bare or sparsely vegetated with low scrub which has slowly encroached but has been kept grazed back by livestock.

4.2.3 Riverine Vegetation (Class 1c)

Narrow areas of sub-tropical grassland and woodland occur along the river, major canals and in some parts of old river valleys as the result of permanent water supply through seepage and/or a locally high groundwater table. These are the main grazing areas for local cattle as well as a source of good quality cut forage (see Annex V). Several tree species, including mangoes, are found in these areas and Ricinus communis (wild castor), which is an escapee from previous cultivation, is very common. Only the larger areas of this sub-class were measured and are demarcated on Map 1E. However, most areas are limited to 10 to 50 m wide strips along the major canals and are too small to be mapped.

4.2.4 Permanently Inundated Land (Class 1d)

Prior to the use of groundwater for the irrigation of bananas during the jilal season, surplus river water was stored during the der season in large surface reservoirs with earth banks. Most of these reservoirs have since been abandoned and are now cultivated but some remain as permanent reed-filled reservoirs used occasionally for irrigation. Other inundated areas are the result of seepage from the river or major canals into nearby depressions which now provide natural habitats for hippopotamus and a large number of birds.

4.3 Marginal Annual Crop Production (Land Class 2)

The Inception Report (MMP, 1977) indicated that substantial areas of rainfed cropping existed in the Study Area. However, the recent studies show that the area of true rainfed cropping is limited to some 640 ha which represents less than 1% of the entire cropped land in the Study Area. The remainder of this land use class (14 925 ha gross) is where smallholders attempt to obtain irrigation via hand-dug canals but are frequently unsuccessful. This irrigation is often limited to a single application for maize crops and insufficient pre-plant flooding for sesame crops. Consequently, crops in these areas are very dependent on seasonal rainfall distribution and are generally poor. The last good crop year was reported to be 1972. Two main areas of marginal crop production exist:-

(a) South of Dhamme Yaasiin canal and due to poor water supplies from the canal beyond the second secondary canal (see Annex VII).

(b) A large area north of the Shabeelle river where topography prevents the effective extension of existing small canals. Poor water supplies along most of the Asayle canal have also resulted in the large area of marginal cropping around Tawakal, Murale and Buulo Koy, where the area extends quite close to the river (see Annex VII).

Land use intensity can vary from 10% to 70%, generally decreasing with distance from the river or major canals. However, the overall land use intensity is low (32%). Due to poor irrigation supplies, much of the land remains uncultivated and is vegetated with low scrub and sparse grass cover. Virtually all farmers in these areas are smallholders and yields are lower than average for the Study Area (see Chapters 6 and 7). Most of the previously uncultivated Acacia woodland that has been brought into cultivation since 1962 is contained in this land use class.

4.4 Irrigated Annual Crop Production (Land Use Class 3)

Land use class 3 areas are defined as those where irrigation supplies for annual crop production generally allow two to three irrigations per maize crop and moderately sufficient pre-planting flooding for sesame crops. However, the water supplies can be erratic and often inadequate due mainly to neglected canal maintenance, inefficient usage and a high demand (see Annex VI). Crops in these areas are, therefore, still largely dependant upon adequate rainfall distribution each season such that irrigation supplies can be considered as supplementary. Dependence on rainfall, however, is less than for class 2 areas.

As shown in Table 4.2, class 3 is the predominant land use in the Study Area and covers:-

(a) 40% of the gross Study Area

(b) 54% of the total gross cultivated area, and

(c) 55% of the total net cultivated area.

The major area of class 3 land use is situated in the western half of the Study Area on both banks of the river and was the main area of smallholder agricultural expansion since 1925. Smaller areas occur elsewhere and are generally associated with the majority of large-scale growers, co-operatives and government farms who are in a position to ensure better irrigation supplies. The small percentage of other annual crops grown in the Study Area (rice, groundnuts, tomatoes) are produced mainly in these areas. Also, due to the better irrigation supply, there is less hagai cropping than in class 2 areas (see Chapter 5).

The relatively good water supply characterising this land use class has resulted in a higher land use intensity than class 2 land (see Table 4.2), with 89% of class 3 land having an intensity greater than 40% (see Table 4.1). The average land use intensity is 43%. The maximum land use intensity of 70% was determined by the mapping of 5 large-scale farms and compared with reported net cropped areas in 1976 and 1977. Also, information collected from the district governor, Qoryooley, showed an average land use intensity of 53% for 6 villages with land in class 3 areas. Close to these villages, around 60% land use intensity occurs, such that on many holdings a cropping intensity of 200% is practised. However, the average cropping intensity is about 120% (see Section 4.6). Remaining unused land is occupied by canals, strips of bush, tracks and village areas.

4.5 Irrigated Perennial Crops (Land Use Class 4)

The area under perennial crops is the only land use class that can be considered as using controlled irrigation. Although irrigation methods are similar to those of maize farmers (basin-flooding), irrigation supplies are more reliable such that over-irrigation can occur. The land use class covers a broad belt bordering the river and the Primo Secondario Canal and represents the remnants of the original banana producing area (see Chapter 3). About 93% is presently planted to bananas but the total area includes 647 ha currently (1977/78) under development by ENB on 3 farms and 2 other large private farms. The estimated net cultivated area in 1976 was 3 420 ha.

The land use intensity of 60% shown in Table 4.2 includes fallowed areas waiting to be replanted, but does not include large areas of plantation land diverted to smallholder annual crop production.

4.6 Cropping Intensities in Class 2 and 3 Areas

The cultivation of maize and sesame constitutes the dominant land use in these classes. It is estimated that less than 5% of annual crop production in either the gu or der seasons consist of other crops such as rice, groundnuts, tobacco and tomatoes. Thus, for planning purposes it has been assumed that maize and sesame constitute 100% of annual crop production. During the gu season, maize is virtually the only crop planted, but in the der season, the extent of maize cultivation is a reflection of the success of the gu crop. For example, in 1977 and as a result of a poor gu season, the der ratio of maize to sesame was high and was estimated to be:-

Class 2 areas	75% maize : 25% sesame
Class 3 areas	50% maize : 50% sesame

In normal years, it is considered that maize constitutes only 40% of der cropping. Therefore, the annual cropping pattern in these areas is assumed as follows:-

	Gu	Der
Maize	100%	40%
Sesame	-	60%

However, this annual cropping intensity of 200% (i.e. double-cropping) only refers to the net areas cultivated each year. The overall cropping intensity is much less than 200% because it is proportional to the present land use intensity of an area and the maximum net cultivable area possible under existing irrigation systems. The maximum net cultivable area (or land use intensity) in the Study Area under annual crops is 70% (see Table 4.1). Therefore, the overall cropping intensity for any area under annual crops can be calculated as follows:-

$$\frac{\text{Maximum cropping intensity} \times \text{land use intensity}}{\text{Maximum possible land use intensity}} = \text{overall cropping intensity}$$

Therefore, for class 3 areas, with an average land use intensity of 43%, the overall cropping intensity is as follows:-

$$\frac{200\% \times 0.43}{0.7} = 123\%$$

Consequently, in areas adjacent to villages where land use intensities of about 60% are known (see Section 4.4), the overall cropping intensity is about 170%.

CHAPTER 5

FARMING SYSTEMS

5.1 Introduction

The crop production sector can be divided as follows:-

(a) annual crop production (discussed below and in Chapters 6 to 10)

(b) banana production (to be discussed in Chapter 11).

Annual crop production is presently undertaken by four main farming groups:-

(a) smallholders

(b) co-operative group farms

(c) large-scale private farmers

(d) Government production farms.

Despite this wide range within the farming community, production methods hardly differ for either major annual crops (maize, sesame) or minor crops (tobacco, tomatoes), except for rice, which has only recently been introduced into the Study Area. Rice is cultivated by semi-mechanised methods by farms in groups (c) and (d) above.

This chapter describes the four farming groups and their general methods of annual crop production. Specific details relating to individual crops are described in Chapters 6 to 10.

5.2 Smallholder Farming

Smallholders comprise the vast majority of farmers in the Study Area, growing maize and sesame as well as a range of minor crops. Results from the land tenure survey of 166 household-families indicated an average holding size of 1.86 ha/household-family (Annex III, Chapter 5). Further survey work on Study Area livestock ownership in another six villages (64 households) determined an average holding size of 2.20 ha. The weighted average obtained from these two surveys is 1.95 ha/household-family and includes both owned and rented land. The range of holding size was from 0.2 to 13.0 ha with a modal range of 1 to 2 ha. In half the surveyed villages, no holding was larger than 5 ha. All household-families interviewed possessed or rented land. The average figure of 1.95 ha/household-family compares well with other information concerning the Study Area (see Table 5.1).

TABLE 5.1

Estimation of Study Area Smallholder Holding Sizes

Data			Notes
Study Area population		112 316	Annex III, Chapter 4
Number of household-families		18 940	5.93 members/family
Gross area of annual crops (ha)		42 575	Land use classes 2 and 3
NCA (1) annual crops (ha)		16 590	(Annex IV, Chapter 4)
Average holding size (ha)	(a)	2.25	42 575 ha/18 940 families.
	(b)	1.95	Land tenure and livestock survey.
	(c)	2.00	Citaco (1974)
Average cultivated area per household-family (ha)		0.90	16 590 ha/18 940 families

Notes: (1) Net cultivated area

(2) Represents approximately 60% of estimated maximum cultivable area (MCA) per household-family. MCA taken as 70% maximum efficiency of gross area of annual crops (42 575 x 0.7 = 29 803 ha). MCA per household-family is 1.60 ha (i.e. 29 803 ha/18 940 families).

Citaco (1974) reported that prior to establishment of the ENB farm near Golweyn, the appropriated land belonged to 128 individuals with an average holding size of 2 ha, ranging from 0.1 to 6 ha. A simple division of gross area under annual crops by population gives an average holding size of 2.25 ha. All three average figures serve to show that virtually all land that contains annual crop production is occupied (see Annex III, Chapter 5; Land Tenure). However, using land use data, the average net cultivated area is only 0.90 ha/household-family, indicating that only a proportion of most holdings is cultivated at any one time. Reasons are given below:

(a) Losses due to canals, areas of scrub, tracks and village sites. These are unavoidable losses in any farming system. The maximum possible land use intensity in the Study Area is estimated at 70% (see Chapter 4; Present Land Use). As calculated in Table 5.1, this represents a maximum cultivable area per holding of 1.60 ha/household-family.

(b) Villagers with larger holdings practise fallowing, although this is not the case for most smallholders (see Section 5.13).

(c) Land can be held but not farmed. In outlying areas this is due mainly to poor irrigation supplies (i.e. land use class 2 areas). Elsewhere, larger-scale farmers (i.e. with 5 to 13 ha holdings) may have problems obtaining labour. Also, the furthest distance from any village to fields belonging to that village can be up to 5 km and is often at least 2 km. This is particularly the case in Qoryooley district as the result of village centralisation. Consequently, as most farmers with more than 1 or 2 ha will have several sub-holdings, the sub-holding nearest the village is utilised more. Agricultural intensity often increases progressively toward the village.

(d) The average figures cited in Table 5.1 were obtained from widely ranging data. Land use intensity under annual crops varies from 10% to the maximum possible 70%. Likewise, the initial survey of 10 villages gave an average holding size in each village ranging from 1.0 to 2.9 ha. Consequently, an average figure combining both will include all situations between the following extremes found in the Study Area:-

(i) large holdings with only a small area cultivated, which is particularly the case with several large-scale farmers on the Asayle canal, and

(ii) smallholdings in area of intense cultivation (e.g. around Faraxaane) where each holding is often demarcated solely by an irrigation bund between two basins.

Therefore, in conclusion, the average smallholding size of 1.95 ha has been taken to represent smallholders in villages away from the banana areas, because average holding sizes in banana farm villages were found to be correspondingly smaller.

5.3 Co-operative Group Farms

As reported in Annex III, Chapter 3, the establishment of co-operative group farms from 1974 onwards represents the only means by which smallholders have adopted any form of improved crop management. Details of existing co-operatives in the Study Area are given in Table 5.2. All group farms currently in production have been established on old banana farms or unutilised concession areas. Consequently, all members work communally on the group farm as well as cultivating their own smallholding elsewhere in the village area. The small area cultivated per member (about 0.5 ha) indicates the amount of extra work undertaken. During 1977, some group farms possessed their own tractor whereas others had easy access to hired equipment. Each village to which several group farms are attached also has a small general store, instructors and organised co-operative committees.

TABLE 5.2

Study Area Co-operative Group Farms (1977)

Number registered	36
Number in production	27
Total area under group farms (1977)	1 530 ha
Area in production (1977)	963 ha
Number of registered members:	
(a) active group farms	1 817
(b) total	2 499
(c) range per group farm	23 - 100 members
Average area cultivated per member	0.53 ha

Source: Department of Co-operative and village surveys

5.4 Private Large-scale Producers

These farmers form a small but significant section of the Study Area farming community, not only simply for their contribution to surplus production. They are also a source of both equipment for hire to smallholders as well as income through hiring labour, when extra money is required by smallholders. Large-scale farmers can be sub-divided into two groups as shown below:

(a) Farmers with 10 to 30 ha

On average there are several such farmers per large village with an estimated total number of 50 to 60 in the Study Area. These farmers do not possess their own equipment but are able to hire locally with few problems.

(b) Farmers with 30 to 200 ha

There are an estimated 50 such farmers distributed evenly throughout the Study Area, except for 13 farming from the Asayle canal. Most farmers have less than 100 ha with approximately five with 100 to 200 ha. A large proportion of these farmers are private businessmen who have come into farming. All will have equipment for basic land preparation.

Few of these farmers, however, cultivate all their land every year due mainly to problems of labour availability and irrigation supply. Beyond land preparation, their methods are similar to smallholders and will involve any method of reducing labour requirements e.g. broadcasting seed and harrowing, rather than hand planting. All crop operations are done by hand. A few of these farmers will also cultivate crops other than the traditional maize and sesame. Several grow small areas of tobacco, tomatoes and/or onions; one grows 20 ha of rice and one grows 10 to 20 ha of groundnuts annually.

5.5 Government Production Farms

With the Study Area, these can be split into two groups of farms as shown below:-

(a) Official production farms which include two state farms (Janaal and Beerdiid) and two crash programmes (Janaale and Shalambood).

(b) Quasi-government farms where land has been allocated to government departments and related bodies as part of the general campaign to increase crop production. Such farms of 20 to 40 ha are currently run by ADC, the police, Marka prison, a local army unit and, as a more loose arrangement, the Palestinian Liberation Organisation (PLO).

All farms have been established on old banana or concession farms and are generally engaged in producing maize and sesame. Janaale state farm is currently not farmed because efforts have been concentrated on Beerdiid farm and a similar farm at Tugarey, located outside the Study Area near Mubaarig. With the exception of the independent PLO farm, production methods at the quasi-government farms are the same as for smallholders. The production farms, however, are the most heavily mechanised farms in the Study Area, mainly as they are the major producers of upland rice. Estimated production is given in Table 5.3.

TABLE 5.3

Study Area Government Production Farms: 1977 Estimated Farmed Areas

	Areas cultivated (ha)					
	Rice	Maize and sesame	Extra sesame	Ground-nuts	Perennial crops	Total gu/der
Shalambood Crash Programme	100	100	100	-	176 (1)	376/376
Janaale Crash Programme	80	115	-	-	42 (2)	237/157
Beerdiid state farm (5)	200	120	40	20	-	320/160 (4)
Janaale state farm	-	60	-	-	-	60/60 (3)

Notes:
(1) Includes 130 ha bananas
(2) All bananas
(3) Total farm area is 400 ha; 340 ha given over to smallholder agriculture.
(4) 200 ha fallowed each der season.
(5) Partially situated in the Study Area.

Source: Survey data

5.6 Cropping Calendar

The basic pattern of annual crop production in the Study Area is double-cropping of maize in the gu season and maize and sesame in the der season. The cropping calendars for this traditional production as well as for the more important minor crops are given in Appendix A, Figure A.1 and summarised in Table 5.4. Large-scale producers and the state farms will offset planting dates in order to minimise labour demand problems for the crucial operations of planting, weeding and harvesting. The data given in Table 5.4 represent about 80% of each crop grown per season. Planting, particularly of hagai and der crops, can vary beyond the general limits, ranging from July until at least January depending on water availability, the success of preceding crops, and the extent of der rainfall. This is reflected in the extent of sesame production as a catch crop during the hagai season between the major gu and der growing seasons.

5.6.1 Hagai Catch-cropping (Sesame)

Hagai catch-cropping, as opposed to the planting of small areas of normal hagai crops (tomatoes and tobacco) which extend into the der season, is practised by farmers in areas where irrigation supplies are erratic and poor. These areas correspond to areas demarcated on Map 1E as marginal crop production (land use class 2). Often it necessitates interplanting the sesame within a maturing but low-yielding gu maize crop. The success of the crop depends upon the amount of residual soil moisture, obtaining further irrigation and sufficient isolated hagai storms or showers. A normal der season sesame crop will follow the hagai crop, often, again, by interplanting before the harvest. Occasionally, a late crop of maize will follow. Little land preparation is practised as this type of farming represents an almost continuous cropping of poor crops from April onwards because any crop is heavily dependant upon erratic rainfall and light irrigation whenever water is available. An estimated 1 000 ha (net) of sesame is grown this way each year in most parts of the Study Area except the more reliable and intensely cropped areas centred around Faraxaane in the west of the area (see Map 1E). The inclusion of this third crop each year enables a farmer to improve his total yields beyond the already marginal production from the gu and der crops. That it is not more widely practised is indicative of individual requirements, the level of moderate yields which are considered satisfactory to a smallholder and the overall availability of water supplies. Certain agronomic problems also exist to act as a deterrent, and these are discussed in Chapter 7 (Sesame).

5.7 Cropping Patterns and Intensities

As previously described in Chapter 4 (Present Land Use) the predominant cropping pattern on cultivated land involves double-cropping maize and sesame in the following ratio:-

	Gu	Der
Ratio	Maize 100%	Maize 40% Sesame 60%
Total	100%	100%

TABLE 5.4

Study Area Annual Crop Production: Cropping Calendars

Month	Maize	Sesame (hagai)	Sesame (der)	Rice	Tomatoes/ tobacco
March	Land preparation		Harvesting, final threshing		
April	Planting				
May	Planting, irrigation, weeding			Land preparation, planting, irrigation, weeding	
June	Irrigation, weeding			As for May	Nursery
July	As for June	Light cultivation		Planting, weeding, irrigation, bird scaring	Nursery, land preparation irrigation, transplanting
August	Harvesting, stooking, cob picking, shelling	Irrigation, planting		Irrigation, weeding, bird scaring .	As for July, plus weeding
September	As August, plus land preparation for der	Irrigation, planting, weeding		Irrigation, harvesting, bird scaring	Transplanting, weeding, irrigation, harvesting
October	Irrigation, planting	Weeding	Land preparation, flood irrigation	Bird scaring, harvesting	Weeding, irrigation, harvesting
November	Irrigation	Harvesting	As October, plus planting,	As for October	Harvesting
December	As for November	Harvesting, threshing	Weeding		Harvesting (tomatoes only)
January	Harvesting, post-harvest operations		Weeding		
February	As for January		Harvesting, threshing		

Note: For major operations only. Table represents 80% of each crop.

Source: Survey data

The intensity of der maize and sesame will vary according to the success of each gu maize crop, but is normally the above ratio of 40% : 60%. As stated in Chapter 4, although this traditional double-cropping represents a cropping intensity of 200%, it only refers to land actually under cultivation. The overall cropping intensity will be less than 200%, being proportional to the land use intensity and the maximum possible land use intensity under irrigation. The derivation of overall cropping intensity and average cropping intensities in the Study Area is given in Table 5.5. This shows that, except for a small area of intensive cropping (60 to 70% land use intensity), the overall cropping intensity in the Study Area is less than 130%.

TABLE 5.5

Study Area Annual Crop Production: Average Cropping Intensities

Land use class	Gross area (ha)	NCA (ha)	Land use intensity (%)	Overall cropping intensity[1] (%)
2. Marginal annual crop production	11 565	5 078	33	94
3. Irrigated annual crop production	27 010	11 512	43	123
TOTAL	42 575	16 590	39	112

Notes: (1) Overall cropping intensity = maximum cropping intensity x land use intensity divided by maximum land use intensity[2]

e.g. $= \frac{200\% \times 0.33}{0.70} = 94\%$

(2) Maximum land use intensity under irrigation in the Study Area taken as 70% (see Chapter 4).

Source: Land use survey data (Chapter 4)

Exceptions to the above pattern are few and are as shown below.

(a) Triple-cropping involving the hagai sesame catch-crop. An estimated 1 000 ha (net) is cropped this way, which represents only 6% of existing areas under production. As hagai catch-cropping is practised in areas with a low level of land use intensity, the overall cropping intensity varies between 130 and 170%, assuming a maximum cropping intensity of 300%.

(b) Tomato and tobacco production. The estimated combined areas of these hagai/der crops is 600 ha (net) annually, which is about 3.5% of total cropped area. Virtually all is grown under a system of double-cropping as follows:-

(i) gu - maize (early planted)
hagai/der - tomato/tobacco (late planted)

or (ii) hagai - tomato/tobacco (early planted)
der - sesame (late planted)

Overall cropping intensities are, therefore, the same as for the traditional maize and sesame double-cropping.

(c) Upland rice production. The entire production of upland rice in the Study Area is, apart from weeding and bird scaring, fully mechanised. To avoid peak labour requirements and tractor movement on the undrained heavy soils, planting is not until May and finishes in July. The 120-day varieties currently grown also create problems for double-cropping. The bird problem that starts in late July can intensify severely after December. There is also the risk of water shortage from December onwards. Consequently any area under rice is mostly single-cropped (100% intensity) with a proportion double-cropped with a late sesame crop following the earlier planted rice crop. As the four farms growing rice also cultivate other crops (see Table 5.3, plus one private farmer), their overall cropping intensity can vary from 135% to 160% depending also on the degree of fallowing in either the gu or der season. Current rice production in, or adjacent to, the Study Area is estimated at 400 ha (net) which represents 2.5% of total cropped area.

In conclusion, therefore, the traditional maize/sesame pattern involves nearly 90% of the Study Area under annual crops.

5.8 Mechanisation

Availability of agricultural equipment in the Study Area has been discussed in Annex 3, Chapter 3 (Agricultural Infrastructure). With the exception of rice production, mechanisation of annual crop production is limited to a small proportion of the total cultivated area, and involves only land preparation. All mechanised inputs are summarised below:-

(a)	disc-ploughing	-	all crops
(b)	disc-harrowing	-	all crops
(c)	bund formation	-	all crops (use of disc-ridger to form irrigation basins)
(d)	field lateral canal formation	-	all crops (using small V-ridger)
(e)	irrigation bund preparation	-	sesame (bulldozers producing metre-high banks for flood irrigation)
(f)	drilling	-	rice only
(g)	combine harvesting	-	rice only

Four-wheel drive 65 to 75 hp tractors are used for all operations and, under very dry or moderately wet conditions, are essential for ploughing. Some two-wheel drive 60 hp tractors are available via the ONAT hire services but are only adequate for all operations under optimum conditions. Four-wheel drive, however, is essential for any tractor movement under wet conditions for non-field operations. Typical operating times for land preparation are given in Table 5.6, and the total estimated area of land prepared by tractor is given in Table 5.7.

TABLE 5.6

Study Area Annual Crop Production: Land Preparation Operating Times (h/ha)

Disc ploughing	3.0
Disc harrowing	1.5
Bund and lateral formation	1.0
Preparation of banks for sesame flood irrigation	1.5 - 2.0(1)

Note: (1) By bulldozer.

Source: Survey data.

TABLE 5.7

Estimated Study Area Mechanised Inputs: Land Preparation for Annual Crops

Information		Notes
(a) Privately hired equipment		
Number of privately owned tractors	100 - 120	Survey data (Annex III, Chapter 3)
Hire availability for land preparation	25% (2)	During February, March, September and October
Average operation time	4 - 6 h/ha	Survey data
Total cropped area	16 590 ha	Land use survey data
Area prepared in two months	1 900 ha(1)	At 6 hours per working day
% total NCA	11%	1 900 ha/16 590 ha
(b) Large-scale farmers using own equipment		
Estimated NCA	1 500 ha	Survey data
% total NCA	9%	1 500 ha/16 590 ha
(c) Government production farms		
Estimated NCA	1 000 ha(3)(4)	Survey data
Estimated NCA	1 000 ha(3)(4)	Survey data
% total NCA	6%	1 000 ha/16 590 ha

Notes:-
(1) Includes most co-operative group farms.
(2) Most tractors involved permanently on banana farms.
(3) Includes remaining few co-operatives and all ONAT hire equipment.
(4) Includes 400 ha rice production.
(5) ONAT hire service is limited to only 27 tractors, absorbed entirely by production farms and a few co-operatives (see Annex III, Chapter 3).

The maximum estimated area prepared by tractor represents 26% of the total area under annual crops. This proportion, however, is centred largely on large-scale producers, co-operative group farms and state production farms, such that tractor use by smallholders (on hire) represents an estimated maximum of 8% of the total cultivated area.

Operational skills of tractor drivers and practices are poor, such that the full advantages of mechanisation are diminished in relation to new problems that arise. Ploughing and harrowing methods particularly in badly weed-infested fields, create uneven land with subsequent irrigation problems because no land levelling is practised, even on government farms. On these farms, several discings are carried out to create a fine tilth and eliminate some of the more severely uneven land. The use of disc ridgers for bund formation results in small channels around the edge of each basin due to its gouging action. The use of V-ridgers to form field lateral canals without any use of fill results in part of the lateral being below field level. Both methods therefore result in further decreased irrigation efficiency.

Poor weed control during crop growth also creates problems for mechanised operation. Post-harvest cultivations are often delayed or not done at all and greatly increase pre-planting land preparation operations. Also high weed infestation of rice crops causes harvest losses due to the weeds reducing efficiency of combine operations.

The simplest mechanised input is preparing the high banks, for flood irrigating sesame, in large basins of up to 2 ha in area. Often, however, banks are prepared by pushing from within the basin rather than from outside. The subsequent flood, without further levelling, then becomes unequal. These banks are being prepared continually throughout each year whenever money or bulldozers are available and are reasonably permanent structures requiring little annual maintenance. However, the majority of the sesame crop is still irrigated using the same small basins as for maize.

At harvesting, transportation of maize cobs and threshed sesame to villages is done mainly by donkey or ox-cart by smallholders with some hire of locally available trucks. Some use is also made of tractors and trailers beyond the few large-scale producers and government farms. Widely distributed ADC buying stations and their own produce transportation arrangements between these stations, large farms and their depots minimise transportation requirements for farmers.

5.9 Labour Availability

Labour requirements and availability within the Study Area are discussed in full in Appendix A. Virtually all farm operations involve the use of hand labour and further development of crop production must take into consideration the efficiency and availability of labour. The availability study was undertaken following observations and reports suggesting that there are labour shortages at certain times of the year, which coincide with the peak periods of planting and weeding in both the gu and der rains. The study showed that although quite large fluctuations in labour requirements occur, the maximum daily labour requirement never exceeds 60% of the estimated available manpower, even assuming a modest working day of only four hours. Therefore, in theory, no shortages should exist, even at peak periods. This apparent discrepancy is partially explained by the locality-concentrated nature of labour demand, in relation to the source of labour. For example, banana farms are concentrated in relatively small areas and insufficient labour is available from villages within the banana-producing area. On the other hand, where banana farms or large-scale maize farms are more isolated, the problem is not so clear cut. Here, the shortage of labour is due to either low motivation levels of smallholders toward supplementing their subsistence agriculture or the failure of producers (private and state alike) to provide sufficiently attractive rates of pay. Therefore, development proposals must consider population distribution, individual motivation and adequate remuneration in order to tap an under-utilised working population.

5.10 Fertiliser and Chemical Usage

Estimates of chemical and fertiliser usage on annual crops in the Study Area have been previously reported in Annex III, Chapter 3 (Infrastructure). Usage of both is limited to only some co-operatives and the state production farms, reflecting the current emphasis of technical services and credit availability. Survey work showed that no other smallholder or farmer uses either chemicals or fertiliser with the exception of three large-scale producers (two private and the PLO farm).

5.10.1 Fertilisers

Fertilisers are applied to an estimated area of about 1 000 ha (net) of maize and upland rice. This represents applications to less than 6% of the total cultivated area. The only fertiliser used is urea (46% N) which is applied as a basal and/or top dressing. Methods of application vary in efficiency. Broadcasting onto rice crops is often uneven, causing patchy growth. For maize, placement methods are used with better effect although some broadcasting is carried out, which is wasteful for wide row crops. All fertiliser application is by hand. Agronomic implications of unbalanced fertiliser usage due to lack of phosphorus applications are discussed in following chapters.

5.10.2 Chemicals

Usage of chemicals is also limited to only about 900 ha of annual crops. Most applications were either for the control of stemborers (Chilo partellus) in maize, or herbicidal weed control in rice. Some spraying to control rice stemborers (Chilo) and whitefly on tomatoes (to control curly top virus disease) is also carried out. Exact pest problems and control efficiency are discussed in following chapters of this annex.

5.11 Land Preparation

Apart from the small proportion where ploughing is done (Section 5.8), land preparation in over 90% of smallholdings (i.e. 85% of the total annual crop area) is by hand. Remaining weeds and residues are cleared and a shallow cultivation given by using a small hoe (yambo). Virtually no burning is carried out unlike in many areas of East Africa. Irrigation basins are then prepared with a flat two-man implement (kawawa) by scraping the surface soil into bunds about 15 cm high. Each basin measures 25 large paces square, a jibal (about 0.06 ha) and is often subdivided into four smaller basins (moos) in order to improve irrigation efficiency because no land levelling is practised. These operations for the gu season maize crop take place in March and April. Prior to der season cropping, the pre-planting cultivation is repeated but often there is little need to repair bunds. The kawawa is also used to prepare shallow field lateral canals to supply water to a group of basins.

5.12 Irrigation and Drainage Methods

Basin irrigation, with a few modifications, is the only method practised for annual crops in the Study Area. A break is made in the bund and the basin or several basins are flooded before closing off the supply when sufficient water is judged to have been applied. Each field lateral leading from minor canals will supply about 30 jibals (1.9 ha) and from one break in the appropriate bund, 2 to 4 jibals can be flooded at one time. In order to build up water levels, checks are made by blocking the lateral with earth. No attempt is made to apply specific amounts as the major problem is usually failing to obtain sufficient irrigation. As discussed in Chapter 4 (Present Land Use), the system of irrigation is as supplementary irrigation of variable reliability to augment rainfall. In order to limit effects of inadequate irrigation supplies, several farms prepare small ridges using a tractor-drawn cultivator, prior to forming basins. Maize is then planted in the furrow. True furrow irrigation, however, is practised only for tomato production at the PLO farm.

Irrigation of gu season maize starts in May following early growth under rainfed conditions. For the der season crops, unless there are effective planting rains, a pre-planting irrigation is applied. Because of its greater susceptibility to waterlogging, sesame is generally grown using a single pre-planting irrigation. The large basins with metre-high banks enable a substantial flood irrigation to be applied. Several weeks are needed for application and infiltration to take place in sufficient quantities to support a good crop. However, only about a quarter of the total sesame crop can be irrigated this way. The remaining crop is grown in the normal jibal basins and the single irrigation is insufficient unless well supplemented by rainfall and a further irrigation. Consequently most sesame crops receive insufficient water. Maize crops recieve from one to three irrigations depending on locality and water availability. Other crops grown under more specialised conditions, for example rice, receive better irrigation. Specific irrigation details for each crop are given in later chapters.

In general, irrigation usage and efficiency is poor, except in a few circumstances, due to the major reasons which follow:-

(a) Poor initial supply to most areas, particularly outlying areas, due to command problems and poor maintenance of primary, secondary and minor canals.

(b) Inadequate scheduling. In the few days allowed per section of canal, insufficient supply results in slow distribution around each holding. Villagers will organise a rota to minimise inability by any one farmer to obtain any irrigation when theoretically made available.

(c) No land levelling is practised such that even in the smallest basins (moos), marked variation in crop growth occurs.

(d) Wastage through spillage from broken bunds and minor canals' banks, the latter often being caused by cattle when drinking.

(e) Farmer's absence during a schedule period resulting in a missed irrigation.

(f) The total lack of surface drainage facilities to draw off surplus water often causes farmers to withhold irrigation, when there is the risk of heavy rain. This occurred in May 1977 when, despite high river levels, many wilting maize crops were not irrigated because farmers expected the gu rains to continue beyond April as normal. Conversely, exceptionally heavy der rains in 1977 caused waterlogging of substantial areas of maize. No other form of field drainage system is practised in the Study Area.

5.13 Rotations and Fallows

The predominant role of maize and sesame in annual crop production and the effective lack of any other alternative cropping, particularly of legumes, has resulted in a partial rotation of maize and sesame or, in some cases, continuous cropping of maize. Consequently, fallowing is effectively the only method of attempting to maintain soil fertility. However, deliberate fallowing is practised by only a few farmers. Most smallholders, due to the small size of their holding, cannot afford to rest any land. Survey data indicated that only those farmers with more than 3 or 4 ha rest part of their land each year 'to improve yields' i.e. to prevent further decline. Larger scale farmers (10 ha or more) will fallow their land but this is due mainly to problems of working all their land each year rather than a deliberate farming policy. The overall lack of effective rotations or fallowing (in the absence of fertiliser applications) has resulted in high levels of pest infestations such as maize stemborer (Chilo sp.), and the steady decline in yields due not only to pest damage but also to nitrogen and phosphorus deficiencies.

5.14 Inter-cropping

In most traditional agricultural systems, inter-cropping is a dominant form of crop production such that at low levels of inputs it can be shown to be superior to the appropriate mono-cropping of each crop involved. In the Study Area, inter-cropping is practised by a minority of farmers despite the use of a wide range of inter-crops. Most interplanting is done in maize crops with little in sesame. It is estimated that 25% of maize crops are interplanted with cowpeas and/or green grams (i.e. about 5 800 ha/year) with some form of interplanting occurring in about 40% of all maize crops. Other important intercrops are pumpkins and tomatoes. Occasionally hyacinth beans (Lablab), lima beans, groundnuts, sweet potatoes and bottle gourds (Lagenaria) are also interplanted. Melons are interplanted in der crops only. However, the system used is not as well established as other practised in East Africa, for example, by the Wasukuma of Northern Tanzania. Most intercropping is desultory with thin stands of isolated plants despite a higher intensity seen in der maize compared to gu maize crops. It is considered that the insubstantial extent of legume inter-planting has little effect on overall soil fertility and resultant maize yields.

5.15 Utilisation of Animals

Despite a high cattle population in the Study Area and a tradition of using donkey and/or ox-carts for transport purposes, no field operations are carried out using animal-drawn equipment, unlike in some other regions of Somalia. Several farmers were reported to have used ox-ploughs sometime in the last 20 years but abandoned them due to the heavy nature of the Study Area soils. However, there is scope for utilising draught animals for light operations such as planting, bund formation, simple levelling and cultivation of crops.

CHAPTER 6

MAIZE

6.1 Introduction

Maize is the major staple food crop grown in the Study Area with an estimated 23 226 ha (net) grown annually as described in Chapters 4 and 5. The majority is grown by smallholders and the methods of land preparation and irrigation, as well as growing seasons, have also been discussed in previous chapters. Specific field operations, crop characteristics, production problems and yields are described below.

6.2 Field Operations

6.2.1 Planting Methods

The most common method is to plant 4 to 7 seeds in rough lines approximately every metre. Despite good germination, the final number of plants per stand can vary from 1 to 7 due to stemborer attack, cutworm or chafer grub damage and, occasionally, thinning. Plant populations can vary from about 15 000 to 49 000/ha. Where 3 or more plants per stand occur, only 1 or 2 plants grow strongly, repressing the other later-germinating plants. The seed rate varies from 20 to 25 kg/ha.

On some farms, maize is broadcast before harrowing in. This leads to variable germination and poor stand uniformity. One co-operative tried machine-planting but with ungraded seed, which resulted in very uneven stands. No gapping is practised. Dry-planting prior to rains or irrigation is also not practised due to general unpredictability.

6.2.2 Planting Dates

Despite planting being over a considerable period in both seasons, early planting is considered advantageous and is practised by better smallholders and farmers. In the gu season, planting after the first two weeks of significant rainfall is considered risky due to unpredictable continuation of the rains. Earlier planting will also reduce severity of stemborer attack.

For the der crop, planting dates are not considered as crucial and can take place in September and October depending on water availability for the first irrigation. However, planting is usually in October to catch the November der rains. After October, any planting is at risk due to falling river levels from December onwards, resulting in the total lack of water at tasselling.

6.2.3 Weed Control

In general, weed control by most farmers is inadequate. All weeding is done by hand using a very small hoe (yambo). Due to poor weed clearance in canals and poor land preparation, weeds are one of the major agronomic problems of not only maize but all crops grown in the Study Area. Maize crops are weeded one to three times depending upon location, rainfall received after planting and/or irrigation frequency. Each weeding, however, is often only after weeds have become well established and is very labour intensive in the absence of a suitable tool to replace the yambo, such as the East African jembe (mattock). Often weeding is done prior to an irrigation and as basins are rarely cleared, weed re-growth is almost immediate. A minority of farmers weed early and are able to maintain quite weed-free crops, which, in the gu season, enables succeeding der season crops to become established with less weed competition. Important Study Area weeds are given in Appendix B.

6.2.4 Irrigation

Irrigation frequency and application rates are major constraints on maize yields in the Study Area such that the success of a crop is, with a few exceptions, dependent largely upon good rainfall. Irrigation, therefore, is a supplementary water supply. Irrigation availability has been used to distinguish land use classes and is discussed in Chapter 4. In marginal areas where one or sometimes two irrigations are applied, supplies are invariably inadequate and often delayed beyond tasselling. Even in better maize areas (land use class 3) where two to three irrigations are applied, application frequency is also erratic and often late, causing short drought periods before tasselling. In areas close to the river or main canals, three irrigations, if applied at the correct time, can give good crops provided pest control measures and fertilisers are also applied.

6.2.5 Harvesting Methods

Harvesting usually takes place from late July and into August for the gu crop and in January and February for der crops. All crops are harvested by cutting and stooking. When mature, the stems are cut at soil level. Bundles of plants are either laid on the ground to dry for a further one to three days, or carried directly to the stook. Stooks can vary in size from 2 to 12 m in diameter, the largest being from the harvest of 1 ha. Stooking allows further drying to take place and land preparation to start. However, normally little land is prepared for the next crop until after harvesting is completed. Stooks can be left for two weeks up to over one month before final cob picking is done. For domestic supplies small amounts are picked every few days. The bulk of the picking is completed only when either labour is available, land preparation required, shellers available or ADC has started purchasing. When the cobs are picked and not transported to the village they are stored, de-husked, beneath the stover. Large-scale farms will have watchmen to protect their harvest. The often long delay between stooking and picking encourages termite and rodent damage, which can cause up to 5% losses.

6.2.6 Post-harvest Operations and Storage

Surplus requirements are shelled before sale to ADC or locally. In small villages this is either by wooden pestle and mortar or by beating filled sacks with sticks. In large villages, private hand or machine-operated shellers are available for hire, costing between So.Shs. 1 and 2 per bag (quintal) of shelled maize. Except when hired by large-scale farmers, these shellers will be sited at ADC buying stations.

Domestic requirements, which constitute most of the annual production, are stored as cobs. Pits up to 1 m deep are dug, or old pits renovated, and lined with maize stover. The pits are filled, covered with a final layer of stover and then covered completely with earth. Often branches of <u>Acacia</u> thorn trees are placed over the pit to deter animals. Several pits were inspected and despite initial weevil and grain moth attack at harvest, further infestation is minimal if the pits were prepared well and kept closed. Consequently, families usually have several small pits to store maize. Where storage is done in the home, maize weevil (Sitophilus) and grain moth (Sitotroga) damage continues and can be severe after six months.

6.2.7 Stover and Crop Residue Disposal

Virtually all stover is used as cattle feed, particularly in the jilal season. Village herds are taken to the fields after harvesting is complete and as this is generally a communal operation, no charges for grazing rights are levied. Larger producers will be paid by other cattle-owners only if his own herd does not utilise the stover fully. Occasionally stover is bought and transported to Mogadishu. Prices vary around So.Shs. 300/ha. Virtually no stover is burnt off. After shelling, the remaining cob stalks are generally used for firewood.

6.2.8 Labour Requirements

Average manhour inputs for maize production are given in Appendix A (Section A.4) and summarised in Table 6.1. Data collected during farm surveys showed that these average figures can vary up to 30 to 35% due to differences in labour quality, skills, weed levels and final yields.

TABLE 6.1

Study Area Maize Production: Labour Inputs

Operation	Manhours/ha per operation	Frequency
Land preparation and bund formation	65	1
Planting	24	1
Irrigation	8	1-3
Weeding	56	1-3
Harvesting (2 operations)	80	1
Shelling	5 (1)	1
Miscellaneous (10%)	24 - 37	-

TOTAL (a) 262 - 403 manhours/ha
(b) 66 - 101 mandays/ha (2)

Notes: (1) By hand operated machine. By hand: 2 to 3 h/q
(2) At 4 working hours per day

Source: Survey data

6.3 Varieties

Virtually all maize production in the Study Area utilises the local variety but in 1977, 215 ha of the new Somali Composite maize were grown on four co-operative farms near Janaale.

Imported hybrid seed has also been tried on one or two large-scale farms but with limited success due to adaptability problems. Varietal characteristics of the two Somali varieties are described in Table 6.2.

TABLE 6.2

Study Area Maize Varietal Characteristics

Character	Variety: Local White	Variety: Somali Composite
Germination	5 - 6 days	5 - 6 days
Initial slow growth	20 days (1)	20 days (1)
Tasselling	50 days (1)	55 days (1)
Maturity	100 days (1)	105 days (1)
Seed type	White, small seeded, flint. Small percentage of yellow and red grains. Occasional all red cobs occur	Yellow and white, large seeded, flint
Ear type	Variable length and rows per cob (12-18). Average cob weight less than 200 g	Less variability and larger average size (200-300 g per cob)
Plant height	2 - 2.5 m under good management; 1.5 m average	2 - 2.5 m
Ear height	1 - 1.75 m	1 - 1.5 m
Cobs per plant	1 - 1.05	1 - 1.15
Genetic variability	Large; seen in ear types, plant pigmentation and husk types	Moderate, noticeable only in ear types
Yield potential	Low to moderate	High
Pest resistance	Poor stemborer resistance	More susceptible than Local White

Note: (1) Days from planting

Source: Field survey data

Both varieties are classified as early maturing and are well adapted to requirements in the Study Area. Short season varieties are needed to enable double-cropping and decrease risks of water shortages. Short stature prevents lodging particularly in the strong hagai winds. The Somali Composite variety was developed at CARS, Afgooye in 1974 involving 22 selected exotic lines and one local variety. Unfortunately, further bulking has not been under proper supervision and a certain amount of impurity from accidental crossing with undesirable lines has resulted, both at the research and seed multiplication centres at Afgooye. However, its potential is greater than the local variety but, being predominantly yellow seeded, it is not as acceptable to the local population for preparing their traditional dishes of cambuulo and soor. Further work is necessary to produce a high-yielding acceptable variety to replace the low yield potential of the local variety. This is discussed further in Annex VI.

6.4 Pests and Diseases

Stemborer (Chilo partellus) is the major maize pest. Observations showed that infestation can affect 25% of stands in any one field. Yield losses can, in some cases, reach at least 75%, although 30 to 50% losses are more normal. Generally, infestation levels are higher in the der season than the gu season, mainly as the result of pest build-up through the gu season. The overall severity of stemborer is also the result of several other factors:-

(a) Continuous maize cropping within very limited areas.

(b) Effectively no ploughing to bury remaining stem bases in which immature stages can remain.

(c) No burning of other residues and trash not consumed by livestock.

Severe infestation can reduce stands as well as retard surviving plants. During the 1977 der season, many crops had 100% infestation with at least 25 to 50% of all plants containing from 4 to 10 stemborer larvae such that growth would never exceed a height of 0.5 m. Any further development of maize production in the Study Area must involve effective stemborer control. Existing methods and extent of control measures are discussed in Chapter 5 and Annex III, Chapter 3 (Infrastructure).

Other pest problems are minor. Isolated outbreaks of cutworm (Agrotis sp.) and chafer grubs (Schizonycha sp.) occur at the seedling stage but are not as serious as on sesame (see Chapter 7). Aphids (blackfly) can occasionally be a problem in May and June affecting tassels and restricting pollen-shedding.

No diseases are considered serious. Under abnormally wet conditions, as experienced in the 1977 der season, only light attacks of Helminthosporium blight were observed. Rainfall distribution in the Study Area is not conducive to the spread of fungal or bacterial diseases.

6.5 Crop Nutrition

The long history of continuous maize and sesame production in most areas, without the use of fertiliser or cattle manure and with minimal fallowing, has resulted in the steady decline of yields over and above reductions caused by irrigation and pest problems. Many older farmers reported the ability to produce better maize crops in previous years. Observations of unfertilised standing crops revealed moderate nitrogen and light phosphorus deficiency symptoms in nearly all crops. When the crops matured this could also be seen in small ears with incomplete tip development of nearly all ears plus imperfect row development on approximately 10% of all areas. Responses to fertiliser applications were clearly seen on the co-operative and government farms where urea (46% N) was applied. However, despite the absence of nitrogen deficiency symptoms on these crops, incomplete ear development was still observed, further indicating phosphorus deficiency.

No potassium deficiency was observed and despite the high soil pH (7.5 to 7.8), no micro-nutrient deficiencies were seen. Likewise, no symptoms of soil salinity were noticed, confirmed by soil analysis results discussed in Annex I, Chapter 4.

6.6 Yields

Present yields were assessed by collating information collected by three methods:-

(a) weighed harvests from selected field plots

(b) village surveys

(c) data collection from government production farms and reliable full-time large-scale farmers.

All yields are for shelled grain.

6.6.1 Field Plot Assessment (Gu 1977)

Plots were selected at 42 sites on co-operative farms in order to cover the full spectrum of crop management in the Study Area from improved management of Somali Composite maize to poorly irrigated local maize. At each site, one jibal (0.06 ha) was selected at random from an average part of the field, its area measured, its separate harvest arranged and plot yields assessed. Due to difficulties finalising harvest during Ramadhan, unshelled cobs only were weighed, with sample bags taken for shelling and weighing to obtain a representative shelling percentage for further calculations. Average results are given in Table 6.3. Of the 42 selected plots, only 27 were finally assessed, with 15 abandoned for various reasons. Although the 1977 gu season had poor rainfall distribution, yields from management levels (4) to (6) are considered to represent the range of maize yields obtained by the majority of farmers in the Study Area.

6.6.2 Village Survey Data

Obtaining valid yield information during this survey proved difficult. High yields claimed by farmers often related to unusual years and careful interpretation of collected information was required. In areas classified under

TABLE 6.3

Mean Yield of Selected Study Area Maize Crops: 1977 Gu Season

Method of crop management	Number of plots	Mean yields (q/ha threshed grain) (1) At harvest	Adjusted to 12% moisture content (2)	Net yield (2)
(1) Somali Composite with full fertiliser and pest control; with good irrigation	4	38.0	36.1	28.0
(2) As (1) but local variety only	6	26.7	25.4	20.3
(3) As (2) with average irrigation (2 times)	5	19.6	18.6	14.9
(4) As (3) but without fertiliser	5	16.5	15.7	12.6
(5) As (4) but with no fertiliser and pest control	4	12.1	11.5	9.2
(6) As (5) but with one irrigation only	3	6.6	6.3	5.0

Notes:
(1) Average plot size = 0.06 ha
(2) Assumed moisture content at harvest = 17% (ADC, 1977)
(3) 80% adjusted yield to allow for field losses.

land use class 3 (average irrigation) reported yields vary from 8 to 16 q/ha of shelled grain on land continually in production. The final yield will depend upon seasonal rainfall distribution and stemborer incidence. In normal years, yields vary between 8 and 12 q/ha and in above average years from 12 to 16 q/ha, the last such 'good' year being considered by farmers to be 1972. Due to higher stemborer incidence, der season yields are generally lower than in the gu season.

Under similar conditions, on previously uncultivated land, yields of 20 to 30 q/ha were reported but this probably represents yields obtained 15 to 20 years ago when areas under cultivation were expanding. These reported yields give an indication of the known yield decline.

In areas classified under land use class 2 (marginal crop production) average reported yields are lower, ranging from 3 to 10 q/ha, again reflecting seasonal rainfall and pest incidence variability. In the 1977 gu season, due to poor rainfall, large areas effectively yielded nothing. However, examination of 1977 der crops that received adequate rainfall for 45 days, but often no irrigation, confirmed the low yield expectancy of these marginal areas.

6.6.3 Production Farm Data

In 1976, four surveyed farms that cultivated a total net area of 120 ha, obtained average yields of 18 to 20 q/ha using the local variety with fertiliser (urea) and stemborer control measures. In 1977, without fertiliser and in a poorer gu season, these farms produced between 10 to 13 q/ha from 142 ha. At the Afgooye - Mordiile project (Libsoma), average yields for the local variety were 15 q/ha with fertiliser (1975) and only 7.5 q/ha without fertiliser (1976). In three seasons the FAO pilot project at Afgooye averaged 19.2 q/ha from a total of 40 ha (net) grown in 1973/74 (FAO, 1975).

6.6.4 Yield Summary

Average expected maize yields in the Study Area are estimated to be:-

(a) 10 q/ha shelled grain in land use class 3 areas receiving several irrigations.

(b) 6 q/ha shelled grain in land use class 2 areas receiving marginal irrigation or grown under rainfed conditions.

6.7 Summary and Conclusions

The large area of maize cultivated in the Study Area is dominated by low yields as the result of four main production problems: poor weed control, inadequate irrigation, low soil fertility and high stemborer incidence. Any development must therefore remove or control these constraints. The introduction, in 1977, of the Somali Composite variety grown under improved management indicates that with further development, much higher yields can be obtained.

CHAPTER 7

SESAME

7.1 Introduction

Like maize, sesame is a major food crop grown along the Lower Shabeelle river, being the most imporant source of vegetable oil which forms a fundamental part of the traditional diet. Due to its high demand and value, it also represents a small but important cash crop to larger producers as production methods and problems are less than for maize. An estimated 11 000 ha are cultivated annually, mostly in the der season but with about 1 000 ha of earlier hagai catch-cropping as described in Chapters 4 and 5. Production is mainly by smallholders. Land preparation and irrigation methods have been described in previous chapters; specific production methods are described below.

7.2 Field Operations

7.2.1 Planting Methods

Planting is by the same check-row method as used for maize, but generally with a shorter distance between planting stations. A usual spacing is 0.5 to 0.7 m^2 but wider spacings of 0.9 to 1.0 m^2 also occur. A pinch of seeds is dropped at every pace and scuffled in with the foot. After rapid germination, 20 to 40 seedlings emerge at each station. Thinning is often not practised because the high population per stand is a safeguard against early cutworm attack, other minor pests or heavy rain inducing some damping-off. If thinning is carried out, it is generally done at the end of the slow early growth stage before rapid elongation and flowering starts. The lack of thinning does not appear to have an adverse effect on yields because normally only three to five plants dominate at each stand with remaining plants either suppressed or dying off during flowering. Consequently the effective plant population varies from 150 000 to 200 000 plants per hectare. Seed rate ranges from 5 to 10 kg/ha.

7.2.2 Planting Dates

The optimum planting date is acceptd by farmers to be between mid-Octobe and December, although most of the der crop is planted in November to utilise the der rain and is always planted after the der maize crop. Small areas are planted virtually all the year round, for example, hagai crops. However, any crop planted earlier than October can be badly attacked by several pests as well as suffer poor pod-set due to overcase conditions during flowering. Conversely, crops planted after December will be harvested from the end of March and can be badly affected by early gu rains.

7.2.3 Weed Control

Sesame requires less weeding than maize for the following reasons:-

(a) The growing season is generally during the dry jilal season or the drier part of the hagai season.

(b) Nearly all crops are irrigated before planting rather than during growth, with the flood irrigation effectively suppressing most weeds.

(c) It is an earlier maturing crop than maize (90 days) and after about 20 days, growth is rapid to produce a good cover which suppresses weeds from 40 days onwards.

Consequently, crops planted in November generally require only one weeding during the slow early stage of growth since, during later stages, the soil surface is dry. Earlier planted crops may require two weedings, particularly in areas near rivers and canals or during abnormally wet years.

7.2.4 Irrigation

As described in Chapter 5, all sesame crops are given a pre-planting irrigation. As only an estimated 25% of the crop is grown in high-banked flood irrigation basins, most of the crop does not receive adequate water from this single application. Consequently most der season crops also rely upon the November der rains to supplement this irrigation. Occasionally, when water is available, a second irrigation is applied but only when the crop is well established and flowering, to avoid damping-off or waterlogging. Hagai crops are, therefore, more at risk due to less time being available to apply the pre-planting irrigation and the more erratic nature of the rainfall. Observations of the 1977 hagai crops showed that most had an inadequate water supply and 10 to 20% of the crop wilted badly during flowering. Properly flood-irrigated crops, however, have adequate moisture to produce a good crop. Measured flood depths varied between 30 and 50 cm but net application is difficult to estimate due to surface evaporation and the variable length of time taken to direct water into the basin area. Occasionally, if water becomes available again, more water is applied before the first has fully infiltrated. Three to four weeks is the usual period from starting flooding until planting. Under proper flood irrigation, yields are limited by pests, soil fertility and prevailing cloud conditions, but for most crops, inadequate irrigation is a major constraint on yields.

7.2.5 Harvesting Methods

The local variety is a dehiscent type badly prone to shattering. Therefore, early harvesting by hand is essential. When the lowest pods are ripe and about to open, the plants are pulled and tied in small stooks in one area of the field. As most crops mature unevenly, this process is repeated several times until all the field is stooked. Stook sizes vary from 0.75 to 1.5 m in diameter. The crop is then left for approximately 15 days to ripen fully. Consequently it is essential that sesame crops are planted so as to be harvested in the dry weather between January and March. Any rainfall during harvesting can cause considerable losses. Threshing is by shaking carefully upturned plants over a large piece of heavy cloth or grass mats before winnowing.

7.2.6 Post-harvest Storage

Most of the sesame grown is for domestic consumption and stored in sacks in the farmer's home. There is virtually no damage from storage pests and due to low yields and requirements compared to maize, elaborate storage requirements are not necessary.

7.2.7 Crop Residue Disposal

Very little sesame straw is eaten by, or fed to, livestock. Also very little is burnt off. Some straw is used for thatching houses but otherwise most is left in the field.

7.2.8 Labour Requirements

Average manhour inputs for sesame production are given in Appendix A (Section A.4) and summarised in Table 7.1. As for maize, these inputs can vary by up to 30 to 35% from average figures.

TABLE 7.1

Study Area Sesame Production: Labour Inputs

Operation	Manhours/ha per operation	Frequency
Land preparation	45 - 65	1
Irrigation	8	1 - 2
Planting	40	1
Weeding	56	1 - 2
Harvesting	90	1
Threshing	50	1
Miscellaneous (10%)	29 - 37	-

TOTAL (a) 318 - 380 manhours/ha
(b) 80 - 95 mandays/ha(1)

Note: (1) 4 working hours per day

Source: Survey data

The estimated input of 318 to 354 manhours/ha represents the full range under normal circumstances. The average requirement is for 340 manhours/ha (85 mandays/ha).

7.3 Varieties and Crop Characteristics

The only variety grown in the Study Area is the local cultivar which is a mixture of lines. This can be seen on examination of seed types. White, cream, brown and black-seeded types all occur, being pure lines within a mixed population. Examination of crops under good management and growth conditions showed that up to 8 pod-bearing branches can occur, excluding the main stem. However, despite this strong vegetative growth, yield potential of the local variety is moderate due to its fruiting characteristics. Flowers and pods are borne singly at each axil and each pod consists of only 4 locules with less than 20 seeds per locule. No plants were seen bearing the possible 3 pods per axil or composed of more than 4 locules per pod. Other growth characteristics of the local variety are given in Table 7.2. Because the majority of crops in the Study Area receive insufficient water for full development, their final height is less than 1 m with only 4 to 6 pod-bearing branches.

TABLE 7.2

Sesame: Local Variety Growth Characteristics

Germination	3 - 4 days
Onset of rapid stem elongation	25 days (2)
Onset of branching	35 days (2)
Onset of flowering	40 days (2)
Onset of fruiting	50 days (2)
Onset of maturity (harvesting)	85 - 90 days (2)
Crop height at maturity	1 - 1.5 m (1)

Notes: (1) Good crops only
(2) Days after planting

Source: Survey data

7.4 Pests and Diseases

At optimum planting dates and with most vegetative growth during the dry jilal season, sesame is only sporadically affected by one pest, cutworm (Agrotis sp) and, occasionally, chafer grubs. Attacks are at the seedling stage only and can be much more severe than on maize, necessitating replanting crops in some cases. Incidences were reported and observed throughout the Study Area but due to both seasonally sporadic and isolated attacks, most crops are not affected. No serious diseases occur on der season sesame crops.

However, due to wetter conditions, sesame grown in either the gu or hagai seasons is susceptible to several pests and diseases:-

(a) Cutworms. Incidences are more common than during other seasons.

(b) Webworm (Antigastra sp.). Nearly all hagai crops are attacked by webworm with the most serious damage occurring during early growth. The larvae mat and damage the newly formed leaves and growing points, severely stunting plants in some cases. Often plants grow out of the attack, shedding affected leaves, but renewed infestations can occur during later stages and continue to cause an overall loss in yields. In most cases, yield losses are estimated between 10 to 25%, but in severe attacks more than 50% losses can occur.

(c) Podborers. The larvae of several species attack and damage ripening pods after stooking. In the 1977 hagai season, incidences were isolated, but could affect up to 50% of pods. Chilo, Sesamia and Antigastra were all observed to cause pod-boring damage.

(d) Occasional light damage caused by red spider mites was seen on isolated crops but always in association with predatory ladybird larvae.

(e) Diseases. During wetter weather, isolated incidences of damping-off and brown leaf spot (Cercospora) affected seedlings but with minimal damage. However, severe defoliation of maturing crops caused by Cercospora was seen during the heavy 1977 der rains.

Therefore, pests on sesame are minimised appreciably by planting at the correct time of year.

7.5 Crop Nutrition

The overall lack of information and clear-cut deficiency symptoms make it difficult to assess effects of soil fertility on crop growth under the existing situation. Sesame is not a heavy feeder and no farmer in the Study Area has ever used fertiliser or manure on a sesame crop. Occasional crops were paler green in colour than normal, indicating nitrogen deficiency, and the few crops seen to grow vigorously to 1.5 m height were planted on land that had been fallowed for several years. Therefore, the effect of declining soil fertility through continuus cultivation is probably less on sesame than maize.

7.6 Crop Growth and Climate

Apart from reduced pest attacks, the major reason for growing sesame in the der and jilal seasons is to avoid cloudy conditions. Maximum branching and pod set occur during prolonged periods of hot, sunny weather and both are reduced during cooler cloudier weather. Sesame is particularly susceptible to cloudy conditions during the final 40 days until harvesting when most flowering and branching takes place. Hagai catch-cropping, therefore, is a calculated risk necessitated by overall poor irrigation supplies in certain areas. This adverse effect of overcast weather was seen during observations of several crops in the Study Area. Where flowering coincided with a period of dull weather, pod set was between 5 and 25%, despite good vegetative growth. However, hagai crops planted several weeks later, such that flowering coincided with a spell of hot clear weather, had a pod set of more than 75%. All crops flowered prolifically.

7.7 Yields

The timing of this study did not allow sample plot yield assessment of der sesame crops. Yield estimates have therefore been based on reported information collected during village surveys as well as visual estimation of standing crops. Expected average yields vary markedly with season (hagai or der), irrigation, pests and climatic conditions, as discussed earlier. The demarcation between average crop production and marginal production used for maize yields is not so clear-cut for sesame. For example, in land use class 2 areas where most farmers obtain inadequate irrigation, there are several farms with high-banked basins where an average flood irrigation can be obtained slowly. Under normal conditions, der season crops average 3 to 5 q/ha of threshed grain with 5 to 8 q/ha reported in good years. In villages situated in land use class 2 areas (marginal production), reported yields were 1 to 5 q/ha with 1 to 3 q/ha being a more normal yield for both hagai and der crops. Three large-scale farmers cultivating 145 ha in 1976, produced an average of 4 to 5 q/ha (threshed) with average irrigation supplies. Observations of standing crops showed that all yields reported above were possible but that average yields were low because many crops reached a final height of only 0.5 to 1.0 m. Therefore, estimated average sesame yields in the Study Area have been taken as:-

(a) 2.5 q/ha threshed seed in land use class 2 areas.

(b) 4 q/ha threshed seed in land use class 3 areas.

7.8 Summary and Conclusions

As with maize, the large area of sesame production in the Study Area is dominated by low yields, but this is basically the result of poor irrigation supply and less the effect of pests and soil infertility. Grown at the right time, sesame is less labour-demanding than maize. Moderate yield increases are easily effected with the minimum of extra inputs, involving fertiliser and an improved irrigation supply.

CHAPTER 8

UPLAND RICE

8.1 Introduction

Upland rice production was only started in the Study Area in 1974 and present production is estimated to be about 400 ha (net) involving three government farms and one private farmer with all produce sold to ADC. Although a minor crop compared to maize and sesame, it is the only crop grown under mechanised conditions in the Study Area, being part of the government programme to increase rice production in Somalia. This encouragement is reflected in the current high ADC buying price of So.Shs. 350/q of milled grain which makes upland rice more profitable as a cash crop even at moderate yields than the more traditional annual crops. Land preparation, irrigation methods and growing seasons have been described in previous chapters. Specific operations and agronomic information are discussed below.

8.2 Field Operations

8.2.1 Planting Methods

All crops are drilled. Seedbed preparation is carried out with two harrowings before drilling with a standard 13-row drill at 17 cm row-spacing. Seed rates vary from 90 to 120 kg/ha. Germinating stands vary in density due in part to inefficient irrigation, poor operator skills and also seed impurity. The two varieties used (Dawn and Saturn) have been intermixed and no pure seed stocks exist. As Dawn is long-seeded and Saturn short-seeded, uniform drilling is difficult to attain. All drilling is done on dry land and is followed by bund formation and field lateral preparation. The first irrigation is applied immediately after planting.

8.2.2 Planting Dates

All crops are planted from May until July. Earlier planting in April is difficult for several reasons:-

(a) Heavy storms at the start of the gu season impede machine-drilling and tractor movement in the absence of any surface drainage.

(b) Erratic rainfall and drought sensitivity of germinating rice require planting to be only when irrigation is possible, which usually occurs from May onwards.

(c) Staggered planting after smallholder maize crops have been planted enables rice farms to have fewer problems obtaining casual labour for weeding.

Planting can theoretically be extended until the end of August. Crops planted later are at risk due to water shortage and heavier bird attack from the end of December. However, July-planted crops can also be difficult to combine harvest during November der rains. With the existing 120-day varieties, bird-scaring is necessary even if crops are planted at the start of the gu rains. Consequently, optimum planting dates under existing management in the Study Area are May and June.

8.2.3 Weed Control

Due to the wetter conditions necessary for upland rice production, weed infestations can be severe. In 1977, several crops, where only hand weeding was attempted, were abandoned and replanted due to inability to control weeds. Moderate control was only achieved on farms that used a post-emergence herbicide. Stam F34 (propanil) at 12 l/ha applied at about 8 to 10 days after germination gave reasonable weed control for 4 to 6 weeks. However, a further 2 to 3 hand weedings are required for good weed control. Herbicide application is by knapsack sprayer. Uneven application caused some scorching and resulted in uneven weed control. All crops, however, contained sufficient weeds to impede combine harvesting as a result of insufficient labour to complete the necessary hand weeding.

8.2.4 Irrigation

Methods of application are identical to maize crops. Depending on hagai rainfall, each crop receives 5 to 7 irrigations over 100 days. This frequency is inadequate and together with unlevelled land causes significant yield losses as shown below.

(a) Over-irrigation in parts of each basin during germination and seedling stages results in rotting and reduced stands.

(b) Under-irrigation where high patches occur, and infrequent irrigation both quickly induce wilting at all stages and, at flowering, result in empty heads (whiteheads). All crops examined in 1977, had wilted at least once.

(c) Retarded growth affecting evenness of maturation.

(d) Overall yield losses due to general moisture stress.

8.2.5 Harvesting Methods

All crops are combine harvested. Apart from poor handling, harvesting efficiency is also affected by the factors shown below:-

(a) Weed levels at harvest prevent clean cutting and pick-up into the auger mechanism. Choking often occurs.

(b) Storms and undrained land, particularly in November, can delay harvesting by up to one week, until drying out has taken place.

(c) The overall low level of crop management results in uneven maturation. In several fields planted within the same week maturation differences of between 2 and 3 weeks were seen. Although both varieties grown are not prone to shattering, some losses occur as the result of this uneven ripening, and an extra period of bird scaring is required.

(d) The method of bund and field lateral formation (see Section 5.8) results in awkward banks every 25 m for the combine to cross. Consequently field operations are slow, taking between 2.0 and 2.5 h/ha with a standard 3 m cutting width. Stationary off-loading into trailers or onto bare ground for bagging is also necessary.

8.2.6 Post-harvest Storage and Processing

No rice farms in the Study Area possess covered storage areas. All harvested paddy is stored temporarily in heaps on the ground. The paddy is then bagged by hand and transported to Shalambood for milling. Consequently, further losses can occur as a result of occasional storms and the general lack of protection from rain. Bagging is delayed as a final winnowing is necessary to remove weed trash. Inspection of harvested crops showed 5 to 10% weed contamination can occur, mainly as vegetative matter rather than weed seeds.

The rice mill at Shalambood is the only mill serving the Shabeelle river area and is currently running near to capacity (see Annex III, Chapter 3; Crop Processing). Consequently as most crops are harvested during the same period, a further period of storage is required in Shalambood before final milling. Milling percentage is reported to be between 65 and 70% with up to 30% broken grain, but inspection of some harvested paddy indicated that at times the milling percentage may be less than this. The high percentage of broken seed can be attributed to improper drying and farm storage. ADC purchases only milled rice.

8.2.7 Crop Residue Disposal

Little use is made of crop residues. Straw left in the field is ploughed in. After milling virtually all the bran is sold in Mogadishu.

8.2.8 Labour Requirements

Under present management methods, labour is required for irrigation, broadcasting fertiliser, weeding, bird scaring and final winnowing and bagging. Actual labour inputs can vary tremendously depending on availability and requirements. Major requirements are for weeding and bird scaring. Each weeding requires more labour due to greater weed intensity and greater crop growth necessitating more careful work. The numbers used for bird scaring vary from 2 to 5 people per hectare. Only children and adolescents are employed and they work from dawn to dusk. It is impossible to hire adults in the numbers required and, also, farmers cannot afford the higher wage rates. Bird scaring is normally necessary for 40 days after heading occurs. Estimated labour inputs and variability are given in Table 8.1. The high requirements reflect not only the extra labour required for rice production but also the problems currently experienced in production methods. Timely weeding and the use of better adapted implements would improve weeding efficiency. The high number of bird scarers on several of the government farms is also considered unnecessary.

TABLE 8.1

Study Area Upland Rice Production: Labour Inputs

Operation	Estimated manhours/ ha/operation	Frequency	Total manhours/ha
Broadcasting fertiliser (1)	5	2	10
Irrigation	8	5 - 7	40 - 56
Herbicide spraying	3	1	3
Pest control (2)	2 - 3	1 - 2	5
Weeding	65 - 80	(a) 2 - 3 (3) (b) 5 - 6 (4)	145 - 195 325 - 480
Bird scaring	2 - 5 80 - 200	non-adults/ha for 40 days = non-adult days/ha.	
Winnowing and bagging	20	1	20

TOTAL	(a) With herbicide treatment:	223 - 289	manhours/ha
		+ 80 - 200	non-adult days/ha
		= 136 - 272	mandays/ha (5)
	(b) Without herbicide:	400 - 570	manhours/ha
		+ 80 - 200	non-adult days/ha
		= 180 - 343	mandays/ha (5)

Notes: (1) Basal dressing before planting and one top dressing
(2) Occasional requirement against stemborer
(3) With herbicide
(4) Without herbicide
(5) As manday equivalents per hectare at 4 hours per working day, except bird scaring.

Source: Survey data

8.2.9 Mechanised Inputs

The estimated number of tractor and combine hours necessary under present management methods are given in Table 8.2.

TABLE 8.2

Study Area Rice Production: Estimated Mechanised Inputs

Operation	Frequency	Hours/ha
Disc-ploughing	1	3
Disc-harrowing	2	3
Drilling	1	2
Bunds and laterals	1	1
Harvesting	1	2 - 2.5
Grain carting	1	0.5
TOTAL		11.5 - 12

Source: Beerdiid and Tugarey State Farms

8.3 Varieties

Two 120-day varieties of upland rice are grown in the Study Area, Dawn and Saturn. Both are USA varieties introduced into Somalia, released following several years of research at Afgooye and now form the basis of upland rice production on the Shabeelle river. However, due to the lack of proper multiplication and seed inspection facilities, both varieties are mixed with no pure stocks available (see Annex III, Chapter 3). Inspection of Study Area crops showed that both varieties contained from 10 to 12% of the other variety. In general, characteristics of both varieties are similar and are given in Table 8.3.

Neither variety is prone to shattering unless harvesting is delayed abnormally. Likewise, neither is susceptible to lodging unless heavily dressed with nitrogen. Dawn is the preferred variety possessing better cooking quality, yielding higher and producing a cleaner, better standing crop.

TABLE 8.3

Study Area Upland Rice Varietal Characteristics

Germination	4 - 7 days
Onset of tillering	15 days (1)
Onset of rapid growth	25 - 30 days (1)
Boot stage	75 - 80 days (1)
Flowering	80 - 85 days (1)
Maturity	120 days (1) (2)
Seed type	Awnless and either short-seeded (Saturn) or long-seeded (Dawn).
Tillering (full tillers)	Dawn 2 - 3 per plant Saturn 5 - 6 per plant
Height	1.0 m

Notes: (1) Days after planting
(2) Can vary from 115 to 130 days depending on management.

Source: Survey data and CARS, Afgooye

8.4 Pests, Diseases and Growth Disorders

With the exception of attacks by Quelea quelea (Sudan dioch), and given moderate management, upland rice is minimally affected by pests, diseases and growth disorders. Such problems as occur are described below.

(a) Quelea quelea

The Sudan dioch is the most important seed-eating species of weaver bird attacking rice in the Study Area. Annual population levels vary depending on other circumstances affecting its migration across the Sahel regions. The other species of weaver bird (Ploceus spp) are non-migratory such that seasonality of bird incidence has two phases:-

(i) migration of Quelea to the Shabeelle river from mid July until February

(ii) influx of other seed-eating species from rainfed to riverine areas after the der rains from mid December until April.

The problem of birds is fully discussed in Annex VI. Variability in seasonal rainfall affects the seasonal arrival of the birds and the severity of their attack upon irrigated rice crops. However, despite variations in season and numbers, the small isolated areas of upland rice in the Study Area are sufficient, at the moment, to attract significant numbers of Quelea and Ploceus to warrant bird scaring measures. In 1977, the first flocks of Quelea were observed on July 18th and by early February were still seen along the Lower Shabeelle river from Janaale to Afgooye, numbers increasing noticeably towards the end of January. Losses from unguarded fields can be up to 100% as was seen in fields near Afgooye in September, 1977. The level of bird attack in 1977 was not considered to be severe, unlike the drought year of 1975. Bird scaring measures observed in the Study Area minimised losses to birds but indiscriminate movement of the guards caused other losses through trampling.

(b) Whiteheads

After flowering in all fields examined, up to 10 to 15% of all heads were empty producing the condition of whiteheads. Careful examination showed incidence of stemborer (Chilo partellus) to be low. In the absence of other symptoms or causes, these whiteheads were the result of moisture stress at booting and heading stages as the result of poor irrigation. Stemborer is normally not considered serious and an attack on one farm in 1977 was easily controlled with a single spray of Dimecron (phosphamidon) at heading.

(c) Tip-burn

Marginal necrosis and yellowing of leaf-tips were observed in several crops before and after heading in apparently healthy stands. No other symptoms or causes were identified. Potassium deficiency was ruled out as being unlikely in the Study Area soils (see Annex I). Its occurrence close to wilted patches remaining in recently irrigated fields indicated that tip-burn was caused again by irregular irrigation.

(d) Reduced tillering

In all crops examined, tillering of both varieties rarely exceeds two per plant. Although possibly caused by phosphorus deficiency (see Section 8.5), this can also be the result of insufficient irrigation during early growth stages.

(e) Diseases

Light attacks of Cercospora, narrow brown leaf spot, were seen on lower leaves and senescing crops and are not considered serious. No other diseases were seen.

8.5 Crop Nutrition

All crops grown in the Study Area were fertilised using two dressings of urea (46% N) at 1 to 2 q/ha. Where applied correctly, vegetative growth was good and the bands of pale green stands where poor broadcasting had been done indicated the necessity of nitrogen applications. However, despite healthy vegetative growth in well-managed fields, final head sizes were small commensurate with this vegetative growth. Coupled with poor tiller development, these symptoms are indicative of phosphorus deficiency accentuated by applications of urea, although poor tillering can also be caused by moisture stress. Despite high soil pH, no micronutrient deficiencies were observed.

8.6 Yields

Present yields are low due to the many production problems described in this chapter. Average yields on all farms in 1976 and 1977 varied between 10 and 17 q/ha of unmilled paddy, although most farms achieved 15 to 17 q/ha.

8.7 Summary and Conclusions

Despite the small hectarage of upland rice in the Study Area, many production problems exist that need careful examination. Greater skills and techniques are required in levelling, bund formation and weed control methods to improve irrigation efficiency, harvesting methods and yields. Bird scaring labour requirements can easily restrict final cultivated areas. Improved yields will also result from a more balanced application of fertilisers.

CHAPTER 9

TOBACCO AND TOMATOES

9.1 Introduction

Although tomatoes and tobacco are grown on a small scale in the Study Area, they are limited, but important, cash-crops for smallholders and large-scale producers. In most villages there are several farmers cultivating a total area of 1 or 2 ha per village. A further 6 to 10 large-scale producers each grow between 3 and 15 ha of either or both crop. The largest producer of either crop is the PLO farm which grows about 40 ha of tomatoes annually on contract to the ITOP processing factory at Afgooye. Several other tomato producers also grow for ITOP. The estimated total area under cultivation in 1977 was 350 ha (net) of tomatoes and 250 ha (net) of tomatoes and 250 ha (net) of tobacco. Most tomatoes are marketed in Marka town or sold to ITOP. All tobacco is sold locally for processing into the traditional chewing tobacco (chiko) or snuff. Production methods are discussed below. Land preparation and irrigation methods have been described in Chapter 5. Both crops are grown primarily in the hagai season, mainly to avoid wet conditions. Small areas of tobacco are grown after the der rains, but tomato cultivation extends into the der and jilal seasons depending on water availability.

9.2 Tobacco

9.2.1 Field Operations

Nurseries are planted by watering seed onto prepared beds which are situated near canals for regular watering. The transplanted crop is grown on a single pre-planting irrigation because of its susceptibility to waterlogging. Field spacing varies between 40 cm x 40 cm and 40 cm x 60 cm giving a population of 40 000 to 60 000 plants per hectare. Nurseries are prepared from early June and transplanting begins in early July. Transplanting in August is rare because most harvesting is finished by the end of October in order to avoid the November der rains. Several weedings are given and fields are relatively weed-free as no further irrigation is given to encourage weeds and, being grown in the hagai season, prolonged wet weather is avoided.

Most crops are topped after flowering and several weeks before harvesting to encourage leaf growth. Some desuckering is also practised. Harvesting takes place between 2.5 and 3 months after transplanting and involves a single harvest of the entire plant by cutting at soil level. Crop height at harvesting varies between 50 to 75 cm depending on irrigation, hagai rainfall and soil fertility. Harvested plants and, earlier, topped heads and desuckered side-shoots are dried for two days in the field before curing in covered pits for one to two weeks. The tobacco is then tied into roughly 0.5 kg bundles before further sun-drying, sale and processing. Tobacco growing seasons and growth stages are given in Table 9.1, and estimated labour inputs in Table 9.2.

The variety grown is a small-leafed type resembling Turkish tobacco more than Burley tobacco although easily distinguishable from both. The low level of management results in a thick leaf which, on curing, produces a very dark-coloured, strong tobacco and snuff.

TABLE 9.1

Study Area Tobacco Production: Growing Seasons

Operation	Duration	Month
Nursery	20 - 30 days	June - July
Transplanting	-	July
Topping	55 - 75 days (1)	September - October
Harvesting	75 - 90 days (1)	September - October
Total crop length	95 - 120 days	-

Note: (1) Days after transplanting

Source: Survey data

TABLE 9.2

Study Area Tobacco Production : Estimated Labour Inputs

Operation	Manhours/ha /operation	Frequency
Nursery	9 (1)	-
Land preparation	65 (2)	1
Transplanting	64	1
Irrigation	8	1
Weeding	56	2-3
Topping etc.	48	1
Harvesting	48	1
Curing (3 parts)	100	1
Miscellaneous	45-51	-

TOTAL (a) 499 - 561 manhours/ha
(b) 125 - 140 mandays/ha (3)

Notes: (1) Per transplanted hectare
(2) Most holdings by hand
(3) Four hours per working day

Source: Survey data

9.2.2 Pests and Diseases

During 1977, few pests were seen or reported to attack tobacco crops. Budworm (Heliothis) causes minimal leaf damage but occasionally requires controlling. Only one farmer reported spraying his tobacco. Generally, rotation is practised and, other than occasional outbreaks of cutworms (Agrotis), no other soil pests occur. No fungal diseases were seen and incidences of virus diseases are very rare.

9.2.3 Crop Nutrition and Growth Problems

Only one farmer reported applying fertiliser to his tobacco crop, using a small amount of urea. Most fields contained patches where growth was retarded and pale, indicating nitrogen deficiency. The average low plant height is also indicative, in part, of poor nutrition. A good crop is capable of reaching a height of 1 m. However, the major problem, due to unlevelled land and the lack of surface drainage was damage caused by temporary waterlogging. Large parts of leaves become necrotic and plant growth is stunted with significant yield losses, decreasing further the low yields normally achieved.

9.2.4 Yields and Marketing

Yields are low as a result of poor management. Estimated yields of cured leaf vary between 300 and 500 kg/ha. Local market prices vary from So.Shs. 3 to 6/kg such that farmers can expect a gross return of So.Shs. 900 to 3 000/ha. This, in comparison to smallholder production of maize and sesame, represents, on a small scale, a better cash crop, as shown in Table 9.3.

TABLE 9.3

Study Area Annual Crop Production: Estimated Gross Returns for Maize, Sesame and Tobacco

Crop	Estimated yield (q/ha)	Market price (So.Shs./kg)	Estimated gross returns/ha (So.Shs.)
Maize	10	0.75 (1)	750
Sesame	4	2.40 (1)	960
Tobacco	3 - 5 (2)	3.00 - 6.00 (3)	900 - 3 000

Notes: (1) ADC 1977 producer price
(2) Yield includes stalk
(3) Estimated market price

Source: Survey data and ADC.

However, local markets are easily saturated and the higher returns are obtained only by farmers who produce at the earliest part of the season.

9.3 Tomatoes

Tomato production can be considered as two sectors:-

(a) smallholder production for the local market, and

(b) commercial production for sale under contract to the ITOP processing factory.

Although production methods vary between these two sectors, problems affecting production and yields differ only slightly.

9.3.1 Smallholder Production

Crop management is similar to smallholder tobacco. No fertiliser or pest control measures are applied. Seed is broadcast onto prepared beds and watered regularly and the transplanted crop grown on a single pre-planting irrigation supplemented by hagai rainfall. Transplanting is at a spacing of 60 cm x 60 cm to 60 cm x 90 cm gving a population of between 19 000 to 28 000 plants per hectare. Tomatoes are planted later than tobacco due to the risk of waterlogging and pest and disease problems that are more severe during the gu season. Nurseries are prepared mainly in July with transplanting from August onwards. Harvesting takes place 2½ to 3 months after transplanting and, if there is adequate hagai or der rainfall, can continue for up to two months. Most harvesting is completed by January. Crops are given several weedings and are generally weed-free except during der rains. No staking or pruning is practised, the crops being allowed to straggle on the ground. Tomatoes are also interplanted in maize and sometimes sesame. Inputs, as for tobacco, are mainly for labour. The occasional farmer may have access to a hired tractor for land preparation. Estimated labour inputs are given in Table 9.4.

TABLE 9.4

Study Area Smallholder Tomato Production: Estimated Labour Inputs

Operation	Manhours/ha/ operation	Frequency
Nursery	9 (1)	1
Land preparation	65	1
Transplanting	50	1
Irrigation	8	1
Weeding	56	2
Harvesting	60 (3)	1
Miscellaneous (10%)	31	-

Total input (a) 335 manhours/ha
(b) 84 mandays/ha (2)

Notes:
(1) Per transplanted hectare
(2) 4 hours per working day
(3) 3 hours per quintal and average yield of 20 q/ha

Nearly all smallholders grow the local cherry-type tomato which produces small fruit, rarely more than 2.5 cm in diameter. Yield potential of this variety is low compared to other available varieties. In research trials in 1964/65 at Afgooye, the local variety yielded 4 - 11 t/ha compared to 24 to 30 t/ha obtained from introduced varieties (CARS, 1966). However, the local cherry tomato has better resistance to whitefly-transmitted curly top virus disease which severely attacks other varieties. Some farmers are changing to other varieties, mainly plum tomatoes such as Roma and San Marzano, but with little yield improvement due to low levels of management.

Apart from damage caused by curly top virus disease, yield losses also occur through cutworms, fruitworm (Heliothis) and fungal blight (Alternaria and Phythophthora). All four pests and diseases can be severe during the gu season but only light infestations occur during the hagai season. Low yields are also attributable to poor crop nutrition.

Estimated yields vary between 1 and 2 t/ha of fresh fruit. Due to the crop's perishable nature, market prices fluctuate markedly from So.Shs. 1 to 6/kg, although higher figures have been reported. The average price received by growers is, however, nearer So. Shs. 2/kg giving a gross return between So.Shs. 1 000 and So. Shs. 4 000/ha. Like tobacco, tomatoes represent a better small-scale cash crop than maize or sesame but have a limited and easily saturated market.

9.3.2 Commercial Production

Commercial production is carried out by a few large-scale farmers who cultivate 3 to 15 ha each, and the PLO farm which cultivates about 40 ha. Crop management varies from modified smallholder methods to, in the case of the PLO farm, an attempt at intensive production techniques. Some farmers maintain the system of a pre-planting flood irrigation and, having high-banked basins unlike most smallholders, are able to give better irrigation. Other farmers have changed to regular irrigation with three to four applications per crop after transplanting. The PLO farm has adopted furrow irrigation attempting up to seven applications per crop. All farmers applied fertilisers, usually 1 to 2 q/ha of urea, and were able to spray crops against whitefly and fruitworm. Extra weeding is also given to control weed regrowth encouraged by regular irrigations. All farmers prepared land by using tractors. Subsequent labour inputs are given in Table 9.5 and represent an intermediate level of improved management, compared to management levels at the PLO farm discussed later in this section.

The most common variety grown is Roma with seed provided at cost by ITOP. Roma is the main recommended variety following several years research where it outyielded 24 other varieties under test (CARS, 1965/66). Some farmers grow a similar variety of plum tomato, San Marzano. Although potentially high-yielding, all introduced varieties tested or grown in Somalia are very susceptible to curly top virus disease. The importance of this virus disease is discussed in Section 9.4. Observations in 1977 at the PLO farm and two other large-scale farms showed that fruitworm (Heliothis) damage affected up to 20% of all fruit in unsprayed fields, whereas where reasonable spraying against whitefly was practised, incidence was as low as one or two infested fruit every three or four plants. Incidence of blossom end rot was equally low. No fruit-cracking was observed on these farms. Blight disease was also minimal, being absent in several fields.

TABLE 9.5

Study Area Tomato Production: Labour Inputs under Improved Management

Operation		Manhours/ha/ operation	Frequency
Nursery		9 (1)	-
Transplanting		50	1
Irrigation		8	4
Weeding		56	4
Harvesting		180 (2)	1
Miscellaneous (10%)		50	-
Total input	(a)	545 manhours/ha	
	(b)	136 mandays/ha	
Smallholder production:-		84 mandays/ha	

Notes: (1) Per transplanted hectare
(2) 3 h/q and 60 q/ha yield
(3) Covers small input of fertiliser and pest control application

Source: Survey data

Due to variable management and disease incidence, reported yields under improved management vary from 5 to 10 tonnes of fresh fruit per hectare, although average yields are normally between 5 and 7 t/ha. In 1976, the PLO farm obtained 15.5 t/ha from one 10 ha field as a result of intensive management. In 1977, average yields were only 7.5 t/ha due mainly to poor control of whiteflies and high incidence of curly top virus disease. The PLO farm represents a higher form of improved management compared to other farmers for the following reasons:-

(a) fertiliser application is by placement and not broadcast

(b) pest control measures are more frequent and regular

(c) the land is levelled and tomatoes planted on flatbeds and furrow irrigated.

As an indication of the relative profitability of tomato growing for processing, production data were collected from the PLO farm and are given in Tables 9.6 and 9.7.

TABLE 9.6

Study Area Tomato Production: Typical Crop Budget, PLO Farm (1976)

Data [(1)]	So.Shs./ha
Gross income:- 15.5 t/ha at So.Shs. 40/q	6 200
Production costs:	
(a) Land preparation - ploughing, harrowing levelling and furrowing	690
(b) Labour - nursery, transplanting, weeding, irrigation and picking	1 160 [(2)]
(c) Fertiliser - 2.5 q/ha DAP [(3)] 2.5 q/ha urea	690
(d) Pest and disease control - 2 l/ha Rogor E, 1 l/ha Diazinon, 1.3 l/ha Dithane	150
(e) Transport to ITOP, Afgooye	300
(f) Miscellaneous	480
TOTAL costs/ha	3 470
Net returns/ha	2 730

Notes: (1) All details per hectare derived from total costs and returns for one 10 ha field.

(2) High value as labour had not been employed on piece-work basis.

(3) Diammonium phosphate.

Source: PLO farm, 1977.

TABLE 9.7

Study Area Tomato Production: Typical Crop Budget, PLO Farm (1977)

Data	So.Shs./ha
Gross income:	
7.5 t/ha fresh fruit at So.Shs. 45/q	3 375
Production costs:	
Nursery (including seed and labour)	75
Land preparation - 10.5 h/ha at average cost of So.Shs. 49.50/h	520
Labour - (all operations including harvesting)	890
Fertiliser - 1 q/ha DAP, 0.5 q/ha urea	210
Chemicals - 0.5 l/ha Dimecron and Rogor	20
Transport to ITOP, Afgooye (estimate)	200
Miscellaneous	190
TOTAL costs/ha	2 105
Net returns/ha	1 270

The lower yields obtained during 1977 were mainly the result of less pest control, but also an overall decrease in management level due to labour shortages, irrigation supply difficulties from the Dhamme Yaasiin canal and cash flow problems. The two years' crops therefore show the level of requirements involved and the importance of higher yields. Returns in 1976 would have been greater if better labour management had been practised and less fertilisers applied. Yield improvement in both years would have resulted from better whitefly control (see Section 9.4). Labour and transport problems also result in irregular harvesting and losses due to picking and carting over-ripe fruit. Production problems, therefore, can easily reduce returns.

9.4 Curly Top Virus Disease of Tomatoes

This disease is the major cause of yield losses in commercial tomato production in the Study Area. Although research recommendations indicate the necessity of regular weekly spraying to control the whitefly vector (Bemisia tabaci), no farmer sprayed at less than a 15-day interval. Spraying normally was not practised until crops were transplanted. The first symptoms of curly top do not appear until about four weeks after transplanting and unless careful crop inspection is undertaken by the farmer, the whitefly population often goes unnoticed. Any spraying, therefore, is too late once the virus is transmitted by the insect vector. The virus causes a rosetting and stunting of the plant, affecting only the upper parts if infection is moderate and giving the plant its characteristic 'curly top' appearance. Stunting can be severe. In 1977, observations at the PLO farm showed that whereas healthy plants reached a height of 50 cm and spread over an area of approximately 75 cm in diameter, severely infected plants were rarely taller than 25 cm and spread reached only 30 cm diameter. Estimations of yield losses were made. Severely infected plants gave approximately 30% of normal yields, and moderately infected plants gave 60% of normal yields. At harvest, only 20% of the crop was unaffected with 60% of plants severely infected and 20% moderately infected. Using these data and the average yields obtained in 1977 of 7.5 t/ha of fresh fruit, an estimate of yields with effective whitefly control can be made and is given in Table 9.8. Infection levels on other farms were equally severe. Using the 1977 ITOP producer prices of So.Shs. 45/q, the estimated increased yield of 6.0 t/ha represents an increased gross return of So.Shs. 2 700. Improved whitefly control would necessitate four or five sprays at the nursery stage and a further eight to ten sprays after transplanting and before harvesting. Estimated improved net returns are given in Table 9.9.

TABLE 9.8

Tomato Production: Estimated Yield Increases with Improved Whitefly Control

(i)	Average yield per hectare	7.5 tonnes
(ii)	Present estimated yield losses	(a) 20% crop = Nil (taken as y[(1)]) (b) 20% crop = 40% (taken as 0.6 y) (c) 60% crop = 70% (taken as 0.3 y)
(iii)	Yield components for 7.5 t/ha	= (0.2 y) + (0.2 x 0.6 y)+ (0.6 x0.3 y) = 0.2 y + 0.12 y + 0.18 y = 0.50 y [(2)]
(iv)	Estimated yield with full control	= $\frac{7.5}{0.50}$ = 15 t/ha
(v)	Estimated yield with expected 90% control	= 13.5 t/ha
(vi)	Increased yield with 90% control	= 6.0 t/ha

Notes: (1) y = yield with no losses.

(2) Estimation of mean yield loss i.e. 7.5 t/ha represents 50% yield loss

Source: Survey data, PLO farm (1977)

TABLE 9.9

Study Area Tomato Production: Estimated Improved Net Returns with Improved Whitefly Control

Data			So.Shs./ha
Increased gross return:-			
6.0 t/ha at So.Shs. 45/q			2 700
Increased production costs:-			
Chemical	(a)	Dimecron ULV at 25 l/ha at So.Shs. 168.10 per 5 litres (1)	840
	(b)	Application costs at 9 sprays and So.Shs. 3.50 per spray per hectare (1)	35
Labour So.Shs. 0.50 per box (20 kg net) and 6.0 t/ha (2)			150
Transport to Afgooye (estimate)			200
Miscellaneous			125
TOTAL increased costs/ha (3)			1 350
Estimated increased net returns/ha (3)			1 350

Notes:
(1) Chemical and labour for nursery minimal
(2) Current picking rate Study Area
(3) All figures are estimates. Exact requirements are given in Annex VI.

Source: Survey data, PLO farm (1977)

Although Table 9.9 is purely an estimation of possible increased returns, it indicates the importance of improved whitefly and curly top control. Production of tomatoes for processing represents a small moderately profitable enterprise that has a controlled market which is currently under-saturated (see Annex III, Chapter 3; Marketing).

CHAPTER 10

MISCELLANEOUS ANNUAL CROPS

10.1 Legumes

With the exception of groundnuts, all legumes are grown as intercrops. Groundnuts are cultivated on a very small scale involving two private farmers and two co-operative group farms who cultivate a total of less than 50 ha. Details of intercropped cowpeas and green grams, the main grain legumes grown in the Study Area, are described in Chapter 5.

10.1.1 Groundnuts

Production methods are similar to maize, involving basin irrigation and hand labour except for land preparation. The final tractor operation is a light cultivation to produce small ridges at about 60 cm spacing to facilitate line planting. Unshelled pods are planted every 30 cm. Three or four irrigations are given together with a similar number of weedings. Crops are planted in May/June or in October to avoid heavy rain at harvesting. The seed planted is a mixture of lines, all of which are erect bunch types, taking approximately 120 days to mature. No fertiliser is applied. Pests and diseases are minimal, being restricted to late and insignificant attacks of Cercospora brown leaf spot. Yields are low. One co-operative produced 8 q/ha of unshelled nuts in 1977. Reasons for low yields are:-

(a) Inadequate irrigation at lengthy intervals, accentuated by un-levelled land which causes under-irrigation and temporarily waterlogged patches.

(b) Inadequate weeding. Several surveyed crops had heavy weed growth during later stages.

(c) Iron deficiency. Despite the high soil pH (7.5 to 7.8), groundnuts are the only crop to show micronutrient deficiencies consistently. All crops suffered varying degrees of interveinal chlorosis typical of iron deficiency.

The problems of groundnut production on the heavy alkaline clay soils of the Study Area are discussed in Annex VI.

10.1.2 Cowpeas and Green Grams

Both these grain legumes are used with chopped boiled maize in the traditional dish of cambuulo. Although cowpeas are preferred, the local variety of green gram has a higher yield potential, being determinate in growth habit and capable of moderate pod production. The local cultivar of cowpeas is a mixture of lines (based on seed colour) with a low yield potential. It is a late-maturing, spreading indeterminate type producing vegetative growth and few pods. Cowpeas are also more susceptible to several pests, including pod-borers and leaf-miners. Present yields are estimated at 100 to 400 kg/ha depending on the degree of intercropping. Management is effectively nil.

10.2 Vegetables

Small-scale production of several vegetables, other than tomatoes, is practised in the Study Area. Onions and sweet peppers are the most predominant, although less than 100 ha are grown of each crop. Others include chili peppers, lettuce, aubergines and chinese radishes.

10.2.1 Onions

Both bulb onions and shallots are cultivated. Shallots are grown by smallholders, but some farmers grow several hectares of the more highly-prized bulb onions. Due to their longer growing season and, therefore, increased susceptibility to thrips (Thrips sp.) and waterlogging from isolated storms, bulb onions are difficult to produce in the Study Area. They are usually transplanted after 30 to 40 days in the nursery and take four months to mature. Occasionally fertiliser (urea) is used as a light application. Fields are irrigated as for maize but, to avoid waterlogging and bulb-rotting, the seedlings are transplanted onto small ridges 60 cm apart, or double rows on ridges 90 cm apart. Final spacings are invariably too wide. At least five sprayings are given to control thrips. The spraying requirement and the need for careful management effectively limits the number of growers as well as their cultivated areas under onions, which is often less than 2 ha. Average yields are estimated at between 4 and 7 t/ha. Reported market prices fluctuate from So.Shs. 180 to So.Shs. 800/q. These high prices were verified at vegetable markets where prices varied between So.Shs. 8 and 20/kg in 1977/78. Consequently, although bulb onions are difficult to produce, gross returns would be at least So.Shs. 7 200/ha. Shallots are often harvested early, having been cultivated in the same way as smallholder tomatoes. Both types of onion are grown outside the gu season to avoid the heavy rains.

10.2.2 Sweet Peppers

Peppers are grown in the same way as tomatoes by several large-scale farmers for sale in Marka and Mogadishu. Yields, again, are low and do not exceed 4 t/ha. Management problems are mainly irrigation supply and the control of occasional but moderately serious attacks of fruitworm (Heliothis). Like tomatoes, the open market is easily saturated and, therefore, limits the area under production.

10.3 Other Crops

There is a range of other minor annual crops grown in the Study Area either presently or in the last two or three years.

10.3.1 Sunflower

Several hectares were grown on one crash programme farm in 1975 but were badly attacked by birds, reducing yields to nil. Although 1975 was a drought year and bird populations in irrigation areas were high, sunflower was never tried again in following years. However, growth was reported to be good with heads reaching 20 cm in diameter, indicating a potential for sunflower in the Study Area.

10.3.2 Paddy Rice

In 1975/76, the People's Republic of China's Technical Aid team planted a reported 50 ha of paddy rice at three co-operative group farms. In 1975, 1 ha was transplanted and yielded 60 q of unmilled paddy. In 1976, the 50 ha yielded an average of 30 q/ha of unmilled paddy, with most of the crop drilled directly and not transplanted. Problems encountered were birds (Quelea) and field management, but no reason was given or reported for stopping this extension work. Paddy rice production compared to upland rice is discussed fully in Annex IV.

10.3.3 Interplanted and Other Crops

Intercropping and types of intercrops are listed in Chapter 5 and include pumpkins, various minor legumes, sweet potatoes and bottle gourds. Pumpkins are the most common of these minor intercrops, being the easiest to produce with minimal requirements and no observed pest or disease problems. Melons can also be intercropped or grown as a single crop, being planted from the der rains onwards. Melons are more popular than pumpkins but due to their availability being limited to the jilal season, the indication is that production is difficult during wet weather. The PLO farm reported a heavy infestation of cucumber mosaic virus disease in 2 ha of the Blackstone variety.

Isolated production of several hectares of uncommon crops was observed in 1977 including sorghum and cassava.

CHAPTER 11

BANANAS

11.1 Introduction

The history of banana production in the Study Area is described in Chapter 3. Briefly, production expanded to the maximum cultivated area in 1962 (5 700 ha net) and maximum export production in 1965 (606 700 quintals), since which a steady decline in production areas and productivity has taken place. Reasons for this decline are many, some of which are agronomic. Other reasons include economics, production costs, marketing organisation and unwillingness of private farmers to enter into banana production and so replace, since Independence, the declining Italian farming community. Despite this, banana production still represents, in value, between 15 and 20% of national exports, 46% of which is produced in Lower Shabeelle region. Study Area production is estimated at 88% of the regional production i.e. 41% of national export production (see Chapter 1). Consequently, banana production remains the most important form of cash-cropping in the Study Area as well as being the major source of casual employment to subsistence smallholder agriculture.

In an attempt to arrest the decline in productivity, in January 1977, the Government announced several incentives to producers:-

(a) producer price of export fruit increased by So.Shs. 7 to the present So.Shs. 75/q;

(b) existing farmers' debts to be repaid at greatly reduced interest rates whilst fresh loans were to be made available at a low 5.5% interest rate;

(c) machinery spare parts to be made available;

(d) diesel fuel price to be reduced during the dry season (jilal) to lessen pumping costs;

(e) establishment of the ENB seedling nursery.

Credit availability and finance problems are discussed in Annex III. Little evidence existed in 1977/78 to support sections (c) and (d) and the seedling nursery is considered of minimal advantage at present (see Annex III, Chapter 3). Therefore, present assistance effectively lies in the increased producer price and low interest rate on loans.

The present area under cultivation in the Study Area is estimated at 3 420 ha (net), with a further net area of 647 ha under development in 1977/78 by ENB and several large-scale private farms. Methods of production have remained virtually unchanged during the past 10 to 15 years as the result of:-

(a) little or no overseas contact with other banana producing regions, and

(b) effectively no research into improvement of crop management.

Consequently, although the technical department of ENB has published recommendations on irrigated banana production, such information (e.g. pest control, fertilisers) is not based on specific research data. These, plus more general recommendations, are only implemented in part as the result of the overall lack of expertise and related problems of crop management, such as finance and labour supply. Present methods, inputs and problems are described and discussed in this chapter. The role of ENB in banana production (technical services, marketing etc.) has been discussed in Annex III, Chapter 3.

11.2 Field Operations

Apart from land preparation, transportation of harvested fruit to packing stations and some cultivation, all field operations are done by hand.

11.2.1 Land Preparation

Land preparation is divided into two parts:-

(a) deep ploughing followed by a fallow

(b) preparation immediately prior to planting.

Deep ploughing to a depth of 50 to 60 cm is carried out by using a 50 to 70 hp crawler-drawn mouldboard plough. In some cases a 100 hp four wheel drive tractor is used. The main reason for deep ploughing is to bury remaining trash and weeds, particularly couch grass (Cynodon dactylon), in abandoned fields which are to be brought into production after previous cropping. Because of weed problems in planted crops, especially couch grass, farmers aim to deep plough early in the jilal season, although it is usually practised from July onwards, once the gu rains have finished. The land is then left fallow until the next crop is to be planted, generally a period of three to six months, depending on the time of year. A green manure crop (sunnhemp) is occasionally planted during this fallow (see Section 11.6).

Prior to planting, fallowed land is then given a second ploughing, again using a mouldboard plough and usually to a depth of 30 cm, before being disc-harrowed. Some farmers disc-harrow twice instead of the second ploughing. Despite old equipment being available on some farms, there was little evidence of any land levelling. Final preparation is to produce the planting furrows. Using a large V-ridger, wide furrows to a depth of 30 to 40 cm are prepared, normally either 2.5 or 3 m apart. Final land preparations are carried out outside the heavy rainfall periods of the gu and der seasons. Estimated operating times are given in Table 11.1. Nearly all farmers use crawlers for these operations, except for harrowing.

TABLE 11.1

Study Area Banana Production: Land Preparation Inputs

Operation	h/ha(1)
Deep ploughing (50 - 60 cm)	9
Second ploughing (30 cm)	3
Harrowing	1.5
Furrowing	3
Bund and field lateral preparation (2)	1
TOTAL	17.5

Notes: (1) All data for crawlers, except harrowing
(2) Carried out eight to ten months after planting (see Section 11.2.2)

Source: Banana farm survey data

11.2.2 Planting Methods

Planting material is mainly obtained from abandoned fields with some suckers taken from fields still in production. Because of overall poor management and pest and disease incidence, all material is of poor quality and little selection is carried out. As both sections of bull-heads and different-sized suckers are taken, planting material (sets) varies markedly in size, ranging from 30 to 50 cm in length and 10 to 20 cm in diameter. All sets are trimmed of dead material and diseased or infested surface areas of the corm. Sets can be stored up to one week before planting. No cleaning is practised. Inspection of prepared planting material on several farms showed that between 70 and 90% of all sets were infected with either root-burrowing nematodes (Radopholus similis) and/or banana weevil (Cosmopolites) even after trimming. Theoretically, all of these sets should have been discarded, but no other healthier planting material is available.

Planting is done along the previously prepared furrows, usually on dry soil without pre-planting irrigation. Sets are normally planted every 2 m, although on poorly-drained land where a shorter crop life is expected, a reduced in-row spacing of 1 to 2 m is practised. The standard spacing used by farmers is 2 m x 2.5 m (2 000 plants/ha.) Occasionally, farmers plant in double rows every 4 m to make mechanical cultivation easier. Where better than average crops are expected, usually on the lighter, better drained levee soils adjacent to the river, a wider spacing of 3 m by 3 m is practised.

At each planting station, a hole is dug by yambo, fertiliser applied and covered before planting the set. Prior to planting, sets are dipped in Nemagon (DBCP) and, after planting, gammexane gamma - BHC is sprinkled around each set. The first irrigation is then applied immediately.

11.2.3 Planting Dates

The most important factor affecting planting dates is the availability of river water for irrigation and, as such, no farmer plans to plant during the jilal season until the gu high-flow period begins.

The cost of supplying pumped groundwater as the first irrigation on deeply-cracked soils during the jilal season would be prohibitive. Most groundwater quality is poor for irrigation purposes and its use would affect germination of the planted crop. Planting is therefore between April/May and October in order for the crop to become established before the next jilal season. Later planting after June/July also lessens weed problems due to drier weather.

11.2.4 Replanting

Due to the variability and overall poor quality of planting material as well as irrigation problems on unlevelled land, a proportion of sets fails to germinate, necessitating replanting. From observations, up to 30% replanting is necessary in most fields and is usually done only once. Variability of planting material also results in delayed germination with shoots and suckers emerging from two to six weeks after planting. As a result, replanting is usually delayed until two to three months after planting.

11.2.5 Weed Control

Weed control can be a serious problem for banana growers until the crop produces an effective canopy to shade out weeds. Delayed weed emergence of up to several months can occur with timely deep ploughing, with the second stage of land preparation after the gu rains and immediate planting. Poor initial weed control results from poor land preparation with harrowing practised instead of ploughing and delays between operations. Once weeds emerge, weeding is required every two to three weeks until eight months after planting and partial shading develops. Until the crop is 12 months old, and full cover reached, weeding should be every three to four weeks. After this, only light weeding every six to eight weeks is necessary. Unfortunately, few farmers are able to maintain this schedule, mainly due to seasonal labour shortages (see Appendix A). Weeding is therefore late and, in the worst circumstances, only certain fields are concentrated upon. In poorly weeded fields, rampant couch grass (Cynodon dactylon) was seen to retard growth of banana plants by more than 50% in six to eight month old crops.

Most farmers use hand labour for weeding but some farmers cultivate mechanically during the first eight to ten months using tined cultivators drawn by small crawlers. Hand labour is then used to weed between mats. However, mechanical cultivation increases damage to the superficial root system. During 1977, four farms experimented with herbicides on several fields as a means of reducing labour requirements. Gesapax 500 FW (ametryne) was used as a pre-emergence spray at a rate of 8 l/ha (4 l/ha a.i.). Where the correct rate was applied, good weed control was obtained for three to four months.

11.2.6 Irrigation

Irrigation is along the furrow for the first eight to ten months, by which time the furrows become silted up. Bunds are then formed by a small crawler and disc-ridger, with subsequent irrigation by the standard basin-flood method. Irrigation intervals vary from 7 to 28 days for the reasons given below:-

(a) During the jilal season, irrigation is required every 7 to 15 days, whereas during the gu season, every three to four weeks is sufficient, depending upon rainfall.

(b) Variations in topography. The overall lack of drainage and soil type also dictate the required irrigation frequency. In general, longer intervals are required in low-lying fields, soils other than levee soils and fields close to the river where water table interference occurs.

(c) Periodic water shortages.

On average, irrigation frequency is about every 15 days with between 20 and 25 irrigations per year, providing adequate supply is available. Actual applied quantities are not known and no measurement is practised. Over and under-irrigation can occur as the result of un-levelled land. In poorly-drained areas, surplus water is drawn off after variable times. Infiltration rates vary with topography, soil type and crop-life at the time of each irrigation. Uneven crop growth also results in difficulty in selection of optimum frequency. The effects of irrigation practices and drainage are discussed in Section 11.7. In general, most crops suffer from both temporary drought and waterlogging.

During the jilal season pumped groundwater is used, on average, every second year, when there is insufficient river water. On most farms, the total cultivated area is limited by the area that can be irrigated from existing irrigation tubewells. The groundwater has high average salinity levels and this can affect crop growth. This aspect is discussed in Section 11.8.

11.2.7 Pruning (Desuckering)

Pruning is carried out, on average, once a month. Every three or four months, depending on the field, one or two suckers per mat are left to grow out as followers. However, pruning is poorly managed. Little selection of suckers is practised. The strongest sucker is not always left to grow out, resulting in slower ratooning. Slower ratooning also occurs when more than one follower every three months is left and over-shading occurs. Position of retained suckers in relation to the mat is generally ignored. Consequently, the loss of distinct mats results in gaps and variability in crop density with subsequent effects on growth, weed control, irrigation efficiency and yields.

11.2.8 Other Field Cultural Practices

Due to labour supply problems, hired labour is usually employed for the basic field operations of planting, weeding, pruning, irrigation and harvesting. As a result, other field operations are usually undertaken infrequently. Dead and dying leaves are only occasionally cut from growing plants. From three to eight such leaves per plant can be seen often resting on bunches and causing more than necessary fruit-scarring and deformed finger development. If leaf-trimming is practised, long petioles are left, the latex then dripping onto the developing bunch and staining the fruit.

Basin clearance is carried out every several months to remove dead fallen leaves, cut stems (after harvest) and pruned suckers. Clearing is often only to the edges of basins or, where found, into surface drains. Uncleared basins affect weed control, irrigation and movement within fields.

No protective bagging of developing bunches is practised.

11.2.9 Chemical and Fertiliser Applications

Chemicals are applied to control root-burrowing nematodes (Radopholus similis), banana weevil (Cosmopolites) and Sigatoka disease (Mycosphaerella musicola). ENB recommendations are given in Table 11.2. No farmer routinely applies a second chemical treatment after initial applications at planting and many farmers do not apply any chemical control measures to some of their fields. The necessity and effectiveness of these control measures are discussed in Section 11.4.

TABLE 11.2

Study Area Banana Production:

ENB Recommended Pest and Disease Control Measures

Pest/disease	Chemical control	Application frequency	Method
Banana weevil	6 kg/ha 10% gamma-BHC (0.6 kg/ha a.i.)	At planting and every 6 months	Sprinkle around set or mat, cover with earth and irrigate
Root-burrowing nematodes	7 l/ha Nemagon (70% DBCP)	At planting	Sets dipped in solution (enough for 100 sets):- 100 litres water 350 cc Nemagon 3 kg copper salts (1) 200 g sticking and wetting agents (2)
	10 l/ha Nemagon	Every 12 months	Poured around each mat, covered and irrigate
Sigatoka disease	Shell Cuiverol (2 l/ha) and mineral oil (10 l/ha)	Every 6 months	Aerial spray arranged by ENB

Notes: (1) Control of soil fungi during germination
(2) Irol and Lutensol

Source: ENB, 1977

No specific fertiliser recommendations were available from ENB, but two different sets of information are given in two separate technical bulletins. These are summarised in Table 11.3. Recommended rates as levels of applied NPK are given in Table 11.4. These rates represent the application of 8 to 11 q/ha/year of fertiliser. Actual surveyed farms are given in Table 11.5, illustrating this variability. At lower levels of application, reported from other farms, the use of urea becomes more prevalent. Evidence of the overall low usage of fertilisers can also be obtained from ONAT (Shalambood) sales figures. Sales from January to August 1977 were:-

Urea	3 758 q
12.6.20	2 086 q
DAP	772 q
Sulphate of potash	1 072 q
TOTAL	7 688 q

This represents an annual sale of about 11 500 quintals or, based on the net area of 3 420 ha, an average of only 3.4 q/ha/year. Also this estimate ignores sales to banana farms around Mubaarig and any sales to government maize/rice production farms and co-operatives.

TABLE 11.3

Study Area Banana Production: ENB Recommended Fertiliser Rates

Application date	Applied fertiliser in q/ha				Notes
	Urea	DAP(1)	Sulphate of potash	NPK	
	46 0 0	20 50 0	0 0 50	12 6 20	NPK/q of fertiliser
At planting	-	3 - 4	-	-	
At 6 months	1 - 2	-	-	-	
Every 2 months from month 8	3	3	1	2	Annual requirement - recommendation A
Every 2 months from month 8	3 - 4	-	3	2 - 3	Recommendation B

Note: (1) Diammonium phosphate

Source: ENB, 1977

TABLE 11.4

Study Area Banana Production: Recommended Annual NPK Applications

	Application levels (kg/ha)			
Year	N	P_2O_5	K_2O	Notes
Year 1	217 - 283	231 - 281	45	Recommendation A
Year 2	222	162	90	
Year 1	127 - 202	156 - 209	95 - 105	Recommendation B
Year 2	162 - 220	12 - 18	190 - 210	

Source: Table 11.3

TABLE 11.5

Study Area Banana Production: Fertiliser Application Rates, 1976

	Application levels (kg/ha)		
Surveyed farm	N	P_2O_5	K_2O
A	112	19	224
B	208	12	140
C	115	22	105
D	178	52	140
E	150	6	70

Source: Banana farm survey data

11.2.10 Harvesting

The first harvest occurs from 9 to 12 months after planting, depending on crop management, but successive harvests vary in frequency. This frequency is related to boat arrivals, which have been discussed fully in Annex III, Chapter 3. On average, farmers harvested 1 to 4 times per month for export. Also, there is usually one harvest per month for local sale. Consequently, most farmers harvest, on average, every 15 days. However, harvesting should be carried out every 7 to 15 days, depending on the season. Frequent harvests are needed during the hot, wet gu season but less frequently during the cooler hagai season. The optimum harvest frequency was considered to be every 10 days. Only 38% of boat arrivals during 1977/78 were at a frequency of between 5 to 10 days (Annex III, Chapter 3; Table 3.14).

Each harvest starts 1 to 2 days before a boat arrival and continues through the 1 to 2 days of packing i.e. 2 to 4 days per harvest. Bunch selection is done mainly by eye, being originally based on the size of the outer middle finger of the third hand as follows:-

(a) export to the Middle East: 34 to 35 mm width,

(b) export to Italy: 32 mm width.

Finger length should be between 18 and 20 cm.

Selected plants are cut at the stem-base, the bunch lowered and severed before being carried on a wooden back-rack or on the head to the edge of the field. When harvesting starts, bunches are stacked horizontally at the edge of the field and covered with banana leaves until packing starts. Each stack is 1 to 1.5 m high. Later harvested bunches are transported directly to the packing station. Bunches are placed vertically in trailers with the cut stem upwards.

Harvesting methods are poor with little protection offered against physical damage to bunches. Carriers use little or no padding on their heads or back-racks. Only a few banana leaves are used to line each trailer, with no protection between bunches. Farm tracks are in poor condition and only two farmers were known to grade these tracks regularly. Some farms are up to 5 or 6 km from a packing station. Neck injury and direct fruit damage are therefore higher than necessary. For the local market, handling is even worse. Harvested bunches are stacked, weighed and transported unboxed and unprotected. Five-tonne trucks are often loaded to the roof. The main local market is Mogadishu.

11.2.11 Packing and Marketing

On arrival at the packing station, bunches are handled as follows:-

(a) slung onto overhead wire-carriers and fingers deflowered;

(b) hands cut and placed in the first of two washing tanks, during which the first grading and selection is made;

(c) hands cut into units of three or four fingers and transferred to the second washing tank, during which a second selection is made;

(d) selected fruit transferred to small treatment tanks containing benomyl (Benlate) solution before drying on wooden trays with rubber supporting straps;

(e) packing and weighing in polythene bags in ventilated cardboard cartons (16.5 kg net per carton); air is removed by a vacuum line before bags are tied and boxing completed.

In general, the handling of fruit, selection and packing is not done well. Deflowering is often inadequate. Selected fruit contains a significant proportion of stained and slightly damaged fingers. Cutting often leaves ragged crowns or insufficient crowns. Handling between stages is rough and careless. Packing is too high in boxes such that lids do not fit cleanly. Polythene bags are often punctured. All these faults cumulatively increase fruit damage and disease risk during ripening, as well as inhibiting proper ripening. Although all selected fruit are treated with benomyl as a protection against fruit diseases, the dip solution is changed less frequently than recommended, due mainly to expense. Also treatment tanks are too deep (about 1 m) such that flocculation and sedimentation takes place because no proper agitation is done.

Marketing of fruit is described in Annex III, Chapter 3.

11.2.12 Labour Requirements

During the survey of banana farms, information on the number of manhours required per field operation was collected. However, in terms of existing methods of production, it is difficult to use these data to calculate average annual labour requirements per hectare because reported operation requirements (frequencies) vary with labour supply, season and finance. Also, on all farms, certain fields are managed more intensively than others. Finally, all labour is paid on a piece-work basis, which is often quite a complicated procedure. For example, at harvest-time there is one rate for carriers and another rate for loaders. Consequently, farmers found it difficult to report actual manhour requirements per operation. Therefore, estimated requirements are based on data given in Appendix A and summarised in Table 11.6.

TABLE 11.6

Study Area Banana Production: Estimated Labour Inputs

	Average		Maximum
Field operations:			
Estimated daily labour employment/ha	0.72		1.06
Estimated mandays/ha/year	263		387
Packing station:			
Number of hectares per packing station(1)		207	
Labour requirements per pack (mandays)(2)		132	
Number of packs/year		36	
Estimated mandays/ha/year		23	
TOTAL mandays/ha/year	286		410

Notes: (1) 3 420 ha (net)/16.5 stations (16 stations in Study Area but some farmers use one station near Mubaarig).

(2) 66 people employed per day for two days per packing.

Source: Survey data from six farms (774 ha net) and three packing stations as reported in Appendix A.

Labour inputs for the first year of each crop are different from the second and following years. This is due mainly to different requirements for weeding and harvesting.

11.3 Varieties

Poyo (syn. Robusta) is currently the only variety grown for export production, having been introduced into Somalia in 1963/64 from the Ivory Coast and Costa Rica. It then replaced the indigenous variety Juba which had been commercially grown from the early 1930's. Juba was replaced because of its low yield potential and unsuitability for modern production. It produced a cone-shaped bunch which was difficult to pack economically and the fruit had an insufficiently thick skin for safe handling. However, although Poyo is a much better export variety (higher yielding, cylindrical bunch-shape, thicker-skinned and longer-ripening fruit) it is not as well-suited agronomically to growing conditions in southern Somalia. Poyo is taller and more susceptible to toppling in high wind conditions than Juba and is less drought-resistant. It also possesses less field resistance to Cosmopolites and Radopholus similis. Reported average crop-life for Juba was given as four to six years, whereas most fields of Poyo had to be abandoned after only three years. Poyo was introduced and adopted for export production without any prior assessment or comparison with other modern varieties to determine the most suitable replacement for Juba.

Small areas of other varieties are grown, sometimes planted in dense belts around banana fields as shelter-belts. Two varieties were noted:-

(a) Zanzibarini - short-fingered, thin-skinned, sweet fruit.

(b) Unknown variety - medium length fat angular fruit with a thick skin. When ripe, possesses a neutral taste and is used for cooking, although not a plantain.

11.4 Pests and Diseases

The two important problems in the Study Area are:-

(a) root-burrowing nematodes (Radopholus similis)

(b) banana weevil (Cosmopolites sordidus).

Recommended control measures and actual applications have been described in Section 11.2.9.

11.4.1 Root-burrowing Nematodes

Nematode infestation in the Study Area is severe and is one major reason for the decline in productivity and short-lived duration of banana crops in the Study Area.

In 1976, an ENB survey of pests and diseases in the area showed:-

(a) at 6 months: 30% of all mats infected by nematodes

(b) at 10 to 12 months: 90 to 95% infection;

(c) at 12 to 36 months; 95 to 100% infection with 80% of all mats moderately or heavily infected.

In a survey for the Janaale study, infection was first seen in 3 to 4 month crops with 10 to 12% of mats lightly infected. At 9 months this increased to 30 to 40%, but from 12 months onwards infection levels varied between 80 and 100% and increased in severity. As a result, by two years, infection was moderate to heavy. In two-year-old fields, between 10 and 30% of plants could easily be felled by pushing the stem firmly. Losses through toppling are the joint result of nematode attack and poor root development due to drainage problems. Toppling is greatest during the jilal season, affecting crops as follows:-

(a) less than 1 year crops: minimal damage

(b) 1 to 2 year crops: 5 to 10% of all plants toppled

(c) 2 to 3 year crops: 10 to 30% toppled.

Highest incidences of toppling were reported by farmers in areas known to have poor drainage.

Field survey data showed that control measures applied at planting give reasonable protection for the first 12 months, after which no control occurs.

On one farm where repeated six-monthly applications of Nemagon were made on several hectares, a three-year-old crop showed no decline and was growing vigorously. Only light infections of nematodes were seen. The previous crop in the same field had to be abandoned after three years.

11.4.2 Banana Weevil

Incidence of weevils is less severe. The 1976 ENB survey showed that, after three years, only 30% of inspected mats were infested. These levels were confirmed during the Janaale study. Control measures at planting protected plants for only 6 to 8 months, but although weevil incidence is widespread, further control was necessary only in the occasional badly infected field. One farmer was able effectively to control weevils by baiting fallen stems. Using 10% gamma-BHC and repeating the treatment every two years, infestation levels were lowered to less than 2%.

11.4.3 Other Pests and Diseases

Scale, thrips, aphids and mites have all been recorded in the Study Area but incidences are low and are ignored.

Although ENB organises two aerial sprays per year as prevention against Sigatoka disease, litle evidence of this disease was seen in the Study Area. The gu season represents the only risk period and although infection required control in the Afgooye area in the early 1970's, the disease has not spread to the Study Area due to drier climatic conditions. Control measures are therefore considered unnecessary, and was confirmed by the visiting SIATSA agronomists (personal communication).

Anthracnose (crown rot, neck rot; Colletotrichum musae) is the only serious disease occurring on harvested fruit. As a result of poor handling, incidence on ripening fruit for local sale is widespread and is also reported to be contributory to significant losses during ripening of exported crops. The SIATSA experts considered that better handling would greatly reduce losses due to the disease. Higher incidence is reported between May and August due to more humid conditions.

No Panama wilt (Fusarium oxysporum) or virus diseases were seen, all of which are serious in other banana-producing countries.

11.5 Crop Nutrition

The general low level of fertiliser application and variability between applied levels of N, P and K can be seen as nutrient deficiencies in most crops. Both nitrogen and potassium deficiency are widespread. However, not all observed symptoms are due to poor crop nutrition. Nitrogen deficiency was often seen in areas with poor drainage and some farmers applied extra urea in attempts to correct poor growth but with minimal response. Moderate to severe potassium deficiency was seen in fields where no fertiliser or only urea had been applied. However, mild potassium deficiency was seen in several fields known to have been dressed regularly with potassium fertilisers, this lack of response being attributable to either:-

(a) nematode attack (Purseglove, 1972) or

(b) high soil pH (Wardlaw, 1961).

Despite the high soil pH in the Study Area (pH 7.5 to 7.8), few incidences of micronutrient diseases were seen. Occasional plants were affected by iron deficiency.

11.6 Fallows and Rotations

The decision to abandon a field or maintain it for a further year of production is usually made during the jilal season. The abandoned field is then used for 6 to 10 months to provide planting material for other fields and is generally not cleared and ploughed until the following jilal season. The field is then left as a bare fallow for a further 3 to 12 months before the second ploughing and planting (see Section 11.2.1). A few farmers rotate a small area of their land by planting annual crops for one year before replanting bananas. Consequently, most fields have an effective fallow of only 3 to 6 months before replanting. This is considered an inadequate period in which to reduce nematode populations. Many farmers used to plant sunnhemp (Crotalaria juncea) as a green manure in the fallow period. This not only improved soil fertility but also reduced weed levels through smothering but only four farmers now continue the practice on part of their land. The cultivation method is as follows:-

(a) land ploughed and flood irrigated if outside gu season

(b) sunnhemp broadcast and harrowed in

(c) ploughed in after 6 to 7 weeks at onset of flowering.

The main reason given for the decreased use of green manure crops is the organisation required. Few farmers are able to predict being able to plant 2 months ahead due to labour problems, equipment breakdown, water supply etc. Farmers provide their own seed, harvesting by hand at 10 to 12 weeks and threshing in the same way as sesame.

Extending the fallow period would be difficult for several reasons:-

(a) On small farms (e.g. 50 to 70 ha), farmers cannot afford land lying idle.

(b) On larger farms, the area cultivated is regulated by the number of irrigation tubewells that can be used during the jilal season. Consequently, the remaining areas of these banana farms are given over to smallholders or are abandoned. Banana production is concentrated on between 30 and 50% of the total farm area.

11.7 Drainage Problems

Methods and frequency of irrigation have been described in Section 11.2.6. No method of regulating or determining application rates is practised and optimum requirements are difficult to judge as a result of unlevelled land, soil type and variable crop growth. Sometimes, it is necessary to draw off surplus water which, as this is done after variable times, contributes further to the tendency to over-irrigate. In addition to this, not all farms possess a surface drainage system in order to alleviate any sub-surface drainage requirements. Where surface drains exist, poor maintenance and dumping of cleared trash reduces their efficiency. Also, surface drains are not linked to any network so that water only collects in these drains. Drains are cleared either by pumping back into canals or the river, or the water is left to infiltrate slowly. Consequently, poor surface drainage, the prolonged unbroken irrigation period of several years, the heavy water requirements of bananas, the usage of heavy soils and the lack of sub-surface drainage, result in waterlogging and drainage problems.

Part of the banana farm survey was to assess the nature and extent of these problems in the Study Area. The results showed that the effects of inadequate drainage in many areas are complicated and camouflaged by heavy nematode infestations, poor weeding and variable fertiliser usage. All three of these problems were seen to affect crop growth markedly such that assessing drainage problems was difficult. (The opposite can also be said in that assessment of nematode damage is complicated by the problem of impeded drainage).

All 20 surveyed farms had some form of soil drainage problem, reflected in the following observations:-

(a) all farmers reported infiltration rates to decrease as crop-life increased.

(b) most crops do not exceed three years' life and in these 'normal' fields, root-depths rarely exceeded 50 to 60 cm.

(c) mild symptoms of salinity were seen in most crops where impeded rooting was known, but not in the few areas of well-drained soils.

However, severe problems were limited to certain areas within most farms, as a result of low-lying areas and, occasionally, variability of soil type. Only one extensive area suffered above average soil drainage problems; farms between the river and Primo Secondario Canal from Mushaani to the Qoryooley road. Conversely, only small isolated areas on certain farms had minimal soil drainage problems.

11.7.1 Minimal Problem Areas

These are restricted to areas of sandy clay soils that occur as levee soils along certain parts of the river or as isolated areas elsewhere, and are generally situated on higher ground. Well-established roots penetrate beyond 80 to 100 cm depth. Infiltration rates are fast (one to two hours per irrigation) with little reported decrease with crop age. Irrigation is required every 7 to 10 days. Only in these areas do banana crops continue longer than 3 to 4 years and these are the highest-yielding crops. In all cases, stem height is between 3 and 4 m. An estimated 10 to 15% of the total cultivated area of bananas has minimal soil drainage problems.

11.7.2 Severe Problem Areas

These constitute an estimated 10 to 15% of the total cultivated area and comprise low-lying areas and isolated depressions found on all farms. Two major zones were identified but at present there is little cultivation of bananas in these zones. The zones are:-

(a) Janaale to Uguunji, parallel to the river but away from the strip of lighter levee soils adjacent to the river

(b) a belt of land south of the Dhamme Yaasiin canal.

Root development in these areas is poor, with sparse roots growing to a depth of only 35 to 50 cm. Plants are very pale and stunted, rarely exceeding a stem-height of 2 m. Infiltration rates are slow, taking between 5 to 10 hours per irrigation although, in some cases, surplus water is drawn off after 5 hours. The upper soil layer remains very wet for up to 4 days after irrigation which is usually every 3 to 4 weeks. In most areas where crops are around 2 years old, free water was found between 70 and 100 cm depth even up to 10 to 14 days after the last irrigation. Crop life in these areas varies from 2 to 3 years, being 3 years where farmers draw off surplus water and do not irrigate frequently. The borderline between these areas and normal fields is exemplified by farmers who over-irrigate. In several farms where crops showed clear symptoms of poor soil aeration, adequate soil moisture to 80 to 100 cm depth was available up to 10 days after the last irrigation. No signs of wilting were seen, yet the next irrigation was being applied. Extreme cases of waterlogging were associated with low-lying areas of Saruda soils.

11.7.3 Average Problem Areas

These constitute the remaining 75 to 80% of cultivated areas within the Study Area. Rooting depths vary from 50 to 70 cm and stem-height varies from 2 to 3 m, the height decreasing with age after two years. Infiltration rates are between 2 and 4 hours per irrigation during the first year and decreasing to 4 to 8 hours in the third year. The slower rates occur on farms between the river and Primo Secondario Canal, where there is also a need to draw off surplus water after 5 hours.

Irrigation intervals vary from 10 to 20 days. Crop life is usually three years but farmers practising careful irrigation and drawing off surplus water can obtain four years from a single crop. Four years crops are found on farms south-west of the Qoryooley road where infiltration is influenced less by the high water tables found near the river. In most areas the effects of nitrogen deficiency and soil drainage problems appear identical. However the problem of impeded soil drainage was most easily identified when passing from sandy clay areas to isolated depressions, where found in the same large field. The gradation in crop height, colour and vigour is marked and as management of that field was the same throughout, the cause was clearly impeded soil drainage.

11.8 Salinity Problems

Salt toxicity symptoms, seen as marginal scorching of leaves, were observed in isolated fields throughout the Study Area. Incidences were associated with fields with poor or bad soil drainage. Extreme cases were seen in isolated patches, covering less than several hectares. Here, a thin black layer of wet salts occurred on the soil surface, which were easily confirmed by taste. The evidence given in Section 11.7 shows that incidences of salt toxicity are the result of impeded soil drainage and the lack of leaching. However, salt toxicity can also occur when groundwater is used during the jilal season. It was reported that moderate leaf scorching occurs during use of groundwater but disappears when irrigation reverts back to the use of river water. Crop growth is, therefore, retarded temporarily. No groundwater was used for irrigation during the period of the study, so that the exact effect on crop growth could not be confirmed. However, the present concentration of banana farms in areas of groundwater with the lowest salinity is a reflection of what had been a serious irrigation problem elsewhere in the Study Area (see Annex II; Groundwater, and Chapter 3; Agricultural History). However, groundwater salinity in these areas is still high for use on a susceptible crop like bananas. Consequently, its continued periodic use, coupled with known poor soil drainage, must increase salt toxicity problems.

11.9 Yields and Crop Longevity

Yields of exported fruit from 1969 and produced in Lower Shabeelle region (Janaale and Afgooye) are given in Table 11.7, in which a decline in productivity can be seen. From 1962 to 1966, exported yields were reported to be between 140 and 160 q/ha/year but production includes a significant area of the lower-yielding variety, Juba (La Rosa Filippo, 1967). It can be assumed, therefore, that yields increased at the time of introduction of the variety Poyo but have since declined to previous levels obtained from a lower-yielding variety. It must be noted that the low 1977 exported yield (108 q/ha/year) was due to poor marketing during the latter half of 1977. Separate survey data collected from several better-managed farms (SIPA, SVIC) gave export yields of 129 to 137 q/ha/year in 1975 and 1976.

TABLE 11.7

Banana Production: Yields of Exported Fruit, Lower Shabeelle Region (1969 - 1977)

Year	Exported fruit ('000 q)	Area in production (ha)(1)	Exported yield(2) (q/ha/year)	ENB(3) estimated yield
1969	422.7	2 021(4)	209	-
1971	367.1	2 292	160	166
1972	606.5	2 194	276	187
1973	467.2	3 236	144	152
1974	414.7	3 097	134	152
1975	349.9	2 726	128	124
1976	338.7	2 535	134	129
1977	288.1	2 658	108	108

Notes:
(1) Area older than 12 months and in fruit
(2) Derived from columns 1 and 2
(3) Export yields (q/ha/year) as reported by ENB in 1978 statistical data
(4) Estimated, based on total NCA of 3 031 ha (HTS, 1969) and assuming three year crop-life.

Source: ENB, 1978

Total yields were more difficult to obtain because farmers keep less accurate or no records of produce sold locally. Survey data from nine farms gave an average total yield of 203 q/ha/year with a reported range of 149 to 250 q/ha/year. Yields from the SIPA and SVIC farms are well recorded and average total yields in 1976 were 184 and 200 q/ha/year respectively. Estimated present yields for the Study Area are given in Table 11.8.

TABLE 11.8

Study Area Banana Production: Estimated Yields

	Yield (q/ha/year)
Total	200
Exportable	130
Percentage exportable	65%

Source: ENB (1977) and banana farm survey data.

Crop longevity was determined in several ways. Survey data from five farms showed 80% of the banana crop does not exceed three years, with an average crop-life of 3.2 years (Table 11.9). From annual figures given for areas in production and total cropped areas, an estimation of annual replanting can be made and, therefore, an estimated crop-life. Details are given in Table 11.10, which shows that, on average, 34% of the total cropped area is abandoned annually, indicating crop-life is generally three years. A detailed area breakdown by crop age in 1976 is as follows (source; ENB, 1977):-

less than 1 year old	1 362 ha	(35%)
1 - 2 years	851 ha	(22%)
2 - 3 years	773 ha	(20%)
3 - 4 years	493 ha	(13%)
greater than 4 years	418 ha	(10%)
Lower Shabeelle region total area	3 897 ha	(100%)

TABLE 11.9

Study Area Banana Production: Estimated Crop Longevity

Farm	Area (ha) and years to abandonment: 1	2	3	4	5	6	Total area (ha)
A	-	-	65	64	-	-	129
B	-	25	20	15	15	15	90
C	-	-	30	6	-	-	36
D	-	25	250	-	-	-	275
E	-	-	33	4	4	-	41
TOTAL	-	50	398	89	19	15	571
Percentage	-	9	70	15	3	3	100%

Source: Banana farm survey data

TABLE 11.10

Banana Production: Estimated Crop Longevity, Lower Shabeelle Region

	Year and area (ha)								
	1971	1972	1973	1974	1975	1976	1977	Annual average	%
Total NCA	3 400	3 917	4 700	4 695	4 209	3 897	N/A	4 136	100
NCA in production(1)	N/A	2 194	3 235	3 097	2 726	2 535	2 658	2 740	66
Area out of production(2)		1 206	682	1 603	1 969	1 674	1 239	1 396	34

Notes: (1) Area older than one year and in fruit.

(2) Calculated by subtracting NCA in production from total NCA of preceding year; e.g. 3 400 - 2 194 = 1 206 ha.

N/A = not applicable.

Source: ENB 1977 statistical data.

From these figures, 77% of the 1976 crop was less than three years old and only 10% was older than four years. From reported information, few crops exceed five years, with the maximum life estimated at seven years, despite claims to the contrary. In conclusion, average crop longevity is between three and four years within, effectively, a total range of two to five years.

11.10 Economic Problems

During survey work, many farmers reported a decline in profitability of banana production over the past 10 to 15 years. However, accurate data to confirm these statements were difficult to obtain, but the following brief analysis serves to illustrate present problems.

Bauer (1967) and La Rosa Filippo (1967) both reported estimated production costs and returns, summarised in Table 11.11.

TABLE 11.11

Banana Production: 1966 Estimated Crop Budget, Janaale Production Area

Source	So. Shs./q exported fruit	
	Bauer (1967)	La Rosa Filippo (1967)
Field production costs	30.50	23.40
FOB costs (Marka)[2]	24.65	24.50
TOTAL COST	55.15	47.90
Producer price (FOB Marka)[1]	72.00	69.70
Net return	16.85	21.80

Notes: (1) For variety Poyo only.

(2) From packing to ship.

Net returns per quintal were estimated as So. Shs. 17 to 22/q of exported fruit.

In 1977, the FOB producer price was So. Shs. 120/q, but with carton costs of So. Shs. 45/q, the effective producer price is So. Shs. 75/q (see Annex III, Chapter 3). During the mid-1960's, the contracts arranged by SACA (now ENB) and the importing agent COGIS were free of carton costs. Consequently, effective producer prices have changed only slightly over this period. A brief estimate of present field production costs is given in Table 11.12. Cost per quintal of exported fruit is therefore estimated as follows:-

Yield/ha/year (Table 11.8)	=	130 q
Yield/ha under cultivation assuming 3 year crop-life	=	87 q/ha/year
Cost per quintal (at So. Shs. 4 300/ha/year)	=	So. Shs. 49.50

TABLE 11.12

Study Area Banana Production: Estimated Production Costs (1977)

	Data	So. Shs./ha/year
Field production costs:		
(a)	Labour 350 mandays/ha at So. Shs. 5/manday	1 750
(b)	Pumping (fuel costs only): So. Shs. 625/24 hours/35 ha for 90 days every two years	810
(c)	Aerial spraying: So. Shs. 65 per spray; 2 sprays/year	130
(d)	Chemical costs (at planting only):	
	7 litres Nemagon x So. Shs. 20.55/litre	
	4 kg wetting agents x So. Shs. 17.30/kg	
	6 kg gamma - BHC x So. Shs. 5/kg (applied every three years)	80
(e)	Fertilisers: 8 q/ha/year at So. Shs. 140/q	1 120
(f)	Land preparation costs:-	
	17.5 hours x So. Shs. 70/hour (every 3 years)	410
TOTAL field production costs/ha		4 300

Note: Data based on information reported in Chapter 11.

Estimated net returns are given in Table 11.13 which shows that profitability has declined, particularly as inputs have decreased over the years, in many cases, to the barest minimum. Present returns, on average, barely cover the estimated production costs which do not include such overheads as permanent supervisory staff and outstanding loan repayments. Some farmers reported higher costs, averaging So. Shs. 6 000 to 8 000/ha/year, but farmers were unable to give specific costs and were prone to exaggeration by referring to management given only to their better fields. SIATSA experts considered a break even point to be 150 q/ha/year of exported fruit.

TABLE 11.13

Study Area Banana Production: 1977 Estimated Crop Budget

	So. Shs./q (exported fruit)
Field production costs	49.50
FOB costs (ENB charges)	23
TOTAL costs	72.50
Effective producer price(1)	74 - 78
Estimated net returns	1.50 - 5.50

Note: (1) So. Shs. 75/q adjusted at final quality control

Source: Section 11.10 and Annex III, Chapter 3 (ENB)

However, local sales have been ignored as very little accurate information is available. Present local prices average So. Shs. 30/q (on the stalk), varying seasonally from So. Shs. 20 to 35/q.

11.11 Discussion

From the above information, current production is affected by many problems which, although individually identifiable, are closely interrelated. The main technical problems of weed control, nematode control, crop nutrition, impeded drainage and varietal suitability are complicated by poor labour supply, inconsistent marketing, increased production costs and reduced returns.

Present crops are low-yielding and short-lived. Farmers have reported production costs during the first year of production to be approximately 2.5 times greater than subsequent years. Production costs are therefore high as a result of establishing new crops after only three or four years.

Introduction of improved methods to increase crop life would considerably reduce existing production costs. As such, the two most important improvements required are nematode control and soil drainage because both were seen to be the major factors limiting the productive life of each planting. The SIATSA experts considered nematode levels in the banana areas of Somalia to be the worst they had seen in any banana producing region. Most banana farmers are aware of drainage requirements but lacked capital to invest in extensive ditching to improve existing shallow surface drains. The continued use of saline groundwater during the jilal season is bound to accentuate any salt toxicity problem brought about by impeded drainage. Improved drainage is therefore necessary to improve soil aeration as well as enable leaching out of accumulated salts.

However, implementation of improved drainage and nematode control will only be beneficial if other improvements, given below, are also carried out:-

(a) Re-organisation of the labour supply situation.

(b) Research into better varieties and valid fertiliser and chemical recommendations.

(c) Regular export marketing.

(d) Reappraisal of fixed FOB costs in relation to the high costs of cartons in order to assist profitability even at moderate production levels.

CHAPTER 12

MINOR PERENNIAL CROPS

12.1 Introduction

A wide range of miscellaneous perennial crops is grown in the Study Area, a proportion of which is cultivated at a low level of management on banana farms, with the remainder growing wild. Estimated cultivated areas are given in Table 12.1; these areas do not include untended areas.

TABLE 12.1

Study Area Minor Perennial Crop Production: Estimated Areas

Crop	Net cultivated area (ha)
Grapefruit	200
Coconuts	80
Mangoes, limes and papaya	25
TOTAL	305

Note: Excludes isolated clumps of mango, lime, coconut, papaya, guava, sugar-cane and avocado situated close to the river and main canals or used as avenues on some banana farms.

Source: Land use survey data (1977)

Where cultivated, management is limited to infrequent weeding and irrigation. No pest control measures or fertilisers are applied. All produce is either consumed in villages or sold on local markets. These markets are limited and subject to fluctuating market prices during the year. Production of these crops is therefore secondary to export banana production and, in the face of present production problems, few farmers are able or willing to invest in these minor crops. Labour availability, limited local markets and disproportionately expensive chemicals and fertilisers effectively limit production.

12.2 Grapefruit

12.2.1 Orchard Management

Most orchards are at least 25 to 30 years old with only a few new plantings, estimated at less than 20 ha, in the last 10 years. The largest orchard is 25 ha (net), attached to the SIPA banana co-operative.

Trees are spaced at 8 m x 8 to 10 m giving a density of 125 to 156 trees per hectare. In established orchards, the normal basin irrigation is practised with one tree per basin. In the few newly-planted orchards, budded seedlings have been planted at the final wide spacing and furrow-irrigated. Orchards are irrigated every 4 to 5 weeks (i.e. 10 to 12 times per year). No drainage practices are implemented, and rooting is shallow with a high proportion of surface roots. The effects of poor irrigation management were apparent and seen as wilted trees and patches of waterlogging. Irrigation problems are accentuated during dry seasons when farmers must use saline groundwater. Because the banana fields will be given irrigation priority, grapefruit orchards suffer more during the dry season through not only poor water quality, but also inadequate applications. Weeding is irregular and is either done by hand or by mechanical cultivation. The predominant weed is the perennial grass, Cynodon dactylon. Hand weeding gives poor control and mechanical cultivation, which gives marginally better control, also damages surface roots. Only in old orchards are weeds less of a problem as the result of shading from a closed canopy. This, in turn, indicates growth competition between trees at too narrow spacings.

The lack of fertiliser or chemical applications also contributes to the poor condition of nearly all orchards. New growth is sparse and weak and soon exhibits symptoms of nutrient deficiencies, particularly nitrogen and several micronutrients. In the Study Area, a wide range of pests attack grapefruit, including scale (Coccus and Parlatoria), leaf miner (Phyllocnistis), orange dog (Papilio), wood-borer (Macrotoma) and mites. Sooty mould, greasy spot and gummosis are prevalent diseases, but their incidence is less than that of pests. Some pest control measures are practised in newly-planted orchards mainly to control scale, orange dog and leaf miner, although application frequencies were still inadequate for effective control.

Very little pruning is or was practised, resulting in uncontrolled vegetative growth and harvesting problems. Although occasional windbreaks were planted when banana farms were originally established, no specific wind protection is given to any orchards. Fruit-scarring is, therefore, common.

12.2.2 Varieties

There are many varieties grown in the orchards and although most fruit have a poor external appearance (mainly through scale and fruit-scarring), at least 50% have a good flavour and good pulp quality as well as being seedless. Citaco (1974) identified most of the major commercial varieties in orchards between Afgooye and the Study Area, including Marsh Seedless, Triumph, Foster, Walter, and Ruby. At the Janaale Seed Multiplication Centre, IPC and Marsh Seedless are available as budded seedlings (see Annex III, Chapter 3; Seed Multiplication). Estimated sales from the Janaale centre in 1977 were sufficient to plant about 20 ha, which corresponds to the area of young orchards in the Study Area. Both varieties are budded onto Rough Lemon or Rough Orange stock.

12.2.3 Fruit Production, Yields and Marketing

Although flowering occurs all the year round, as a result of poor and irregular management practices, flowering peaks occur in April/May (gu rains) and October/November (der rains). Fruiting therefore is also throughout the year, but with maximum production during May to June and in December/January. Citaco (1974) estimated the yields in the Study Area to be low, averaging between 5 and 8 tonnes of fresh fruit per hectare per year. By comparison, under good management, 20 to 30 t/ha/year is considered obtainable. However, farmers were unable to give specific yield data as harvesting is irregular, 'losses' occur and no harvest or sales records are kept. Harvested fruit vary markedly in size, mainly as a result of poor management. Mature fruit are mottled greenish in colour, typical of fruit ripening at high temperatures.

Between 1960 and 1970, an estimated 233 to 389 t/year were exported to Italy from Somalia, representing approximately 20% of the estimated total annual production of 1 500 t/year (Citaco, 1974). Present production, however, is all sold locally for either direct consumption or for preparation into fruit juice in local cafes and hotels. The reasons for stopping export of fresh fruit are not known, but poor external fruit quality was probably one major factor. The ITOP processing factory tried canning grapefruit juice but ran into marketing problems, mainly due to expense. ITOP is presently exploring export possibilities in the Middle East before continuing production. Farmers reported obtaining an average of So.Shs. 50/q of fruit which, at an estimated average yield of 6 t/ha/year, represents a gross return of between So.Shs. 2 500 and 3 000/ha/year. The average yield is expected to decrease as little re-establishment of orchards is done.

12.2.4 Discussion

There is little stimulus to encourage present producers to improve or expand production of grapefruit beyond the present low levels of management and production. Better cultural methods, guaranteed irrigation throughout the year and expensive chemical control would be necessary to obtain fruiting during present off-seasons in order to maintain reasonable returns without saturating the local market. Export production is very dubious unless fruit are protected from wind damage and many old orchards replaced. Consequently, financial liabilities are correspondingly greater for grapefruit than for other crops, particularly as fruiting is not until the fourth or fifth year, with maximum production not until after 10 to 12 years.

12.3 Other Crops

12.3.1 Coconuts

Most groves in the Study Area were planted during the pre-war development period using the tall late-maturing variety found along the East African coast. These groves are given no management, and survive on seepage water from nearby canals. In the last 15 years, a few new groves have been planted to meet the small local demand. Management of these groves is also minimal with little beyond a monthly irrigation and several weedings per year. However, where the land is freely drained and over-irrigation does not occur, coconuts grow reasonably well with few problems. There is some damage by rhinoceros beetle (Oryctes) and all trees are mildly infected by Cercospora leaf spot. Trees are planted at a density of 100 to 150/ha. No recorded yield data were available but, on examination of groves, yields are probably not greater than 30 nuts/tree/year. This is the average yield obtained along the East African coast (Acland, 1971). Production is steady throughout the year and at an average price of So.Shs. 0.50 per nut, the maximum gross return under present management is between So.Shs. 1 500 and 2 250/ha/year. Nuts are used solely for local consumption. No copra production exists. Coir from discarded nuts is used locally for stuffing cushions and mattresses.

One farmer has planted a small area of a dwarf variety that fruits after three years. Nut sizes are smaller than the later-maturing variety already grown in the area. The farmer is considering production for oil.

12.3.2 Papaya (Carica papaya)

Several farmers cultivate small areas of papaya. Seedlings are transplanted at a spacing of 4 m x 4 m with each plant within its own irrigation basin. Irrigation is given every month, and fields weeded regularly. No fertilisers are applied. No pests or diseases were observed. The local variety grown is the standard dioecious type. Crops are maintained for about three years. Yields are modest, estimated at 5 to 6 t/ha/year although accurate data are not available. Although all sales are local, ITOP purchases fruit for jam manufacture at So. Shs. 45/q which represents a current gross return of between So.Shs. 2 000 and 3 000/ha.

12.3.3 Mangoes

The only strain cultivated or growing in the Study Area is the common East African local variety that produces a large dark-fleshed fruit. Orchard management involves occasional irrigation and weeding. Fruiting is prolific but only for short periods in June/July and, to a lesser extent, January/February. As in most parts of East Africa, mango trees survive well without specific irrigation, relying on seepage water from canals. Pest and disease problems are minimal.

12.3.4 Other Crops

Lime trees are found throughout the banana producing areas and along the Shabeelle river. All trees are virtually wild and produce adequate good quality fruit for the local market throughout the year.

One farmer has planted avocado trees as avenues along field canals, utilising seepage water. No pest or disease problems were observed but growth varied markedly from tree to tree, exemplifying susceptibility of avocado to variation in water supply.

Guavas grow in the same areas as mangoes and are equally seasonal in fruit production. One farmer is growing khat (Catha edulis) under irrigation. Khat is used as a stimulant and is widely sold in Mogadishu. Small areas of sugar-cane are cultivated by villagers, usually as a crop that is permanently ratooned and grown for direct consumption.

CHAPTER 13

EXISTING DEVELOPMENT PROJECTS

13.1 Introduction

In the Janaale Study Inception Report (MMP, July 1977), reference was made to existing development proposals in the Study Area. Since presentation of this report, new information has become available, altering the number of committed projects. The only committed project is the EDF-financed grapefruit production scheme to be established near Golweyn. The proposed 5 000 ha rice project, for which a pre-feasibility study was prepared by the State Planning Commission during 1977, is now considered to be only provisionally committed. Agricultural proposals for both projects will be described and discussed in this chapter.

The remaining areas stated in the Inception Report to be under development have been already discussed under co-operatives (Annex III, Chapter 3; Annex IV, Chapter 5) and government production farms (Annex IV, Chapter 5). Agricultural development of these areas is similar to existing methods described in Chapters 4 and 5.

13.2 EDF Grapefruit Production Scheme

All data concerning this scheme have been extracted from 'Final design for a grapefruit plantation', Citaco (1974) and from discussions held with EDF staff involved with establishment of the project's first stage.

13.2.1 Production Proposals

The aim of the scheme is to establish 1 386 ha (net) of grapefruit (1 845 ha gross) in three stages. Following this, 966 ha (net) of annual crops (1 190 ha gross) will be prepared to be farmed by the scheme labour force, mainly for their personal food supplies (Table 13.1). Management will be based on a collective co-operative in conjunction with declared government policy. For the first ten years, at least, expatriate management has been recommended by Citaco.

TABLE 13.1

EDF Grapefruit Scheme: Development Stages (ha)

	Grapefruit		Annual crops	
Year	Net	Gross	Net	Gross
1	230	325	-	-
2	465	645	-	-
3	691	875	-	-
4	-	-	322	396
5	-	-	322	397
6	-	-	322	397
TOTAL	1 386	1 845	966	1 190

Source: Citaco (1974)

At full establishment, the total gross area will be 3 035 ha of which 2 485 ha will be situated within the Study Area between Golweyn and Buulo Mareerta. This area will include the entire 1 386 ha (net) of grapefruit. Production will be mainly for export, involving an estimated 67 to 76% of the total production (Citaco, 1974).

Preparation of budded seedlings is already in progress at the Janaale Seed Multiplication Centre. Transplanting of Zone 1 (230 ha net) is planned for 1979. Two varieties have been recommended; Marsh Seedless (75% of total area) and Ruby Seedless (25%). Recommended budding is onto Rough Lemon (75% of all trees) or Sour Orange stock (25%). For the first phase, seedlings budded onto Sour Orange stock will mainly be used. Transplanting will be at around 18 months and to a population of 125 trees/ha (10 m x 8 m spacing). To protect trees from seasonal high winds, windbreaks will be established using Casuarina spp. in two ways:-

(a) external windbreaks with acacia thorn trees to prevent entry of wild animals, and

(b) internal windbreaks every 50 m involving three rows per windbreak arranged in quincunxes.

Orchards are to be fertilised regularly using sulphate of ammonia, triple superphosphate and potassium sulphate. Provisional recommendations for the first phase are for trees to be fertilised three times per year for the first two years before reverting to two applications per year. Provision has been made, as a result of high soil pH levels, for foliar applications of boron, zinc, manganese, magnesium and iron.

A trickle irrigation system was proposed, this being considered by Citaco to be more economic both in terms of water use and labour in comparison with basin irrigation. However, it has now been decided to revert to surface irrigation, due to the technical problems involved with trickle irrigation and the high sediment levels in the river water.

A range of pests and diseases are described but only control recommendations are given against the known Study Area pests, involving the use of kelthane, mineral oil, malathion and aldrin (against termites). Correct pruning will also be practised to maintain tree-shape and facilitate harvesting, pest control and in-field movement as well as encourage high levels of fruiting. Trained specialised teams will be employed solely for pest control and pruning.

Production is expected to commence in years 4 to 5 with exportable fruit available from year 6. Full production is estimated to be reached in years 10 to 12 and the economic crop life of a tree to be between 30 and 35 years. Projected yields are 2 t/ha/year to year 6, rising to 30 t/ha/year from years 16 to 30, and then declining to 20 t/ha/year at year 35. Maximum production of the commercial crop is envisaged at 30 000 t/year for the whole project comprising:-

(a) 22 - 23 000 t/year for export mainly to Italy

(b) 4 - 6 000 t/year for processing

(c) 2 - 3 000 t/year for domestic consumption and/or sale to neighbouring East African countries.

Fruiting is planned for two seasons in the year, which are virtually identical to the existing peak periods of production. These seasons are:-

(a) May - July, following flowering during the der rains.

(b) November - December, following flowering during the gu rains.

Accelerated maturation for this second harvest is required and is reported by Citaco as being possible through the use of lead arsenate sprays after flowering.

These two seasons were selected in order to fit periods of demand in Europe as well as remain agronomically possible under climatic conditions in Somalia. The important season for export production was considered to be between June and September when competition from American, Israeli and Cypriot producers is minimal.

However, due to envisaged problems, which are discussed briefly in Section 13.2.2, and following discussions between the EDF and the Ministry of Agriculture, several changes in the implementation of this project have been made. These changes are:-

(a) Phase 1 (230 ha net) will be regarded as a pilot scheme.

(b) Finance has been voted for the development of Phase 2 (465 ha net) but its use for continued grapefruit production will depend on the success of the pilot scheme.

(c) Phase 3 (691 ha net) is being reserved for grapefruit by the Ministry of Agriculture, but has not been entered into any financial plans.

13.2.2 Discussion

The technical problems of grapefruit production in the Study Area are, briefly, as follows:-

(a) A high level of management is required to maintain production of quality fruit that will be acceptable on the now sophisticated European market with its consumers' quality preferences and prejudices. This management will be at a level that has not been previously practised in Somalia, involving horticultural techniques, accurate irrigation, intensive pest control, harvesting methods and effective wind-breaks in order to produce high yields of blemish-free fruit.

(b) The erratic rainfall distribution which will complicate the controlled irrigation required to enable controlled seasonal fruit production to take place.

(c) The use of saline groundwater during certain times of the year. Salinity levels in the project area vary from 1.2 to 1.5 mmho/cm, which will affect susceptible crops like grapefruit (see Annex II, Groundwater).

(d) The market survey conducted by Citaco used 1971 data. Since nearly seven years have elapsed, a new market survey will be required, particularly involving the Middle East, in order to re-assess viability of export production.

Full discussion of these points is given in Annex VI, Chapter 15.

13.3 State Planning Commission Rice Production Project

All data concerning this scheme have been extracted from the pre-feasibility study report prepared by the UNDP technical assistance team attached to the Planning Commission and published in June 1977.

13.3.1 Production Proposals

The aim of this project is the intensive production of upland rice as part of government policy to decrease current rice imports. Full maturity will be reached by year 5 when 170% cropping intensity will be reached based on the cropping pattern given in Table 13.2.

Proposed production is based on improved implementation of methods already practised along the Lower Shabeelle river and, briefly, are as follows:-

(a) Upland rice. Fully mechanised including herbicide application and broadcasting fertiliser. Hand labour only for two weedings, irrigation and bird scaring. Fertiliser rates will be 0.5 q/ha DAP and 1.5 q/ha urea. Herbicide rates will be 10 l/ha Stam F34, and pesticides needed will be 4 kg/ha Carbaryl to control stemborer. Varieties to be planted are standard 120-day strains presently cultivated.

(b) Maize. Land preparation, planting, fertiliser and pesticide application to be mechanised, with weeding, irrigation and harvesting by hand. Recommended fertiliser rate given is 1.5 q/ha urea.

(c) Sesame. After land preparation, hand labour for all operations, with 1 q/ha urea to be applied at planting.

In order to double-crop using the 120-day rice varieties, early planting in March and April has been recommended. Due to the unpredictability of river flows at that time, initial irrigation of gu rice crops will be with pumped groundwater until arrival of either gu rains or the gu river high flow period. Apart from this, the cropping calendar remains similar to standard practices in the Study Area.

TABLE 13.2

State Planning Commission Rice Project: Cropping Pattern at Year 5

Crop	Area (ha) Gu	Der
Upland rice	3 500	2 500
Maize	500	-
Oilseeds (1)	-	2 000
Fallow	1 000	500
TOTAL	5 000	5 000
Seasonal cropping intensity	80%	90%

Note: (1) Sesame and some groundnuts.

Source: State Planning Commission, 1977

13.3.2 Discussion

Because the State Planning Commission report is only a pre-feasibility study, and in the light of more recent detailed information collected during the Janaale-Buulo Mareerta study, several technical problems have been identified. These will be fully discussed in Annex VI, Chapter 5 and are summarised below.

(a) Labour constraints. The necessary bird scaring, which is very labour-intensive, will limit intensity of rice production in any cropping pattern.

(b) The use of saline groundwater is not recommended particularly during early growth stages. Groundwater salinity in the project area is around 2.5 mmho/cm (see Annex II; Groundwater).

(c) Predicted gu season river water shortages during June and July will also limit the cropping intensity of rice.

(d) The present 120-day varieties recommended and restricted seasonal water availability will prevent double-cropping rice.

APPENDIX A

STUDY AREA LABOUR AVAILABILITY

A.1 Introduction

Two of the major constraints to agricultural expansion and large-scale production reported regularly in the Study Area were seasonal shortages and extreme variability in labour supply. The most seriously affected were banana producers and government production farms. In extreme cases, these problems have led to the dereliction and premature abandonment of fields in production.

However, labour shortages in the agriculture sector are not new to the Lower Shabeelle river area after the start of development programmes in 1973. The Afgooye-Mordiile pilot project (1973-75) reported being able to obtain only 76 casual labourers per day for several months from nearby villages for their 106 ha pilot farm. As a result, they forecasted grave shortages during any development of the proposed 3 000 ha scheme (FAO, 1975). After several years in operation, this Afgooye-Mordiile scheme and a similar cotton production scheme at Balcad both face currently acute seasonal labour shortages, particularly for weeding as a result of depending upon adjacent villages as a source of casual labour. Both projects employ only minimal permanent staff of technical grades for their combined present cultivation of about 2 000 ha. Gu season shortages are avoided by delayed planting. This results in a limitation on maximum cropping intensities as well as delayed planting of der crops. Der cropping is also affected by a der season labour shortage. Both projects were originally planned as smallholder settlement schemes in order to avoid these labour problems (HTS, 1969). The net result has been over-dependence upon mechanised farming at a time when technical expertise had not been developed adequately. The recent introduction of cane-harvesters at the SNAI Jowhar sugar estate was mainly the result of being unable to maintain a labour pool in the face of alternative more attractive agricultural employment in the area. The Chinese Technical Aid experimental farm, also at Jowhar, has reverted to direct drilling paddy rice, being unable to obtain sufficient labour for transplanting.

The seasonal shortages, observed in 1977 and reported verbally for previous years, are due mainly to villagers concentrating upon their own crop cultivations and are often exacerbated by the inability of employers to raise wage rates to meet the seasonal high demands. Low wage rates offered to labourers at CARS, Afgooye, resulting in low casual recruitment levels, is one main constraint on current important research programmes. This is despite the town of Afgooye being within 3 km of the research station.

Within the well-populated Study Area, similar reports were made during 1977 as shown below:-

(a) Beerdiid and Tugarey state farms operate staggered planting dates to lessen demand. Even so, daily labour recruitment fluctuates between only 30 to 120 workers for a net cropped area of at least 300 ha. During the abnormally wet 1977 der season combine harvesting of rice was badly affected such that an estimated 30 ha were abandoned because no labour was obtainable for any hand harvesting.

(b) All interviewed large-scale maize and banana producers could not obtain sufficient labour. Several farmers reported the maximum of only 20 to 30 labourers per day for their 80 to 100 ha farms. Annual crops are often broadcast as one way of minimising labour inputs.

(c) Several banana growers detail transport to collect labour in villages up to a 10 km radius to obtain a sufficient daily workforce.

(d) Badly weed-infested crops were a very common sight and attributable to poor labour inputs. Where labour was obtained very clean fields were in evidence.

In the light of this known but basically unquantified problem, and since any development proposals must be based on a full understanding of labour availability, an assessment of labour supply in the Study Area was undertaken.

A.2 Study Area Available Manpower

The estimated presently available permanent supply of manpower in the Study Area is given in Table A.1. All information is based on Study Area population figures reported in Annex III, Chapter 4.

TABLE A.1

Study Area Estimated Available Manpower, 1977

Study Area population	112 316
Household-family size	5.93
Study Area household-families	18 940
Adults per household-family	2.19
Children per household-family	3.74
Children aged below 14 years	2.00
Maximum working members per household-family	3.93
Available manpower per household-family (1)	2.00
Available manpower in Study Area	37 900

Note: (1) Assumes permanent availability and excludes:-

(a) old people
(b) domestic village occupation (women)
(c) pregnancy
(d) elder children attending school.

All exclusions are either permanent (a) or temporary (b),(c), (d).

Source: Annex III, Chapter 4 (Study Area Population)

A.3 Study Area Crop Production

Net cultivated areas and growing seasons for major crops grown in the Study Area are given in Table A.2. All information is based on present land use and farming systems reported in Annex IV, Chapters 4 and 5.

TABLE A.2

Study Area Crop Production (1977)

Crop	Season	Estimated NCA (ha)	Dates (3) Planting	Dates (3) Harvesting
Maize	gu	16 590 (1)	Mid April-mid May	August
Maize	der	6 636 (1)	October	Mid January-mid February
Sesame	hagai	1 000	August-mid September	November-mid December
Sesame	der	9 954 (1)	November	February
Tomato	hagai	350	July	October-November
Tobacco	hagai	250	June	October
Bananas	-	3 420 (2)	April-November	All year

Notes: (1) Assumes 100% gu maize and 60% der sesame and 40% der maize.

(2) Estimated NCA of bananas for 1976 and, therefore, for early 1977.

(3) Median dates - 80% of planted crops within these dates.

(4) NCA = net cultivated area.

Source: Annex IV (Present Land Use and Farming Systems)

A proportion of hagai crops is either interplanted in maturing gu maize crops or, as with tomatoes and tobacco, transplanted onto the same land after harvesting gu maize. Rice has not been included in this study for the following reasons:-

(a) less than 250 ha (net) actually in the Study Area were planted to rice

(b) planting and harvesting is mechanised

(c) some herbicides are applied, such that extra weeding is as for maize

(d) bird scaring for a 40 day period (two or three persons/ha/d) is done by children.

All other minor crops (groundnuts, inter-cropped pulses etc.) have been ignored because planted areas are minimal or labour inputs very low.

A.4 Labour Requirements - Annual Crops

Daily labour requirements for each field operation were calculated using the following general formula:-

$$\frac{\text{Manhours per hectare}}{\text{Working hours per day}} \times \frac{\text{Net cultivated area per crop}}{\text{Number of days to complete each operation}}$$

= daily labour requirements per operation (manpower per day)

The following general assumptions were also made:-

(a) 4 working hours per day = one manday,

(b) except where stated, the time to complete each field operation is taken as 30 days,

(c) a miscellaneous labour requirement of 10% of total labour requirement is added to cover contingencies. This miscellaneous requirement has been averaged over the entire growing season for each crop.

Estimated labour inputs for major crops are listed below. These are based on average management and input data collected during village and farm surveys and described fully in Chapters 5, 6, 7 and 9.

TABLE A.3

Study Area Annual Crop Production

Calculation of Daily Labour Requirement: Maize

gu - 16 590 ha NCA
der - 6 636 ha NCA

Operation	Manhours/ha	Daily labour requirement gu	Daily labour requirement der
Land preparation and basin formation (1)	65	4 910	3 600
Planting	24	3 490 (6)	1 330
Irrigation (2) (3 x 8 hours irrigation)	24	3 320	1 330
Weeding (3 x 56 hours weeding)	168	23 200	9 290
Harvesting (3) (2 operations)	80	11 100	4 420
Shelling (4)	5	690	280
TOTAL (7)	366	-	-
Miscellaneous (10%) (5)	37	990	420

Notes:-

(1) Assumed as hand cultivation because less than 10% prepared by tractor. Operation period for gu crop is 55 days, starting in jilal.

(2) Assumes all crops receive three irrigations, although at different times in gu and der season due to expected rainfall periods.

(3) Two week drying period separates stooking and cob picking.

(4) Hand-operated or machine-shellers.

(5) Gu crop-period is taken as 155 days (crop season).
Der crop-period is taken as 145 days (crop season).

(6) Includes 167 man units/d applying fertiliser to 1 000 ha (net) in gu only.

(7) Assumes crop management similar in both gu and der seasons. Minimal chemical application excluded.

TABLE A.4

Study Area Annual Crop Production

Calculation of Daily Labour Requirement: Sesame

hagai - 1 000 ha NCA
der - 9 954 ha NCA

Operation	Manhours/ ha	Daily labour requirement hagai (1)	der
Land preparation	45 hagai (2) 65 der	250	5 390
Flood irrigation	8	50	660
Planting	40	220	3 320
Weeding (3)	56	310	4 650
Supplementary irrigation (4)	8	50	660
Harvesting	90	500	7 470
Threshing	50	280	4 150
TOTAL (6)	297 hagai 317 der	- -	- -
Miscellaneous (10%) (5)	30 hagai 32 der	50	530

Notes:

(1) Operation period is 45 days per operation.

(2) No basin formation is necessary because sesame directly follows gu maize.

(3) One weeding only.

(4) Applied where possible by a significant proportion of farmers.

(5) Operation period (crop season) = 155 days hagai
= 150 days der.

(6) No fertiliser or chemical application practised.

TABLE A5

STUDY AREA ANNUAL CROP PRODUCTION
CALCULATION OF DAILY LABOUR REQUIREMENTS: DER SEASON SESAME N.C.A. = 9954 ha

MONTH / OPERATION	OCT		NOV		DEC		JAN		FEB		MAR	
Land preparation		5390 (1)										
Flood irrigation			660									
Planting			3320									
Weeding					4650							
2nd Irrigation							660					
Harvesting									7470			
Threshing											4150	
Miscellaneous							530					
TOTAL DAILY LABOUR REQUIREMENT	–	5920 / 6580	9900	4510 / 8500	5180	5840 / 1190	1190	530	8000	12150	4680	–
15 DAY MEAN DAILY LABOUR REQUIREMENT	–	6360	990	7160	5180	2740	1190	530	8000	12150	4680	–

Note:- (1) Daily labour requirement per field operation (see section A.4)

TABLE A.6

Study Area Crop Production

Calculation of Daily Labour Requirement: Tomato

hagai - 350 ha NCA

Operation	Manhours/ ha	Daily labour requirement
Nursery	9 (1)	30 (2)
Land preparation	65	190
Transplanting	50	150
Field irrigation (5 x 8 hours irrigation)	40	120
Weeding (4 x 56 hours weeding)	224	660
Harvesting (3)	60	90
TOTAL	448	-
Miscellaneous (10%) (4)	45	20

Notes:

(1) Manhours per transplanted hectare.

(2) Thirty day operation period but 60 day season to include seedling growth.

(3) Thirty day operation period but 60 day season to include maturation period. Assumes three manhours/q and 20 q/ha yield.

(4) To include small proportion of pest control and fertiliser application. Operation period (crop season) = 160 days.

TABLE A.7

Study Area Annual Crop Production

Calculation of Daily Labour Requirement: Tobacco

hagai - 250 ha NCA

Operation	Manhours/ ha	Daily labour requirement
Nursery	9 (1)	20 (2)
Land preparation	65	140
Flood irrigation	8	20
Transplanting	64	130
Weeding (3 x 56 hours weeding)	168	350
Topping and suckering (3)	48	100
Harvesting (4)	48	100
Post-harvest curing and preparation (5)	100	210
TOTAL	510	-
Miscellaneous (10%) (6)	51	20

Notes:
(1) Manhours per transplanted hectare.
(2) 30 day operation period plus 30 day period for seedling growth.
(3) One time only.
(4) One time only.
(5) Two operations separated by 10 day drying/curing period in pits.
(6) Includes small amount of pest control and supplementary irrigation.

A.5 Labour Requirements - Perennial Crops

The only perennial crop under consideration is bananas. The low input given for the small net area of other perennial crops can effectively be included in miscellaneous labour requirements for bananas.

Bananas

NCA = 3 420 ha

Estimated daily labour requirements were obtained as follows and based on data collected during the survey of banana farms.

(a) Field Operations

Six surveyed farms totalling 774 ha (net) employed an average of 555 labourers per day. Estimated average total daily requirement for Study Area is:-

$$\frac{555}{774} \times 3\,420 \text{ ha} = 2\,450 \text{ workers per day.}$$

The maximum average for a single farm was 1.06 workers/ha/d i.e. a maximum total Study Area requirement of 3 600 workers/d.

(b) Packing Operations

Three packing stations were surveyed and employed, on average, 66 workers per day. Total labour requirement is based on these assumptions:-

(a) 17 stations drawing labour from the Study Area

(b) 2 days packing per ship

(c) 36 ships per year (1977 data).

Therefore, average daily requirement:-

$$\frac{66 \times 2 \text{ days} \times 36 \text{ ships} \times 17 \text{ stations}}{365 \text{ days}} = 220 \text{ workers per day}$$

Maximum daily requirement = 66 workers x 17 stations
= 1 120 workers/d
(i.e. 900 workers above average daily requirement)

(c) Total Labour Requirements

Labour requirements for bananas under optimum management have been previously estimated at 403 mandays/ha (Inter-riverine Study; HTS, 1977). This is equivalent to a present Study Area requirement of 3 780 workers/d.

Survey data reported above indicate a total requirement ranging between 2 670 and 3 820 workers/d as follows:-

	Labour requirement/day Minimum	Maximum
Field	2 450	3 600
Packing station	220	220
TOTAL	2 670	3 820

Peak requirements are estimated as a further 900 workers/d during packing. However, no other field work is undertaken during packing, apart from finishing harvesting which started several days prior to packing. Therefore this peak requirement is absorbed within overall daily requirements. An average total daily labour requirement has, therefore, been taken to be 3 500 workers/d and will include the small requirement for other perennial crops.

A.6 Seasonal Labour Utilisation and Requirements - Annual Crops

Estimated cropping and field operation calendars for the major annual crops are as given in Chapters 5, 6, 7 and 9 and Sections A.3 and A.4, and are represented diagrammatically in Figure A.1.

Based on data reported in Section A.4 and cropping calendars given in Figure A.1, full daily labour requirements per crop were calculated and are given as 15-day means in Figure A.2. Representative examples of the method of calculation are given in Tables A.3 to A.7.

A.7 Seasonal Labour Requirements - Perennial Crops

Although optimum production of bananas aims at uniform production throughout the year, seasonal fluctuations in field management requirements occur in the Study Area as follows:-

(a) lower weeding requirements in jilal season, than in rainy seasons,

(b) no planting practised in jilal season,

(c) harvesting peak requirements in gu and der seasons, but lower in hagai due to cooler weather.

Variations in labour requirements during the year are given below:-

(a) maximum - May, June, October, November

(b) average - April, July, August, September, December

(c) minimum - January, February, March.

Citaco (1974) surveyed 8 banana farms in the Golweyn area for maximum and minimum labour requirements. Results are given below:-

(a) minimum - February 2 400 employees

(b) maximum - June 4 700 employees.

The ratio between maximum and minimum is, therefore, 1 : 1.96. Based on the above data and that given in Section A.5, seasonal variability in daily labour requirements is given below:-

(a) maximum = 4 640 employees/d (May, June, October, November)

(b) average = 3 500 employees/d (April, July, August, September, December)

(c) minimum = 2 360 employees/d (January, February, March).

A.8 Total Seasonal Labour Requirements

Estimated total daily labour requirements for all crops, based on data in Sections A.7 and A.8, are given in Figure A.3.

A.9 Summary and Conclusions

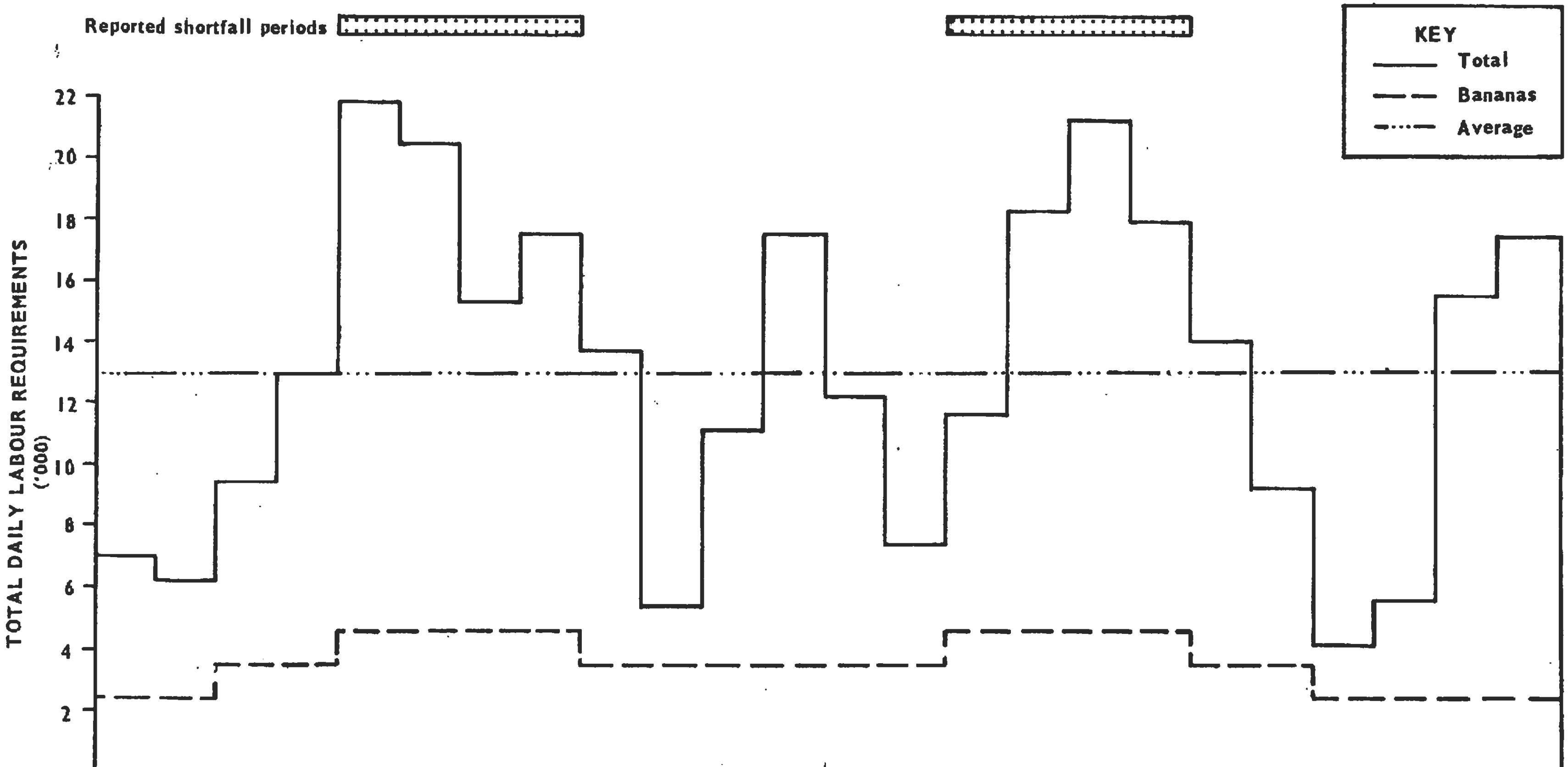
Data given in Figures A.2 and A.3 indicate the tremendous fluctuations in seasonal labour requirements within the Study Area, a phenomenon to be expected with the known intensity of annual crop production in the area. Peak requirements coincide with planting and weeding of gu and der crops, plus, to a lesser extent, harvest periods. Whereas crops tend to be planted over a short period, harvesting is generally more spread out. At maximum labour demand periods in May/June and October/November, annual crop production absorbs an estimated 73 to 80% of the actual estimated working population. In other months (July and January) the proportion can be as low as 35 to 40% of the total working population.

However, the permanently available manpower in the Study Area is estimated at about 37 900 people, which takes into consideration the temporary availability of some family members, particularly child-bearing women and mature children (Section A.2). This estimated manpower, at two members per household-family, still represents only 34% of the total estimated Study Area population. Therefore, even with the tremendous seasonality of labour needs, the maximum working population at any one time (e.g. May) represents only 57% of the estimated available workforce (Figure A.3). Theoretically, therefore, despite known periods of shortage, as indicated in Figure A.3, labour supply does not appear to be critical, particularly considering that this availability study has erred toward overestimation when calculating requirements. For example:-

(a) not all maize crops are weeded and irrigated three times, particularly in areas of marginal crop production away from the river and main canals (land use class 2);

FIGURE A.3

STUDY AREA CROP PRODUCTION
TOTAL DAILY LABOUR REQUIREMENTS AND AVAILABILITY (1977)



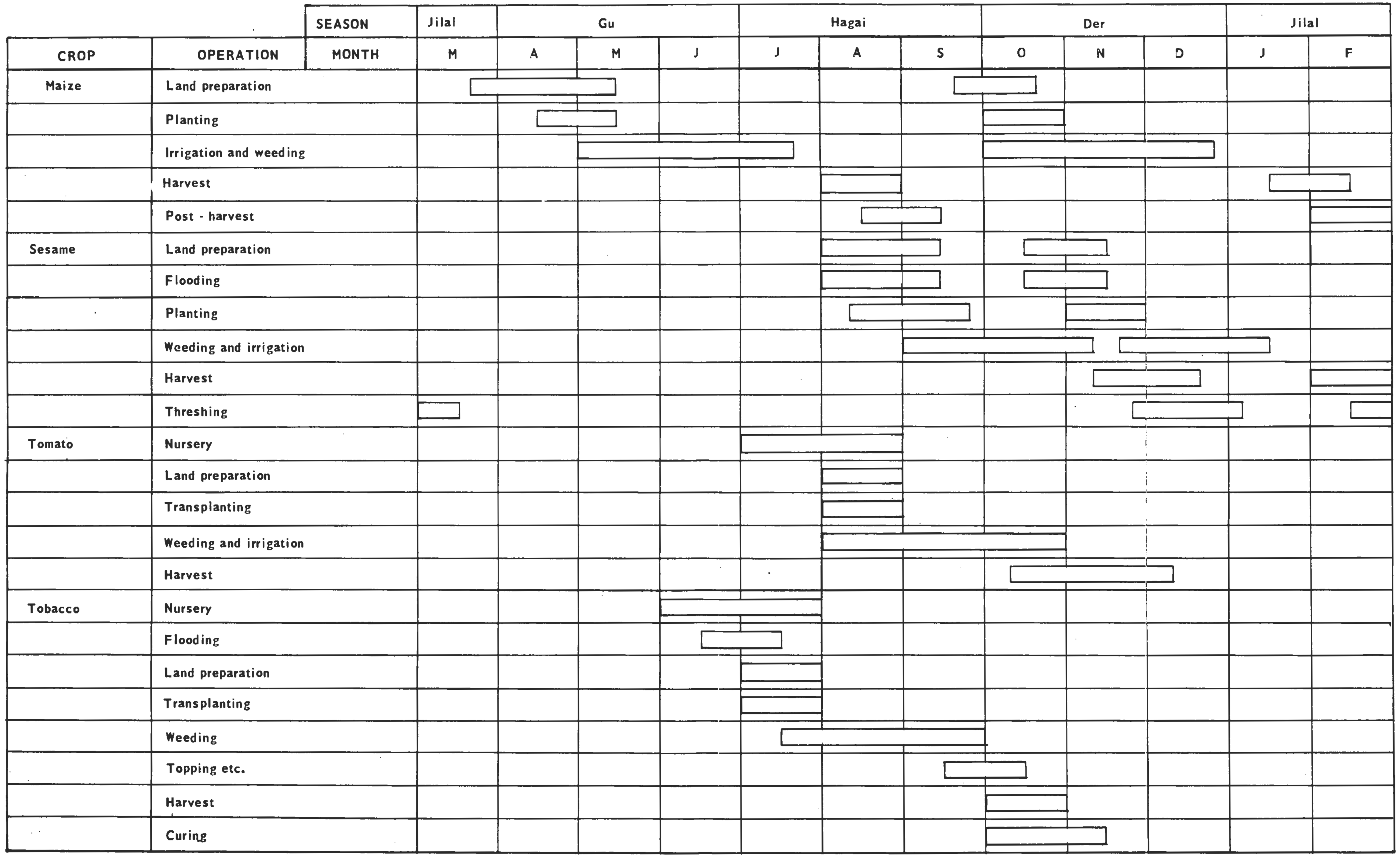
MONTH	M		A		M		J		J		A		S		O		N		D		J		F	
SEASON	Jilal		Gu						Hagai						Der						Jilal			
Annual Crop	4680	3930	5900	9380	17120	15740	10620	12850	10210	1830	7600	14050	8710	3920	6960	13560	16510	13290	11070	5710	1720	3160	13120	15060
Bananas	2360	2360	3500	3500	4640	4640	4640	4640	3500	3500	3500	3500	3500	3500	4640	4640	4640	4640	3500	3500	2360	2360	2360	2360
TOTAL	7040	6290	9400	12880	21760	20380	15260	17490	13710	5330	11100	17550	12210	7420	11610	18200	21150	17930	14570	9210	4080	5520	15480	17420

Maximum daily labour requirement:- 21760 working people per day (May)
Maximum available workforce :- 37880 people (3)
Maximum utilization :- 57.4% available manpower

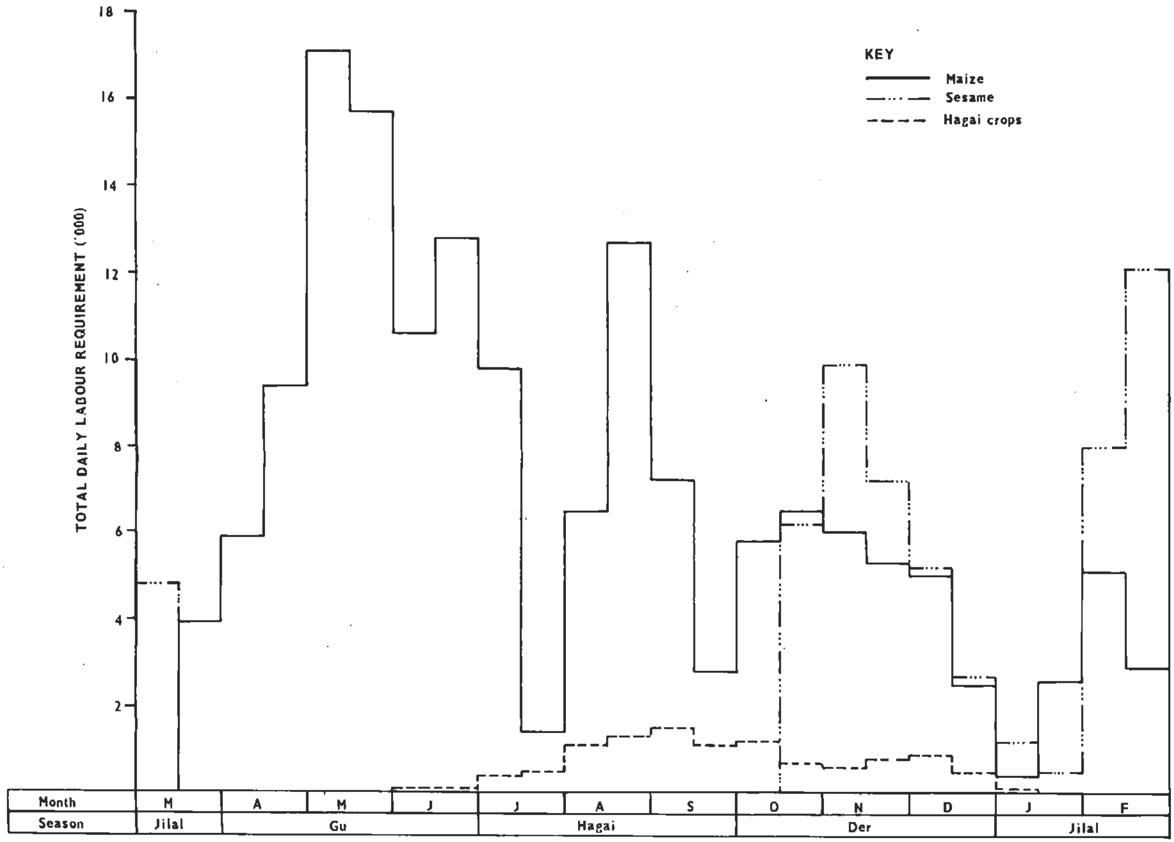
Notes:- (1) See Figure A.2
(2) See Section A.7
(3) See Section A.2

FIGURE A.1

STUDY AREA ANNUAL CROP PRODUCTION: CROPPING AND FIELD OPERATION CALENDAR



STUDY AREA ANNUAL CROP PRODUCTION: ESTIMATED SEASONAL DAILY LABOUR REQUIREMENTS (1977)



Crop	Season	NCA (ha)	M		A		M		J		J		A		S		O		N		D		J		F	
Maize	Gu	16590	–	3930	5900	9380	17120	15740	10580	12790	9840	1360	6520	12740	7210											
	Der	6636														2820	5780	6480	6030	5290	4990	2480	420	2630	5120	2910
Sesame	Hagai	1000											490	570	880	460	400	90	400	730	830	490	110			
	Der	9954	4680															6360	9900	7160	5180	2740	1190	530	8000	12150
Tomato	Hagai	350									50	50	410	600	400	400	410	300	110	110	70					
Tobacco	Hagai	250							40	60	320	420	180	140	220	240	370	330	70							
TOTAL			4680	3930	5900	9380	17120	15740	10620	12850	10210	1830	7600	14050	8710	3920	6960	13560	16510	13290	11070	5710	1720	3160	13120	15060

Average daily requirement for all annual crops = 9450 working people
All figures are 15 day means as calculated in Table A.3

N.C.A. = Net cultivated area

FIGURE A.2

(b) although the study has sharply defined cropping calendars, actual cropping seasons are spread over long periods, particularly in the der season; the assumed calendars represent about 80% of each crop, but labour requirements have been calculated assuming they include the entire crop; therefore, peak demand may be less than estimated;

(c) no estimate was made for the seasonal migratory labour arriving in the jilal season which, although annually variable, would increase available manpower;

(d) a working day is assumed to be only 4 hours per day.

The conflicting evidence of this theoretical permanent labour availability with known labour shortages cannot be explained in a simple way. Most adults and grown children are physically capable of performing the assumed 4 hours work a day. The speed at which planting and harvesting of traditional crops takes place, once it has been started, indicates that considerable effort can be stimulated during these times of the year. This capability of hard work confirms, again, that no labour shortage should exist. Therefore, the distribution of a labour pool in relation to the source of employment must be examined. Self-employment in smallholder agriculture is the predominant form of employment in the Study Area. In contrast, the greatest permanent demand for labour is centred upon the banana plantations which represent an elongated but compact gross area of about 7 500 ha (75 km^2) and which contains many evenly distributed, small villages. The area extends for about 30 km (see Map 1E) and assuming an immediate labour catchment area of a further length and width of 1 km, labour availability can be assessed from a gross area of 110 km^2. Estimated availability is given in Table A.8. This extension of the direct labour catchment area would include important villages like Buulo Mareerta, Majabto and Degwariiri. Table A.8 shows that, in theory, periodic labour shortages can exist. This is confirmed by the present practice of certain farmers of collecting labour from outlying villages.

However, labour shortages are reported elsewhere in the Study Area where demand for casual labour is much smaller and more isolated. One therefore needs to examine whether the working population requires extra employment and if payment for this labour is adequate. One common observation made was that the casual labour employed by both banana farmers as well as medium and large-scale maize and sesame farmers was predominantly women and teenage children. Labour rates for women and children are less than those demanded by men, being about 70% (for women) and 50% (for children) of the full wage. They are also more easily obtained and controlled as a result of the traditional relationship of male dominance. Wage rates will also fluctuate seasonally and annually, depending on climatic conditions and the success of each crop. On average, the cost for work involving an estimated four hours can vary from So.Shs. 4 to So.Shs. 12, but can be lower during or after bad seasons when many people seek work to alleviate food shortages.

Conversely, wage rates can occasionally rise up to So.Shs. 20 for the same amount of work. Therefore, under these circumstances, the labour availability problem also reflects a low motivation among the population to improve upon their basic subsistence requirements by seeking alternative employment away from the smallholding. It also reflects an obvious desire by farmers employing labour to minimise these costs for intensive field operations.

TABLE A.8

Study Area Banana Production: Estimated Labour Availability within Immediate Catchment Area

Data	Location: Plantations only	Location: Labour catchment area	Notes
Area	75 km^2	110 km^2	See text
Estimated population	12 530	18 730	167 per km^2 (1)
Number of household-families	2 110	3 100	5.93 members/family
Estimated permanently available labour	4 220	6 190	2 persons/family (2)
NCA annual crops by above families	925 ha	1 360 ha	Families / 37 900 (2) x 16 590 ha (3)
Maximum daily labour requirement for annual crops	955	1 400	NCA / 16 590 ha x 17 120 (4)
Average daily labour requirement	530	770	NCA / 16 590 ha x 9 450 (4)
Daily labour requirements for banana farms:			
(a) average	3 500	3 500	See Figure A.3
(b) maximum	4 640	4 640	
Estimated surplus daily labour available to banana farms:			
(a) average	3 690	5 230	e.g. 4 220 - 530
(b) minimum availability	3 265	4 790	e.g. 4 220 - 955

Notes:
(1) See Annex III, Chapter 4 (Population)
(2) See Section A.2
(3) See Section A.3
(4) See Figure A.2

APPENDIX B

STUDY AREA WEEDS

There is a wide range of annual and perennial plants that constitute the weed flora found throughout most parts of the Study Area, as well as other cultivated areas along the Shabeelle river. The FAO pilot project at Afgooye-Mordiile identified many common weed species, most of which are found in the Study Area (FAO, 1975; Table B.1). The most important weeds in the Study Area are discussed below.

Somali names are in parentheses.

Abutilon spp. (balambaal). Common throughout the area and a difficult weed once established due to its woody nature.

Cassia obtusifolia. Common and, like **Abutilon**, difficult to weed out by hand once established.

Chionothrix spp. (fiideey malabeey). Common, easily established weed. Serious weed in wet areas and rice crops.

Commelina diffusa (baar). Easily established, difficult to eradicate. Very common in rice crops and wet areas close to the river and major canals.

Cyperus spp. (gunje). Common only in wet areas near the river and main canals. Indicative of areas with adequate water supply for crop growth. Difficult to eradicate by hand cultivation.

Cynodon dactylon (deg-degow). Rarely problematic in annual crops but can be the most serious weed in banana fields, requiring deep-ploughing to effect good control.

Echinochloa sp. (caws jeereed). Common grass in rice fields and wet areas.

Eragrostis major (salbir, kuley). Common grass, difficult to eradicate.

Heliotropium ovalifolium (cadde-cadde). Common in drier areas and laborious to eradicate once established.

Ipomea spp. (barreyle). Common in most areas, particularly where wet. Most serious in rice crops.

Psolarea corylifolia (geed biyod). Very common weed in all crops. Very easily and quickly established, although easy to control if early weeding practised.

Sonchus spp. (kable). Serious weed, when found, in all crops.

Sorghum halepense (marsandey, maladhey). Prevalent grass in most crops and difficult to eradicate by hand cultivation.

TABLE B.1

Common Weeds in Somalia

Botanical name	Somali name
Abutilon fruticosum	Balambaal cad
Abutilon hirtum	Balambaal
Abutilon pannosum	Geed cad
Abutilon somalense	Balambaal geed
Achyranthes sicula	-
Aristolochia bracteata	Booro
Becium (Ocimum) obovatum	-
Brachiaria regularis	Qaalmo weeyneeye
Cenchrus ciliaris	Caws geereed
Chionothrix spp	Fiideey malabeey
Cissus rotundifolia	Carmo
Coleus spp	-
Commelina forskali	Baar
Convolvulus spp	Barreyle
Crotalaria pycnostacya	Geed garoob
Crotalaria scassellatii	Dharqo
Cucumis dipsaceus	Qara dameer
Cucumis ficifolius	-
Cucumis pustalatus	Qalboob
Cynodon dactylon	Deg-Degow
Cyperus chordorriizus	Qunje
Cyperus fenzelianus	Qunje
Cyperus immensus	Qunje
Cyperus nubucus	Qunje
Dactyloctenium ciliare	Dooyo
Digitaria scalarum	Kurde
Echinochloa haploclada	Xajimood
Enteropogon monostachys	Dareemo
Enteropogon ruspolianum	Hoorin
Erlangea conica	Karrawle
Eragrostis major	Salbir
Gymnopogon digitatum	Hoorin
Heliotropium benadirense	Daba haraan
Heliotropium ovalifolium	Cadde-cadde
Heliotropium pallans	Daba harraan
Hibiscus dongolensis	Balambaal madow
Hibiscus ovalifolius	Geed ashaamud
Hibiscus panduriformis	Balambaal madow
Indigofera arrecta	Elan
Indigofera articulata	Elan gini
Ipomoea spp	Barreyle
Lactuca traxicifolia	Kable
Momordica trifoliata	Alantooy
Nymphaea spp	Kawlo
Ocimum falcatum	Riimaan
Orthosiphon spp	-
Panicum pyramidatum	Caws weyne
Pavonia haematophtalmos	-
Pavonia grewioides	-

TABLE B.1 (cont.)

Common Weeds in Somalia

Botanical name	Somali name
Phaseolus spp	Geed waxarood
Phragmites vulgaris	-
Portulaca oleracea	Canyo weyn
Ricinus communis (wild castor)	Geed jinni
Scirpus spp	-
Solanum spp	Arundo
Sonchus exauriculatus	Kable xaraar
Sorghum arundinaceum	Makadeey
Sporobolus ruspolianum	Saydho
Sporobolus senegalensis	Jarop
Taninum portulacifolum	Kaamu'
Tetrapogon macranthus	Jeebin
Tetrapogon tenellus	Hoorin
Tragia cannabina	Canaaniye
Trianthema pentandra	Raasoow dameer
Typha australis	Kaxandho
Vigna vexillata	Geed waxarood

Source: FAO (1975)