MICROFICHE N° 05570

République Tunisienne

MINISTERE DE L'AGRICULTURE

CENTRE NATIONAL DE

DOCUMENTATION AGRICOLE

TUNIS

الجمهورية التونسية

وزارة الفلاحة

المركز القومي

للتوثيق الفلاحي

تونس

F 1

S. Ben Rhouma

PN-AAT-570

TUNISIA
INTERMEDIATE RAINFALL ZONE
DRYLAND FARMING PROJECT

SAGRIC INTERNATIONAL

TUNISIA
INTERMEDIATE RAINFALL ZONE
DRYLAND FARMING PROJECT

Prepared
for
THE OFFICE DE L'ELEVAGE ET DES PATURAGES,
MINISTRY OF AGRICULTURE,
GOVERNMENT OF TUNISIA

by

SAGRIC INTERNATIONAL

With funding assistance from:
THE TECHNICAL SUPPORT FACILITY,
DEPARTMENT OF TRADE AND RESOURCES,
COMMONWEALTH GOVERNMENT OF AUSTRALIA.

ACKNOWLEDGEMENTS

The Mission wishes to acknowledge the valuable assistance it received from the many people contacted in Tunisia during the preparation of this report. In particular, Mr. Habib Najar, President Director General of the Office de l'Elevage et des Paturages, and his staff were extremely helpful. Without this assistance the Mission could not have completed its task in the limited time available.

A list of the main persons contacted is given at Annex 7. Our thanks are extended to all these and to the many others not mentioned who gave their time and attention to the Mission's purpose.

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UNITS & ABBREVIATIONS

WEIGHTS AND MEASURES

Metric		Imperial
1 hectare (ha)	=	2.47 acres
1 litre (l)	=	.22 gallons
1 metric tonne (t)	=	2 205 pounds

CURRENCY

Currency Unit	=	Tunisian Dinar (TD)
TD 1	=	$A1.7 (December 1981)
$A1.00	=	$US1.12 (December 1981)

ABBREVIATIONS

BNT - Banque Nationale de Tunisie
(Tunisian National Bank)

CNEA - Centre National d'Etudes Agricoles
(National Centre for Agricultural Studies)

CRDA - Commissariat Regional de Developpement Agricole
(Regional Agricultural Development Commission)

DPA - Direction de la Production Animale
(Animal Production Department)

DPV - Direction de la Production Vegetale
(Crop Production Department)

DAPME - Direction pour l'Assistance aux Petites et Moyennes Exploitations (Department for the Assistance of Small and Medium Sized Farms)

FOSDA - Fonds Special pour le Developpement Agricole
(Special Fund for Agricultural Development)

ICC - Institut des Grandes Cultures
(Institute for Large Crop Schemes)

INAT	-	Institut National Agronomique de Tunsie (Tunisian National Institute of Agronomy)
INRAT	-	Institut National de la Recherche Agronomique en Tunisie (Tunisian National Institute of Agricultural Research)
OC	-	Office des Cereales (Cereal Board)
OEP	-	Office de l'Elevage et des Paturages (Livestock and Pasture-land Office)
OMIVAL	-	Office de Mise en Valeur du Lakhmas (The Office for the Development of the Lakhmas Valley)
OTD	-	Office des Terres Domaniales (Public Land Office)
SONAM	-	Societe Nationale de Motoculture (National Company for Agricultural Machinery)
UCP	-	Unite Cooperative de Production (Production Cooperative Unit)
UNAT	-	Union Nationale des Agriculteurs (Farmers National Union)
ERR	-	Economic Rate of Return
FU's	-	Forage Units
GOT	-	Government of Tunisia
HYV	-	High Yielding Varieties
IFAD	-	International Fund for Agricultural Development
IRZ	-	Intermediate Rainfall Zone
MOA	-	Ministry of Agriculture
NPV	-	Net Present Value
WFP	-	World Food Programme

Table 7: Equipment Costs - Phase 1

1. AUSTRALIAN SOURCED

Item	No.	Unit Cost $A	Cost cif.(1) Tunis TD
Tillage Equipment			
- Scarifier (21 tyne)	2	6 500	11 470
- Seed drill - with small seeds box (20-24 row)	2	15 500	24 618
- Booleroo plough	1	3 500	3 088
- Harrows	2	5 000	8 823
- Spare parts for above @ 20%	-	11 500	9 132
Other Equipment			
- Fencing - prefabricated sheep fence plus 3 barbs	2 km	2 400	4 235
- Jackman seed pickler	1	350	309
- Portable sheep yard (to work 200-250 sheep)	1	1 400	1 235
TOTAL			TD 62 910

2. MAY BE SOURCED ELSEWHERE

Item	No.	Unit Cost $A	Cost cif. Tunis TD
Tractors			
Bulldozer - D7 with angle blade	1	175 000	100 000(2)
100 PP wheeled tractor	3	42 000	111 177
60 HP " "	1	19 000	16 765
Machinery			
Harvester - 5.2 m self propelled	1	70 000	41 176
Hay baler	1	12 000	10 588
Rotary mower	1	4 500	3 970
Hay rake	1	2 200	1 941
Workshop equipment incl. welder, tools etc.	-	8 000	7 060
Spray unit	1	3 000	2 647
Grain auger (with insecticide applicator)	1	3 800	3 353

2. MAY BE SOURCED ELSEWHERE (Cont'd.)

Item	No.	Unit Cost $A	Cost cif. Tunis TD
Other			
Grain silo (16 000 L)	2	2 500	4 412
Portable sheep weighing crate	1	2 200	1 941
Fencing tools	-	500	441
Trailer (4-wheel)	2	3 500	5 558
Soil Surveying Equipment			
Level, staff, drafting table etc.	-	5 000	4 412
Training Equipment			
Photocopier, typewriter etc.	-	6 000	5 294
Vehicles(2)			
4 Wheel Drive Long Wheel Base	1	18 000	13 000
Station Sedans	2	10 000	7 222
TOTAL			340 957
GRAND TOTAL			403 867

(1) Does not include costs of Customs duty and clearance charges or transport to project site.
Conversion factors used:-
$A1.70 = TD 1.00
15% - handling charges
35% - freight and insurances

(2) Imported directly from overseas supplier. All other items are costed as if imported from Australia. Significant savings could probably be made if these items were obtained from European or American suppliers.

N.B. 20% spare parts are supplied with Australian tillage equipment. Spares for other equipment are purchased as required. Cost estimates included under operating expenses.

Table 8: System Evaluation - Phase 2 Preparation Costs - Phase 1

	TD				
	Yr 1	Yr 2	Yr 3	Yr 4	Total
System evaluation[a]	-	-	-	-	-
Phase 2 Preparation					
Professional fees[b]					
Agriculturalist	-	-	12 375	-	12 375
Animal Husbandry Specialist	-	-	12 375	-	12 375
Agricultural Extension Specialist	-	-	8 250	-	8 250
Rural Sociologist	-	-	8 250	-	8 250
Agricultural Economist	-	-	20 625	-	20 625
Agricultural Credit Specialist	-	-	8 250	-	8 250
Unallocated	-	-	4 125	-	4 125
Trilingual translators (3)	-	-	8 400	-	8 400
Sub total	-	-	82 650	-	82 650
Travel					
International travel	-	-	9 800	-	9 800
Internal travel	-	-	2 000	-	2 000
Sub total	-	-	11 800	-	11 800
Accommodation and meals	-	-	9 750	-	9 750
Other Costs					
Report preparation and printing	-	-	5 000	-	5 000
Secretarial time	-	-	2 000	-	2 000
Telephone, telex, photocopy, postage etc.	-	-	3 000	-	3 000
Sub total	-	-	10 000	-	10 000
TOTAL	-	-	114 200	-	114 200

(a) Costed under Farm Management Economist in Technical Assistance Costs (See table 6 this annex)

(b) TD 4 125/man month for all positions except TD 1 400/man month for translator.

Table 2: Summary of Phase 1 Costs (Tunisian Dinars x 1 000) Annex 4

	Year 1 Local	Year 1 Foreign	Year 1 Total	Year 2 Local	Year 2 Foreign	Year 2 Total	Year 3 Local	Year 3 Foreign	Year 3 Total	Year 4 Local	Year 4 Foreign	Year 4 Total	Total Local	Total Foreign	Total
1. OEP Farm Development															
Pasture Establishment & Management	2.0	4.7	6.7	2.7	4.2	6.9	2.8	6.6	9.4	3.3	7.8	11.1	10.8	23.3	34.1
Cereal Production	1.6	0.2	1.8	3.7	0.4	4.1	4.1	0.5	4.6	4.4	0.5	4.9	13.8	1.6	15.4
Soil conservation & erosion control	6.0	1.5	7.5	6.0	1.5	7.5	6.0	1.5	7.5	6.0	1.5	7.5	24.0	6.0	30.0
Livestock Development	3.5	-	3.5	9.4	-	9.4	17.7	-	17.7	12.6	-	12.6	43.2	-	43.2
Farm Infrastructure Development	40.0	10.0	50.0	-	-	-	-	-	-	-	-	-	40.0	10.0	50.0
Sub total	53.1	16.4	69.5	21.8	6.1	27.9	30.6	8.6	39.2	26.3	9.8	36.1	131.8	40.9	172.7
2. Training															
Study tours	0.5	30.4	30.9	-	-	-	-	-	-	-	-	-	0.5	30.4	30.9
Field days	0.3	-	0.3	1.0	-	1.0	1.0	-	1.0	1.0	-	1.0	3.3	-	3.3
Postgraduate projects	-	-	-	0.3	-	0.3	0.3	-	0.3	0.3	-	0.3	1.3	-	1.3
Sub total	0.8	30.4	31.2	1.3	-	1.3	1.3	-	1.3	1.3	-	1.3	5.3	30.4	35.9
3. Technical Assistance															
Farm Management Adviser	11.6	35.0	46.6	11.6	35.0	46.6	11.6	35.0	46.6	-	-	-	34.8	105.0	139.8
Soil Conservation Agronomist	11.6	35.0	46.6	11.6	35.0	46.6	11.6	35.0	46.6	-	-	-	34.8	105.0	139.8
Pasture Agronomist	-	-	-	11.6	35.0	46.6	11.6	35.0	46.6	-	-	-	23.2	70.0	93.2
Animal Production Consultant	1.5	11.1	12.6	1.5	11.1	12.6	1.5	11.1	12.6	1.5	11.1	12.6	6.0	44.4	50.4
Farm Management Economist	0.8	5.5	6.3	0.8	5.5	6.3	0.8	5.5	6.3	2.3	16.5	18.8	4.7	33.0	37.7
Pasture Agronomist Consultant	1.5	11.1	12.6	0.8	5.5	6.3	-	-	-	-	-	-	2.3	16.6	18.9
Other Consultants	0.8	5.5	6.3	1.5	11.1	12.6	1.5	11.1	12.6	1.5	11.1	12.6	5.3	38.8	44.1
Administration	[illegible]	23.5	[illegible]	7.1	10.6	17.7	7.3	14.1	21.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	82.4
Sub total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4. Equipment															
Australian Equipment	-	42.9	42.9	-	-	-	-	-	-	-	-	-	-	42.9	42.9
Other Equipment	-	388.9	388.9	-	-	-	-	-	-	-	-	-	-	388.9	388.9
Sub total	-	431.8	431.8	-	-	-	-	-	-	-	-	-	-	431.8	431.8
5. Project Evaluation & Phase 2 Preparation															
Professional fees	-	-	-	-	-	-	-	81.6	81.6	-	-	-	-	81.6	81.6
Travel	-	-	-	-	-	-	2.0	9.0	11.0	-	-	-	2.0	9.0	11.0
Accommodation	-	-	-	-	-	-	9.0	-	9.0	-	-	-	9.0	-	9.0
Other costs	-	-	-	-	-	-	2.0	8.8	10.8	-	-	-	2.0	8.8	10.8
Sub total	-	-	-	-	-	-	13.0	100.4	114.4	-	-	-	13.0	100.4	114.4
Total Base Cost	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Add Physical Contingencies 10%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Cost (Constant TD)(a)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Add Price Contingencies	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Cost (Current TD)(b)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(a) 1981 Prices
(b) Assuming 1982 start up.

A. 4.3 Phase 2 Financial and Economic Analysis

The following preliminary economic analysis aims to demonstrate that a broad-based project based on the introduction of improved farming systems in the IRZ could be economically viable, provided Phase 1 succeeds in proving the technology. The assumptions used in the economic analysis are listed below:

a) Labour is shadow priced at 75% of the wage rate. This estimate has been prepared by CNEA in association with World Bank economists and is used as a standard throughout Tunisia. There is some evidence that a lower figure should be used for the IRZ, and further attention should be given to this during Phase 2 prepe ation.

b) The shadow price of foreign exchange is 12% above the official rate. This estimate also comes from CNEA and the World Bank and reflects Tunisia's adverse balance of trade position and overvalued currency.

c) Incremental cereal production is valued at the border price, adjusted for internal transport costs. Cereal prices in Tunisia are controlled by the OC and do not necessaryily reflect world prices. Since incremental production would replace imports the economic value of the product at the farm gate is the border (CIF) price plus the costs of handling and transporting the grain from the entry port to the farm gate.

d) Incremental meat production is regarded as a non-traded good and is valued at its financial price. Although Tunisia imports meat and live animals for slaughter, the border pricing approach cannot be used for meat because there are substantial perceived quality differences between the local and imported products, (local is considered superior), and the market for imported chilled meat is quite separate from unchilled fresh-killed meat produced and consumed in the project area. There are no government controls on sheep prices.

e) All other prices are exclusive of taxes and subsidies.

f) Without the project, cereal and livestock production in the IRZ will decline at the rate of 2% per annum due to the effects of soil erosion and soil structural deterioration. This assumption, which has an important bearing on the estimated ERR, is little more than a guess at this stage and a more accurate estimate would be made during Phase 2 preparation.

g) The project life is 30 years after which all soils conservation structures will require rebuilding.

h) Phase 2 will commence after 3 years of Phase 1.

i) No attempt has been made to estimate benefits resulting from income redistribution, reduced urbanisation, increased employment or reduced dam siltation. In the latter case benefits may be substantial and an attempt would be made to estimate this during Phase 2 preparation.

j) The population of the IRZ is about 1 million of which 400 000 are rural. The target group would be the poorest third of the rural population, estimated to be about 20 000 families.

k) The total land area of the IRZ is about 1.4 million hectares. The target group own about 10% of the land area (140 000 ha), or 7 ha per family. Benefits would also flow to landowners outside the target group, leading to about one quarter of the agricultural land in the IRZ (350 000 ha) being converted to the improved agricultural system during the 5 year disbursement period of Phase 2. The 350 000 ha would have the following composition:

Arable crop land (30%)	105 000
Permanent pasture land (35%)	122 500
Rangeland (25%)	87 500
Unproductive wasteland (10%)	35 000
Total	350 000

Estimates of land use, production and income from the above 350 000 ha are shown in table 10. Table 11 provides estimates of farm income and operating costs in economic terms and shows that the project would generate an incremental economic benefit of about TD 21/ha. Assuming that production would build up over a five year period, the total economic benefit from the project would reach about TD 7.4 million annually at full development. The Net Present Value (1) of incremental economic benefits would be around TD 25 million after taking into consideration the assumed 2% decline in productivity if the project is not implemented.

(1) Assuming a 15% discount rate.

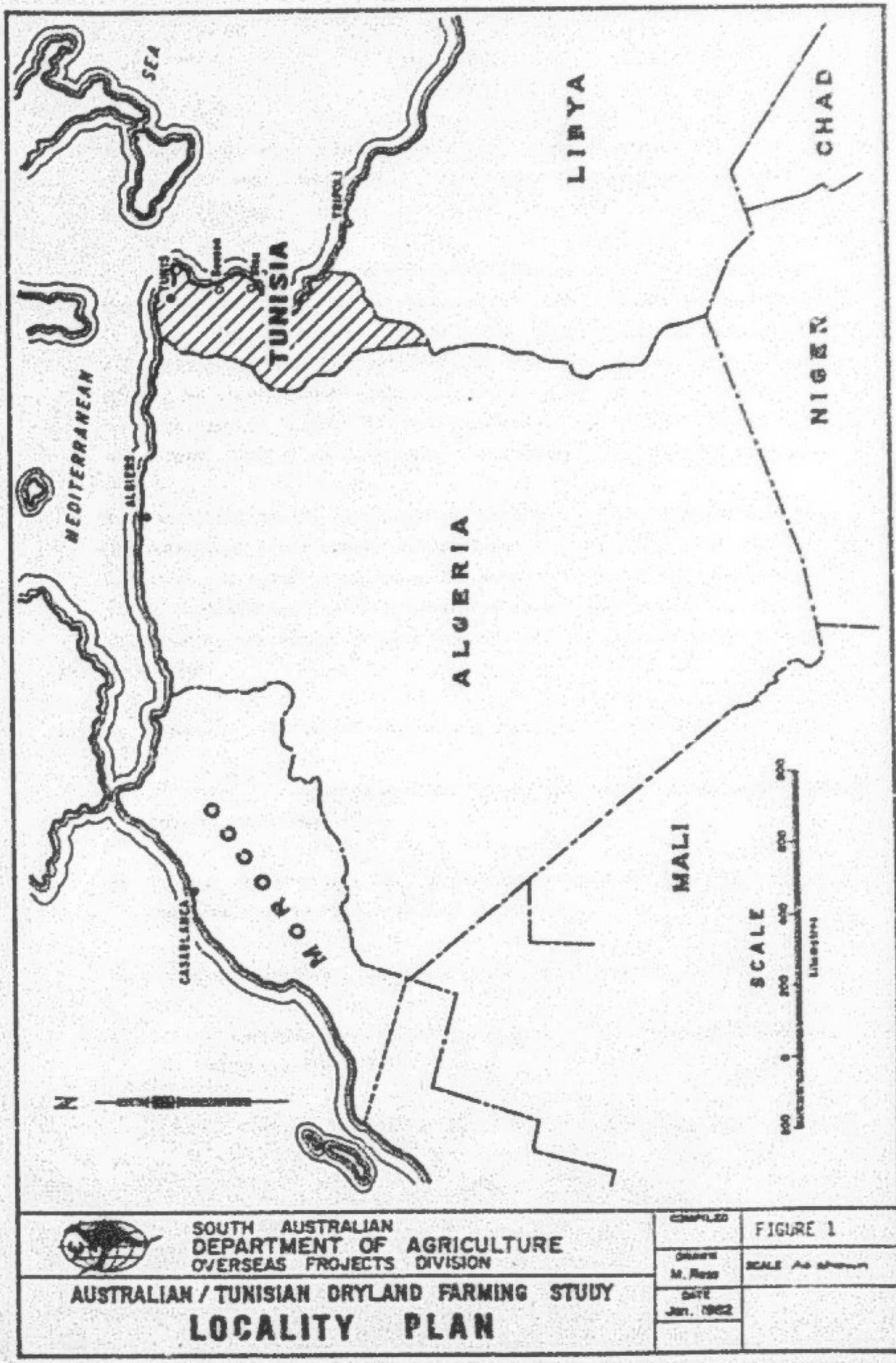
Table 10: Phase 2 - Land Use, Production & Income

		Present Situation	At full Development
1.	**Land Use**		
a)	**Arable cropland**		
	Area of wheat (50% durum, 50% soft)	17 500	23 625
	Area of barley	17 500	23 625
	Area of oats for grazing/hay	17 500	-
	Area of olives	10 500	10 500
	Area of fallow	42 000	-
	Area of medic	-	47 250
		105 000	105 000
b)	**Permanent Pasture land**		
	Area of unimproved pasture	122 500	-
	Area of improved pasture	-	122 500
c)	**Rangeland**		
	Area of unimproved rangeland	87 500	-
	Area of improved rangeland	-	87 500
d)	**Livestock**		
	'000 forage units (FU) produced	77 525	174 000
	'000 forage units purchased	20 000	-
	Ewes (or equivalent) carried	160 000	290 000
2.	**Production**		
	Wheat (t)	8 750	18 900
	Barley (t)	10 500	21 260
	Olives (t)	5 250	5 250
	Lambs	112 000	203 000
	Wool ('000 kg)	250	520

3.	Gross Income (financial)	'000TD		'000TD
	Wheat	801		1 730
	Barley	725		1 470
	Olives	630		630
	Lambs	5 040		9 135
	Wool	286		286
	Other products (eggs, vegetables, handicrafts etc.)	2 000		2 000
	Total Gross Income ('000TD)	9 482		15 251
4.	Farm Operating Costs (financial)			
	Labour (unpaid family labour)	-		-
	Fertilizer	25		230
	Tractor hire	475		159
	Seed	420		340
	Livestock feeds	800		-
	Sundries	200		200
	Total Operating Costs ('000TD)	1 920		920
5.	Total Gross Margin (financial)	7 562		14 322
	Total Gross Margin/ha	TD 21.60	TD	40.92

Table 11: Economic Analysis - Farm Income and Operating Costs

		Present Situation	At full Development
1.	Gross Income (economic)		
	Wheat	993	2 435
	Barley	589	1 439
	Olives	630	630
	Lambs	5 040	9 135
	Wool	286	286
	Other products (eggs, vegetables, handicrafts etc.)	2 000	2 000
	Total Gross Income ('000 TD)	9 538	15 925
2.	Farm Operating Costs (economic)		
	Labour	7 500	7 500
	Fertilizer	47	430
	Tractor hire	475	159
	Seed	520	422
	Livestock feeds	1 000	-
	Sundries	250	250
	Total Operating Costs ('000 TD)	9 792	8 761
3.	Total gross margin (economic)	-254	7 164
	Total gross margin/ha	TD -0.73	TD 20.47
	Economic benefits/ha	TD 21.20	



SOUTH AUSTRALIAN
DEPARTMENT OF AGRICULTURE
OVERSEAS PROJECTS DIVISION

AUSTRALIAN / TUNISIAN DRYLAND FARMING STUDY

LOCALITY PLAN

COMPILED	FIGURE 1
DRAWN M. Ross	SCALE As shown
DATE Jan. 1982	

Table 12: Economic Analysis - Summary of Benefits

Year	Ha. Developed	Economic Benefit[a] ('000 TD) Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11-30
1	40 000	-	210	420	630	840	840	840	840	840	840	840
2	60 000	-	-	315	630	945	1 260	1 260	1 260	1 260	1 260	1 260
3	70 000	-	-	-	367	734	1 101	1 468	1 468	1 468	1 468	1 468
4	80 000	-	-	-	-	420	840	1 260	1 680	1 680	1 680	1 680
5	100 000	-	-	-	-	-	525	1 050	1 575	2 100	1 100	2 100
Total Economic Benefit		-	210	735	1 627	2 939	4 566	5 878	6 823	7 348	7 348	7 348
Productivity Decline Without Project		19	48	80	116	158	155	152	149	146	143	63
Incremental Economic Benefit[b]		19	258	815	1 743	3 097	4 721	6 030	6 972	7 494	7 491	7 411

(a) Assumes economic benefit per ha. developed builds up as follows:

Yr 1	zero benefit
Yr 2	TD 5.25
Yr 3	TD 10.50
Yr 4	TD 15.75
Yr 5-30	TD 21.00

(b) Net Present Value of Total Incremental Economic Benefit with a 15% discount rate is TD 25 million.

Farm development costs (in economic terms) would total around TD 57/ha consisting of pasture establishment (TD 19/ha), soil conservation works (TD 15/ha), and livestock purchased or retained (TD 23/ha). Development costs would be spread over four years as shown in Table 13 below.

Table 13: Economic Analysis - Farm Development Costs

ear	Ha	Farm development costs (TD '000)								
	Developed	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9 +
1	40 000	570	570	570	570	-	-	-	-	-
2	60 000	-	855	855	855	855	-	-	-	-
3	70 000	-	-	998	998	998	998	-	-	-
4	80 000	-	-	-	1 140	1 140	1 140	1 140	-	-
5	100 000	-	-	-	-	1 425	1 425	1 425	1 425	-
otal	350 000	570	1 425	2 423	3 563	4 418	3 563	2 565	1 425	-

The net present value of farm development costs (15% discount rate) is TD 12 million. As the NPV of economic benefits is TD 25 million, public investment in infrastructure, credit, extension and other support services with an NPV of TD 13 million would be permissible, to achieve a 15% economic rate of return. Lower public investment would increase the ERR to perhaps 20%, but increase the risk of failure through inadequate support for farmers.

The composition of Phase 2 public expenditure would be detailed during preparation. Rough estimates indicate the following balance:

Extension	41%
Credit	19%
Phase 1 costs	16%
Soil conservation equipment	12%
Soil conservation manpower	8%
Farm machinery	4%
	100%

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Annex 6

ORGANISATIONS, AGENCIES ETC. RESPONSIBLE TO THE MINISTRY OF AGRICULTURE

(a) DIRECTORATES

- Directorate Administratifs (D.A.R.)
- " de L'Inspection
- " des Plans, Analyses et Evaluations des Projets
- " Affairs, Fonciers et Legislatives
- " de l'Enseignement, de la Recherche et de la Vulgarisation (D.E.R.V.)
- " des Ressources en Eau et Sol (D.R.E.S.)
- " des Etudes et Grands Travaux Hydrauliques (E.G.T.H.)
- " Genie Rural
- " des Forets
- " de la Production Animale (D.P.A.)
- " des Peches
- " Service Veterinaire
- " Pour l'Assistance aux Petites et Moyennes Exploitations (D.A.P.M.E.)

(b) SERVICES EXTERIEURS - C.R.D.A's. - one per Governorate

(c) STATUTORY AUTHORITIES (Agencies)

- Office des Cereales (O.C.)
- " de l'Elevage et des Paturages (O.E.P.)
- Office des Terres Domaniales (O.T.D.)
- " de la Medjerda
- " de l'Huile
- " des Peches
- " du Vin
- " du Mise en Valeur de Lakmes
- " " " " " " des Perimetres de Jendouba
- " " " " " " de Nebhaana.

Annex 6

(d) OTHERS

- Institut National Agronomique de Tunisie (I.N.A.T.)
- " " de Recherche Agronomique de Tunisie (INRAT)
- " " de Recherche Forestiere
- " de Recherche Veterinaire (I.R.V.)
- Ecole Nationale de Medecine Veterinaire (E.N.M.V.)
- Centre National d'Etudes Agricole (C.N.E.A.)
- Co-operative Controle des Grand Cultures (C.C.G.C.)
- " " des Semences en Plants Selectionres (C.C.S.P.S.)
- Groupement Interprofessionnel des Agrumes (G.I.A.F.)
- " " des Dattes (G.I.D.)
- Unite Co-operation de Production (U.C.P.)
- Grafoupast - (organisation for introduction and distribution of grain forage and pasture seeds).

Annex 7

PERSONS CONTACTED IN TUNISIA

MINISTRY OF AGRICULTURE

Mr. Kamoun	Director, International Studies

Office de l'Elevage et des Paturage

Mr. M.H. Majar	President-Director-General
Mr. Balte	Director of OEP farms
Mr.M. Guellouz	Assistant Director OEP
Mr. Balhaz	Dairy Officer
Mr. Chouki	Agronomist
Mr. Said Mohamed	Officer Livestock Studies
Mr. Alaloot Salah	Officer Milk Production
Mr. Hasaine	Manager of the Sanoaf and Djebibina Farms

Department of Planning

Mr. Sahnoun

Mr. Boujbta

Department of Forestry (Soil Conservation)

Mr. H. Hiran	Director Soil Conservation
Mr. W. Biertmann	FAO Consultant

Office of Cereals

Mr. El Adab Abderrazak	President-Director-General
Mr. Ghodbane	Section Leader
Mr. A. Haddad	Crop Agronomist
Mr. Gouti Ibrahim	Extension Officer Kairouan

CRGR

Mr. Si Elsheddine Amami	Director

Annex 7

Grafoupast

Mr. Jabeur Ammar	Director

Department of Soil and Water Resources (DRES)

Mr. Mami	Officer, Soil & Land Use Plans

Dept. Animal Production

Mr. Kassani	Director
Dr. Trigi	Chief, Forage Production

INAT

Prof. A. Dahmane	
Mr. Zouaghi	Forage Production

INRAT

Mr. Seklani	Pasture Agronomist

CNEA

Mr. Jaballah	
Mr. Mtibaa	

ANDEAR

Mr. Chabbi	Directeur

Annex 7

ZAGHOUAN GOVERNORATE OFFICE

CRDA

Mr. Ali Haddad	Commissaire
Mr. Bachir Khaldi	Chef d'Agence OEP
Mr. Jlassi	
Mr. Mahjoub	Forestry Officer
Mr. Zarboui	Extension Officer, Office de Cereals

North-West Project

Mr. Harzallah	Directeur

FIN

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VUES

CHAPTER 1

SUMMARY

1.1 This report presents a design for a project aimed at improving farm incomes and reducing soil erosion in the intermediate rainfall zone (250-400 mm p.a.) of Tunisia.

1.2 Until recently the Tunisian Government has concentrated on developing agriculture in the higher rainfall areas, (more than 400 mm). Currently it is giving more priority to the intermediate zone, (250-400 mm), where agriculture is based on a cereal-fallow rotation combined with livestock grazing on crop residues, volunteer pastures and rangeland. Increasing human population is placing great pressure on the region's land resources, and current farming practices are contributing to severe soil erosion.

1.3 More efficient and productive use of the land resources is possible with the introduction of farming systems based on greater integration of livestock and cereal production. In similar climatic and soil conditions in southern Australia a system based on cereal/medic rotation, shallow cultivation, controlled grazing and soil erosion control has been highly successful.

1.4 The potential benefits of introducing this system are substantial:-

a) increased livestock production through the use of annual legume pasture instead of fallow;

b) halting the long term decline in land productivity by improving soil conservation practices and soil fertility;

c) increased cereal yields due to improved cultural practices;

d) reduced nitrogen fertiliser requirements due to nitrogen fixation by the legume pastures; and

e) reduced costs of cultivation because of shallow tillage technology.

This system has been successfully adopted in Libya and considerable research has been carried out on various components of it in Tunisia - generally in the rainfall zones above 400 mm p.a. However, some further testing is required to adapt the system to the intermediate rainfall zone prior to the initiation of any broad scale extension program.

1.5 A two-phase project is therefore proposed:-

a) Phase 1; Based on the two O.E.P. farms at Saouaf and Nadhour it would test, adapt and demonstrate the system and provide the basis for a much larger;

b) Phase 2; an extension programme aimed at adoption of the system by small and medium scale farmers throughout the intermediate rainfall zone. This phase would possibly require international funding.

1.6 Phase 1, described in detail in Chapters 6 and 7, would last for 4 years and cost TD 1.471 million at constant 1981 prices. If commenced in late 1982 allowances for inflation will add an estimated TD .222 million for a total cost of about TD 1.693 million. Later commencement will add further to this figure.

This cost is made up of:-

	T.D.
a) Farm development	174 000
b) Training	33 900
c) Technical Assistance	611 300
d) Farm Machinery and Equipment	403 800
e) Evaluation and Phase 2 preparation	114 200
f) Contingencies	133 700
Total	1 470 900

1.7 Phase 2, which will be specified in detail as a component of Phase 1 may in fact commence prior to the completion of Phase 1. It would comprise:-

a) on farm investments in seeds, fertilisers, livestock and soil conservation,

b) extension training,
c) rural credit,
d) staff training,
e) technical assistance,
f) investment in special small scale farming equipment.

No detailed costings are possible at present but preliminary estimates indicate an economic rate of return of 10%-20% for the project as a whole.

1.8 It is estimated that the gross margin of an average 10 ha farm could be increased from around 216 TD p.a. currently to around 409 TD after adoption of the new technology. This would significantly improve the incomes and living standards of the small and medium farmers of the zone.

In addition the project would provide increased employment during construction of soil conservation structures and at the national level would contribute to the Governments objectives of increasing food self-sufficiency, reducing rural-urban migration and improving the balance of trade.

1.9 Effective use of project inputs and resources would require liaison between and the co-ordination of the activities of many organisations within the Tunisian buresucracy. During Phase 1 this could be achieved by a Project Steering Committee comprising representatives of the relevant organisations. For Phase 2 however, it is recommended that an independent Regional Development Authority be established.

1.10 Phase 1 should be programmed to commence in the autumn season. This proposal assumes commencement in September 1982. If this is to be achieved a contractor will have to be engaged by May 1982 in order to complete recruitment, purchasing and shipping in time for the agricultural season.

CHAPTER 2
INTRODUCTION

Following discussions between the Ministers of Agriculture of Tunisia and South Australia in May 1979, the Tunisian Government requested assistance to identify and prepare a project to improve dryland farming systems. Although the report of the first mission from South Australia in November/December 1979 was not acted upon, Tunisian interest in Australian dryland farming expertise remained high. When the new South Australian Minister for Agriculture visited Tunisia in December 1980 it was agreed that a second mission should investigate and design a project based on the two state farms at Nadhour and Saouaf in the intermediate rainfall zone.

The mission team arrived in Tunis on 24th November and departed 17th December 1981. It comprised Mr. C.S. Haysen, (Mission leader); Mr. R. French, (Agriculturalist); and Mr. D. Young, (Agricultural Economist). The Mission was funded jointly by the Australian and South Australian Governments with valuable assistance from the Government of Tunisia (GOT). The specific GOT agency responsible for this study was the Office de l'Elevage et des Paturages, (O.E.P.).

Within the limited time available the team toured briefly the intermediate rainfall zone in the Governorates of Zaghouan and Sousse; investigated the two farm sites; studied the available literature relating to the region; and consulted with Tunisian Authorities and experts in the field of dryland farming at both Governorate and central Government level.

CHAPTER 3
AGRICULTURAL BACKGROUND

3.1 OVERVIEW

Tunisia became independent of France in 1956 and is currently a one-party state ruled by President-for-life Habib Bourguiba. The country enjoys cordial relations with France and is a member of, and provides the headquarters for, the Arab League in Tunis.

The population of approximately 6.7 million (based on 1975 census), is increasing at a rate of 2.6% p.a., and is concentrated on the Northern Mediterranean coast, with the interior relatively arid and sparsely populated, especially in the south. Overall population density is 37/km^2, and the urban population is about 35% of the total. Nearly 1.4 million people are at school or in training, reflecting the youthful structure of the population and the Government's high priority for education. There are 31 000 students at university and 10 000 studying abroad.

Around 40% of the labour force is engaged in agriculture, but unemployment and underemployment in rural areas is widespread. Some 350 000 Tunisians are employed in foreign countries, notably about 200 000 in France and 80 000 in Libya.

The national product is particularly sensitive to agricultural conditions and the prices for crude oil and phosphates. The agricultural sector accounts for approximately 15% of GDP and contributes around 20% of exports. GDP per capita was about $US900 in 1979, and annual economic growth was 6.2% under the former development plan (1973-76), and about 4.5% under the current plan (1977-81). The 1979 GDP structure is shown in Table 3.1.

TABLE 3.1: STRUCTURE OF GDP AT CURRENT PRICES, 1979 (TUNISIAN DINARS)

Sector	Millions of Dinars	% of Total
Agriculture and Fisheries	405.5	16.8
Mining and Quarrying	28.7	1.2
Energy - Oil and Gas	198.6	8.2
- Electricity etc.	49.5	2.0
Manufacturing Industry	294.1	12.2
Construction and Public Works	208.0	8.6
Tourism	114.4	4.7
Other Non-Administrative Services	775.2	32.1
Administrative Services	344.0	14.2
TOTAL	2418.0	100.0

3.2 AGRICULTURE IN THE TUNISIAN ECONOMY

About 60% of the country's area is suitable for some form of farming. Dryland farming predominates so production fluctuates greatly due to the uncertainty of rainfall. Of 3 million hectares of arable land only 120 000 hectares are irrigated. Wheat, barley, oats, maize and sorghum are the main cereal crops, and grapes, olives, citrus, dates, figs and sugarbeet are also grown. Tunisia is the world's second largest olive oil exporter. In 1979 livestock comprised 6 million sheep, 1.1 million goats, 1 million cattle, 350 000 horses and mules and 80 000 camels. Agricultural production is summarised in Table 3.2.

TABLE 3.2: SUMMARY OF AGRICULTURAL PRODUCTION ('000 tonnes)

Item	1976	1977	1978	1979	1980
Wheat	880	613	707)		
Barley	270	133	200)	950	1100
Citrus Fruits	161	160	220	183	160
Olive Oil	90	136	85	90	85
Dates	42	33	45	n.a.	n.a.
Tomatoes	250	320	260	300	280
Wine	58	63	41	55	n.a.
Sugarbeet	n.a.	118	80	52	n.a.

Chapter 3.

Agriculture plays an important part in employment with some 40% of the workforce employed in agriculture. Agricultural GDP grew at 6.8% per annum in real terms between 1970 and 1978 but the share of agriculture in the economy fell and the country remains a net importer of food.

3.3 CEREAL PRODUCTION

3.3.1 Statistics

The annual demand for cereals is about 1.5 m tonnes (15 m quintals) and although Tunisia exports some special lots of hard wheat it imports from 0.3 - 0.7 m tonnes per year.

About 65% of the area sown to cereals and 85% of the production is in Northern Tunisia. Wheat yields average about 1 tonne/hectare in the North, but only 0.4 - 0.5 tonnes/hectare in the Centre. Higher yields are now being obtained with improved varieties of both durum and soft wheats, and reach as high as 3.5 tonnes/ha in the best fields.

Barley yields about 1 tonne/hectare in the North and about 0.4 tonne/hectare in the Centre where it is more widely grown than wheat.

TABLE 3.3: CEREAL YIELDS t/ha

	1977	1978	1979	1980/
Durum Wheat				
- North	.81	1.08	.97	1.23
- Centre	.22	.24	.27	.30
Soft Wheat				
- North	1.15	1.31	1.16	1.72
- Centre	.62	.36	.42	.63
Barley				
- North	.63	.92	.87	1.13
- Centre	.32	.27	.32	.42

Source - *Enquete par mesure objective sur les rendements cerealiers* 1980 (February 1981).

About 10% of the cereals are grown on State farms (O.T.D., U.C.P. and pilot farms).

3.3.2 Cultural Practices

The cereals are mainly grown in rotation with *jachers*, (stubble and ploughed fallow), occasionally there is a year of forage such as vetch and oats in the rotation. Only 8 - 10 000 hectares include medicago pasture in the cereal rotation.

Responses to nitrogen fertiliser are usually obtained in Northern Tunisia and 50 kg/ha of 33% ammonium nitrate are commonly applied with the 150 kg/ha of 45% superphosphate.

Deep ploughing is a regular feature of land preparation for cereals.

While this type of ploughing may help control weeds it is detrimental when applied to the soil types found in Tunisia. soil structure is broken down and moisture retention reduced. Deep ploughing inverts the soil, thus burying any plant seeds present in the surface layers. This it cannot be successfully used in a medicago rotation in which regenr-eration of the legume is dependant on maintaining a reserve of seed in the top 6-8 cms of the soil.

Soil erosion is currently widespread. Maintenance of cereal yields will be very dependent on controlling the devastating erosion.

In general, cereal production needs to be increased, and costs of production reduced. Increased yield will come from better varieties, the inclusion of a year of legume forage in the rotation instead of fallow, and a greater attention to timeliness of sowing. The latter factor is particularly important on the small farms without tractors and seeding equipment, for these farmerr have to rely on equipment provided by a hiring service e.g. SONAM.

Reduced costs of production should be possible by reducing the depth of cultivation of all land preparation prior to sowing and, in the longer term, by reducing the cost of nitrogen fertiliser through gains in soil nitrogen from legume pastures.

In the past, the agricultural services have tended to overlook the small farmers. In the future more projects should be aimed at helping this sector of agricultural production. There are significant gains to be made by so doing.

3.4 LIVESTOCK PRODUCTION

Livestock numbers in Tunisia have reached as many as 6 million sheep with a further 1 million cattle, 1.1 million goats, 0.35 million horses and mules and 80 000 camels. These numbers are insufficient to feed the increasing population and the number of livestock imported in 1978 was 14 500 sheep and 7 000 cattle, together with imported foodstuffs amounting to 18 000 tonnes of milk products and powdered milk, 2 500 tonnes of butter, 2 500 tonnes of cheese and 4 000 tonnes of meat. The sheep comprise about 6 different fat tailed breeds.

Livestock are kept on most of the small farms and are the main source of cash income but are not common on the larger farms because of time and labour constraints and because of good markets for hay.

About 30% of the sheep and 70% of the cattle are in Northern Tunisia.

Sheep flocks are looked after during the day by shepherds and returned to yards at night. One shepherd can manage a flock of up to 200 sheep and

his income is based on an entitlement of lambs (equal to 10% of the flock), a bonus if lambing percentage is above 96%, and the rights to graze up to 15 sheep equivalents of his own with the flock.

Sheep are kept mainly for meat production; wool production is only about 2-2.5 kg per head. Feed requirements are calculated from a forage unit, (FU), equal in food value to 1 kg of barley grain. A ewe unit (refer page 76 for definition), requires 600 FU/annum, a cow, 1500 FU/year, a horse 500 and a goat 300. FU values for different types of forages and foodstuff have been determined as a basis for defining carrying capacity. Hand feeding of sheep with hay and concentrates is a common practice on many farms. It is probable that the level of concentrate feeding is greater than the maintenance requirement of sheep.

There are very few watering points for livestock, and flocks may travel many kilometres daily to public wells often crossing many land holdings in the process.

COT policy for the period 1982-86 is to increase sheep numbers by 3.5% per year in the North and by 1.5% in the South. Subsidies and controlled prices have been used as incentives to increase production, although their importance is now diminishing.

Increased livestock production could be achieved on the arable land of many farms through increasing the units of forage in a cereal rotation by replacing the fallow with leguminous forages. Similarly leguminous pastures could carry more livestock in permanent pasture land (parcours) through extra forage and hay production, while on selected areas of uncultivated land, the planting of shrubs e.g. Atriplex, Acacia and Cactus would further increase the amount of feed available.

3.5 AGRICULTURAL DEVELOPMENT OBJECTIVES

The Fifth Developement Plan (1977-1981) emphasised investment in rural infrastructure and the achievement of food self sufficiency. Increased rural incomes, erosion control and employment were subsidiary goals. Now

that the infrastructural constraints of agricultural development have been largely overcome, the Sixth Development Plan (1982-1986), currently being prepared, emphasises directly productive investment to increase rural incomes, particularly among the poorer sectors of the farming population; improved employment; and erosion control to preserve the nation's scarce land resources. The Sixth Plan aims at increasing total agricultural production by 5% per year, with livestock production increasing by 7%. The emphasis on livestock is intended to achieve self sufficiency in meat to replace rapidly growing imports and 75-80% self sufficiency in milk production.

GOT hopes to work towards the development plan objectives by assisting farmers to modernise their production methods through improved extension services and the provision of credit for purchases of improved seeds, fertilisers and other inputs. To date efforts have been concentrated in the higher rainfall northern areas, but there is increasing awareness of the special needs of landholders in the IRZ. GOT will therefore allocate high priority to IRZ projects, particularly if increased animal production is one of the objectives.

The Fifth Plan allocated TD 584 million to agricultural investment which was 13% of the total Government investment target. During the Sixth Plan GOT has increased the share of agriculture to 19% (TD 1360 million) of total investment. Agencies such as the World Bank and IFAD have recently approved large loans for smallholder oriented agricultural development projects. It is envisaged that the major development assistance agencies will continue to support agriculture during the next five years.

3.6 INSTITUTIONS IN THE AGRICULTURAL SECTOR

3.6.1 Agricultural development in Tunisia is affected by a large number of institutions and agencies. Dominant among these is the Ministry of Agriculture which, in addition to the Department of Agriculture and its many Directorates, is ultimately responsible for a number of semi-autonomous Statutory Authorities. The Ministry also has important administrative and coordinating powers at the Governorate level through its Commissariat Regional de Developpement Agricole (C.R.D.A.).

The co-ordination by the C.R.D.A. involves not only the specialised units belonging to the Ministry, (Directorates), but also the many authorities responsible to the Ministry. The C.R.D.A. co-ordinates the operations and plans of action of these Directorates and Agencies. Technical direction however, remains with the Tunis-based headquarters organisation.

The institutions for agricultural research (I.N.R.A.T.) and education (I.N.A.T.) are also responsible to the Ministry of Agriculture.

Refer to Annex 6 for a full list of the organisations within this Ministry.

There is considerable overlapping and duplication of function and responsibility between these groups. The variety of different bodies providing extension services tends to create confusion among small farmers.

3.6.2 There are other agencies not directly connected with the Ministry of Agriculture which have considerable influence on agriculture. The following are the most important:-

- Banque Nationale de Tunisie (B.N.T.) - has ultimate control over most sources of rural credit.

- Societe Nationale de Motoculture (SONAM) - a public corporation which rents, repairs and sells mechanised farming services to farmers.

- Union Nationale des Agriculteurs (U.N.A.) - the farmers union. Provides a means for a dialogue between the GOT and the farming community.

3.7 CONSTRAINTS TO AGRICULTURAL DEVELOPMENT IN THE I.R.Z.

Tunisia is placing considerable emphasis on agricultural development. There have been a number of significant successes but there are still a number of constraints to be overcome. This is particularly so in the IRZ where development efforts have until now taken a lower priority to that of the higher rainfall areas. The following are among the more important.

3.7.1 Environmental

(a) The low rainfall, (250-400 mm), of the zone, combined with its erratic and unreliable incidence inevitably mean that agricultural production is accompanied by a high degree of uncertainty and risk.

(b) The soils of the area are often badly eroded and tend to be depleted of organic matter and essential plant nutrients - particularly nitrogen and phosphorus.

3.7.2 Socio-Economic

(a) Traditional farming methods, which make less than optimum use of these resources, combined with a fragmented land tenure system and generally small holdings, result in low farm-sourced income for most farmers.

(b) Few farmers have adequate title to their lands and are thus unable to obtain loan finance for permanent improvement at reasonable rates.

(c) These factors, combined with the high risk environment, lead to a strong tendency on the part of small farmers to avoid increased risk. Any practice which involves increased expenditure is perceived as increasing risk.

3.7.3 Bureaucratic

(a) There is a multiplicity of organisations within the Ministry of Agriculture and associated bodies, (some 50 separate bodies are responsible to the Minister of Agriculture), many of whom have overlapping responsibilities.

(b) At the farm level each of several Ministry Departments and Agencies are carrying out separate extension programmes. Programmes are discipline-distinct. There is a need to introduce an integrated land or whole-farm management approach drawing together these separate disciplines.

(c) Credit facilities for farmers are likewise complex with several organisations involved. Lending policy varies depending on the original source of finance. Action is currently being taken to rationalise the rural credit structure and to allow more farmers access to necessary financial assistance.

3.7.4 Infrastructural

(a) The agricultural areas of Tunisia are typified by poor and inconvenient access to potable water for both humans and livestock. A considerable amount of time and transport are expended each day in water hauling or in taking stock to water.

(b) The tertiary road system is poor making it difficult to provide services to farmers, and restricting market access, particularly for perishable produce. This constraint will be gradually overcome as the national programme for rural road improvement is implemented. It is scheduled to begin in 1982.

3.7.5 Technological

(a) There is a considerable stock of heavy disc cultivation equipment in the rural areas. Such equipment is suitable for the deep ploughing used in the current cereal/fallow farming system but is inappropriate for a cereal/medic system where shallow tillage is essential and tyned implements are better suited.

(b) Although natural medicago species are widely distributed in the zone their use in a cereal culture is understood by few farmers. The correct use of grazing to ensure full utilisation and maintenance of medicago pastures requires both an understanding of the medicago plant habits and of sheep management.

(c) Tunisian farmers tend to approach farming on an enterprise by enterprise basis. It is necessary however to develop a systems approach so that the inter-relationships of each enterprise to each other enterprise are understood.

CHAPTER 4

PROJECT RATIONALE AND OBJECTIVES

Tunisia has enjoyed rapid economic growth during the 1970's, but food production has not kept pace with increasing demand, and imports of meat and cereals have grown rapidly. Economic growth has been unbalanced with the secondary and tertiary sectors outstripping the primary sector. Incomes of the rural population (38% of the total) are now well below the national average, unemployment is high and there is increasing rural-urban migration. Recognising these problems the Sixth Development Plan, presently being prepared, is allocating an increased proportion of public developmental expenditure to the agricultural sector. Specifically the plan aims to increase agricultural production to reduce food imports, increase the incomes of the small and medium farmers who form the bulk of the rural population, control soil erosion, create employment and reduce urbanisation.

In recent years the Government has concentrated on developing agriculture in the higher rainfall areas (more than 400 mm), but is now giving higher priority to the IRZ (250-400 mm). Here, agriculture is based on a cereal-fallow rotation combined with livestock grazing on crop residues, volunteer pastures and rangeland. Landholdings are small and fragmented and the increasing human population is forcing farmers to increase cropping intensity resulting in deteriorating soil structure and fertility and accelerating erosion. It will therefore prove difficult with existing agricultural practices for the Government to achieve the objectives of improving the welfare of private farmers and increasing production. Knowing this, the OEP requested assistance from the South Australian Government to help test and demonstrate improved farming systems in the IRZ. The OEP indicated that the first step would be to test the improved systems on two of its farms. OEP envisaged that the improved system would be similar to that practised in the intermediate rainfall cereal zone of southern Australia.

The southern Australian system, known as "ley farming" was developed over the last 40 years in response to the problem of declining cereal and livestock production and increasing soil erosion in a region with similar ecological features to those of Northern and Central Tunisia. Its main features are:-

(a) incorporation of annual medicago species in the crop rotation to provide nitrogen, soil organic matter, erosion protection and forage.

(b) with appropriate shallow cultivation, once established, the medicago regenerates after each crop from ungerminated (hard) seed laid down in the previous pasture phase.

(c) adaptation of grazing management will ensure adequate seed set and carryover.

(d) phosphate fertiliser is applied in both the cereal and pasture phases.

As the medicago species used in southern Australia occur naturally in the Tunisian IRI it is likely that the system could be introduced to the IRI as part of an agricultural modernisation package.

Research on medicago technology in Tunisia has provided encouraging results, and other aspects of the proposed modernisation package (high yielding cereals, soil conservation etc.) are sufficiently developed for immediate application. However COT feels that it would be prudent to test and demonstrate the whole package on state farms as a first phase. If successful there would then be a second phase to extend it throughout the IRI.

The CRP farms at Sacouf and Medhour provide an opportunity to complete this testing in an area which is representative of the IRI as a whole. The two-phase approach would enable resolution of any special technical problems specific to Tunisia. It would also enable staff to be trained for implementing Phase 2, and provide time for detailed Phase 2 planning especially in relation to land tenure and associated credit problems, extension programmes and organisational needs.

The modest size of Phase 1 has been determined with regard to the funding capacity of CRP which would be responsible for implementation. Phase 2 which may be supported from external financial resources would form the bulk of the project costs.

CHAPTER 5
THE PROJECT AREA

5.1 Location

The project area is the intermediate rainfall zone (IRZ) with an annual rainfall of 250-400 mm. In general, the zone extends in an arc from Enfida to Kasserine.

The IRZ occupies about 13 000 km^2 and extends across the whole or part of the Governorates of Sousse, Zaghouan, Monastir, Kairouan, Sidi Bou Zid and Kasserine (see Figure 2).

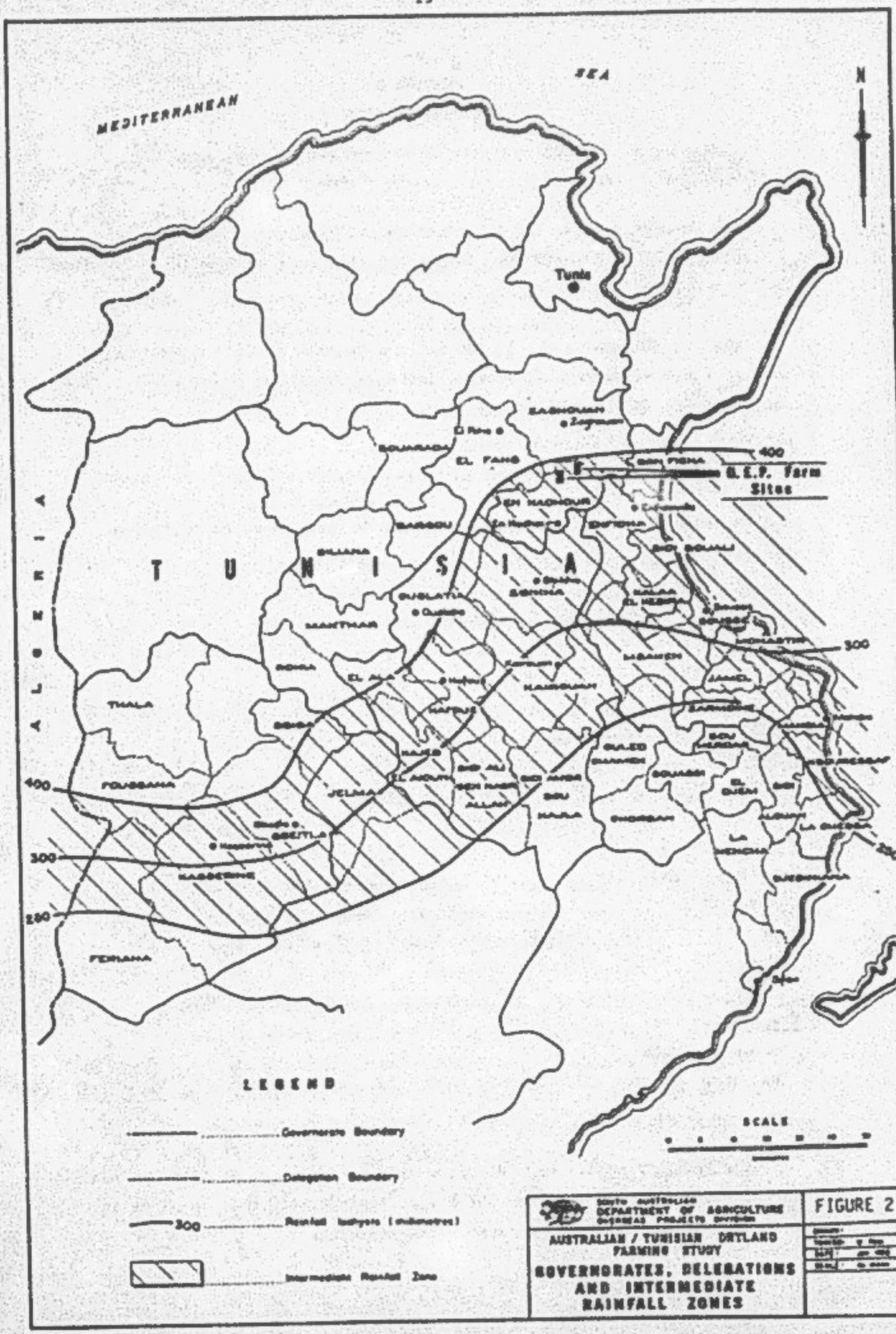
5.2 Climate

A broad assessment of the climate can be seen from the following table.

TABLE 5.1: Climatic data - I.R.Z.

	Month												Total
	S	O	N	D	J	F	M	A	M	J	J	A	
Rainfall (mm)													
Enfida	35	65	33	30	32	32	31	30	20	13	6	13	340
Kairouan	29	39	36	29	20	23	39	28	25	11	3	9	291
Temperature °C													
(daily average)													
Mendi Zitoun													
Max.	30	27	20	18	17	17	19	22	27	32	35	35	
Min.	17	14	8	8	5	6	6	8	12	16	18	19	
Evaporation (mm)													
(Penman formula)													
Kairouan	150	107	74	51	58	73	102	133	184	221	239	215	1607

The rainfall varies markedly from year to year e.g. at Kairouan the annual rainfall in 1960-61 was 167 mm; in 1969-70, 621 mm. The area is also subject to occasional thunderstorms and hail.


MEDITERRANEAN SEA
N
Tunis
T U N I S I A
ALGERIA
400
300
250
E.E.P. Farm Sites
LEGEND
Governorate Boundary
Delegation Boundary
Rainfall Isohyets (millimetres)
Intermediate Rainfall Zone
SCALE
SOUTH AUSTRALIAN DEPARTMENT OF AGRICULTURE
OVERSEAS PROJECTS DIVISION
AUSTRALIAN / TUNISIAN DRYLAND FARMING STUDY
GOVERNORATES, DELEGATIONS AND INTERMEDIATE RAINFALL ZONES
FIGURE 2

Chapter 5.

Cereal yields are influenced by both the date of onset and amount of the autumn rains (September - November) and by the amount of spring rains (March - April).

Cold winds restrict winter growth in the high regions and frosts are not uncommon in spring time. The onset of hot dry winds (sirocco) in early summer usually stops pasture growth and may cause cereal grains to shrivel.

5.3 Topography, Geology, Soils

The project area is bounded by a range of hills (Dorsale) along the northern boundary with individual peaks (jebels) rising to an altitude of 500 - 900 m above sea level.

From here, the land slopes to the south. At first there is an intermediate area of hills and undulations with slopes of 6-20%, often highly eroded. These slopes then extend on to the plains which vary in altitude from 100 - 200 m above sea level.

The basic geological formations which make up the Dorsale range are the massive limestone and calcareous marls of the Cretaceous and Eocene period. Above these are deposited in turn, Oligocene sandstones, mudstones and marls, the clays and conglomerates of the Miopliocene era and the Quaternary alluvials.

The area is dissected by a number of transverse fractures which provide discontinuities between the Northern and Southern area. These form the major creeks and drainage lines e.g. Oued Nebhana.

The soils of the slopes are essentially yellow brown calcareous self mulching clay loams of good depths (over 2 m) but with only weakly developed profiles. The subsoils erode readily and deep gullies are common. Small areas of red-brown loam with some small sized surface limestone are formed on higher ground and these often extend into shallow brown sandy loams over limestone or sandstone.

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The soils of the plains are alluvial and colluvial varying in texture from loams to clays and containing fine lime and gypsum with some salt affected areas.

Although no data were obtained, soil fertility appears somewhat low in nitrogen and phosphorus but the self mulching property of many of the soils ensures a good structure. However rilling develops within these soils and a surface crusting occurs on some of the loams leading to erosion. The lime content of many of the soils may be effecting the availability of phosphorus. Soil testing for available phosphorus is necessary to assess the optimum rates of application of superphosphate.

Erosion is widespread over much of the arable and pasture land and the problem will increase if marginal hillside land is brought under cropping. A number of areas are contour banked but the construction and maintenance of the banks is often unsatisfactory. There are many breaks in the banks and the capacity of the channels has been greatly reduced due to the downward throw of soil from deep disc ploughing. Many existing banks will require survey checks and reforming. In addition most of the arable and pasture land between 2% and 10% slope will also require banking.

5.4 Water Resources

Underground water supplies are fairly widespread in the area of the lower slopes and plains. The main sources of this water are in the Miocene and Oligocene sandstones, and drilling has been undertaken to improve the supply and to provide wells for farmers.

On the slopes, however, while drilling is continuing, there is less permanent water, although major creeks run during the winter.

Nevertheless, if there is to be an increase in the number of livestock in the area, more water points will be needed. Increasing attention should be given to equipping wells and supplying pumps to improve the water supply for domestic and livestock use and for irrigation on the small farms.

5.5 Infrastructure

The Project area has a reasonably good network of main roads, most of them bitumenised and many with Australian gum trees along the roadside. However the tertiary roads are inadequate particularly during the winter months and the donkey is still widely used to transport people and goods to and from market. A rural roads improvement project will favour a better transport system in the future. The GOT is also encouraging people to live in closer proximity to one another so that better services, - water, electricity and education can be provided.

The main towns are Enfida, Sousse, Kairouan, Sbeitla and Kasserine. A limited air service is available to Monastir and a railway line runs along the east coast, with a branch line that runs from Sousse to Kasserine.

Most farms are small, usually less than 20 hectares and property ownership is frequently fragmented as a result of the Moslem system of inheritance. This fragmentation places restrictions on the availability of credit to farmers as loans cannot be approved unless there is a land title. Few farmers have a full compliment of farming machinery and most hire equipment from the government agency and private contractors. Fences for livestock are rare.

5.6 Land Use, Farming Systems and Cropping Patterns

The IRZ is a mixture of hill country which is not cultivated, areas set aside for forestry, permanent pasture, arable land and small areas of irrigation. Cereals are grown on the arable land but smaller areas are also used for olive, almond and apricot orchards. The irrigated areas are mainly used for the production of legume hay, stone fruits or vegetables particularly tomatoes, capsicums and peppers.

On the arable land, cereals are grown in rotation with fallow. Barley is the most common cereal grown for grain, while oats are grown mainly for hay. Small areas of both hard and soft wheat are also grown. Vetch is sometimes sown with the oats but medicago pastures are rarely grown in the rotation. Cereal yields are usually low and less than 1 tonne per hectare. All land preparation for cropping is done with deep disc ploughing.

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Livestock are run on most farms, their fodder coming from grazing of permanent natural pasture, grazing of stubbles and supplementary feeding of hay and concentrates when yarded at night. Sheep and goats are the common farm livestock and these are supervised continuously during the day by shepherds in flocks of up to 200 head. Cattle, horses and camels are also run.

A broad picture of the land use and farming pattern can be seen from data obtained for the 63,000 hectares in the Delegation of Nadhour, west of Enfida (Refer Fig. 2). This Delegation is typical of the eastern sector of the IRZ.

TABLE 5.2: Land Use and Cropping Detail - Nadour Delegation

1. Land Use	(hectares)
Hilly, not cultivated	5,460
Forestry	10,230
Permanent Pasture	22,150
Arable	18,600
Orchards	6,280
Irrigation	280
	63,000

2. Annual area in crop on arable land

	area (ha)	yield (t./ha)
Barley	5,500	0.5
Oats	210	0.4
Wheat	1,550	0.2
Forage	1,950	2.0

The remainder of the arable land (49%) is in fallow or natural pasture. In favourable seasons, cereal yields can be 2-3 times higher than the average. The introduction of new high yielding varieties of hard wheat has increased the area sown to wheat in recent years.

About 115 tonnes of33% ammonium nitrate, 111 tonnes of superphosphate, (mainly 45% P_2O_5), and 11 tonnes of potash are used annually on the arable land. In general fertiliser is not very widely used on small farms.

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Livestock numbers in the delegation in 1978 were sheep 30,000, goats 6,500, horses 2,500 cattle 2,000 and camels 500. Livestock production is usually estimated from the number of forage units (FU) needed by livestock in relation to the number of forage units provided by a particular type of pasture. Thus a ewe and lamb requires 600 forage units (FU) a year, a goat 300, a horse 500, a beast 1,500. Production of forage units from different pastures ranges from grazing cereals 1,500 units a hectare a year, stubble 300 per hectare, natural pastures 200 per hectare, rangeland 50 per hectare per year.

The implications of the data on climate, soils and land use for the project is that more livestock could be carried if a rotation of cereal/ medicago pastures were to replace the existing cereal/fallow rotation. Much of the permanent pasture land with less than 10% slope could also be brought into a cropping rotation and steeper permanent pasture land could be improved with the introduction of Medicago pastures. But in all cases, soil conservation measures such as contour banking would be a necessary first step on any farm improvement plan.

5.7 Socio Economic Conditions

The population of the IRZ is approximately 1.1 million of which around 0.4 million or 37% are classified as rural. Many urban dwellers are also dependent on agriculture for their income.

Table 5 - Population Statistics in the IRZ

	- Population -			
Governorate	Rural	Urban	Total	% Rural
Zaghouan	25,429	14,406	39,735	64
Sousse	45,837	244,310	290,147	16
Monastir	38,506	221,798	260,304	15
Kairouan	176,805	144,657	321,462	55
Sidi Bou Zid	30,315	3,368	33,683	90
Kasserine	82,324	48,351	130,675	63
	399,216	676,890	1,076,106	37

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The age structure of the population is typical of the national average, ie. very youthful with a median age of about 15 years. There are few employment opportunities resulting in substantial emigration of males in the 25-34 years age group. Under employment is widespread both on farms and in the towns.

In 1978 Tunisia had one medical doctor per 4,020 persons, but almost half the doctors were located in Tunis making the ratio for non-metropolitan areas one per 6,200 persons, and the IRZ probably has a less favourable ratio. Schooling is readily available, but female attendance at primary and secondary schools is respectively only about 35% and 30% of the total.

Only 10% of non-metropolitan households in Tunisia have reticulated potable water. In the IRZ the proportion is lower, and a large amount of time is spent carrying water for domestic use.

No data on household incomes are available for the IRZ as a whole, but a German/Tunisian team estimated that in 1975 a 5 hectare farm in the Kef-Siliana area would have an income of about TD130. The 1975 national household consumption survey shows that average expenditure per capita in the North-Western region was between TD36 and TD111. Since the target group have incomes at the lower end of that range (say TD50 per capita) consumption would amount to some TD300 per family, implying that small farmers obtain about half their income from non-farm sources, presumably as wages from seasonal work and from emigrant remittances. Although the above analysis does not necessarily apply throughout the IRZ, it is sufficiently representative to indicate the very low income position of small farmers. A voluntary aid organisation has estimated that present per capita incomes in Nadhour delegation are below TD60 per year for "many people".

Throughout the IRZ the farm size distribution is heavily skewed and an estimated 60% of farmers own only 20% of the land. The small farms also tend to have poorer quality land with a lower percentage of arable cropland.

5.8 Input Supply and Produce Marketing

The availability of physical inputs is not a constraint to agricultural development in the IRZ, although the availability of finance to purchase them is, particularly for the smaller farmers. Although a range of organisations provide credit none is particularly effective in reaching small farmers. As a result small farmers use few purchased inputs in the form of fertilizers, improved pasture and cereal seeds, herbicides, pesticides and animal health products.

The Office des Cereals (OC) provides fertilizers and high yielding cereal seeds at subsidised prices. The OEP and the OC both provide medicago seeds. SOMAM provides a range of farm machinery operations under hourly hire and many farmers now mechanise their production. Private contractors and large farmers also hire out tractors and farm machinery. Hired labour is readily available. Animal feed supplements (locally known as concentrates) are supplied by the OEP.

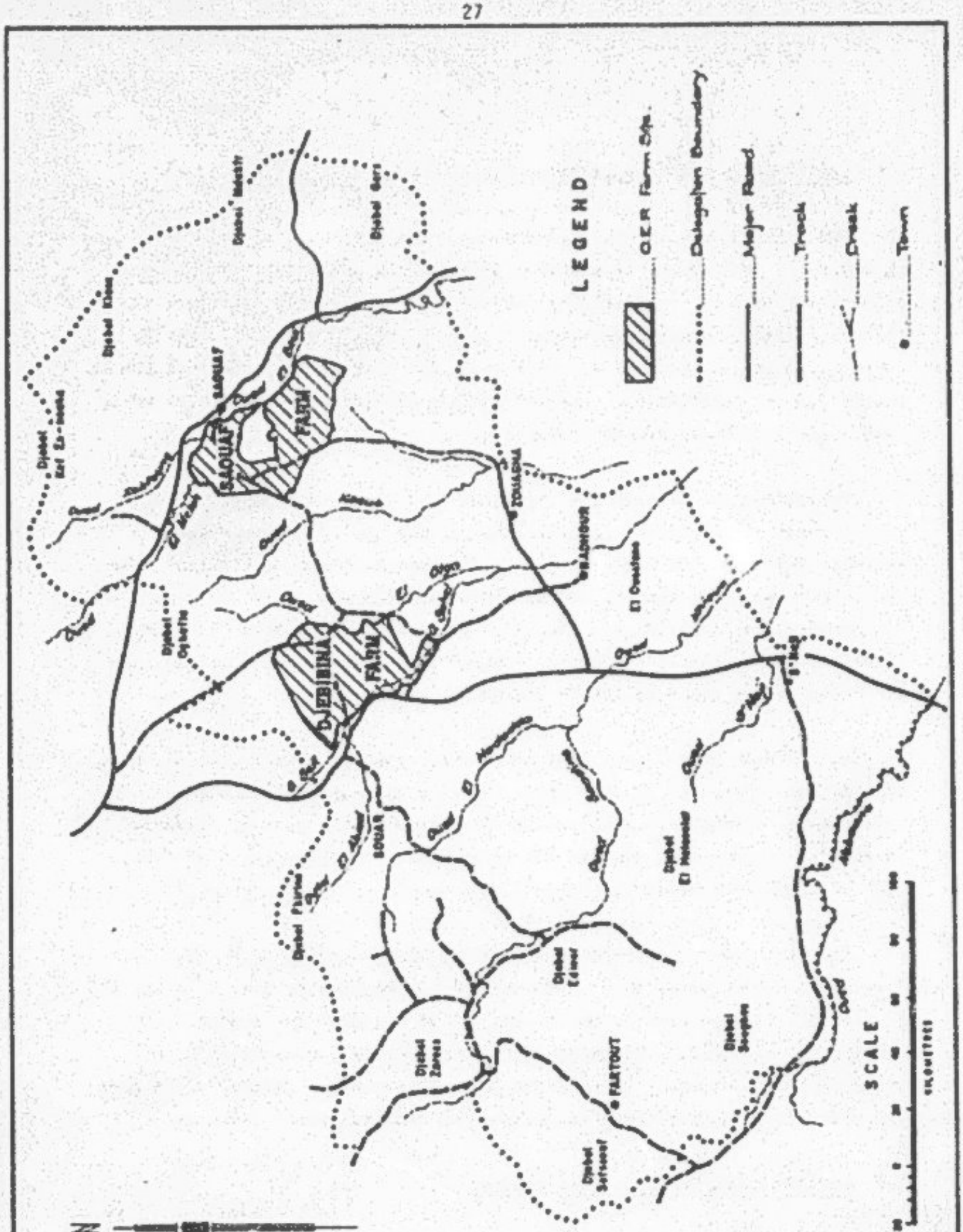
In the past most inputs from government agencies have included a heavy subsidy component, and product price has also been subject to some adjustments, leading to considerable distortion in the economic signals received by producers. However GOT is presently in the process of removing many of these interventions.

The marketing of cereals is officially the monopoly of the OC. However it is estimated that only about 37% is handled by the OC, while 28% is marketed through other channels and 35% is retained for domestic consumption and seed. The market for sheep meat is uncontrolled with farmers selling directly to butchers in local markets. Cattle, which pass through municipal abattoirs, are subject to official price controls.

5.9 The OEP Farms at Saouaf and Nadhour

5.9.1 Description

The two OEP farms at Saouaf and Nadhour (the latter known as Djebibina) have been identified as suitable sites to test and demonstrate an integrated farming system for the intermediate rainfall



SOUTH AUSTRALIAN DEPARTMENT OF AGRICULTURE OVERSEAS PROJECTS DIVISION	COMPILED	FIGURE 3
	DRAWN M. Ross	SCALE As shown
AUSTRALIAN / TUNISIAN DRYLAND FARMING STUDY	DATE Jan. 1982	
NADHOUR DELEGATION		

zone. Both are in the Delegation of Madhour, about 15 kilometres apart and operate as a single managerial unit. Table 5.4 below summarises the important characteristics of the two farms, and a more detailed description appears in Annex 1.

Table 5.4 - Basic Data for Saouaf and Djebibina Farms

Approximate average annual rainfall :- Saouaf farm 410 mm
Djebibina farm 330 mm

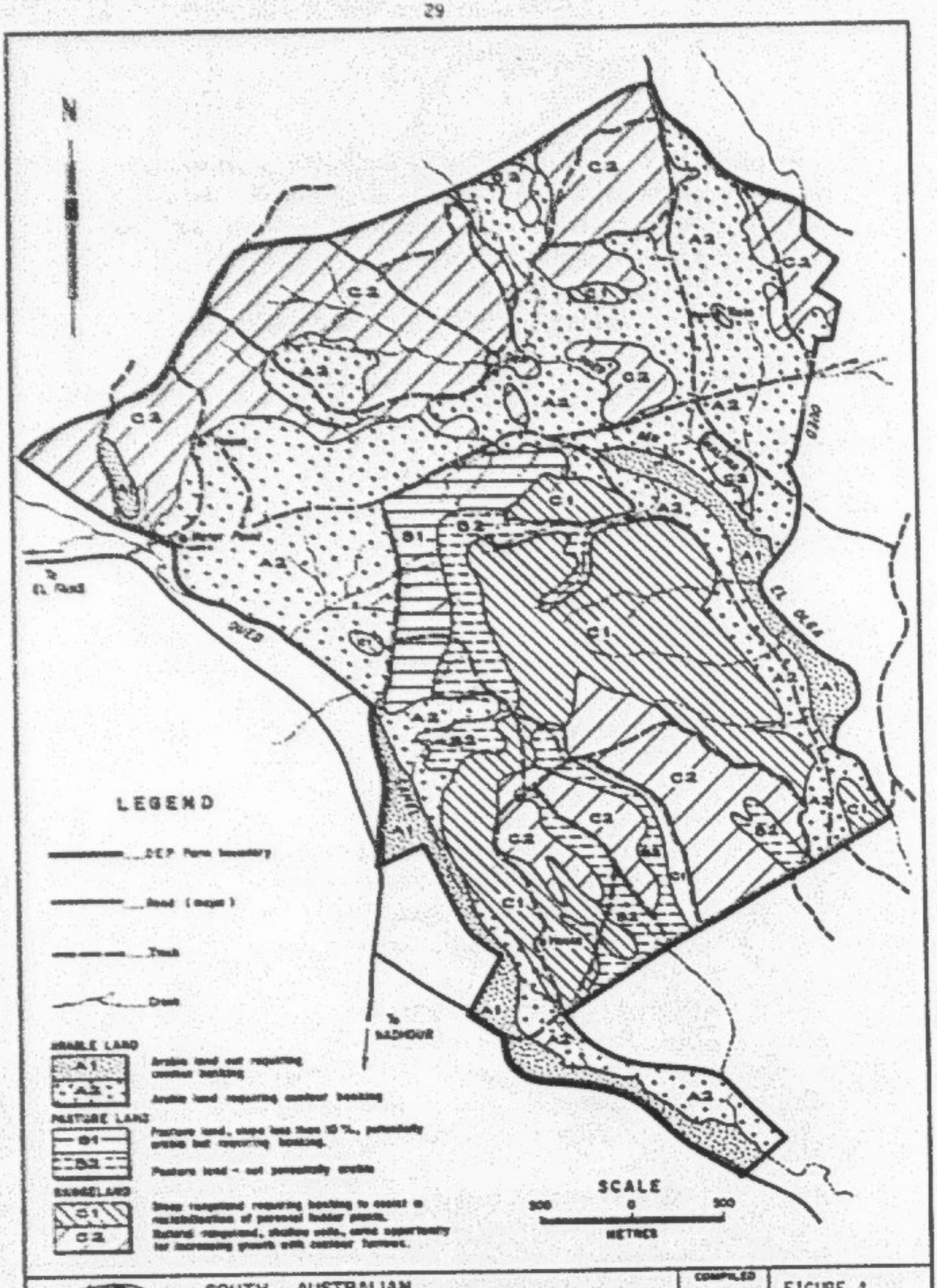
Land-capability		ha
Class A (Arable)		
Class A1 (not requiring contour banking)		210
Class A2 (requiring contour banking)		620
Sub total		830
Class B (Pasture land)		
Class B1 (slope < 10%, potentially arable but requiring banking.)		630
Class B2 (not potentially arable)		320
Sub total		950
Class C (Rangeland)		
Class C1 (Steep rangeland requiring banking to assist in restabilisation of perennial fodder plants)		200
Class C2 (Natural rangeland, shallow soils; some opportunity for increasing growth with contour furrows)		1110
	Sub total	1310
	Total	3090

Livestock	1270	sheep
	470	goats

Soils: Yellow-brown self mulching clay loams with small areas of red-brown loam; shallow limestone soils on rangeland.

Staff: Manager plus 45 others.

Equipment: 3 tractors plus associated farming equipment.



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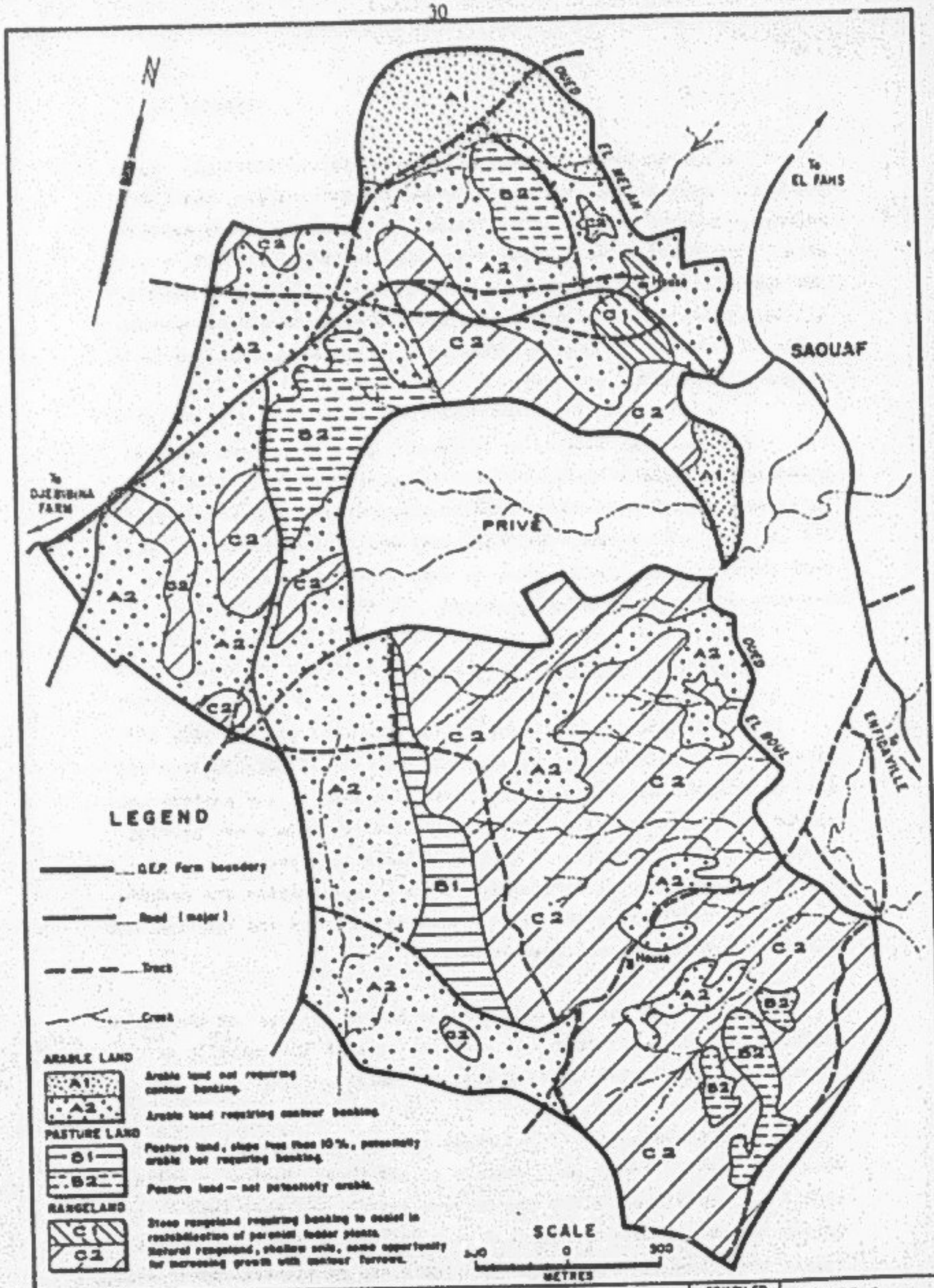
AUSTRALIAN / TUNISIAN DRYLAND FARMING STUDY
O.E.P. DJEBIBINA FARM
LAND CLASSIFICATION PLAN

COMPILED	FIGURE 4
DRAWN M. Ross	SCALE As shown
DATE Jan. 1982	



SOUTH AUSTRALIAN
DEPARTMENT OF AGRICULTURE
OVERSEAS PROJECTS DIVISION

AUSTRALIAN / TUNISIAN DRYLAND FARMING STUDY

O.E.P. SAOUAF FARM

LAND CLASSIFICATION PLAN

COMPILED	FIGURE 5
DRAWN M. Ross	SCALE : As shown
DATE Jan. 1982	

The arable land is worked on a cereal/fallow rotation. About 200 hectares have been sown annually to barley for grain, and 200 hectares to oats, most of which is used for hay. The crops are sown with 100 kg/ha of 45% P_2O_5 superphosphate and 50 kg/ha of 33% ammonium nitrate. Crop yields vary three fold according to season. All land preparation is carried out by deep disc ploughing. No wheat is grown - the reason usually given is that yields are too low to warrant the effort.

Over the last 3 years an increasing area of pasture land has been sown to medicago pasture. This is topdressed annually with 150 kg/ha superphosphate which is broadcast and then disced to a depth of 5-7 cm. In good seasons, the productive medicago pastures can carry 8-10 sheep/hectare from December to May, a 3-fold increase on the carrying capacity of natural pastures.

5.9.2 Suggestions for Future Development

An increasing area of arable land should be brought into a rotation of cereal-medicago pasture and much of the pasture land can also be brought into the same rotation. The rest of the pasture land should be sown to medicago. Some demonstrations with wheat growing should be tried. Reduced and shallow tillage soil preparation should be part of the cropping programme. Rates of application and methods of applying fertilizers should be evaluated on crops and pastures and responses related to soil test values.

Some of the land has been contour banked but most of the banks will require rehabilitation. In addition most of the actually and potentially arable land requires contour banking.

There are a number of buildings on the two farms which could be used by a project team. At Djebibina an old house, basically solid, should be refurbished before the project starts, and made into accommodation suitable for staff during the week. A permanent water supply and a telephone should be connected and an electric power unit installed. A number of farm buildings on both farms are suitable for storing farm machinery and equipment.

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The existing farm machinery equipment - see annex 1 - enables most of the current farming operations to be carried out, while equipment for hay making and harvesting is hired. However much of the farm machinery is old or out of order and should be replaced. In addition there will be a need for a new bulldozer, (D7), together with Australian tillage and seeding equipment, and a special contour banking plough. The project staff will need three vehicles one of which should be four wheel drive. Access roads within the farms are dirt tracks which are easily negotiated except after rain.

There are only four watering points for livestock. This leads to substantial losses of time due to the need to walk animals long distances. Several new watering points are required.

Although comparative performance data are not available the farms appear well managed within the existing system. However considerable scope exists to improve productivity through the substitution of cereal/medic in place of the cereal/fallow rotation, increasing the area under cultivation, controlling soil erosion, and improving livestock management.

CHAPTER 6
PROJECT DESCRIPTION

6.1 Phase 1

6.1.1 OEP Farm Development

The Saouaf and Djebibina farms would be developed to test and demonstrate alternative farming systems applicable to the IRZ. It is proposed that about 30% of the farm be maintained under existing management practices, with the remainder being converted to the modified system over a four year period. Comparative measurements would be made between the traditional and modified systems to permit a rigorous evaluation of the two systems. Farm development would comprise pasture establishment and management, increased cereal production, soil conservation and erosion control, livestock development and farm infrastructure development. Annex 2 gives greater detail of the programmes to be carried out during Phase I.

(a) Pasture Establishment and Management

The objective of this component is to improve forage production, increase soil fertility and reduce the erosion hazard. About 540 ha of medicago pasture would be sown on the existing cereal lands (A1 and A2), and about 540 ha would be established on existing pasture lands (B1 and B2) some of which (220 ha) would be brought into the cereal rotation.

Grazing of the medicago pastures would be managed so as to control weed growth, allow adequate seed set in the spring, and leave sufficient seed pods on the ground to ensure a productive pasture in the following season. Quadrat measurement would be used to determine establishment counts, dry matter production in spring, seed set and seed remaining at end of summer.

(b) Cereal Production

Two thirds of the existing cereal/fallow land would be converted to cereal/medic and about 630 ha of class B1 land would be brought into cereal production after the establishment of

appropriate soil conservation structures. Shallow cultivation is an essential feature of the alternative cereal production technology. Crop yields would be monitored by quadrat measurements of dry matter at flowering and of dry matter and grain at harvest. Broad scale estimates of yield would be made over measured distances using normal harvesting machinery.

(c) Soil Conservation and Erosion Control

On class A2 land 134 ha require rehabilitation of soil conservation structures and about 486 ha require survey, design and construction of new structures. A portion of the class B1 land brought into the cereal rotation will require contour banking and around 200 hectares of class C1 land would be rehabilitated with a combined revegetation/contour banking programme. The estimated total soil conservation works are as follows:

- 60 km of absorption terraces
- 100 km of banquettes
- 40 km of elements of banquettes
- 8 surveyed dams and catchments
- 40 drop inlets
- 200 ha of rangeland revegetation with associated structures.

Final estimates of the extent of soil conservation works would be made after detailed surveys of the property. A Booleroo Contour Banking Plough would be tested for bank construction and rehabilitation on land class A2.

(d) Livestock

The introduction of the cereal/medic rotation in place of cereal/fallow, and the development of permanent pasture on class B2 land would increase forage supplies and enable livestock numbers to be approximately doubled. Traditional livestock management techniques will be subjected to close scrutiny, especially supplementary feeding practices which may have a diminished role under the new feed supply situation. The length of the project is

inadequate to undertake breed evaluation work, but flock productivity would be increased through objective performance measurement and culling.

(e) Farm Infrastructure Development

The existing farm buildings would be upgraded to provide short-term accommodation for OEP and technical assistance staff. Dormitory accommodation should also be provided to enable medium term training courses to be conducted on the farms.

An electricity generator and telephone will be installed.

Domestic water supply would be provided by an extension of the existing pipeline on Djebibina farm to the farm buildings. Investigations would be conducted to determine the most economical way to provide additional watering points for farm livestock. This would include the experimental building of small water catchments and earth dams.

A simple set of sheep yards with weighing facilities would be constructed and about 2 km of Australian sheep fence erected around experimental plots and grazing trial areas.

6.1.2 Training

Tunisian staff would receive training at two levels. At the professional level a group of senior staff from the OEP and other participating agencies would undertake a study tour to observe the system in other countries, particularly southern Australia.

Project staff would also arrange field days on the OEP farms to familiarise MOA personnel with the cereal/medicago system and demonstrate the practical problems in its implementation. Special training courses would be conducted for extension officers and soil conservation technicians. These may be of a week or more in duration and require dormitory accommodation on the farm for trainees.

At the practical level the farm manager would be trained in the physical implementation of the system with particular attention to operating the specialised farm machinery, grazing management and soil conservation works.

In the costing estimates an allowance has been made to enable research projects by post-graduate students from INAT.

6.1.3 Technical Assistance

There is a need for foreign expertise to supplement the Tunisian staff resources. These experts would comprise 8 man years of full-time Tunisian based staff, plus 24 man-months of short term consultancy. The technical assistance team would include:- (a) a farm management adviser with practical skills in the cereal/medicago system, (for a period of three years); (b) a soil conservation agronomist with skills in land management and soil conservation structures in the cereal/medic system (3 years); (c) a pasture agronomist with specialised knowledge of annual medicago (2 years); (d) and short-term consultants in the fields of; livestock production, farm management economics, pasture agronomy and other specialist disciplines as required. The technical assistance team should be provided by a southern Australian based consultancy group.

6.1.4 Equipment

A full list of equipment required for the operation of the farm is specified in Annex 4, Table 7.

This list is divided into two sections.

(a) Items which should be supplied from Australia:

These are items for which the Australian product is either unique or has a distinct quality and functional advantage over competitive makes from other countries.

(b) Items for which the supply source is not important - provided certain specification details are complied with - e.g. Double acting hydraulics on tractors.

A number of the items shown are currently hired from SONAM or borrowed from other OEP farms. They have been specified here to enable the farms to be independent of such arrangements.

6.1.3 System Evaluation and Phase 2 Preparation

There is a need for a thorough technical and economic evaluation of the Phase 1 results before proceeding with Phase 2. Phase 1 is scheduled to last 4 years but if seasonal conditions produce meaningful results it would be possible to commence system evaluation after two years. It is more likely however that 3 to 4 years results will be needed to undertake a worthwhile analysis.

Technical evaluation would include assessing the success of the pasture establishment programme, particularly the persistance of the Medicago pastures through several cropping phases; comparison of cereal yields in the cereal/fallow and cereal/medic rotations; measurement of availability of feed for livestock on fallow, medic pastures, improved and unimproved pastures, and rangeland; assessing the effectiveness of the various soil conservation works; and evaluating the performance of the specialised machinery introduced for the project. An optimal technological package will be formulated and recommendations made for further trials, demonstrations and basic research. Economic evaluation would utilise the results of the technical evaluation to prepare a series of farm models demonstrating the financial benefits to farmers adopting the new technological package.

If the results of the system evaluation indicate good opportunities for widespread adoption of alternative farming systems in the IRZ, a project preparation team would be formed to prepare an IRZ agricultural development project in a form suitable for multilateral financing. The mission should comprise:

(a) an agriculturalist with experience in the cereal/medicago farming system and rangeland rehabilitation,

(b) an animal husbandry specialist with knowledge of sheep, cattle and goats in grazing systems,

(c) an agricultural extension specialist with experience in designing extension programmes in underdeveloped regions,

(d) a rural sociologist with knowledge of the ethnic groups and languages in the IRZ,

(e) an agricultural economist familiar with the preparation of projects for submission to international funding agencies,

(f) a soil conservation specialist,

(g) an agricultural credit specialist with experience in designing credit programmes for small farmers, and

(h) other experts as requested by GOT.

One of the above would act as team leader. Approximately 18 man-months of professional time will be required for the preparation study, which would be undertaken with the assistance of CNEA. The aim would be to design a technically feasible, financially and economically viable and socially desirable project to extend alternative farming technology, better soil management practices and rangeland rehabilitation throughout the IRZ. The study will involve clearly delineating the zone and its sub-zones; preparing a detailed physical resource inventory (climate, soils, topography water resources etc.); conducting a socio-economic survey to identify a target group and determine their needs and aspirations; and preparing an infrastructure inventory including both physical and institutional aspects. Using the foregoing as a data base it would then be possible to formulate and analyse in detail a major project for the IRZ. A broad project outline is provided in section 6.3 but it is recognized that this may change once Phase 1 results become known.

6.1.6 Project Phasing and Disbursement

Table 6.1 presents a schedule of the major project activities. The project would commence in Autumn and pasture establishment would be undertaken in the Autumn-Winter period, cereal production activities would be continuous, soil conservation works would continue year-round, except for Winter, and the farm infrastructure development would be completed during the first 6 months.

The overseas study tour for MOA staff would be arranged to coincide with the Southern Hemisphere Spring during the first year. Farm field days would be held on the farm sites in the Spring of the first year and every Autumn and Spring thereafter.

Two permanent technical advisers would commence duties in the first Autumn, and the third in the second Autumn. The animal production and pasture agronomy consultants would visit the project each Autumn and Spring and the farm management economist would make annual reviews of performance each Autumn, and complete a major review at the end of the project.

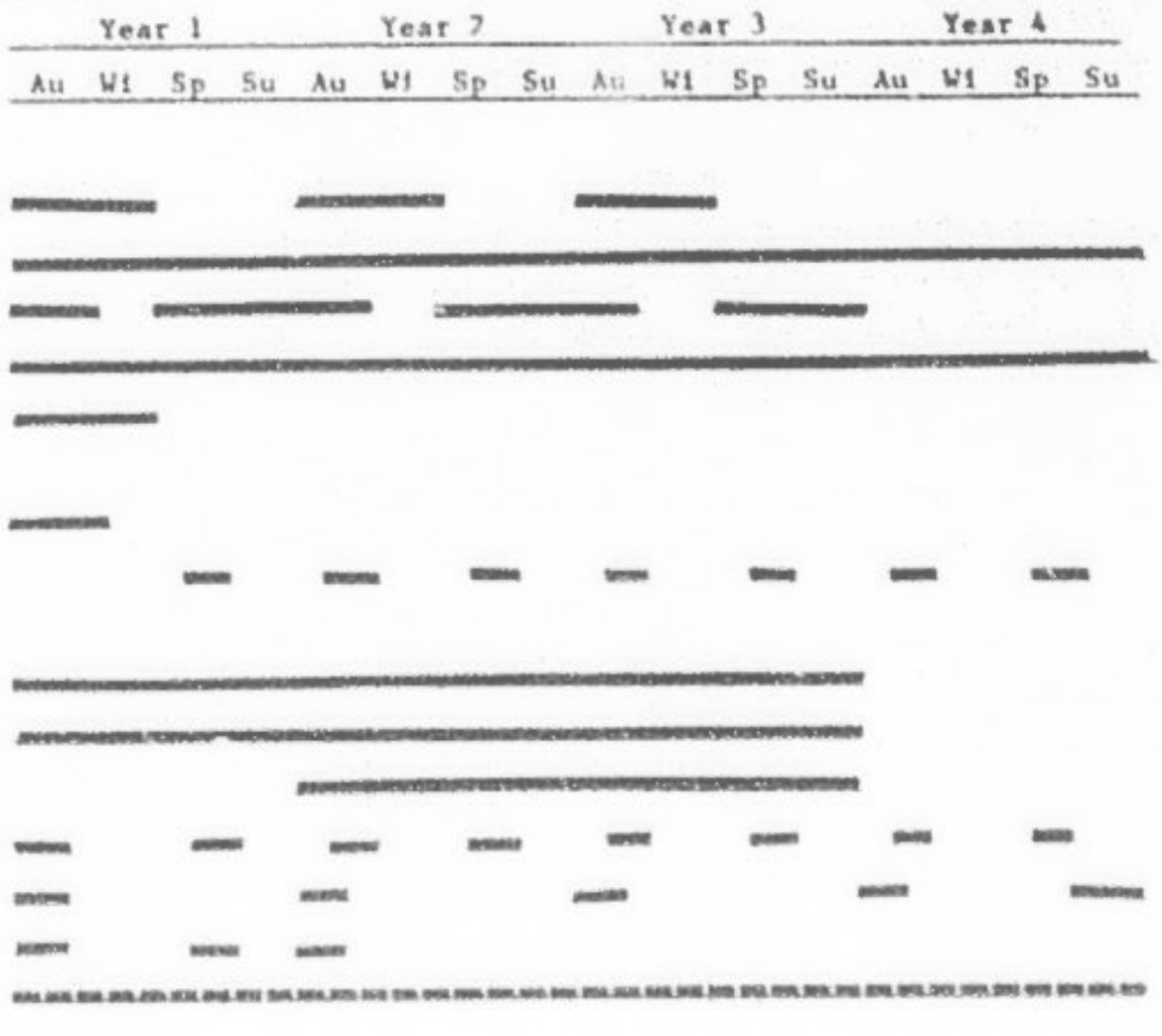
Equipment orders would have to be placed during the Spring and Summer of the year preceeding the first year of the project to ensure procurement and delivery by the first Autumn.

The farming system would be evaluated regularly with a review each Summer to plan the coming years operations and a major review at the end. Phase 2 preparation is scheduled for the Spring of the third year, but could occur earlier if seasonal conditions produce favourable results.

Disbursements

Disbursements would be concentrated into the first year due to the expenditure on equipment and mobilisation of the technical assistance team. Assuming the project begins in the 1982 Autumn (September) the approximate disbursement pattern would be as follows:-

Table 6.1: Schedule of Project Activities - Phase 1



1982	TD 615 000
1983	TD 245 000
1984	TD 312 000
1985	TD 418 000
1986	TD 106 000
	1 893 000

6.1.7 Phase 1 Costs

Detailed cost estimates are provided in Annex 4 and summarised in table 6.2 below. Phase 1 would cost TD 1.470 million in constant 1981 terms, and after allowance is made for inflation this would increase to TD 1.893 in current terms.

6.3 Phase 2

If Phase 1 succeeds in proving the adaptability of the cereal/medic rotation to Tunisian conditions, Phase 2 would facilitate the extension of this system throughout the IRI.

6.3.1 Beneficiaries

As no detailed socio-economic surveys have been conducted in the project area, little is known about the needs of the population except that their incomes are well below the national average, and there are no major projects underway to provide direct development assistance to these people. The project would be primarily oriented towards assisting small farmers, but it is expected that large private landholders, co-operatives and state farms, which own much of the most productive land in the zone, would also benefit. The increased production from these larger landholdings would be important in the project's economic justification.

6.3.2 On-farm Investments

Farmers would be assisted to reduce cropping intensity by growing smaller areas of cereals, but production would be increased by the use of high yielding varieties (HYV), and fertilizers and new tillage practices.

Table 6.2: Total Project Costs A Phase 1[a]

Item	$A '000			TD '000		
	Local	Foreign	Total	Local	Foreign	Total
1. OEP Farm Development						
Pasture establishment & management	18.4	43.0	61.4	10.8	25.3	36.1
Cereal production	23.5	2.7	26.2	13.8	1.6	15.4
Soil conservation & erosion control	40.8	10.2	51.0	24.0	6.0	30.0
Livestock development	72.2	-	72.2	42.5	-	42.5
Farm infrastructure development	68.0	17.0	85.0	40.0	10.0	50.0
Sub total	222.9	72.9	295.8	131.1	42.9	174.0
2. Training						
Study tour	0.8	48.3	49.1	0.5	28.4	28.9
Field days	5.9	-	5.9	3.5	-	3.5
Other	2.6	-	2.6	1.5	-	1.5
Sub total	9.3	48.3	57.6	5.5	28.4	33.9
3. Technical Assistance						
Farm Management Adviser	59.2	178.5	237.7	34.8	105.0	139.8
Soil Conservation Agronomist	59.2	178.5	237.7	34.8	105.0	139.8
Pasture Agronomist	39.4	119.0	158.4	23.2	70.0	93.2
Animal Production Consultant	10.2	75.5	85.7	6.0	44.4	50.4
Farm Management Economist	8.0	56.0	64.0	4.7	33.0	37.7
Pasture Agronomist Consultant	3.9	28.2	32.1	2.3	16.6	18.9
Other Consultants	9.0	66.0	75.0	5.3	38.8	44.1
Administration	48.6	100.0	148.6	28.6	58.8	87.4
Sub total	237.5	801.7	1039.2	139.7	471.6	611.3
4. Equipment						
Australian equipment	-	107.0	107.0	-	62.9	62.9
Other equipment	-	579.5	579.5	-	340.9	340.9
Sub total	-	686.5	686.5	-	403.8	403.8
5. System Evaluation & Phase 2 Preparation	23.5	170.7	194.2	13.8	100.4	114.2
Total Base Cost	493.2	1780.0	2273.2	290.1	1047.1	1337.2
Add Physical Contingencies	49.3	178.0	227.3	29.0	104.7	133.7
Total Project Costs (Constant)[b]	542.5	1958.0	2500.5	319.1	1151.8	1470.9
Add Price Contingencies	105.7	272.2	377.9	62.2	160.1	222.3
Total Project Costs (Current)[c]	648.2	2230.2	2878.4	381.3	1311.9	1693.2

(a) From Table 9, Annex 4.
(b) 1981 Prices
(c) Assuming commencement late 1982

At the same time livestock production would also increase substantially through the substitution of medicago pastures for fallow in the crop rotation. The new farming system would halt the long term decline in land productivity caused by soil erosion and soil structure deterioration resulting from declining soil organic matter content.

The major on-farm investments required to establish the improved farming system would be medicago seed, phosphate fertilizers, new tillage equipment, additional livestock, high yielding cereal seeds and soil conservation structures.

An initial heavy application of superphosphate would be made to assist medicago establishment on arable lands. To ensure persistence of the medicago pasture in the crop/pasture rotation there would be a simultaneous change from deep cultivation using disc or mouldboard ploughs, to shallow cultivation using tyned implements. Land unsuitable for continued cereal production would be sown to permanent medicago pasture. The change from deep to shallow cultivation equipment is essential, and participants should not be provided with the seed and fertilizer inputs until they have either purchased the necessary cultivation equipment themselves, or engaged a contractor with the appropriate equipment.

Small farmers in particular use few modern inputs, and the project would assist them to increase cereal production by providing HYV seeds and fertilizers. Simultaneously increased forage production from medicago pastures would necessitate purchasing or retaining additional livestock. This could involve either increasing the breeding flock or fattening additional lambs during the period of peak pasture production. Both modernisation of cereal production and increased livestock production would require credit assistance.

All participating farms would be required to implement soil conservation works as a condition for receiving assistance with other project components. The required measures would include:

a) on arable land; construction of banks, cordons, gully filling and drop structures, and conversion to contour ploughing,

b) on permanent pasture land; establishment and maintenance of medicago pastures, together with appropriate soil conservation structures, and

c) on rangeland; establishment of new perennial vegetative cover including Atriplex, Acacia and cactus, together with appropriate soil conservation structures.

Participating farmers would be required to assist with the soil conservation component by providing labour and materials where possible.

The total investment per hectare (in economic terms) in seed, fertilizer, machinery and soil conservation would be approximately TD57 spread over about four years.

6.3.3 The Extension Programme

The project envisages extensive changes to the whole farming system, rather than just the introduction of one or two new items of technology into the traditional system. A major upgrading and expansion of extension services will be required to effect these changes. The role of the extension service would be to introduce the new farming system by demonstrating it on the land of leading farmers; assisting small farmers to prepare farm development plans and secure the necessary credit to implement the plans; supervising and assisting plan implementation; and providing ongoing support and advice. This intensive extension approach will require recruiting an enlarged regional extension task force. The field extension workers would be equipped with motorcycles, audio visual equipment and other extension aids. During Phase 2 preparation consideration would be given to adapting the training and visit extension system to Tunisian conditions.

6.3.4 Credit

The investment requirement of TD 57 per hectare would be beyond the financial capacity of most small-to-medium farmers without substantial credit inputs. The land tenure problems mean that existing credit sources

would be unable to provide the credit requirements. Tunisia's agricultural credit system is fragmented and confusing and is not achieving its intended role in agricultural development. A study to be completed under the IFAD supported Project for the Development of Small and Medium Size Farms in the governorate of Kef and Siliana, should provide the basis for an overhaul of the credit system. It will then be possible to design procedures to ensure that the all-important credit component of Phase 2 is met.

In the early years of the farm development programme while livestock numbers are being built up there is lower income than normal from livestock sales because animals that previously would have been sold are retained for breeding. During this period the farmers may require aid to supplement their income. It is envisaged that WFP assistance could be arranged for this component.

6.3.5 Training

Tunisia is reasonably well supplied with university-trained agriculturalists and there are adequate numbers of trained technicians, but the quality of field extension officers (Agents de Vulgarisation) needs upgrading. This is especially true with regard to the relative complexity of the proposed technological package, and the need to introduce the concept of whole-farm planning in place of the enterprise-by-enterprise approach. Intensive in-service training for project staff would therefore be necessary to ensure, firstly, the successful implementation of the project and, secondly, increased capacity to implement similar projects elsewhere in Tunisia.

6.3.6 Technical Assistance

It is envisaged that number of expatriate technical advisers would be required to overeight the development and extension programmes and to train Tunisian personnel. The preparation mission would assess the professional staffing requirements for the project and the necessity for expatriate assistance.

6.3.7 Equipment

The project would require new agricultural machinery for construction and maintenance of soil conservation structures. Labour intensive methods would be used where possible but additional bulldozers, graders and other earthmoving equipment would be needed to ensure timely completion of major works. Substantial investment in new cultivation equipment would also be required. SONAM, farmers and private contractors would receive credit to assist the changeover from existing equipment.

Other equipment would include audio-visual aids for extension workers, motor cycles and vehicles, project offices and regional extension centres, telephones and housing for outposted staff.

6.3.8 Phasing and Disbursement

Due to the fundamental nature of the changes envisaged it is recommended that the project be conservatively phased with funds disbursed over an eight to ten year period. Most of these disbursements should occur in the first five years. The time for individual farms to reach full production would be about five years so full project benefits would not be realised until about the tenth year. The static level of production should be indefinitely sustainable provided machinery is replaced when worn out, medicago pastures are resown when incorrect cultural practices or bad seasons cause their rundown and soil conservation structures are properly maintained and rebuilt at the end of their effective life.

6.3.9 Phase 2 Costs

No attempt has been made by the Mission to estimate total project costs for Phase 2. This requires a clearer definition of the components of the new technological package as it would apply to Tunisian farms, and considerable further planning of the infrastructure, extension, credit and training needs.

These items would be fully specified by the project preparation team for Phase 2. The economic analysis of Annex 4 shows a first estimate for farm development, over 350 000 ha of the IRZ, at TD 12 million, (net present value in economic terms). As the NPV of economic benefits is TD 25 million, public investment in infrastructure, credit, extension etc. could be as high as TD 13 million and still maintain a 15% economic rate of return.

6.3.10 Production, Markets and Financial Results

Incremental production would be mainly in the form of cereals and sheepmeats both of which are imported by Tunisia. The proportion not consumed on-farm would be readily marketable within the region, and the quantity marketed would not have a significant effect on prices, especially as the growing human population places an ever-increasing demand on supplies of basic foods.

The financial results for landholderr should be adequate to ensure the participation of the majority of small farmers. As shown in table 6.3 below, farm income on a 10 hectare farm is estimated to increase from the present TD 216/year to TD 409/year with a proportionate improvement on larger farms.

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Table 6.3: With and Without Project Farm Income

10 ha farm (TD)

GROSS INCOME	WITHOUT PROJECT	WITH PROJECT
Wheat	22.88	49.43
Barley	20.71	42.00
Olives	18.00	18.00
Lambs	144.00	261.00
Wool	8.17	8.17
Other (egg, vegetables etc.)	57.14	57.14
TOTAL	270.90	435.74
COSTS		
Fertilizer	0.71	6.57
Tractor hire	13.57	4.54
Seed	12.00	9.71
Livestock feeds	22.86	-
Sundries	5.71	5.71
	54.85	26.53
Gross Margin (TD's)	216.05	409.21

CHAPTER 7

ORGANISATION AND MANAGEMENT

7.1 GENERAL ASPECTS

The project as outlined in the previous chapter is an integrated multidisciplinary approach to rational land management. It is thus ideally managed by a multidisciplinary management team.

The Tunisian Ministry of Agriculture, and its associated bodies, is a bureaucratic structure based on vertical integration of discipline-specific functional bodies. Vertical integration of many of these bodies continues through to the level of the extension agent. An individual farmer may thus be served by a number of different extension agents - each with a different programme. There is considerable overlapping of responsibility and duplication of function is common. This structure makes a multi-disciplinary approach somewhat difficult unless special co-ordination mechanisms are set up.

Currently some co-ordination of activity - but not function - is achieved at the Governorate level. However many activities are still controlled directly from Tunis through the various semi-independent agencies. The OEP farms for example, have a local manager who is directly responsible to the general manager of all OEP farms located in Tunis headquarters.

The project would be located initially on two of these farms and, during Phase 1, the bulk of project activity would be carried out on the farms. Nevertheless there would be a strong requirement for interaction between the project staff and Governorate-based officers of other agencies or Directorates of the Ministry of Agriculture. A number of these bodies should become actively involved in various components of the project even during Phase 1.

As the project expands its activities into the Phase 2 many more people and a wider range of planning and implementation activities would become involved. The project programme would cross Governorate boundaries and would exceed the technical responsibility of any currently existing organisation within the Ministry of Agriculture.

Special arrangements are therefore necessary to overcome the co-ordination problems caused by the conflict between the nature of the current structure and the needs of the project programme. During Phase 1 it should be sufficient to establish a Project Steering Committee. The greatly expanded activities anticipated by Phase 2 would however require a formal mechanism for the control and direction of many interrelated but currently separate functions. The Mission believes that an independent Development Authority may be necessary - along the lines of that currently being established for the North-West Project.

7.2 PHASE 1 ORGANISATION

7.2.1 Responsibility and Direction

The project has been sponsored since its conception by the OEP; it would be run on OEP farms and many of its components are clearly related to OEP's official functions. Phase 1 of the project should therefore be the direct responsibility of OEP.

The day to day control and direction of the project should be the responsibility of a Project Director, who would be a counterpart to the Team Leader of the expatriate experts. The Project Director should be appointed by OEP from its current senior level staff as soon as the project is approved. It is anticipated that some 20% of his time would be required for project related activities. The Project Director should be Chairman of the Project Steering Committee.

7.2.2 Project Steering Committee

This Committee should be established as early as possible after the project is approved. Its function would be to ensure close liaison and co-ordination between all the administrative and technical bodies with functions related to the project activities. Initially it would be primarily responsible for the two-way exchange of relevant information between the project and these bodies. It would also co-ordinate the inputs and assistance which may be required by the project from other than the OEP.

As Phase 1 progresses the Committee would become involved also as an advisory body for the formulation and planning of Phase 2. It would assist in the smooth transition from Phase 1 to Phase 2.

The Steering Committee should not be responsible for the control and direction of the project. It may advise, liaise, co-ordinate but not control.

To be effective the size of the Committee should be limited. The Mission recommends however that it include, as a minimum, representatives of the following fields:-

(1) OEP (Project Director - Permanent Chairman)
(2) Ministry of Agriculture (Directorate of International Co-operation)
(3) Zaghouan Governorate (CRDA)
(4) Soil Conservation
(5) Cereal Production (OC)
(6) Agricultural Credit (BNT etc)
(7) Project Studies (CNEA)
(8) Agricultural Research (INRAT)
(9) Agricultural Training (INAT)

The expatriate counterpart to the Project Director should be an adviser to this Committee.

The above list is not exclusive. From time to time other organisations may be added or accorded observer status.

The Steering Committee should meet as often as required. However there should be a mandatory meeting at least once every three months.

7.2.3 Reporting

The following reports should be prepared by the project team for presentation to the O.E.P.

(a) Monthly Progress Report: A succinct report of project activities, problems and recommendations for action. The exact format is not important but the report should be prepared under headings related to the project components.

(b) Annual Report: A detailed report to be prepared each August and covering the previous agricultural season to the end of July. The aim of this report would be to bring together the results and conclusions of any trials, to analyse project progress in relation to objectives and to recommend changes in direction of specific programmes. It should also present in detail the proposed programmes for the subsequent agricultural season.

These reports should be the joint responsibility of the Project Team - both counterparts and advisers. The Project Director should co-ordinate and direct their production and present them to the President-Director General of OEP.

(c) Technical Reports: From time to time technical reports may be prepared on specific aspects/components of the project programme.

(d) Consultants Reports: Each visiting specialist consultant should be required to present a report on his activities, findings and recommendations. These reports should be in French but may be presented in English with a French summary.

7.2.4 Monitoring and Evaluation

Project progress should be continuously monitored against the anticipated programme through the above reporting mechanism. In the initial stages it is likely that significant deviation from the programme may occur due to the uncertain nature of the climate and the consequent need for programme flexibility.

At least two full agricultural seasons should be allowed before carrying out a first evaluation of the adaptive success of the technological package. Such an evaluation should be carried out jointly by the Project Team, the OEP and the Steering Committee prior to the commencement of Phase 2 preparation.

7.3 PHASE 2 ORGANISATION

It is anticipated that Phase 2 would be a large and complex project covering a large part of the IRZ. The Phase 2 programme would extend across the administrative boundaries of several Governorates. It would include the need to provide credit facilities, extension services, marketing arrangements, input supplies, research, land tenure rationalisation, farmer co-operative organisation and many others. It would thus exceed the technical or administrative responsibility of any currently existing organisation. The Mission is hesitant at this stage to make any detailed recommendations as to how to solve the organisation problems inherent in the management of such a complex structure. The Phase 2 preparation team would consider this problem in detail.

The recently established North-West Project has solved its similar problem by establishing a central, independent project authority which controls all core activity of the project and has a co-ordinative role over the related activities of other bodies still operating in the project area. Whilst the formation of yet another new organisation compounds the already complex bureaucracy it appears to be the only way to obtain sufficient control over resource needs to ensure that a project will succeed.

The Mission therefore feels that a similar authority should be considered for Phase 2 of this project. Care should be taken to establish it in such a way that its activities could be co-ordinated and integrated with the currently existing extension networks at the Governorate level.

CHAPTER 8

BENEFITS AND JUSTIFICATION

8.1 GENERAL

The Phase 1 benefits would be largely confined to increased production and improved management practices on the OEP's Djebibina and Saouaf farms, plus a few nearby private farmers who would be encouraged to begin testing the alternative systems on their own land. Phase 1 would also stabilise the serious soil erosion situation on the OEP farms, but most importantly it would serve as a lead-in to Phase 2 where the majority of the benefits would be realised.

The principal benefit of Phase 2 would be the opportunity for small and medium scale farmers to break out of the vicious circle of declining cereal yields, increasing cropping intensity and acceleration in soil erosion, by adopting an improved farming system with heavier emphasis on animal production. These small and medium farmers are among the poorest in Tunisia. Benefits would accrue both in the form of increased cash income and improved nutritional standards. The project would also enable larger private farms, state farms and co-operatives to increase output.

At the macro level the project would assist in meeting the Government's objectives of controlling the critical soil erosion situation, moving towards food self sufficiency, and reducing rural-urban migration. The projects staff training and institution strengthening components would facilitate future projects of this nature.

8.2 ECONOMIC RATE OF RETURN

A preliminary (and very approximate) economic analysis has been conducted to demonstrate that Phase 1 is justified on the grounds that the eventual benefits from Phases 1 & 2 together are likely to generate a satisfactory economic rate of return. The key assumptions used in the economic analysis are:

(a) labour is shadow priced at 75% of the wage rate,

(b) the shadow price of foreign exchange is 12% above the official exchange rate,

(c) incremental cereal production is valued at the border price, adjusted for internal transport costs,

(d) incremental meat production is regarded as a non-traded good and is valued at its financial price,

(e) all other prices are exclusive of taxes and subsidies,

(f) without the project, cereal and livestock production in the IRZ will decline at the rate of 2% per annum due to the effects of soil erosion and soil structural deterioration,

(g) the project life is 30 years, after which all soil conservation structures will require rebuilding,

(h) Phase 2 will commence after 3 years of Phase 1, and,

(i) no attempt has been made to value benefits resulting from income redistribution, reduced urbanisation or reduced dam siltation.

Based on the foregoing the project would generate an economic rate of return of between 10 & 20%.

8.3 SENSITIVITY AND RISK

The decision to proceed in two phases is essentially a risk avoidance mechanism, and represents a compromise between the need for quick action to improve incomes and control soil erosion, and the need to fully test the cereal/medicago farming system under Tunisian IRZ conditions. Therefore if Phase 1 clearly establishes the required technical parameters, the technological risk inherent in Phase 2 would be low.

Apart from the normal risks associated with the unknown responsiveness of peasant farmers to technological and social change, the major Phase 2

risks are at the organisational level. Unless a decision is taken to establish a completely autonomous project authority[1] which would provide all the inputs, it would be necessary to co-ordinate inputs from a large number of Government and semi-Government organisation. This involves substantial risks that delays would occur, and in the case of credit, it is difficult to see how existing institutions could meet the projects requirements. Careful attention should be given to these organisational problems during Phase 2 preparation.

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(1) *Such as Office de Developpement Sylvo-Pastoral du Nord Ouest which is responsible for implementing a World Bank assisted agricultural project.*

CHAPTER 9

OUTSTANDING ISSUES

9.1 The precise role of the Governorate office in relation to the O.E.P. requires further clarification. The major activities of the project would be based on the O.E.P. farms and thus O.E.P. should rightly have control of this Phase. However, as Phase I progresses it is proposed to include a number of small farmers in the project programme and these activities should involve locally based extension staff of the Zaghouan Governorate. With limited staff resources it will be essential to use all personnel efficiently. A formal mechanism for co-ordination at the local level between the project staff and the various Arrondissements and Agencies in the Governorate office is therefore required.

9.2 The project should commence in the Autumn season i.e. September/ October. If the project is to commence in 1982 very rapid decisions are required to enable funding arrangements, contract negotiation, staff recruitment, machinery and equipment ordering and supply and certain basic infrastructural arrangements to be completed prior to actual start-up. Australian technical and professional agriculturalists with a fluency in French are rare. The likely need to undertake some preliminary language studies prior to project commencement would further extend the necessary lead-time between decision making and start-up.

SUPPLEMENTARY DETAILS - CEP FARMS

A 1.1 Location

The Saouaf farm is located about 25 kilometres north west of Enfidaville and the Djebibina farm about 10 kilometres north of Nadhour. Both farms are in the Delegation of Nadhour in the Governorate of Zaghouan.

A 1.2 Rainfall

The average rainfall at the two farms is

	Average p.a. (mm)	Range (mm)
Saouaf	410	202-726
Djebibina	310	170-578

A 1.3 Cereal Yields

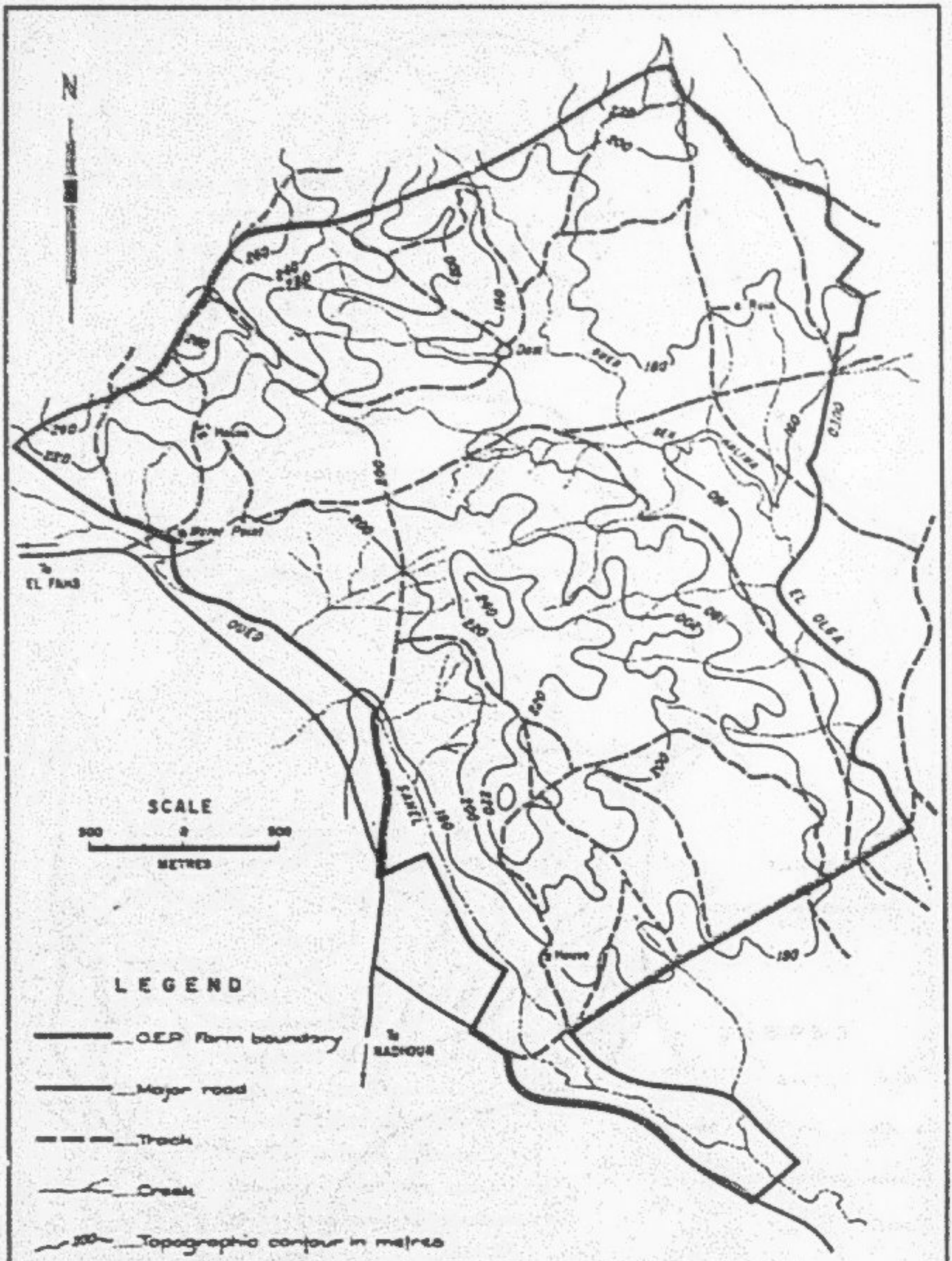
Average yields at Saouaf over the last three seasons have been:-

	1978/79	1979/80	1980/81
Rainfall - (Sept - April) (mm)	473	316	243
Barley (t./ha)	0.4	1.1	0.75
Oats (t./ha)	0.3	1.3	0.93
Hay (t./ha)	1.0	3.0	1.0

A 1.4 Livestock

Livestock carried on the 2 farms are 1 000 ewes, 200 young sheep 70 rams and 470 goats.

Lambing percentages (in October 1981) were 102%. Old ewes are replaced when they reach 8 years of age. Total wool production is 1700 kg.



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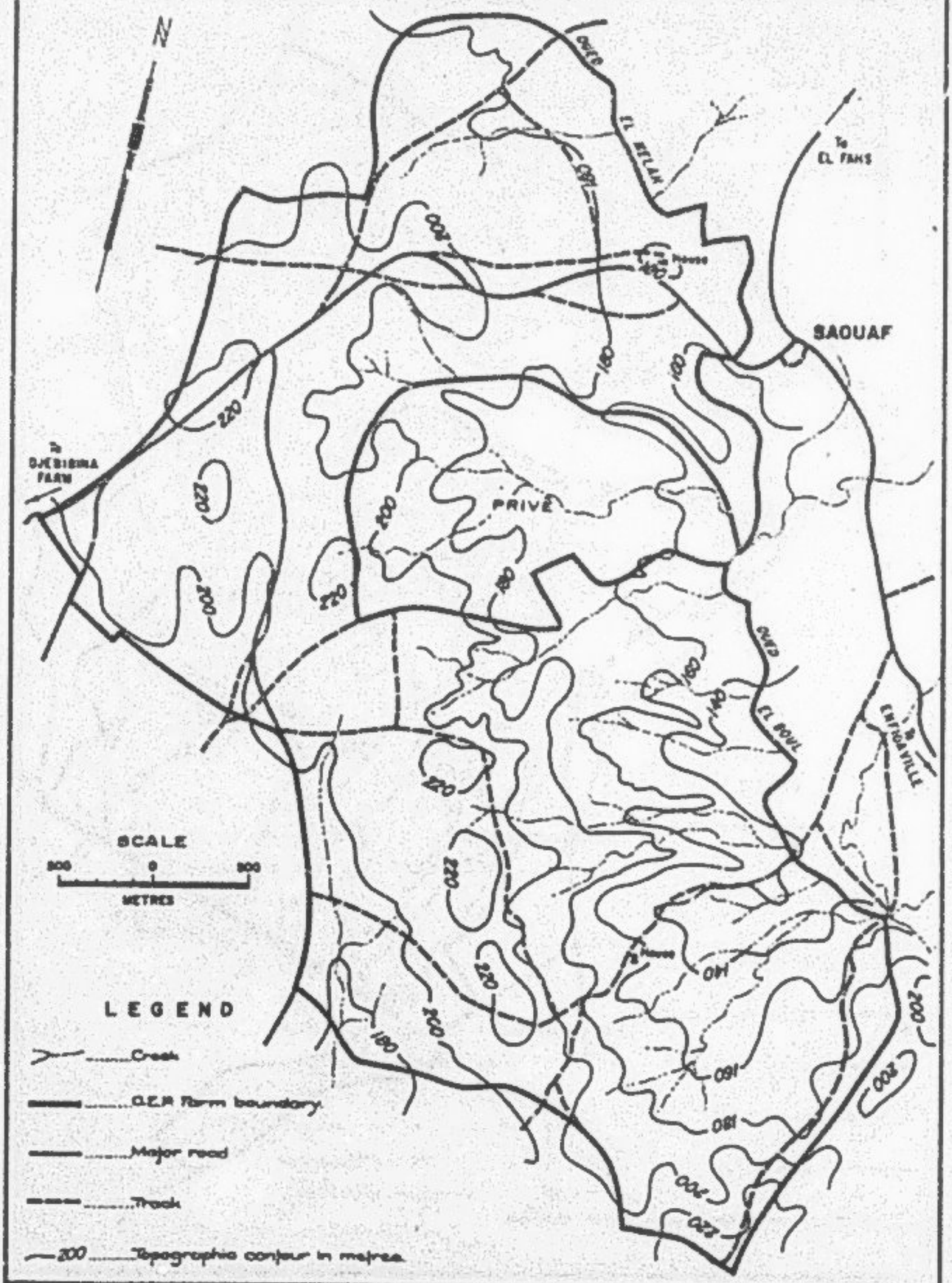
OVERSEAS PROJECTS DIVISION

AUSTRALIAN / TUNISIAN DRYLAND FARMING STUDY
O.E.P. DJEBIBINA FARM
TOPOGRAPHICAL PLAN

COMPILED	FIGURE 6
DRAWN M. Ross	SCALE As shown
DATE Jan. 1982	



SOUTH AUSTRALIAN
DEPARTMENT OF AGRICULTURE
OVERSEAS PROJECTS DIVISION

AUSTRALIAN/TUNISIAN DRYLAND FARMING STUDY
O.E.P. SAOUAF FARM
TOPOGRAPHICAL PLAN

COMPILED	FIGURE 7
DRAWN M. Ross	SCALE As shown
DATE Jan. 1982	

The grazing pattern is

(i)	pasture and cereals	December - Mid May
(ii)	stubbles	May - August
(iii)	rangeland	May - December
(iv)	supplemented with hay	August - December

A 1.5 Equipment

Tractors

2 x D4 crawler - one 70HP.
one 50HP.

1 Massey Ferguson tractor.

Offset disc ploughs (John Deere) - 3

. 2 x 24 discs (1 out of order)

. 1 x 28 discs

Deep disc ploughs

. 2 (1 out of order)

Disc seeder 1

Harrows 2

Trailers 2, but one out of order,

Tanks for gas-oil - 2 x3000L capacity

Water tanks - 2 x 3000L

A 1.6 Personnel

(a) Employees

Manager (Chef)	1
Assistant Manager (Chef adjoint)	1
Storeman (magasiniers)	2
Foreman (chef de culture)	1
Tractor drivers (Conducteurs)	7
Labourers (Ouvriers agricoles)	29
Shepherds (Bergers contractuels)	6
	47

(b) Working hours/day

November	- February	8 hours
September	- October)	
March	- April)	9 hours
May	- August	10 hours

Staff work 7 days a week.

Permanent staff receive an annual paid leave of 15 days.

Casual staff - only 4 days leave.

(c) Staff Wages

Basic salary	-	2 Tunisian dinars (TD) /day + 13% pension
Casual labourer	-	2TD /day and annual increment (180 millimes/day) + technical loading e.g. tractor driving. + 470 mill/day, + 100 mill/for work at night, + 132 mill/for work at harvest
Storeman	-	2 TD/day + annual increment (18 mill/day) + 472 mill/day.
Shepherds	-	receive lambs equal to 10% of the whole flock number in 3 stages. They also receive a bonus of 1 TD/lamb for each lamb above 96% of lambs at weaning. They have permission to graze 15 of their own sheep or 10 sheep and 1 cow. They also receive a tonne of wheat, a tonne of barley and 20TD p.a.

A 1.7 Buildings

(a) Saouaf

3 houses in a poor state

2 sheds

3 store rooms

1 workshop

1 garage

(b) Djebibina

3 buildings in a poor state

3 store rooms

4 sheds

2 stables

All buildings require repairs

PROPOSED MANAGEMENT PRACTICES - OEP FARMS

The actual practices to be demonstrated and tested as part of the farm management strategy are:

A 2.1 Pasture Establishment and Maintenance

(a) increase the area of sown medicago pastures

(b) demonstrate and compare methods of sowing medicago pastures by shallow seeding and by sowing into stubble

(c) compare the growth and production of Australian and local medicago cultivars in fenced off areas by measuring:
- dry matter production at 8 weeks
- dry matter production at flowering
- amount of seed pods formed and the amount of seed set.

(d) demonstrate the effect of different grazing pressures on
- the amount of weed and pasture growth
- the amount of seed pods and seed set
- the rate of decline of seed pods over summer

(e) demonstrate the effect on pasture growth and yield of different methods of applying fertilizer to permanent pastures.
Methods to be compared
- broadcasting
- discing.

(f) compare the production of natural pastures with improved pastures

(g) compare the production of forage crops with improved pastures.

It will be difficult to assess the number of grazing days unless the grazing areas are fenced off. Accurate measurements must also be made of the supplementary feeding given each sheep when yarded at night. Rates of growth of sheep will be measured with portable weighing scale.

Most of these comparisons will be tested by demonstrations, rather than replicated trials, and measurements made in closed and open quadrats. These evaluations are associated with the strategies to increase the area of leguminous forage, to carry more livestock and to improve soil fertility.

A.2.2 Cereal Production

(a) demonstrate the effects on time, costs, weed control and yield of different depths of tillage in the preparation of land for sowing.

(b) demonstrate the effects of different durations of fallow and of different times of sowing, including dry sowing, on yield.

(c) compare the yields from different varieties

(d) compare the response to rates of application of fertilizers and the relation of yield to the levels of available soil phosphorous.

(e) compare yields of cereals in a cereal-fallow rotation with those in a cereal-medic rotation.

These strategies are designed to reduce the cost of land preparation for cereal growing and the cost of applying nitrogen fertilizer, and to increase yields with the use of more timely sowing, and new varieties.

A 2.3 Soil Conservation

Much of the farm will need to be treated with soil conservation structures. The main structures will be:

a) Absorption banks
- usually over a metre high, (and up to 600 m long), and on the level. They would be used on steep or highly eroded land where waterways are difficult to prepare and maintain. Up to 600 m can be built in a day with a bulldozer.

A small hand seeder will be used for sowing pastures on the absorption banks and for applying fertilizer. This will assist in the rapid stabilisation of the banks.

b) Contour banks (banquettes)

Most of the arable land between 2% and 10% slope can be protected with normal size banks. They could be readily built with a Booleroo contour plough, but some topping up of the banks will be required at the gutter crossings. A bulldozer will be needed for this latter task.

c) Elements of banquettes

These consist of a series of mini absorption banks - 10 m long and 1.2 m high with ends which allow the bank to discharge when it contains 30 cm water. The elements are all in the same surveyed line and are separated by gaps of 5 m. The gaps are staggered between the gaps in the elements on other contour lines. Trees are often planted above the elements and cereals can be grown between the rows of elements.

d) Cordon pierres

These are small stone walls 30-40 cm high, built on the contour and planted with grasses, eg. diss grass.

e) Contour furrowing

Some contour furrowing on the less stony ground of the uncultivated hills or rises would assist in reducing run off and in increasing the cover from the natural rangeland bushes.

f) Designed run off catchment for small farm dams.

A number of these could be applied in selected areas to provide additional water points for livestock.

In all over 1 000 ha of land warrants treatment with some form of soil conservation structure. Bulldozer work will be required in gully filling, in topping up banks at gutter crossings and in building small dams.

In addition a vegetative control programme will be part of the overall farm managment plan. This will include the sowing of permanent pasture land in excess of 10% slope to perennial grasses and medicago and the planting of areas of shrubs eg. *Atriplex nummularia*, *Acacia cenophylla* or Cactus (*Opuntia inermis*). The shrubs are planted either in ripped furrows or on small banks built on the contour.

Many of the potential gains in yield due to technology will not be possible unless the erosion problem can be overcome.

A.2.4 Livestock Management

a) Demonstration of sheep management strategies to check weed growth and maintain seed supply in medicago pastures.

b) Monitoring of stock health in particular the incidence of entreotoxaema and in internal and external parasites in sheep grazing improved pastures and the adoption of control measures.

c) Evaluation of the productivity of different local breeds of sheep grazing improved pastures.

d) Regular weighing of sheep to measure growth rates on different pastures and to determine the need for supplementary feeding.

e) Provision of more water points either as wells or as small dams on prepared runoff catchments.

f) Demonstration of the benefits of controlled rotational grazing on the growth and seed set of rangeland vegetation.

g) To develop a ram breeding nucleus scheme by selecting and evaluating local sheep. Selected rams can then be exchanged with small farmers ewes and so continue the selection and improvement process.

PROPOSED DEVELOPMENT PLAN - O.E.P. FARMS

A 3.1 Land Use plan

Table A 3.1 shows the present land use on the OEP farms and the projected land use for each land class in each year of the four year development programme. (The various land classes are described in section 5.9 of the text, and shown in Figures 4 and 5).

On land classes A1 and A2 the crop rotation will be left as cereal/fallow on one-third of the area and converted to cereal/medic on the remainder. On Class A2 the soil conservation structures will be redesigned and rebuilt.

On class B1 land, which is currently a mixture of medic and unimproved pasture, one third of the area will be converted to cereal/fallow rotation and the remainder to cereal/medic. On class B2, (land which is not suitable for cropping), the whole area would be sown to permanent medic pasture.

On the rangeland (Class C), 200ha of C1 land will be improved and the remainder left as unimproved range. Range improvement will comprise establishment of perennial forage plants and erosion control structures.

Table A 3.1 Land Use Plan for OEP Farms Annex 3

A) Present Use

Land Class(1)	C	F	M	Pu	Ru	Ri	O	Total
A1	105	105	-	-	-	-	-	210
A2	300	300	-	-	-	-	20	620
B1	-	-	200	430	-	-	-	630
B2	-	-	-	320	-	-	-	320
C1	-	-	-	-	200	-	-	200
C2	-	-	-	-	1100	-	-	1100
Total	405	405	200	750	1310	-	20	3090

(1) C = cereal, F = fallow, M = medic, Pu = unimproved parcour
Ru = unimproved rangeland, Ri = improved rangeland, O = olives.

B) Proposed Programme

(a) Year 1

Land Class[1]	C	F	M	Pu	Ru	Ri	O	Total
A1	76	100	34	-	-	-	-	210
A2	334	200	66	-	-	-	20	620
B1	100	-	130	400	-	-	-	630
B2	-	-	80	240	-	-	-	320
C1	-	-	-	-	150	50	-	200
C2	-	-	-	-	1110	-	-	1110
Total	510	300	310	640	1260	50	20	3090

(b) Year 2

	C	F	M	Pu	Ru	Ri	O	Total
A1	76	87	47	-	-	-	-	210
A2	334	173	93	-	-	-	20	620
B1	235	-	155	240	-	-	-	630
B2	-	-	160	160	-	-	-	320
C1	-	-	-	-	100	100	-	200
C2	-	-	-	-	1110	-	-	1110
Total	645	260	455	400	1210	100	20	3090

(c) Year 3

	C	F	M	Pu	Ru	Ri	O	Total
A1	77	53	80	-	-	-	-	210
A2	333	107	160	-	-	-	20	620
B1	260	105	185	80	-	-	-	630
B2	-	-	240	80	-	-	-	320
C1	-	-	-	-	50	150	-	200
C2	-	-	-	-	1110	-	-	1110
Total	670	265	665	160	1160	150	20	3090

(d) Year 4

Land Class[1]	C	F	M	Pu	Ru	Ri	O	Tota
A1	70	35	105	-	-	-	-	210
A2	333	67	200	-	-	-	20	620
B1	290	105	235	-	-	-	-	630
B2	-	-	320	-	-	-	-	320
C1	-	-	-	-	-	200	-	200
C2	-	-	-	-	1110	-	-	1110
Total	693	207	860	-	1110	200	20	3090

(e) Year 5+

	C	F	M	Pu	Ru	Ri	O	Total
A1	105	35	70	-	-	-	-	210
A2	300	100	200	-	-	-	20	620
B1	315	105	210	-	-	-	-	630
B2	-	-	320	-	-	-	-	320
C1	-	-	-	-	-	200	-	200
C2	-	-	-	-	1110	-	-	1110
Total	720	140	800	-	1110	200	20	3090

A 3.2 Pasture establishment and management

The medic pasture establishment schedule required to achieve the above objectives is outlined in table A 3.2 below.

Table A 3.2 Medic Pasture Establishment Schedule

Land Class	Area of medic pasture to be sown (ha) yr.1	yr.2	yr.3	yr.4	yr.5+
A1	34	47	46	53	-
A2	66	93	94	107	-
B1	30	55	55	80	-
B2	80	80	80	80	-
	250	275	275	320	-
Kg. medic seed required (15kg/ha)	3150	4125	4125	4800	-
Area of pasture fertilised	310	455	665	855	800
Fertilizer required for medics (tonnes)	15.5	22.7	33.2	42.7	40.0
Medic hay produced (t) 100 ha x 2t/ha	200	200	200	200	200

A 3.3 Cereal Production

The area sown to cereals will be increased with the introduction of class B1 land into the crop rotation. The main increase in area sown will be with barley for grain, while the area sown to oats for hay and some grain will not change. A small trial area of wheat would also be sown. The proposed cereal production programme is summarised in table A3.3. The proportion of the cereal in medic rotations will increase from zero at present to two-thirds by year 5.

Table A 3.3 Cereal Production Schedule

Total Area of Cereals Sown (ha)

Land	Present		yr. 1		yr. 2		yr. 3		yr. 4		yr. 5+	
Class	After medic	After fallow	After medic	After fallow	After medic	After fallow	After medic	After fallow	After medic	After fallow	After medic	After fallow
A1	-	105	-	76	34	42	47	30	70	-	70	35
A2	-	300	-	334	66	268	93	240	160	173	200	100
B1	-	-	100	-	130	105	155	105	185	105	210	105
B2	-	-	-	-	-	-	-	-	-	-	-	-
C1	-	-	-	-	-	-	-	-	-	-	-	-
C2	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	405	100	410	230	415	295	375	415	278	480	240

	Present	yr. 1	yr. 2	yr. 3	yr. 4	yr. 5+
Area of barley (ha)	205	310	445	490	493	520
Area of oats (ha)	200	180	180	180	180	180
Area of wheat (ha)	-	20	20	20	20	20
Total	405	510	645	670	693	720

A. 3.4 Soil Conservation and Erosion Control

Over 1000 hectares in land classes A2 and B1 require some form of erosion control structures. Preliminary estimates of the work required are shown in table A 3.4 below. More accurate estimates will be available after detailed survey work is complete, but the present estimates indicate that about 660 hectares can be treated in the 4 year period.

Table A. 3.4 Soil Conservation Schedule

Area	Structure	Comments	Work per year yr. 1	yr. 2	yr. 3	yr. 4
160 ha	Absorption terraces	Requires about 0.375 km banks/ha	15km	15km	15km	15km
400 ha	Banquettes	Requires about 0.25 km banquettes/ha	25km	25km	25km	25km
120ha	Elements of Banquettes	Requires about 0.33 km of elements/ha	10km	10km	10km	10km
	Surveyed dams and catchments		2	2	2	2
	Drop inlets	Hand built stone structures in gullies	10	10	10	10
200ha	Rangeland shrub planting, banquettes and cordons		50ha	50ha	50ha	50ha

A. 3.5 Livestock Developments

The increased forage availability from the larger area of medic pasture will permit substantial expansion of the sheep flock from the present level of 1000 ewes, 200 young replacement ewes and 70 rams. Table A 3.5 shows the increase in feed availability measured in Forage Units (FU).

Table A 3.5 Livestock Feed Production(1)

	Oats(2)	Cereals(2) under Crop	F	M	Pu	Ru	Ri	O	Total
Present:area (ha)	200	205	405	200	750	1310	-	20	3090
FU's produced ('000)	400	-	121	240	150	66	-	2	979
Year 1:Area(ha)	180	330	300	310	640	1260	50	20	3090
FU's produced ('000)	360	-	90	372	128	63	20	2	1035
Year 2:Area(ha)	180	465	260	455	400	1210	100	20	3090
FU's produced ('000)	360	-	78	546	80	61	40	2	1167
Year 3:Area(ha)	180	490	265	665	160	1160	150	20	3090
FU's produced ('000)	360	-	79	798	32	58	60	2	1389
Year 4:Area(ha)	180	513	207	860	-	1110	200	20	3090
FU's produced ('000)	360	-	62	1038	-	56	80	2	1598
Year 5+ Area (ha)	180	540	240	800	-	1110	200	20	3090
FU's produced ('000)	360	-	72	960	-	56	80	2	1530

(1) Measured in FU's : One FU is equivalent to the feed value of 1kg. of barley.

(2) Assuming Oats = 2000 FU's/ha; other cereals = OFU's/ha; F = 300 FU's/ha, M = 1200 FU's/ha; Pu = 200 FU's/ha Ru = 50 FU's/ha; Ri = 400 FU's/ha; O = 100 FU's/ha.

N.B. Grain crops have been treated as saleable items and are not considered in this analysis. The stubble value of these crops is shown under F, (fallow).

Table A 3.6 shows the rate at which forage supplies would build up, the carrying capacity expressed in ewe units, and the number of ewe units which would need to be purchased (or retained) annually.

Table A 3.6 Livestock Development Schedule

	Present	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5+
FU's produced ('000)	979	1035	1167	1389	1598	1530
No. of ewe units[1] carried	1000	1047	1203	1498	1708	1918
FU's used ('000)	600	628	722	899	1025	1151
Surplus	379[2]	407	445	490	573	379
No of ewe units purchased or retained.	-	47	156	295	210	-

(1) Ewe unit is defined as a ewe, plus lamb to sale age, plus ram, plus replacement carried in the flock, and is equal to 600 FU's.

(2) Utilised by flocks surrounding the farm.

Financial and Economic Analyses

A. 4.1 General Information

A. 4.2 Phase 1 Financial Analysis

A. 4.3 Phase 2 Financial and Economic Analyses

Table 1: Summary of Costs and Prices

1. Input Costs	Unit	Financial Price (TD)	Economic Price (TD)
Ammonium Nitrate (33%N)	tonne	64.5	88.5
Superphosphate (20%P)	tonne	48.5	90.6
Petrol (essence)	litre	0.240	0.265
Diesel	litre	0.088	0.250
Foreign exchange	US$	0.50	0.56
Unskilled labour	man/day	2.0	1.5
Principal Engineer	man/year	4 770	4 050
Engineer	"	3 990	3 390
Assistant Engineer	"	3 570	3 210
Technical Assistant	"	2 620	2 360
Storeman	"	1 730	1 640
Assistant Storeman	"	1 730	1 640
Driver	"	1 730	1 640
Tractor Driver	"	1 380	1 311
Frayeur	"	1 730	1 640
Guard	"	1 300	1 230
Conseil	"	2 560	2 300
Administrative Secretary	"	1 990	1 830
Assistant Admin Secretary	"	2 200	2 090
Administrator	"	2 740	2 470
Young breeding ewe	1 head	60	60
Young ram	1 head	70	70
Medicago seed	kg	1.55	1.74
Rent house in Tunis	month	300	300
Absorption terraces	km	140	176
Banquettes	km	20	22
Elements of banquettes	km	208	258
Surveyed dams and catchments	km	143	184
Drop inlets	1 inlet	60	53
Rangeland rehabilitation	ha	39	29
Tractor hire 35HP	hr	2.35	2.35
70HP	hr	3.35	3.35
225HP	hr	13.80	13.30
300HP	hr	15.70	15.70

2. Output Prices

Soft wheat	tonne	87	95
Durum wheat	tonne	96	132
Barley	tonne	69	54
Sheep - fat lambs	kg live	1.5	1.5
cull ewes	1 head	10	10

Table 2: Machinery Operating Costs

1. Tractor

Type of tractor	100 horsepower
Annual hours of use	1 000 hours
Current landed cost	TD 20 000

Annual operating costs	TD
Repairs (8% of new cost)	1 600
Lubrication (1% of new cost)	200
Tyres and batteries (3% of new cost)	600
Insurance and registration	100
Fuel (15 litre/hour @ TD.088/L)	1 320
Total TD	3 820

Operating cost per hour = TD 3.82 (financial)

Economic cost TD 6.25/hour

2. Bulldozer

Type of bulldozer	D7 with angle blade and ripper
Annual hours of use	1 000 hours
Current landed cost	TD85 000

Annual operating costs	
Repairs (8% of new cost)	6 800
Lubrication	850
Tracks and batteries	1 200
Insurance and registration	100
Fuel (25 litres/hour @ TD 0.088/L)	2 200
Total	11 150

Operating cost per hour = TD 11.15 (financial)

Economic cost TD 15.20/hour

3. Non powered machinery (cultivators, combines etc.)

Repairs: 5% of current landed cost/1 000 hours of operation

Lubrication: 1% of current landed cost/1 000 hours of operation for complex powered machinery. Trivial for simple powered machinery.

a) Booleroo Plough

Annual hours of use	200 hours
Current landed cost	TD 3 000
Annual operating costs	TD
Repairs	30
Lubrication	2
Total	32

Operating cost per hour = TD 0.16

b) Disc Plough

Annual hours of use	500 hours
Current landed cost	TD 6000
Annual operating costs	
Repairs	150

Operating cost per hour = TD 0.30

Table 3: Soil Conservation Costs

1. Absorption Terraces

	TD/km
10 hours bulldozer time @ TD11.15/hour	111.50
2 days bulldozer driver's time @ TD4.40/day	8.80
Labour for finishing: 10 man days @ TD2.00/day	20.00
Total financial cost	TD 140.30/km
Economic Cost	TD 175.80/km

2. Banquettes

Construction requires 2 runs with disc plough and 2 runs with Booleroo plough - say 2 hours of tractor time for 100 horsepower tractor and 1 hour each for booleroo plough and disc plough.

	TD/km
2 hours tractor time @ TD 3.82/hour	7.64
1/2 day tractor driver's time @ TD 4.40/day	2.20
Labour for finishing: 5 man days @ TD 2.00/day	10.00
1 hour Booleroo plough time @ TD 0.16/hour	0.16
1 hour disc plough time @ TD 0.30/hour	0.30
Total financial cost	TD 20.30
Economic cost	TD 22.11

3. Elements of banquettes

	TD/km
15 hours bulldozer time @ TD 11.15/hour	167.25
2.5 days bulldozer driver's time @ TD 4.40/day	11.00
Labour for finishing: 15 man days @ TD 2.00/day	30.00
Total financial cost	TD 208.25
Economic cost	TD 258.25

4. Surveyed Dams and Catchments

	TD/dam
12 hours bulldozer time @ TD 11.15/hour	133.80
2 days bulldozer driver's time @ TD 4.40/day	8.80
Labour for finishing: 10 man days @ TD 2.00/day	20.00
Total financial cost	TD 142.62
Economic cost	TD 184.00

3. Drop inlets	TD/inlet
Materials (wire, steel posts etc.)	30
Labour: 15 man days @ TD 2.00/day	30
Total financial cost	TD 60
Economic cost	TD 52.50

6. Rangeland rehabilitation

Requires combination of banquettes, stone cordons and planting with acacia, atriplex, cactus and other perennial forage plants. Mainly completed by hand labour.

Cordons and banquette construction requires approximately 50 man days/km, with 0.35 km of banks/ha.

Planting requires 5 man days/km of bank.

Total financial cost = TD 38.50/ha

Economic cost = TD 28.87/ha

Table 4: OEP Farm Development Costs (TD) - Phase 1

	Yr 1	Yr 2	Yr 3	Yr 4	Total
1. Pasture Establishment & Management					
Seed @ TD 1.55/kg (15 kg/ha)	4 880	6 390	6 390	7 440	25 100
Fertilizer @ TD 48.5/t (50 kg/ha)	750	1 100	1 610	2 070	5 530
Machinery operation (1 hr/ha @ TD 4/hr)	840	1 100	1 100	1 280	4 320
Labour (2 hr/ha planted)	210	275	275	320	1 080
Sub total	6 680	8 865	9 375	11 110	36 030
2. Increased Cereal Production					
Seed @ TD 0.069/kg (60 kg/ha)	580	1 320	1 570	1 590	5 060
Fertilizer @ TD 48.5/t (50 kg/ha)	250	580	690	698	2 218
Machinery operation (2 hr/ha @ TD 4/hr)	840	1 920	2 120	2 304	7 184
Labour (4 hr/ha planted)	105	240	265	288	898
Sub total	1 775	4 060	4 645	4 880	15 360
3. Soil Conservation & Erosion Control					
Absorption terraces @ TD 140/km	2 100	2 100	2 100	2 100	8 400
Banquettes @ TD 20/km	500	500	500	500	2 000
Elements of banquettes @ TD 208/km	2 080	2 080	2 080	2 080	8 320
Surveyed dam catchments @ TD 143 each	280	280	280	280	1 120
Drop inlets @ TD 60 each	600	600	600	600	2 400
Rangeland improvement @ TD 39/ha	1 950	1 950	1 950	1 950	7 000
Sub total	7 510	7 510	7 510	7 510	30 040
4. Livestock Development					
Ewe units purchased (or retained) @ TD 60/ewe	2 820	9 360	17 700	12 600	42 480
Sub total	2 820	9 360	17 700	12 600	42 480
5. Farm Infrastructure Development					
Building improvements at Saouaf[a]	24 000	-	-	-	24 000
Building improvements at Nadhour[a]	21 000	-	-	-	21 000
Machinary shed	5 000	-	-	-	5 000
Sub total	50 000	-	-	-	50 000
Total farm development costs	68 785	29 795	39 230	36 100	173 910

[a] Estimates provided by OEP.

Table 5: Training Costs - Phase 1

	TD				
	Yr 1	Yr 2	Yr 3	Yr 4	Total
Study tours(a)	28 950	-	-	-	28 950
Field days(b)	500	1 000	1 000	1 000	3 500
Post-graduate/projects(c)	-	500	500	500	1 500
Total	29 450	1 500	1 500	1 500	33 950

(a) 2 month tour to Australia by 5 Tunisian experts

Air fares: TD 1 400/person	-	TD 7 000
Per diems: TD 33/day x 60 days = 1 980/person	-	TD 9 900
Professional fees: 3 man months @ TD 3 850/month	-	TD 11 500
Communication, printing, postage, telex, etc.	-	TD 500
		TD 28 950

(b) Cost for printing, advertising and coach transport from Tunis to farms. One field day in year 1, and two per year thereafter.

(c) Budget for special assistance with machinery operation, fencing etc. for post-graduate students undertaking relevant research projects on the farms.

Table 6: Technical Assistance Costs - Phase 1

	TD				
	Yr 1	Yr 2	Yr 3	Yr 4	Total
Full time Experts[a]					
Farm management adviser (3 years)	46 600	46 600	46 600	-	139 800
Soil Conservation Agronomist (3 years)	46 600	46 600	46 600	-	139 800
Pasture Agronomist (2 years)	-	46 600	46 600	-	93 200
Sub total	93 200	139 800	139 800	-	372 800
Short term Consultants[b]					
Animal Production Consultant (8 months)	12 550	12 550	12 550	12 550	50 200
Farm Management Economist (6 months)	6 275	6 275	6 275	18 825	37 650
Pasture Agronomist Consultant (3 months)	12 550	6 275	-	-	18 825
Other consultants (7 months)	6 275	12 550	12 550	12 550	43 925
Sub total	37 650	37 650	31 375	43 925	150 600
Administration	28 800	17 700	21 800	19 100	87 600
Sub total	29 000	17 700	21 800	19 100	87 400
Total	159 650	195 150	192 975	63 025	610 800

(a) Basic salary ($A30 000/year) 16 500 TD/year
Overseas allowance 2 500
Overheads, social payments, tax, insurance etc. (80% of salary) 13 200
Housing 3 600
Education allowance (2 children) 6 000
Leave fares (return to Australia every second year) 2 800
Vehicle 1 000
Total TD 46 600/year (25% local)

(b) Professional fees ($A7 500/man month) 4 125 TD/month
Per diem 30 days @ TD 25/day 750
Travel TD 1 400 per trip 1 400
6 275 TD/month
(12% local)