The determinants of the future of agriculture in Qatar

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THE DETERMINANTS OF THE FUTURE OF AGRICULTURE IN QATAR

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DEDICATED TO

My Husband Mohammed

My Children Hamad, Reem and Mai

My Mother

and

The Memory of my Father

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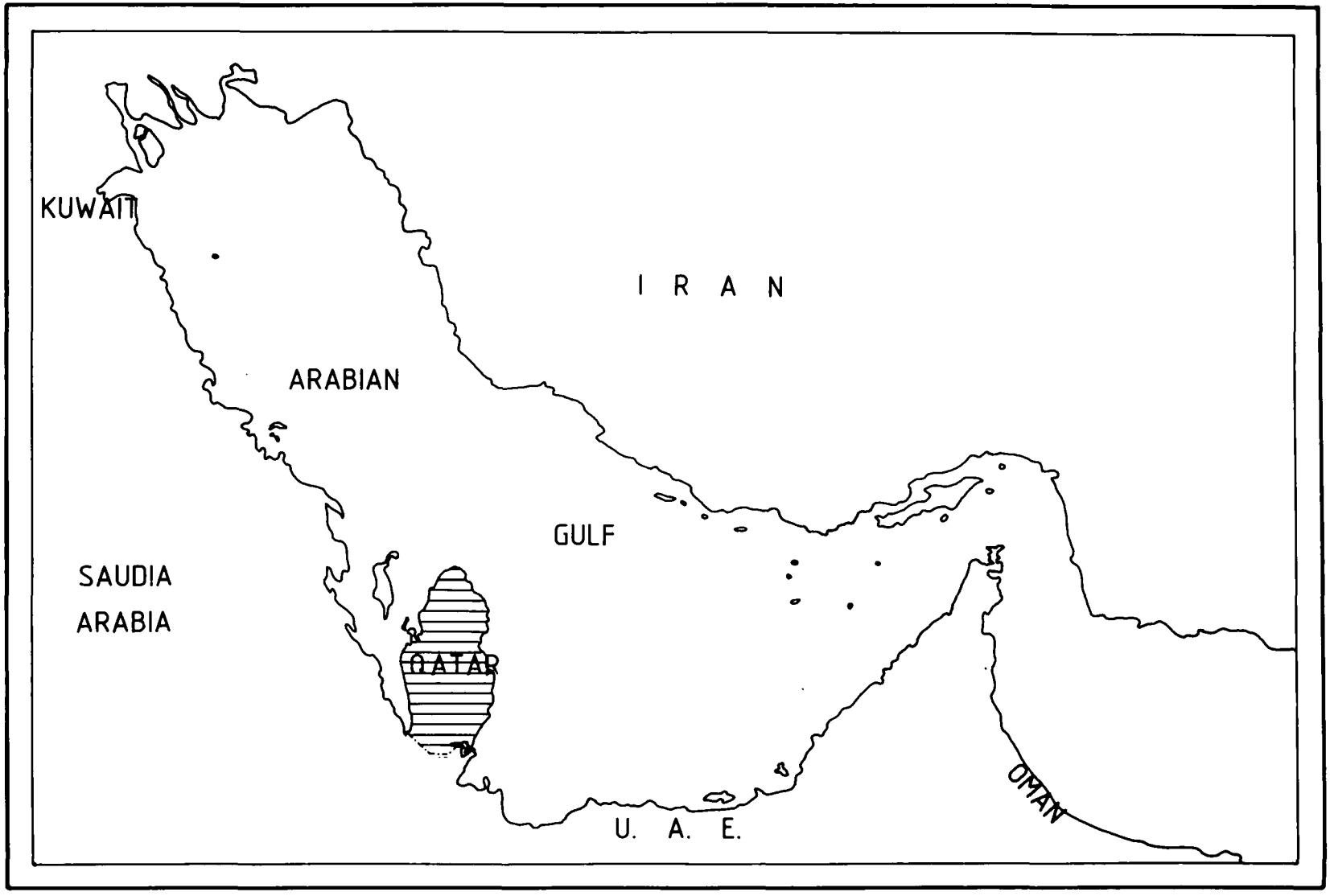
FIG. 1.1 LOCATION OF QATAR



Qatar in 1555 and it became an Ottomanic administrative district. The Ottomans in carrying out their taxation policy, compiled reports on Qatar's population and economic activities and these reports provide the earliest quantitative data relevant to this study. In one report produced during the mid eighteenth century the total population of Qatar and its associated territories was estimated to be about 7,900 in some 3,500 dwellings. This population was mainly made up of pastoral bedouin tribes and pearling was the only commercial activity; there is no mention of cultivation.(4) In a later statistical report Ottoman records give the following revenue information for the late 19th century: (5)

1. Total population 20,000
   Population of the capital 8,000
   Population of the villages 12,000

2. Total mosques of the capital 19
   Village mosques 15

3. Primary schools 15

4. Marine boats of the capital and Qatar's villages are of three kinds : large, medium and small with the exception of boats coming to Qatar during the pearling season from Oman, Bahrain, Qatif and Bar Faris (Iran)

5.

Number of pearling boats	Average labour force per boat	Total labour force in pearling	Number of Qatari pearling boats	Total pearl harvest in Qiran*	Jilatah tax (in Qiran) paid by divers and Saibs**	Tax paid by others on boats
Large: 65	30	1,950	33	1,040,000	16,087	8
Medium: 70	20	1,400	70	700,000	11,550	8
Small: 200	10	2,000	133	800,000	16,500	8
Total 335	16	5,350	236	2,540,000	45,137	24

* Qiran = customary unit of currency

** Saib = Diver's personal assistant (usually a slave)

6. Other revenue from Taxes (in Qiran)

17,000	One Qiran a head Zakat on sheep and goats
1,883	Tax on slaughtered animals (2,200 goats and sheep, 100 camels, 300 cattle)
4,482	Dues for guarding shops and houses
9,900	One Qiran a head tax on sheep and goats imported from Faris (Iran)
33,265	
45,137	Pearling Taxes
78,402	Qiran, Grand Total Revenue

7. Value of imports of main commodities

Qiran	
1,200,000	Rice
240,000	Wheat
50,000	Barley
30,000	Coffee
120,000	Sugar
20,000	Tobacco from Oman and Iran.
8,000	Animal oil, one quarter from Kuwait, Bahrain and Qatif and one half from Iran.
15,000	Kerosene

8. Most clothes imported together with timber (mainly from India) firewood, charcoal and cotton (mainly from Iran). Onions, dried limes, grapes, spices and many fruits as well as barley and flour mainly imported from Iran. Most animals slaughtered were imported from Iran.

It is clear from all of the historical evidence available that Qatar since early times was a rural province almost completely dependent on pastoralism and some fishing, whilst from the 18th

century to the beginning of the 20th century the main economic activity of the inhabitants was concerned with pearling.

British involvement in Qatar goes back to the year 1868[6] but because of the presence of the Turks they could not get as strong a foothold as they had achieved in other Gulf countries. Once the Ottoman Empire entered World War I Qatar signed a protection agreement with Great Britain in 1916. But before that a semi-official British traveller, J.G. Lorimer visited Qatar in 1908. The general investigation of Lorimer showed that Qatar's economy was heavily dependent on pearl diving and trade, while agriculture was absent from Qatar peninsula with the exception of a few small oases.[7]

During the British period, from 1916 up till the end of 1971, several statements were published concerning the condition of Qatar as a whole. In 1954, for instance, Sir Rupert Hay saw the country as "the ugliest stretch of territory that God has created."[8] This in itself supports the general impression of Qatar as a desert land with virtually no agriculture. This is why Qatar faced a serious problem when the pearl industry collapsed in the 1930's. Government, in any structured form, was non-existent before the 1870's and evolved only slowly thereafter. This was mainly due to the independent power of each separate tribe and family. This, alongside the "shame" factor associated with working on the land as a dirt-farmer (this attitude is mainly one derived from pastoral tribal life) produced a situation in which cultivation was and is still seen as the work of the lowest social class menials which no self-respecting Arab should be expected to do. This pattern of social behaviour, unfortunately, has been strengthened by the income from oil exporting.

Oil discovery completely transformed the socio-economic

scene in Qatar. Oil production commenced in 1949 and by 1979/1980 had risen to a stabilised level of about 500,000 barrels a day. (9) Annual income from oil production was about $5,500 million in 1980/81. In 1980 and 1981 Qatar had the highest GNP per capita in the world, over $27,000 and $28,000 respectively.(10)

However, the Government of Qatar became increasingly anxious to diversify the economy to less dependence upon oil and gas exports by investing these revenues in other economic sectors and this need has recently been increased by the fall in oil revenues by some 70% by 1986.(11) Attention and concern are being afforded to agricultural development with the aim of achieving a high measure of self-sufficiency in basic foodstuffs, this in a country where there was virtually no real interest in farming until the 1950's.

During the early 1950's, although there are no extant records other than personal memories, a small number of shaikhs appear to have imported pumps for installation in wells in some of the rōdhat depressions (see Chp. 2). A certain amount of unskilled non-Arab labourers available locally together with migrant Omanis were used to enclose land for private cultivation and it was during this period that one of the main problems confronting agriculture in Qatar arose - the control of potential farmland by powerful families, who were not primarily concerned with productivity or efficiency in agriculture.

A rare initiative towards agricultural production appeared in 1958 when the first highly skilled cultivator was brought to Qatar to work on one of the Shaikh's farms. The cultivator, a Palestinian, was completely upset when introduced to an exhausted farm covered with a salt layer. A quick visit to the north of the peninsula gave him an overall picture of the situation of the country and he told the Shaikh that the future of agricultural activity in

Qatar lay in the northern areas and not in the Doha region. The farmer finally brought from Gaza various seeds for experimental purpose and at the same time brought eight Palestinian families to work with him. (12) Since then a lot of changes have been seen on the agricultural face of Qatar and at the same time the government became more involved in the development of agriculture.

In 1956 the government established a Department of Agriculture the work of which is examined in Chapter 3. (13) In 1970 this Department became part of the new Ministry of Industry and Agriculture, whilst in 1974 an agricultural section was established within the Industrial Development Technical Centre in the first instance for the monitoring of experiments with industrial crops.

In 1971 the Government of Qatar, under its new Constitution of completely independent statehood, began to take various policy decisions which have brought state intervention in agriculture to a high level. Consideration of government policies is deferred to Chapter 3.2 but some salient points need to be made at this introductory stage.

Policy formulation started in the early 1970's with three questions:

a) What was the area of cultivated and of cultivable land?

b) Was there groundwater in sufficient quantity and quality to sustain agriculture and what is the ultimate solution to the problems of water availability not only to agriculture but also to other sectors?

c) What was and is the best way to encourage the private sector to participate in agricultural development?

Between 1971 and 1981 three inter-related programmes concerning land use, water resources and agricultural development in various facets were carried out with FAO/UNDP technical assistance. The question of water availability appeared at the earliest stages and remains crucial. In 1971 the Council of Ministers had promulgated Resolution No.1 (1) of Organizing the Digging of Artesian wells.(15) The resolution stated clearly that no one had the right to dig a well or wells for whatever purpose unless approved by the Minister of Industry & Agriculture. The UNDP/FAO hydological project was very intensive and extensive ranging from detailed climate and hydrological studies to the use of sewage water for agricultural purposes. The study of land availability and soils involved UNDP/FAO from 1975 to 1979.

The third question remains the most important from the government's point of view and has the most costly implications:

a) most of the "rodha" farming areas lie in private ownership;

b) most of the methods used in private agriculture are traditional in type and rely on unskilled labourers;

c) the individual owners of farms do not consider research in agriculture or the adoption of new methods of cultivation as having any priority for themselves; and

d) most, if not all, of the individual farm owners wait for the government to take the first steps towards improvement, these usually followed by other governmental steps.

e) most private landowners are not fundamentally motivated as farmers.

This is why the government had to start and has continued to supply

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* see Chapter 2 III.

the farmers with free inputs i.e. seeds, water pumps, drilling wells, machinery, pesticides, fertilizers and many other inputs, as is considered later.

Agriculture in Qatar is then a complex sector. The physical constraints and opportunities are in absolute terms very clear. In the changing socio-economic conditions of the last thirty years there have developed two different attitudes to the land. Private individuals have taken up land into farmholdings but for most of them commercial viability and resource use efficiency are of little or no concern. The government first allowed this spread of low-productivity motivation farming and even encouraged it by subsidising inputs. It is now emphasising the need for increasing the efficiency of water-utilisation (because of the destructive exploitation of limited water resources) and the need for efficient production of food (in order to reduce the dangerous dependence on imports).

In the following Chapters there will be an analysis and evaluation of the remarkably rapid and fundamental changes which have taken place during the last 30 to 40 years and of the equally dynamic future possibilities.

Agricultural evolution in Qatar can be summarized as follows:-

Traditionally, even before the coming of oil wealth, Qataris, regarded labouring on the land and other manual labour as inferior occupations. Because of that they employed other nationals on their own small areas of cultivated land even when this was used for subsistence production. As we have noted traditional agriculture was extremely limited. During the 1950's and later the impact of oil wealth was considerable and varied but the reliance on imported labour remained and increased. Before 1970 most of the labour force,

Table 1.1 Trends in Agriculture 1958-1982

Year	No. of farms	Area in donum	Labour Force	Inactive farms	Production million QR
1958	40(1)	-	-	-	-
1960	119	1,810	606	869	-
1961	151	3,215	869	1,060	-
1962	185	4,385	1,060	-	-
1963	212	10,275	1,211	-	-
1964	248	6,510	1,392	-	-
1965	284	8,144	1,506	-	-
1966	316	10,207	1,594	-	-
1967	327	10,551	1,635	-	-
1968	349	11,836	1,699	-	-
1969	363	12,421	1,784	-	-
1970	365	13,493	1,872	-	-
1971	411	18,073	2,003	21	-
1972	434	17,191	2,006	45	-
1973	442	14,675	1,361	143	-
1974	450	15,251	1,430	84	-
1975	453	15,538	1,455	115	-
1976	472	17,063	1,500	115	-
1977	493	19,807	1,580	115	-
1978	514	20,655	1,615	116	-
1979	585	143,000	(885)	179	107
1980	603	148,330	-	172	166
1981	674	170,019	-	200	192
1982	-	-	2,939*	-	212(4)

( ) only private sector

* Al-Kuwari, A.K. Analytical Study of the Factors Delimiting the size, structure and type of labour

(1) 1953 Report on visit to Qatar, FAO, 1960

(2) Compiled by the author from Ministry of Economy & Commerce Economic Survey of Qatar (1969-80).

(3) Ministry of Industry & Agriculture (1980-81)

(4) Arrayh Newspaper No.1162 22-9-1983, p.4.

in privately owned farms consisted of Omanis, whilst in the Government experimental farms it was dominantly Palestinian.

Table 1.1 provides a framework for the analysis of change in Qatari agriculture over the last 30 to 40 years and many of the themes discussed later can be associated with these data. The accuracy of data, particularly for the earlier periods, is not always high, partly because of problems of classification as well as of recording. This problem will be examined later. Nevertheless some clear trends appear. In 1960 the labour force in agriculture was 606 employees. This increased to 2006 in 1972 but decreased suddenly to 1,361 in 1973, then increased gradually and by 1978 it reached 1,615. The increase in number of farms and agricultural area clearly will have had a considerable impact on land and water resources - see Chapter 2. A further result of this growth has been a rising demand for agricultural labour at all levels. This remains almost entirely a matter of non-national labour supply.

In 1960 the area under cultivation was 1,810 donums which had increased to 170,019 donums by 1981, that is an increase of about 9,293 per cent during two decades, or at a rate of 9.3 per cent per annum.

It was estimated that in 1958 there were 40 farms, increasing to 119 in 1960 and 411 in 1971, when for the first time reports showed that some 21 farms should be classified as inactive. The total number of farms in 1981 was 674 of which 200 were inactive.

Not until 1979 are there any official estimates of the value of agricultural production, and these will also be analysed later for their significance. What we can be sure of is that by 1981/82, the value of agricultural products reaching the market had become significant. The total value of agricultural production in Qatar

amounted to QR 107 million, this assessed as products reaching the market and utilizing market wholesale prices during the year 1979. In 1982 the value reached QR 212 million. That is to say 0.5 per cent of the GDP.

The number of farm units even at peak, is small for the whole country. The area in farms represents only 1.5 per cent of the total land area of Qatar (see Chapter 4). The total value of production was insignificant compared to other sectors (see Chapter 5). In terms of employment, even the estimate of the number of workers in agriculture in 1982, shows that agriculture is not a major sector.

There is, however, another critical aspect of agriculture. As considered in Chapter 2 agriculture is by far the greatest consumer of groundwater and the planning for the most efficient use of groundwater resources has to involve agriculture.

The relative importance of agriculture in Qatar has also to be viewed from other standpoints particularly for the future. Judging from governmental initiatives, considerable importance is attached to the forward development of agriculture. Evidence for this may be found in the government backing of FAO programmes between 1971 and 1981 and of Arab League assistance, the continuing backing for the Department of Agriculture's research and the support services provided to farmers(see Chpt.3.3).The general aim is to reduce dependence on food imports.

Lastly agriculture, hypothetically at least, is a productive sector which could be of vital importance in the post-oil future. The characteristics of and trends within agriculture are therefore more important than some contemporary statistical indicators would suggest. It is therefore also important to consider the main factors

involved. The main factors which affect agriculture are separately examined in Chapters 2 to 5. They are then considered in combination in Chapters 6 & 7 in relation to Qatar's general development scenarios.

Methodology

All available published official records relating to agriculture have been analysed and as will be seen from the bibliography these are few in number, cover a short period i.e. less than 30 years, and require great care in their use.

Already the differentiation between what recently have been classified "active" and "inactive" farms has been touched on. Throughout all survey reports, statistics etc. this constant difficulty arises both in connection with farms and farmers. Most cultivated land is held by Qataris who do not work the land themselves but who, either directly or indirectly through tenants and managers, employ labour to grow a considerable variety of crops. The Qatari landholders invariably obtain almost all their income from non-agricultural activities ranging from government employment to trade and commerce. In some cases farm production is sold on the market but there are a very few cases of specialisation. In many other cases the farms are treated as small amenity estates or hobby farms.

Throughout the study therefore we have to recognise that there are virtually no normal commercial or subsistence motives influencing landholders' decisions and their responses either to market forces or to government intervention are highly idiosyncratic. This affects all analysis and interpretation of data.

A sample survey of 42 farms, about 10% sample of active farms, was carried out in 1983 specifically to establish some of the key

characteristics of farms in this highly abnormal situation and the data is examined in Chapter 4.

Published data and survey findings in agriculture were reinforced with the results of research in hydrology, climate and soils to provide the context within which Qatari agriculture exists.

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CHAPTER TWO

PHYSICAL RESOURCES FOR AGRICULTURE

In this chapter climate, soil and groundwater are considered and analysed in order to appraise their suitability for agricultural development. Their characteristics have strongly influenced the size, type and design of farms, the types of crops grown and methods of cultivation and irrigation etc.

Furthermore they have had considerable impact on other necessary factors of production i.e. socio-economic factors which are discussed in Chapter three.

I. CLIMATE

Qatar has a hot desert climate, scanty rainfall, high insolation, very hot summers, high humidity throughout the year and sand storms, these characteristic features of the climate resulting from the fact that Qatar lies within the vast mid-latitude desert belt extending from North Africa into South West Asia, the location of Qatar on the west coast of the Arabian Gulf, and the seasonally varying influence of air masses, e.g. the presence of medium-high pressure over Asia during winter and low pressure over India and Afghanistan during summer.

In this part of the study discussion will concentrate on those climatic and weather conditions most relevant to agriculture, i.e. temperature, relative humidity, radiation, wind, rainfall and evaporation. This will be followed by an evaluation of the effect of the combined weather conditions on agriculture as a whole and on irrigation, soil and plants in particular.

1. Temperature

It is clear from Table 2.1 that mean monthly temperature reaches its minimum during January with a lowest recorded mean monthly temperature

Table 2.1

Monthly Temperature (C^{o}) for the Period 1972-1983)

Station	Parameter	Month												Annual
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rawdat	Mean Max. Temp	21.39	23.00	26.64	32.50	38.58	40.96	42.04	41.83	40.73	36.02	29.36	24.1	33.1
Al	Mean Min. Temp.	11.50	11.95	14.68	18.00	18.77	24.82	24.27	26.06	23.42	20.19	16.12	12.91	19.03
Faras	Mean Air Temp.	16.44	16.09	20.28	25.26	30.49	32.89	34.16	33.95	32.03	28.12	22.71	18.51	26.07
Oturi-	Mean Max. Temp.	21.26	22.85	26.71	33.63	39.76	42.56	42.75	42.54	40.80	36.07	29.48	23.99	33.54
yah	Mean Min, Temp.	10.82	11.73	14.80	18.79	23.47	24.88	26.61	26.86	24.30	21.14	17.03	13.20	19.49
	Mean Air Temp.	16.00	16.82	20.80	26.25	31.65	33.73	34.67	34.92	32.59	28.61	23.25	18.55	26.52
Abu-	Mean Max. Temp.	20.64	21.16	25.91	31.62	35.70	36.78	38.39	42.19	37.53	33.71	27.34	23.04	30.94
Samra	Mean Min. Temp.	11.41	12.54	15.55	19.69	23.72	25.64	27.36	26.96	24.23	20.82	16.93	13.14	19.84
	Mean Air Temp.	16.03	17.35	20.74	25.54	29.71	31.21	32.87	32.66	30.92	27.22	22.10	18.10	25.34

Source : Groundwater in Qatar, Department of Agriculture and Water Research, Doha, 1983.

of 6°C in January 1977.[1] From mid-February onwards temperature increases, steadily reaching its maximum during July or August with a highest recorded mean monthly temperature of 40°C (August 1977).[2] It is clear from this table that most of the year experiences high temperatures. Although the variation between the records of the four stations shown in the table is of slight range, it does give an indication that the temperature on the west coast is slightly cooler than on the east one, whilst the coast is on average warmer than the interior during winter and slightly cooler in summer.

In addition to air temperature we need to examine the soil temperature (at surface, 10 cm. and 50 cm depth) in order to obtain a fuller picture of temperature as it affects plant growth in Qatar. The surface soil temperature, as a matter of fact, follows the seasonal regime of the air temperature, but at a different level as shown in Table 2.2. Mean monthly temperature on the surface is very much lower in winter than is the air temperature, the difference being smaller in summer. Generally the 10 cm depth has the lowest mean temperature showing the strong effects of radiation at this depth. At the 50 cm level the seasonal changes in radiation are far smaller so that temperatures during the winter months are usually higher than the surface in the region of 5°C or over even than those at 10 cm. During the summer the surface temperatures and those at 10 cm and 50 cm reach their maximum, due to the air temperature and high solar radiation.

Table 2.2 Soil Temperatures (C) for the Period 1972-1983

Station	Parameter	Month												Annual
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rawdat	Soil Temp. 0cm	13.69	14.65	18.52	23.17	28.00	31.34	32.85	32.42	30.16	26.29	20.67	16.44	24.02
Al Faras	Soil Temp. 50cm	20.39	20.12	21.96	25.24	29.03	32.55	34.30	34.78	33.91	31.41	26.92	23.33	27.80
Oturi-	Soil Temp. 0cm	14.05	16.66	20.81	26.88	32.87	32.36	36.37	36.10	32.46	30.14	22.75	17.94	26.80
yah	Soil Temp. 50cm	20.55	20.25	22.13	26.45	30.55	33.69	34.46	35.49	34.55	32.15	25.11	23.45	28.47
Abu-	Soil Temp. 0cm	15.19	15.69	19.41	24.1	28.76	31.17	32.14	32.1	30.08	26.68	22.09	17.21	24.41
Samra	Soil Temp. 50cm	20.06	20.03	22.46	25.36	28.6	31.35	32.5	32.47	31.5	28.87	25.96	22.99	26.73

Source : Groundwater in Qatar, op.cit.

Table 2.3 Mean Monthly Relative Humidity for the Period of 1972-1983 (%)

Station	Parameter	Month												Annual
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rawdat Al Faras	Mean Max. R.H.	91.40	90.93	90.93	87.64	85.15	83.87	86.85	91.23	94.21	94.58	93.46	92.77	90.26
	Mean Min. R.H.	45.64	39.27	33.02	22.57	16.97	18.53	19.98	22.48	21.88	26.26	37.27	44.06	29.04
	Mean R.H.	74.43	72.19	66.33	58.34	51.26	50.69	53.63	59.62	64.06	66.97	70.82	74.45	63.57
Oturi-yah	Mean Max. R.H.	90.96	93.51	90.07	76.04	63.49	70.76	85.54	88.24	94.08	82.39	89.65	89.34	87.97
	Mean Min R.H.	39.00	33.05	27.31	14.27	10.02	11.79	14.36	15.88	14.37	17.82	29.85	37.45	22.30
	Mean R.H.	70.22	69.52	63.30	51.45	43.99	44.66	48.27	52.27	58.55	61.19	64.35	58.96	58.04
Abu-Samra	Mean Max R.H.	92.50	92.28	90.33	90.03	86.77	85.60	91.56	91.98	94.40	91.98	89.56	89.11	90.26
	Mean Min R.H.	49.18	42.67	34.65	28.15	31.19	33.60	36.43	33.06	31.31	33.58	45.33	47.44	37.26
	Mean R.H.	73.82	72.99	67.52	59.81	60.26	60.04	64.70	63.38	69.12	66.13	71.48	72.63	66.53

2. Humidity

The high relative humidity of Qatar results mainly from the peninsularity of the country where very little of the land area lies more than 30 km from the sea. Mean annual and monthly relative humidity is always above 50 per cent although maximum relative humidity during the winter months may rise to over 90 per cent, which gradually decreases towards May/June to an average minimum value of less than 30 per cent (see Table 2.3). This phenomenon is explained by the prevalence of warm dry north westerly winds in summer. There is also a high diurnal variation in relative humidity. For instance, even during winter it may fluctuate from 40 per cent to 75 per cent in 24 hours, but during the mid-summer months of June/July it may vary from 10 per cent during the early afternoon to over 90 per cent at night, especially in the interior of Qatar.(3)

3. Radiation

As may be expected from the temperature and relative humidity data, the gross incoming solar radiation is high throughout the year, varying from monthly mean values of 345.2 mWh/cm in December to 672.1 mWh/cm in June. These high intensities for long periods can have an adverse effect on the quality and quantity of agricultural produce (see Table 2.4).

Table 2.4 Solar Radiation 1978 (mwh/cm)*

Months	Max.	Min.	Mean
Jan.	454.12	246.24	393.92
Feb.	623.61	94.34	442.99
Mar.	625.21	447.21	555.89
Apr.	701.96	207.87	520.20
May	769.11	361.37	661.47
June	719.55	591.63	672.14
July	700.36	204.67	590.22
Aug.	655.59	511.81	639.84
Sep.	642.80	479.70	554.94
Oct.	673.18	431.73	477.59
Nov.	471.71	287.82	401.71
Dec.	407.74	255.84	345.17
Year average	620.41	343.35	521.34

*Milli.watt hours per square centimentre

4. Wind

During the winter months, daily wind direction is variable, with the predominant direction in December being south to SSE with an average speed of 7.9 knots and in February, NW with an average speed of 8.9 (see Table 2.5). During the remainder of the year the predominant direction is NNW. Wind speeds of 20 knots and over are most prevalent during March to June. In general, such wind speeds are found in Qatar for 19.5 per cent of the year.

Table 2.5 Wind speed and direction

Months	Mean wind speed (knots)	Maximum sustained wind speed		Maximum wind speed (gust)		Wind speed of 20 knots or more (days)
		Degrees	Knots	Degrees	Knots	
Jan.	11.0	340	28	300	39	6
Feb.	8.9	300	30	300	39	6
Mar.	10.5	350	29	220	37	9
Apr.	10.8	360	32	360	41	10
May	11.3	330	30	340	37	11
June	12.6	340	35	340	49	13
July	8.9	310	28	320	30	6
Aug.	11.6	350	22	350	32	6
Sep.	5.9	20	19	330	24	Nil
Oct.	6.1	320	22	320	29	1
Nov.	9.9	360	22	310	25	2
Dec.	7.9	180	21	190	28	1

Computed by the author from:

Ministry of Communication and Transport, Annual Climatological Report 1978

5. Rainfall

Rainfall in Qatar is very low in quantity and generally confined to the winter months of November to March, but in some years, as Table 2.6 indicates, as a result of thunderstorms, rainfall has occurred as early as October and as late as April. Generally speaking the rainfall of Qatar is of two types : winter frontal precipitation occurring during December - February and, secondly, winter thunderstorms. The benefits even of small amounts of rainfall in a country like Qatar are noticeable and can be seen in the context of:

a. The improvement of plant growth.
b. The reduction, to a certain extent, of salinity concentration.
c. The amelioration of the effect of other extreme climatic elements, e.g. temperature.
d. A hypothetical reduction in manpower requirements for irrigation.
e. A reduction, potentially at least, in the massive extraction of groundwater resources.
f. The provision of aquifer recharge.

But, unfortunately, these advantages occur only in and for very short periods and associated with particular types of rainfall, and there are disadvantages which can be listed as follows:

a. If the rainfall is low but continues for two days or more it can lead to eliminating plant growth due to complete or near water-logging of soils of low impermeability.
b. If the rain is of high intensity this can lead to flooding, soil erosion, and actual physical damage to plants.
c. Rain associated with high temperature and high insolation can cause tissue burning of plants and, at the same time, can create local micro-climates unsuitable for some types of plant growth but conducive to many plant diseases.

Table 2.6 Rainfall (cm)

Month	1975	1976	1977	1978	Average 1975-78
Jan.	31.3	25.2	41.4	Nil	24.5
Feb.	46.3	23.9	17.9	12.8	32.7
Mar.	1.1	23.1	0.5	1.0	6.4
Apr.	1.8	40.3	2.3	5.9	12.6
May	Trace	Trace	Nil	Nil	Nil
June	Nil	Nil	Nil	Nil	Nil
July	Nil	Trace	Nil	Nil	Nil
Aug.	Nil	Nil	Nil	Nil	Nil
Sep.	Nil	Nil	Nil	Nil	Nil
Oct.	Nil	5.4	17.3	Nil	5.7
Nov.	Nil	45.5	8.1	Trace	13.4
Dec.	4.4	Trace	3.1	Trace	1.9
Year average	7.1	16.1	7.6	1.6	8.1

Source : Ministry of Communication & Transport, Annual Climatological Reports, 1975-78, Meteorological Section.

Table 2.7 Long-term Rainfall characteristics

	Doha
Years of Record (years)	18
Maximum annual rainfall (mm)	190.7
Minimum annual rainfall (mm)	2.0
Mean annual rainfall (mm)	63.3
Upper Quartile (mm)	102.3
Lower Quartile (mm)	22.0
Standard Deviation (mm)	52.8
Coefficient of variation (%)	83.4

Source Pike, J.G. The Agro-climatology of Qatar
Technical Note No.1
FAO/Qstar 1978 p.23.

d. Heavy raindrops splash, in uncovered areas, which can pit the soil and damage the plants.

6. Evaporation and Evapotranspiration

The immediate conclusion one can reach is that evaporation under the above mentioned weather conditions is very high indeed and the loss of water, especially during the summer months, is very high. In summer, with its high solar radiation, high air and soil temperatures, and a dry NNE wind, the calculated open water evaporation rate reaches its highest with a maximum daily rate of 27.7 mm. Table 2.8 shows the seasonal pattern of mean monthly evaporation.

Table 2.9 gives the data for potential evapotranspiration rates utilising the standard Penman formula modified for cultivated land taking the crop mix at Rodhat al Faras government farm as standard. The ratio between these values and computed open water evaporation rates is also given. The very high annual and seasonal crop water requirements in this hot summer, warm winter, windy arid region are clear, annually rising to almost 2000 mms at Oturiyah in the centre of the island. The demand made by irrigation on the limited groundwater resources available are enormous and are leading to accelerating irreversible depletion.

Table 2.8 Mean Open Water Evaporation, Eo, (Penman), (mm) for the Period 1972-1983

Station	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Abu Samra	106.6	110.1	159.5	202.5	242.2	256	256.6	247	211.1	181.8	135.8	109.1	2214.4
Oturiyah	107.68	111.62	169.95	219.23	279.89	309.27	307.47	291.12	236.85	193.37	138.85	111.45	2480.27
Govt.Farm	93.16	101.66	149.42	185.62	241.25	251.23	273.42	253.48	214.58	173.69	122.57	95.57	2178.60

Source : Groundwater in Qatar, op.cit.

Table 2.9 Mean Monthly Modified Potential Evapotranspiration, Eto*, (Penman) (mm) for the Period 1972-1983

Station	Parameter	Month												Annual
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Rawdat Al dat Faras	Eto*	69.52	77.78	117.81	144.49	188.04	217.27	219.75	207.30	174.29	137.44	93.24	70.92	1717.79
	Eto* Eo	0.746	0.765	0.788	0.778	0.779	0.865	0.804	0.818	0.812	0.791	0.761	0.742	0.788
Oturi-yah	Eto*	82.75	87.63	135.44	170.83	201.62	241.63	242.41	232.47	188.29	153.83	106.76	85.29	1948.56
	Et* Eo	0.768	0.785	0.797	0.779	0.720	0.781	0.788	0.798	0.795	0.795	0.769	0.765	0.786
Abu-Samra	Eto*	81.6	86.4	129.1	161.4	196.6	210.3	213.6	206.8	175.8	148	105.7	82.4	1797.7
	Eto* Eo	0.765	0.785	0.809	0.797	0.812	0.821	0.832	0.837	0.833	0.815	0.778	0.755	0.803

Source : Groundwater in Qatar, op.cit.

Livestock farming on the other hand under these circumstances is possible at one of two levels:

a) traditional "bedu" pastoralism reliant on poor desert/range, and which is very limited; and

b) modern "zero-grazing" based on the irrigated cultivation of feed and fodder; this today is the commonly used system in Qatar.

Traditional irrigation systems are very simple and based on flood irrigation through open channels leading to small open basins or strips carrying different crops. This kind of system is not and never has been accompanied by any sort of artificial drainage or even any careful management of soil or water. The result has been to destroy the quality of the soils and, at the same time, to utilise the available groundwater with low efficiency. The soils, as discussed in Chapter 2.2, are naturally unleached and can have a high salt content. These conditions, together with poorly controlled flood irrigation and weather conditions, encourage salinisation and waterlogging. This can lead, very quickly to serious problems of deteriorating soil structure and water quality and to low yields.

During the last few years there has been some change from traditional irrigation systems to the utilization of more efficient methods of irrigation, but, as considered later, the identification of the more appropriate systems as well as their adoption is a complicated matter.

II. SOIL

A reconnaissance soil survey of Qatar was completed in 1973, and recent investigations have been directed towards detailed soil surveys and soil management studies. The original soil survey classified the soils of Qatar into four soil associations and eight soil series, summarized as follows(5)

Rodha Soil Association (A)

Series A: Silty clay loam to clay loam, sometimes with soft lime secretions of moderately deep profile 30 - 150 cm, salinity of virgin soil as expressed by electrical conductivity ranges between 0.5 - 1.70 mmoh/cm (23,100 hectares).

Series A2: sandy loam to sandy clay loams with a shallow to moderately deep profile with a surface cover of aeolian sand 10-15 cm deep occurring in hummocks around vegetation (6,520 ha).

These soils are deposited in depressions, the formation of which is explained later, and are generally known as rodha (pl. rodat or riyad) and constitute the main agricultural soils of the country, particularly series A.1.

Saline Sabkha Soil Association (B)

Series B1: Gypsiferous depression soils of clay loam texture and greyish clay in the subsoil as a result of water logging (6,517 ha)

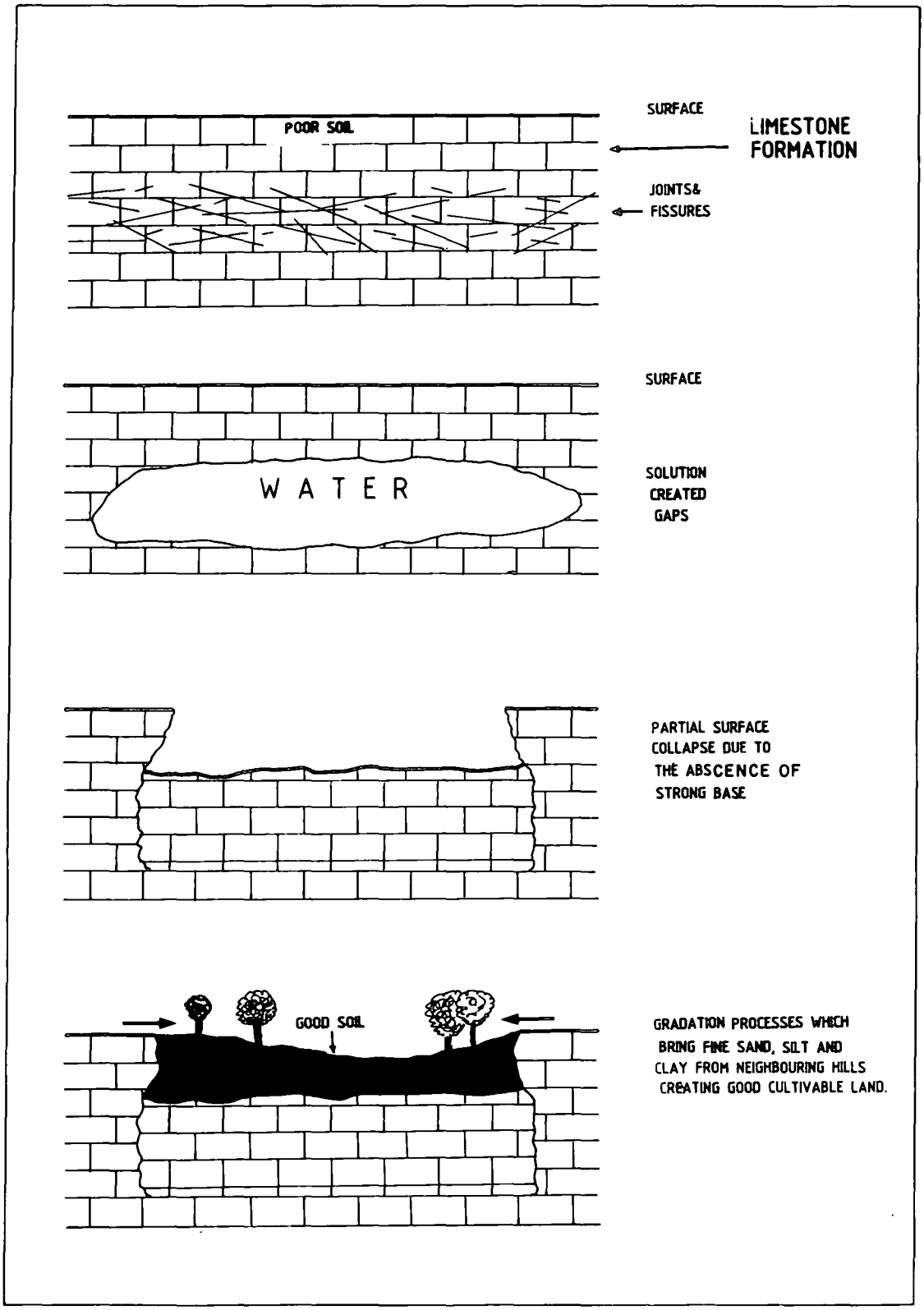
Series B2: Sandy clay loam to sandy loam in texture with profile depth of 40-100 cm., characteristic sabkha deposits of southern Qatar (63,607 ha).

Lithosol Association (C)

Series C: very shallow soils 19-30 cm of calcareous sandy loam uniformly covered with rock fragments scattered on the surface and overlying a layer of rock debris, followed by limestone outcrop (958,072 ha).

Series C2: Rocky hill outcrops, mainly in central and southern Qatar (62,925 ha).

FIG 2.1 FORMATION OF RODHA SOIL .



Sandy Soil Association (D)

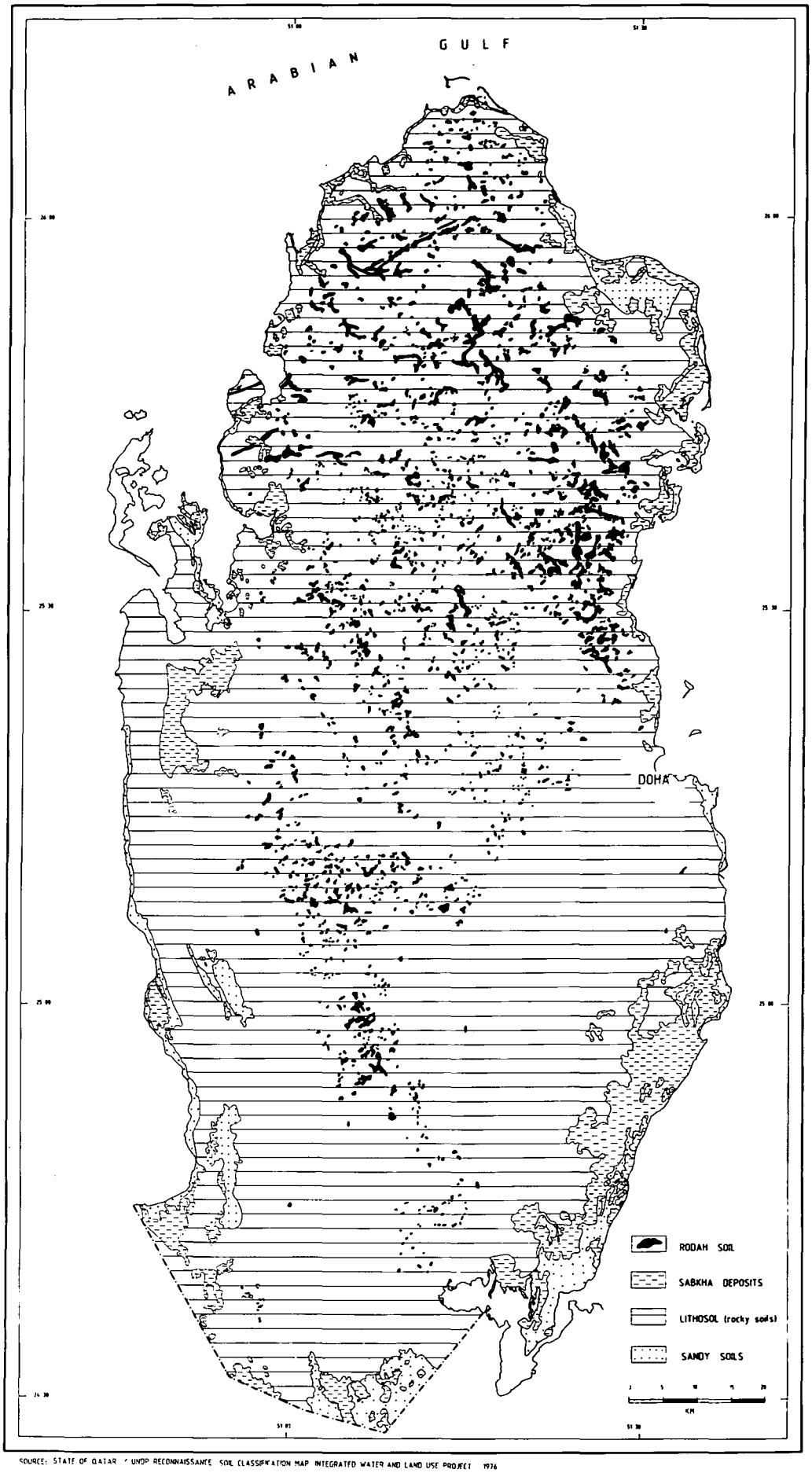
Series D: Aeolian sandy soils of southern Qatar characterized by a deep profile with calcareous coarse sand to loamy coarse sand and a mixture of desert and marine sand. Occurring either as a thin mantle overlying rodha soils or bare rock in depressions or in isolated mobile barchan type dunes on limestone pavement (4,755 ha).

Series D2: White oolitic sand or marine origin, usually found adjacent to the coast (31,392 ha).

Rodha soil formation (See Fig. 2.1)

Climate and surface geology have led to the formation, in some localities, of rodha soils, which are the best cultivable soils available naturally. Most of the superficial rocks of Qatar are of sedimentary origin. In addition the peninsular surface has been affected by gradational processes. Within the dominantly calcareous rocks, porous, permeable and partially soluble, water movement creates gaps and fissures underneath the surface. When the gaps are widened into subsurface hollows by further solution by groundwater the surface collapses. This is the first step in the formation of collapse structure depressions - rodhat. Within such depressions fine sedimentary soils evolved from insoluble particles in the limestones and inwashed silt together with wind borne material have been deposited in relatively thick accumulations. The gradational effects of weathering operations where high temperatures and insolation and large temperature variations mechanically and chemically affect the rock structure and its chemical formation, combined with periodic surface water movement, transfers the weathered detritus from neighbouring higher land to the basins and builds up the rodha soils.

FIG. 2.2 SOIL CLASSIFICATION MAP



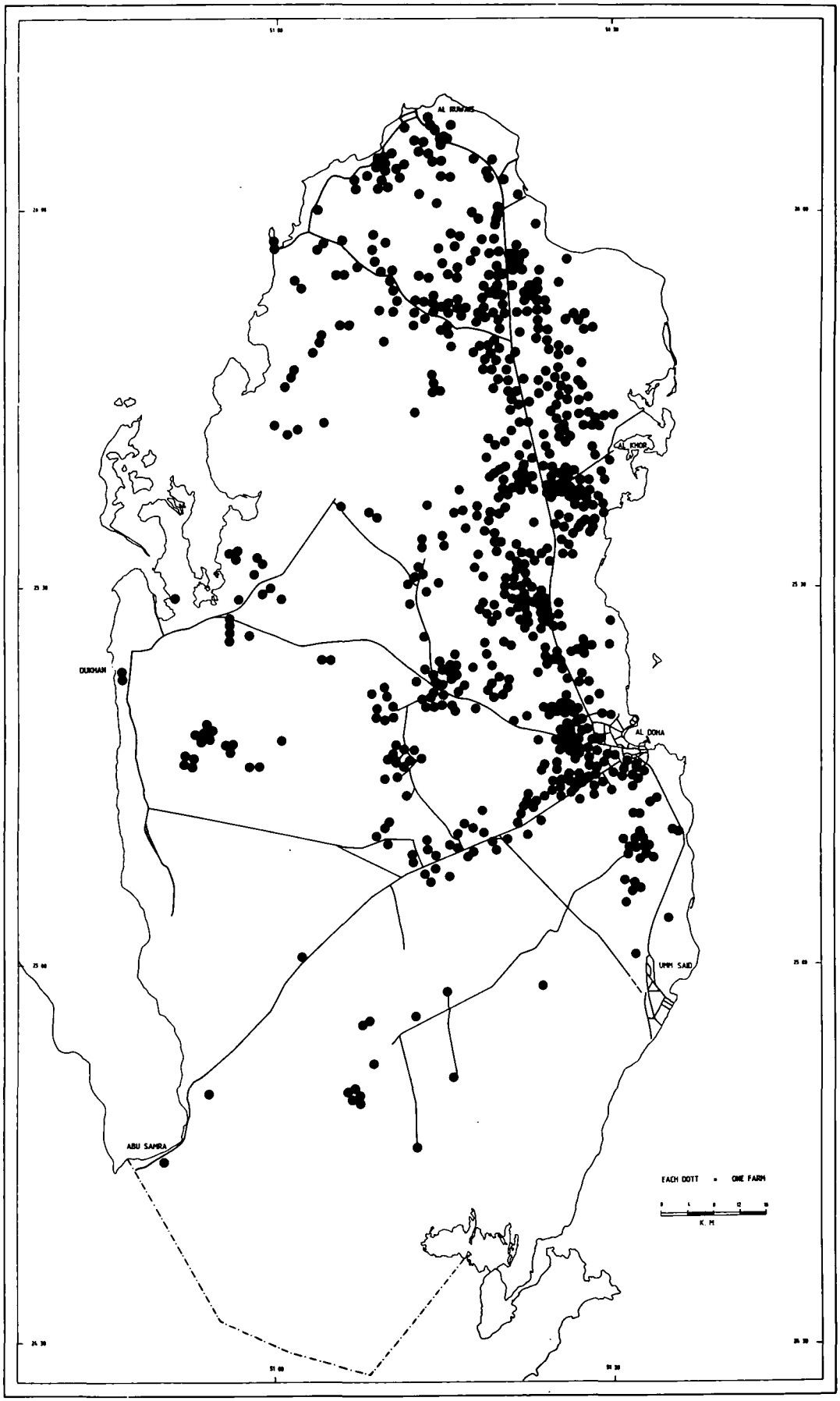
SOURCE: STATE OF QATAR / UNDP RECONNAISSANCE SOIL CLASSIFICATION MAP INTEGRATED WATER AND LAND USE PROJECT 1976

Because of the dominant limestone lithology of the Qatar peninsula we find the above mentioned mechanism of rodha soil development in most regions, but due to the varying hardness of the limestone from one place to another and the non-uniform presence and depth of surface and groundwater flows, the rodhat depressions and associated soils are scattered unevenly over the peninsula with concentrations in the north and in the centre of Qatar (see Fig. 2.2).

According to FAO reports there are 850 scattered rodha with areas varying between a few hectares to 60 ha. with a soil thickness of between 30-150 cm. The aggregate area of rodha soils in the Qatar region is some 30,000 ha. However, usually, and because of the above process of rodha formation these depressions are isolated from each other by large areas of poor lithosols (see Fig. 2.2). The control exerted on agriculture by the spatially varying availability of rodha soils is clearly shown by a comparison of Fig. 2.2 with Fig. 2.3.

A soil sample was taken from Barada farm in Northern Qatar, this exemplifying rodhat soil. The results of physical and chemical analysis of this sample are shown in Table 2.10.

FIG. 2.3 FARM DISTRIBUTION IN QATAR



SOURCE MINISTRY OF INDUSTRY & AGRICULTURE FARM DISTRIBUTION MAP AGRICULTURE & WATER RESEORCE DEPT. QATAR

Table 2.10 Characteristics of a typical Rodha soil

Characteristics	Depth. cm		Soluble cations and anions	Depth. cm	
	0-15	30-45		0-15	30-45
Clay %	42	42	Ca	35.7	34.4
Silt %	25	26	Mg	20.5	13.7
Sand %	33	32	Na	66	59.9
Field capacity %	24	25	K	3.22	1.24
Wilting point %	15	15	HCo_3	1.38	1.23
Available moisture %	9	10	Cl	57.7	64.0
Moisture Saturation%	56	58	So_4	66.4	51.2
pH	7.82	7.80	Exchangeable cations, me%		
Ex x 10^3	9.83	9.56			
$CaCo_3$%	17.8	19.5	Ca	10.8	10.9
Organic matter %	6.49	0.27	Mg	4.36	4.20
p.ppm	15.5	13.7	Na	4.21	3.81
N%	0.05	0.04	K	0.79	0.77

III Third : Water Resources/Groundwater

Underground water is essential to agricultural development in Qatar because there is no permanent surface water present in Qatar and effective precipitation is too low to support cultivation. Agriculture is the largest consumer of groundwater. It was recorded that in 1972/73 the average total extraction of groundwater for irrigation usage was about 44.1 million m^3 per annum, of which 20 per cent returned to the aquifers. That is to say a net total of 35.28 mm^3 per annum was consumed, already slightly higher than a safe permanent extraction rate. Extraction continued to increase for agricultural as well as for domestic and industrial use. Table 2.11 illustrates the volume of groundwater extracted for two main usage groups in the period of detailed study up to 1980. In addition, the table also shows the output of distilled sea water of Ras Abu Aboud and Ras Abu Fountas plants.

It is clear from this table that the consumption of groundwater has increased rapidly from 14 mm^3 in 1964 to 58 mm^3 in 1980. That is to say an increase of 7.64 per cent per annum. The domestic commercial and industrial usage of groundwater kept increasing from 1964 till 1975, they then started to decline from 6.21 mm^3 in 1975 to 3.67 mm^3 in 1980. This was achieved by expanding the operations of sea water distillation which was 2.4 mm^3 in 1964 and reached 44.35 mm^3 in 1980, an increase of about 11.2 per cent per annum.

Clearly, since 1975 agriculture has become the predominant consumer of groundwater and the economic justification for and the question of efficiency of water use in agriculture have to be examined. The difficulty is that all agricultural production in Qatar depends on the availability of water.

Table 2.11

Water Consumption - Qatar

1964-1980

(m x 10)

Year	Agricultural/Forestry					Domestic/Commercial						Total Domestic Comm.
	Groundwater			Effluent	Total Agriculture	Groundwater			Distilled Sea Water			
	Fresh 1/	Brackish 2/	Total			Fresh 3/	Brackish 4/	Total	Aboud	Fontas	Total	
1964	14.0	-	14.0	-	14.0	1.59	-	1.59	2.40	-	2.40	3.99
1965	16.0	-	16.0	-	16.0	1.37	-	1.37	2.85	-	2.85	4.22
1966	18.5	-	18.5	-	18.5	1.29	-	1.29	2.79	-	2.79	5.37
1967	20.5	-	20.5	-	20.5	1.54	-	1.54	2.30	-	2.30	3.84
1968	21.5	-	21.5	-	21.5	1.61	-	1.61	2.93	-	2.93	4.54
1969	24.0	-	24.0	-	24.0	1.58	-	1.58	4.50	-	4.50	6.08
1970	28.0	-	28.0	-	28.0	2.07	-	2.07	4.74	-	4.74	6.81
1971	30.0	-	30.0	-	30.0	2.58	-	2.58	5.34	-	5.34	7.92
1972	33.0	-	33.0	-	33.0	3.84	-	3.84	5.14	-	5.14	8.98
1973	35.3	-	35.3	-	35.3	4.26	-	4.26	5.90	-	5.90	10.16
1974	38.0	-	38.0	0.2	38.2	4.33	-	4.33	8.80	-	8.80	13.13
1975	40.0	-	40.0	0.5	40.5	6.21	-	6.21	10.40	-	10.40	16.61
1976	43.0	0.2	43.2	0.5	43.7	6.07	-	6.07	10.22	-	10.22	16.29
1977	45.6	0.9	46.5	0.6	47.1	6.00	-	6.00	10.06	4.74	14.80	20.80
1978	48.3	0.8	49.1	1.0	50.1	5.40	-	5.40	10.01	13.05	23.06	28.46
1979	49.8	0.9	50.7	1.5	52.2	4.07	0.50	4.57	8.46	23.49	31.95	36.52
1980	57.2	0.8	58.0	1.6	59.6	1.17	2.50	3.67	10.95	33.40	44.35	48.02

1/ Net after deduction 25% irrigation return

2/ Alat Aquifer. Abu Samra and Wadi el Araig

3/ Incl. Dukhan

4/ Doha blending water and Abu Samra reverse osmosis plant

Source : FAO, Qatar, The water resources of Qatar and their Development : Vol.1 Qatar, 1981.

The facts about groundwater study can be summarised as follows : the FAO field study of the peninsula's water resources indicate that Qatar can be divided into two groundwater provinces, the northern and southern which are separated along a V-shaped boundary.

1. The northern groundwater province is the most important source of water for agriculture. The water in this province occurs as a fresh water lens floating on brackish and saline water. This lens is present mainly within limestone and dolomite structures of the Dammam and Rus (Eocene) formations, whilst the more saline groundwater lies within the Umm er Rhaduma (Palaeocene) formation. In 1958 the upper surface of potable groundwater was found to be about 6 m above sea level to 7.5 m below sea level and the lens had a thickness of about 100 m. In 1975 because of heavy pumping (see Table 2.4) the surface levels had changed to between 2 m above and 10 m below sea level. The quantity of potable water in this northern aquifer was estimated in 1977 to be about 2,500 million cu.m.

2. The southern groundwater province is completely different from the northern part. Potable water is found in several relatively small aquifers surrounded by brackish water and in this area which occupies more than half of Qatar area there is no single major water lens. Salinity is regionally variable and in some places is increasing as can be found near the Dukhan anticline where extraction has led to an invasion by sea water of the fresh water aquifers.

The depth to groundwater mainly depends on the regional topography. The northern water level is almost always less than 30 m below ground surface, while in the southern part it is invariably

in excess of 30m below ground surface. The hydraulic behaviour of the lenses is governed by the Ghyben-Herzberg principle whereby a lowering of the water table will cause a rise of the fresh water/saline water interface at the base by a factor of 25.

Physical Resources in relation to agriculture

The critical interaction between physical resources and human activity as it has influenced Qatari agriculture so far can be summarised thus:

(a) The best cultivable soils in Qatar lie in the dispersed, non-contiguous rodhat depressions. Qatari farming has evolved therefore in at first tens and later hundreds of small oases separated by barren lithosols.

(b) Groundwater has always been most easily accessible either to human and animal labour operated wells or pumped wells in these same rodhat, thus reinforcing the pattern of coincidence illustrated in Figs. 2.2 and 2.3

(c) Most of these rodhat lands became available for individual development during the early 1950's as rural depopulation accelerated and village dwellers moved to town. Many of the tribal and family lands were then purchased by a new generation of landholders.

(d) The question of whether groundwater was sufficient to meet unlimited demand was not as such of interest to the new landholders since they were not strongly motivated by factors of productivity and efficiency (see Chp. 3). The need for conservation of water resources first appeared in urban Doha and not in the countryside.

(e) The growth of soil salinity and the decrease in groundwater quality have been slow to affect cultivation - at least in ways important to the landholders.

(f) Farming practices have been strongly influenced by the physical environment. From analysis of the climaatic elements it can be concluded that the period most suitable for cultivation extends from the middle of September or the beginning of October to May. During this period rain, although very little, does fall, evaporation and radiation are at their lowest, the average temperatures are tolerable to many plants and there is no danger of freezing temperatures as the lowest temperature recorded in January is 6°C.

The rest of the year, i.e. from June to September is characterised by the absence of rainfall and high temperature and evaporation. High temperatures i.e. maxima exceeding 40°C, and a very large daily temperature range accompanied by strong dessicating North-West winds, negatively affect the quality and quantity of yields. Some plant species are impossible to be cultivated as the cell's enzymes are destroyed at high temperatures. Additionally, these temperatures when accompanied by high relative humidity create a suitable environment for parasites and plant disease as examined in Ch.6. High evaporation leads to resalination as we shall see in Chapter 6 and high evaporation and transpiration increase the irrigation water requirements of the plants. Furthermore any cultivation must be protected by windbreaks in order to avoid mechanical plant damage and to reduce evaporation and this becomes a question of cost.

Soil quantity (depth of profile) and quality and salinity allows the cultivation of a wide range of plants. However, rodhat surfaces are flat and thus natural drainage is poor. Mechanical soil analysis shows the clay content to be about 42% which can further hinder water penetration and this forms a crust layer at the soil surface which can impede the functioning of artificial drains as we shall see in Chapter 6. Furthermore the organic matter of the soil content is poor.

(g) The efficient use of scarce and difficult physical resources for agriculture generally has appeared as a matter for governmental concern rather than of rural importance. Even during World War II food shortages were sufficiently damaging to remind older Qataris of the need to preserve at least some natural physical resources for pastoralism and cultivation. During the late 1970's the general question of food security in the Gulf appeared at the same time as the dislocation of vegetable and fruit supplies from Lebanon followed civil war in and Israeli invasion of that country. The Iraq/Iran war has further destabilised regional trade.

Whilst, therefore, we can say that the physical factors are, within certain limits, suitable for agricultural exploitation, they are sensitively balanced and demand high standards of accuracy and experience for their utilisation. National policies for resource use now have to be developed as far as agriculture is concerned, in the context of very rigid ecological, pedological and climatic controls but also recognising internal and external socio-economic realities.

References for Chapter II

1. Ministry of Transport & Communication, Climatological Report 1977 Climatological Department. Qatar.

2. Ibid.

3. Ministry of Industry & Agriculture/FAO-in-Trust, Qatar : Water Resources and Their Development, Qatar 1981.

4. Ibid. p.414.

5. Ibid.

CHAPTER THREE

SOCIO-ECONOMIC FACTORS

In Chapter 2, the essentially passive physical factors were examined; here we consider the active socio-economic factors i.e. those involved in human decisions of whether and how to use the physical resource endowment for agricultural purposes. These are especially crucial since the decision has been taken by the government to increase agricultural production with the aim of achieving a high measure of self-sufficiency in basic food stuffs, priority therefore being given to agriculture development. Various aspects of these socio-economic factors of production are analysed below:-

3.1 Population

Population is one of the factors which affects the agricultural development both directly or indirectly because population is not only the supplier of labourers, technicians and administrators, but also the domestic market for agricultural products.

For analytical and quantitative purposes however we are faced with serious problems of data deficiency. Only two population censuses have been held, in 1970 and 1986, and delay in the publication of the results of the latter has made it necessary first to postpone the submission of this thesis and ultimately to proceed without the 1986 data. This section has had to be based on a series of varied estimates, sample surveys and different official organizations.

3.1.1 Population Growth

The population of Qatar, in 1970, was 111,113 of which 59.5 per cent of them being expatriate. In 1975 the population figure was

estimated to be around 180,000, that is to say an increase of 62.0 per cent over 1970. In 1980 the population was estimated to have risen to 243,000 of which 175,300 were estimated to be foreigners, or 71.8 per cent of the total. In 1985 the total population was estimated to be somewhere around 300,000 of which 75.9 per cent were non-Qatari (see Table 3.1.1).

Table 3.1.1 The Population Estimations

Year	Qataris	% of annual growth	Non Qataris	% of annual growth	Total	% of annual growth	% of non-Qatari at the total
1970	45,019	-	66,094	-	111,113	-	59.5
1975	57,200	4.8	122,800	12.0	180,000	9.5	68.2
1980	67,700	3.4	175,300	7.1	243,000	6.0	71.1
1985	80,000	3.3	250,000	7.0	330,000	6.1	75.8

Source: William L. Pereira, National Growth Forecast, Qatar 1977, p.

As shown in Table 3.1.1, there has been a continuous increase in the number of Qatar's inhabitants. Much of this growth was a result of massive in-migration which raised the rate of increase to 7.5 per cent per annum over the 1970-80 period, far higher than any normal rate due to natural increase. This rate of increase, due to changes in the economic situation of Qatar, especially between 1977-78 and later, from 1983 to the present, has not always been consistently high. Qatar, during 1977-78 was faced with heavy price inflation due to the earlier trade construction boom and this together with government measures to reduce the inflation also reduced the demand for foreign labour. Since 1983 the government has been forced to cut public expenditure due to the oil income slump and this has been followed by

another reduction in both government and private employment.

The general underlying increase of population, however, has led to a growth in food demand especially in fruit, vegetables, meat, milk, etc. these especially associated with rising incomes. In addition, the coming of foreigners to the country created a demand for foodstuffs and agricultural products previously unknown to local farmers as we shall see later.

The population structure of Qatar in 1981, as shown in Table 3.1.2 had the general features of a dominantly working age society, where the age group of 20-59 comprise 57.7 per cent out of the total. This phenomenon was caused by the large number of foreign workers who poured into the country during the oil-boom period.

The average sex ratio for population of 163.4 reflects the predominance of males among the immigrant workers.

Table 3.1.2 Population Structure by Age Group and Sex (1981) (000)

Age group	Male	% of male group	Female	% of female group	Total	% of the group	% of male	% of female	% of male to female
0-4	15		14		29				51.7
5-9	13		13		26				50.0
10-14	12	32.7	13	52.2	23	39.8	20.7	19.1	52.2
15-19	11		9		20				55.0
20-24	18		9		27				66.7
25-29	23		8		31				74.2
30-34	21		7		28				75.0
35-39	14	64.7	6	45.6	20	27.7	41.1	16.7	70.0
40-44	11		4		15				73.3
45-49	7		4		11				63.6
50-54	5		2		7				71.4
55-59	2		1		3				66.7
60+	4	2.6	2	2.2	6	2.5	1.6	0.8	66.7
Total	156	100	90	100	246	100	63.4	36.6	63.4

Source: Central Statistical Organization, Annual Abstract 1981 Qatar, 1982.

3.1.2 Labour Force

The labour force in the agricultural sector is especially difficult to analyse because many immigrant labourers are not necessarily farming specialists but entered Qatar from general rural backgrounds in Iran and Pakistan. As such they tend to gravitate to whatever sector pays the most for unskilled labour at any one time. Turnover can often be high even though the total numbers involved are small (see Table 3.1.3).

Table 3.1.3 Labour Force and Economic Sectors by Nationality (1981)

Sector	Qataris	Non Qataris	Total	% of the Total
Agriculture, hunting and husbandry	500	2,439	2,939	2.4
Oil and quarrying	1,114	2,083	3,197	2.6
Manufacturing industry	475	9,210	9,685	8.0
Electricity and water	2,731	5,777	8,508	7.0
Construction	364	17,053	17,417	14.3
Trade	1,035	13,080	14,115	11.6
Transport, store and communication	1,205	2,751	3,956	3.3
Government services	10,835	25,730	36,565	30.1
Other services	651	24,539	25,190	20.7
Total	18,910	102,662	121,572	100.0

Source : Al-Kuwari, A.K. Analysis study of the factors delimiting the size, structure and type of labour force in Qatar. Qatar University 1982 Appendix L.A.

There is no government office concerned specifically with agricultural labour but, since all studies have shown that employment in farm work is virtually confined to foreigners,[2] one can utilize data of the Ministry of the Interior concerning residential visas necessary for expatriate workers to indicate the general level of demand for farm labour. The annual average demand as indicated by the number of new visas issued during the last period for which data are available is small absolutely and as a proportion of the total (see Table 3.1.4).

Table 3.1.4 New Residential Visas

Year (A.H).	Farmers	Total	% of Farmers
1396	184	33,566	0.55
1397	329	37,495	0.88
1398	359	36,112	0.99
1399	255	28,771	0.89

Source: Al-Kubaisi, M.A., Industrial Development in Qatar (unpublished thesis) Durham University, England 1984, p.285.

Renewed visas can also be used as indicators of the general level of foreign agricultural workers resident in Qatar. As shown in Table 3.1.5 only once did the total number of such workers rise over 2,000 in 1398, whilst during the rest of the period the total remained below 1,600.

Table 3.1.5 Renewed Residential Visas

Year (A.H)	Farmers	Total	% of Farmers
1396	1,616	64,805	1.57
1397	1,555	90,694	1.72
1398	2,277	119,591	1.90
1399	1,157	130,032	0.89

Source: Al-Kubaisi, M.A.

The labour force of the agricultural sector is then small and predominantly consists of Asian expatriates. These brought with them, either no farming experience at all or else traditional peasant farming skills from areas as diverse as Bangladesh, Pakistan and southern Iran. They had never practiced modern agricultural technology, a situation worsened by the absence of training centres for farm workers. Farming in Qatar which depends on the use of difficult land and water resources has thus been in the hands of generally unskilled short contract labour.

3.1.3

Undoubtedly the social structure of any community affects the evolution and progression of agricultural development either negatively or positively. Unfortunately, the tribal social structure in Qatar has negatively affected agriculture development. The fundamental problem is that even in the pre-oil tribal era actual farm work on the land was (and is still) seen as work fit only for the lowest social class member which a superior person should not carry out - the "shame" factor. This aspect of social behaviour, unfortunately, was further strengthened by growth and dispersal throughout Qatari society of

high incomes relatively effortlessly derived from oil.

3.1.4

Agricultural technicians and Administrators represent the upper echelon of manpower engaged with (and sometimes in) ensuring that daily and seasonal agricultural operations are carried out efficiently i.e. ploughing, irrigating, seeding, fertilizer spreading, plant protection, harvesting etc. They include also the agricultural extension team necessary to advise and supervise farmers' agricultural operations. Most of the above work for the Ministry of Industry and Agriculture. Most technicians and administrators, as with expert groups, are expatriates.

3.1.5

Landowners and landholders are predominantly Qatari as considered in more detail later. Land ownership is confined to Qataris but the relatively small number of tenant farmers includes a few non-Qatari Arabs. The situation therefore is one in which farming decisions are taken mainly by Qatari private landowners who by tradition have a social aversion to working the land and who now derive most of their incomes from other activities. The few state owned units are not primarily commercial. Both skilled and field labour inputs are made almost entirely by short contract expatriate workers.

3.2 Administration : policies and structure

The Government of Qatar established in 1956 a Department of Agricultural Affairs in order to supervise and implement agricultural development and at the same time to provide necessary assistance for farming. This department remained active until 1970 when it was replaced by the Ministry of Industry and Agriculture. The responsibility

for agriculture, according to Qatari laws and decrees, is vested within the authority of the Ministry of Industry and Agriculture. Law No. (5) of 1970 specified that the Ministry would undertake the following responsibilities:- (5)

1. To lay down general policy for developing agriculture production and agricultural industries, as well as the supervision of policy implementation.
2. To prepare projects and programmes which could lead to the growth of fisheries and livestock wealth.
3. To provide the necessary experience, technical assistance and production inputs e.g. seeds, fertilizers, machinery, pesticides etc. and to improve storage and transport facilities.
4. To improve agricultural yields and production of animals.
5. To establish agricultural training centres.
6. To reclaim and restore suitable land for agriculture.
7. To organize the utilization of the grazing areas.
8. To carry out agricultural tests and research and to collaborate with other countries and international organizations in the field of agricultural diseases.
9. To organize agricultural guidance.

What was missing from the legal statements was any statement of what kind of agricultural contribution to Qatari economy and society was desired i.e. what target objectives were laid down for the Ministry. A step in this direction was taken when in 1979 the government established the Department of Agricultural and Water Research in order to perform experiments in agriculture, water use and protected cultivation (greenhouses) to find out varieties, methods of cultivation, quantities of nutrients etc. of and for crops most suitable for Qatar.

For its implementation of policies the government early called on the technical expertise of the Food and Agriculture Organization (FAO) of the United Nations by commissioning three successive FAO assisted projects concerned with water resources and agriculture development over the period 1971-1981 as follows:(4)

1. First project from late 1971 to mid 1974: the government with the technical assistance of the United Nations Development Programme (UNDP) and FAO initiated a project known as "Hydro-Agricultural Surveys". This preliminary project was brought to a close in 1973 after having established a hydrometeorological and hydrogeological observation network throughout the country, and carried out a geophysical survey and the exploratory drilling of 10 wells, provided an initial quantitative assessment of the hydrological balance of Qatar, completed a soil reconnaissance survey and limited horticultural trials, and provided a land classification.

2. Second project from mid 1974 to mid 1977. The Ministry of Industry and Agriculture, with the collaboration of the Water Department of the Ministry of Electricity and Water and increased technical assistance by UNDP and FAO, initiated a follow-up project in mid 1974 known as "Integrated Water and Land Use". The objective of this expanded project was to carry out a wide range of studies and investigations arising from the previous project's recommendations aimed at achieving a close integration of the limited groundwater resources with agricultural production. The project carried out a wide range of observations, investigations, experiments, trials and special studies on both water resources and agriculture. In 1977 a technical report "The Water Resources of Qatar and their Development" was prepared but it was decided to withhold publication

pending the completion of expanded work programmes planned for the third phase project.

3. Third project, from mid 1977 to 1981. The government of Qatar decided to intensify these integrated water resources and agricultural investigations particularly in the light of project results which showed clearly the potential for agriculture production under improved practices and especially with regard to water conservation.

The government more recently has benefited from the Agriculture Development Organization of the Arab League, which is performing detailed water and soil studies in Qatar at present.

As the various projects have proceeded a general pattern of agricultural development has been developing over the years, emerging in 1979 in a form which has seven major elements.(7) These are as follows:-

First : Land and water use:

1. Identification and classification of agricultural land, in order to preserve and improve the soil and its yields.

2. Investigation of best utilization of suitable water and effluent for irrigation purposes.

3. Guidance in the use of water.

Second : Development of plantation and forest production:

1. Improving production by importing plants and seeds from other countries and the selection of suitable varieties for the local environment.

2. Protection of agricultural crops from diseases by supplying the farmers with suitable pesticides.

3. Practicing dromedary research.

4. Publishing of agricultural competence laws.

5. Plantation of wind-breaker trees to protect farmland and for beautification of the country.

6. Developing grazing areas.

7. Providing free relevant machinery.

Third : Development of animal resources

1. Organization of the annual drawing on animal stocks in order to preserve animal wealth; providing veterinary services.

2. The development of animal stocks of sheep and poultry and obtaining suitable breeds for the local environment.

3. Studies concerning the dairy production.

Fourth : Agricultural economics and statistics:

1. Collection, classification and analysis of agricultural statistics.

2. Economic studies of production, marketing, consumption and foreign trade.

3. Re-evaluation of marketing policy of agricultural crops.

Fifth : Development of fisheries resources :

1. The drawing up of a general policy for developing fisheries.

2. The encouragement of private fishery development.

3. Preparing and training Qatari personnel for fisheries sector.

Sixth : Agricultural guidance :

1. Providing agricultural guidance and information for and between the producers to encourage the development of agricultural capability.

2. The establishment of governmental guidance farms.

3. The establishment of protected environment farms (greenhouses).

Seventh : Agricultural Applied Research:

1. Carrying out scientific research in the fields of crops and fodders.

2. Research in maintenance of soil fertility.

3. Research in irrigation methods.

4. Research in other aspects of land and water resource utilisation and conservation.

5. Studies in connection with the technical and economic feasibility of water desalination.

6. Research on and recommendations for protected environment agriculture.

3.3 Government and financial inputs into agriculture.

As will appear from later analysis the analysis of agricultural finance in Qatar is not only difficult to carry out but is in part impossible. Because the vastly preponderant private sector is not primarily commercial in its approach to agriculture most landowners do not keep financial input/output let alone profit/loss accounts. Moreover even where gross expenditure is known these data only cover part of the spectrum of inputs because of government supplied services and/or materials, free or subsidised. In this section are summarised these inputs and incentives provided by government, inputs and incentives associated with a general policy of supporting agricultural production.

Between 1973 and 1980/81 oil revenues rose so fast that the government of Qatar had no financial restraint on its ability to provide fixed and operational capital assistance to agriculture and the subsequent recession had little effect on such governmental expenditure by 1983. A certain amount of budgetary restraint has since followed in all sectors

Table 3.3.1 Qatar's Annual Oil Revenue 1979-1983

Year	Oil Revenue (mn. QR)
1979	12,090
1981	20,006
1982	15,339
1983	10,893

Source : Gulf Co-operation, Statistical Bulletin; Kuwait Ministry of Planning, Nov. 1984, p.53.

During the decade 1973-1983 the government provided to agriculture fixed capital valued at QR 826 million. As shown in Table 3.3.2 this capital grant, non-refundable, took several forms but the general effect was to encourage both the expansion and the intensification of agriculture.

Table 3.3.2 Government Capital Grants to Agriculture 1973-1983

Item	Price/Million Q.R.
Value of arable land	284
Wells, pumps, pipes and dwellings	285
Husbandry	217
Date palm and fruit trees and Alfalfa seeds	40
Total	826

Source: Ministry of Industry and Agriculture, Annual Statistical Reports on Agriculture (1977-1983), Qatar.

The provision of official grants for and subsidies of current expenditure has been equally lavish and whilst some incentives have been aimed at increasing labour effectiveness others have been designed to improve husbandry, yields and product quality. For example, the Ministry of Industry and Agriculture offers its own agricultural machinery to perform, free of charge, work requested by the farmers. The available though incomplete data relating to these machines are shown in Table 3.3.3 and indicate that numerical levels remained roughly constant between 1978 and 1984 due to a policy of replacement of old machinery rather than of a building up of the number of units.

The Ministry also supplies the farmers with free seeds and plants. The distribution of winter and summer vegetables between 1973 and 1983 is shown in Table 3.3.4. The distribution of fruit and vegetable plants and seedlings for the same period is shown in Table 3.3.5. Both Table 3.3.4 and Table 3.3.5 show the efforts made by the government to supply the most appropriate seeds and seedlings to the farmers. Most of these inputs had been tested by the government and approved as suitable to the local climate and soils.

The government distributes pesticides free of charge to farmers in order to maintain a reasonable quantity and quality of yield. The quantity of such pesticides is shown in Table 3.3.6; the range of types indicates the sort of problems facing the farmers in their farms, especially those of pests and diseases. The most important pesticide on the government list is Lannate following by Malathion.

The last significant material supply by government is of wind-breaker trees, such trees being vital for the protection of the farmland as well as for out put. The tree distribution is shown

Table 3.3.3 Governmental machines used in agriculture 1975-84

Type	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Tractor	25	22	34	55	55	60	68	68	86	82
Spraying motor	143	203	263	323	323	323	*	*	*	*
Carried pump	120	180	240	300	300	300	*	*	*	*
Harvest machine	3	3	13	13	13	23	20	*	*	30
Harrowing machine	3	3	3	13	13	13	13	*	15	40
Combine	1	1	3	4	4	4	3	3	3	*
Agricultural trailers	-	6	12	12	12	12	22	*	12	24
Irrigation unit	-	37	42	42	42	51	*	*	*	*
Drip irrigation unit	-	6	6	6	6	*	*	*	*	*
Spray irrigation unit	-	-	1	1	1	*	*	*	*	*
Ploughs	-	22	40	84	84	84	56	*	83	117
Lineation machine	-	2	2	2	2	12	*	*	*	*
Seeding & fertilizing machine	-	-	4	8	8	8	4	*	8	*
Coddling machine	-	6	21	21	21	21	46	*	30	*
Leveling machine	-	-	4	19	19	19	21	*	*	*
Baling machine	-	-	2	2	2	2	*	*	*	*
Stone Collector machine	-	1	3	3	3	3	3	*	*	*
Grinder Caterpillar motor	-	1	2	4	4	6	10	10	10	10
Loading machine	-	-	4	4	4	4	4	*	*	*
Bulldozer	-	1	2	3	3	3	3	3	3	*
Compressor	-	2	2	2	2	2	2	*	*	*
Shovels	-	1	2	2	2	2	2	2	2	*

* No information

Derived from : Ministry of Industry & Agriculture
Annual Statistical Reports on Agriculture
(1977-1983) Qatar

Table 3.3.4 Vegetable seeds distributed to the producers 1973-84

Kg

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Lettuce	54	78	75	237	182	10	*	127	205	104	152	52
Cabbage	27	36	53	63	83	57	*	95	239	292	201	92
Cauliflower	62	51	50	68	101	59	*	96	218	227	87	77
Turnip	61	79	99	126	159	-	*	164	256	280	308	88
Beetroot	100	81	105	113	84	125	*	160	117	257	114	118
Spinach	395	431	262	546	369	676	*	675	800	1044	213	1106
Chards	-	100	100	100	1	-	*	234	749	775	261	607
Chorchorus	468	245	295	951	416	582	*	835	1585	1415	756	416
Tomato	92	100	55	148	67	68	*	209	346	333	425	403
Snake cucumber	242	195	251	285	-	346	*	464	552	810	209	406
Radish	438	472	400	526	371	323	*	625	1059	777	750	349
Parsley	185	242	300	300	757	334	*	873	908	1155	931	795
Gourd	293	618	106	300	552	149	*	838	743	924	1022	160
Egg plant	61	79	55	18	55	12	*	167	226	-	163	75
Squash	542	590	524	458	489	718	*	640	1075	1487	1581	1090
Cucumber	516	598	500	763	670	861	*	1071	1694	1415	1084	642
Broad Beans	685	500	467	233	732	434	*	369	834	389	619	384
Beans	371	165	402	328	180	600	*	536	1009	200	238	234
Okra	391	167	272	425	440	234	*	882	1043	344	565	742
Onion	167	193	162	90	48	275	*	308	545	277	43	469
Carrots	453	518	500	173	548	398	*	752	1084	912	179	649
Water melon	530	588	965	697	1208	2389	*	818	1440	2489	1495	1342
Melon	564	540	685	417	413	978	*	963	1141	-	1628	1290
Pepper	103	167	92	-	25	-	*	187	251	197	267	165
Purslane	46	142	110	202	94	353	*	465	1019	685	824	309
Cow Peas	480	32	-	-	18	372	*	-	100	100	159	200

* No information

Source : As Table 3.3.3

Table 3.3.5 Fruit and vegetable plants and seedlings distributed from the governmental farm (1973-83)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Grape	1400	2000	950	-	280	2500	1800	5400	6200	2600	11306	8000
Figs	2445	1000	1075	1038	700	2850	1950	5000	8000	14000	11126	9000
Pomegranate	1700	2000	950	83	150	2150	800	2500	2500	600	700	200
Guava	860	-	-	115	80	-	400	400	4000	5000	5367	3055
Morus	750	350	965	100	55	800	-	1700	3000	3400	-	1000
Citrus*	2	6	3	0.5	4	0.3	5	10	24	29	15	-
Tomato*	73	14	23	69	89	54	220	80	100	171	310	391
Egg Plant *	39	12	11	-	30	-	90	50	72	57	120	214
Pepper *	3	3	-	-	17	20	30	25	129	42	130	198
Cauliflower *	24	2	10	6	20	17	90	21	77	33	100	96
Cabbage*	13	2	8	14	21	16	70	20	70	48	100	126
Onion*	-	-	-	-	105	55	100	65	97	60	135	100
Lettuce*	-	-	-	-	36	-	20	-	-	32	112	175

* Figure in thousands

Source : As Table 3.3.3

Table 3.3.6 Quantities of Pesticides Distributed to Farmers

	Unit	1978	1979	1980	1981	1982	1983	1984
Albolineum	ltr.	549	764	1025	1408	2880	-	-
Ratak	ltr.	174	220	396	518	63	-	-
Acrathane	ltr.	787	1292	2587	1129	1942	3371	2029
Milcurb	ltr.	110	767	2386	2090	2486	2025	943
Gramaxone	ltr.	454	693	475	1368	1500	678	-
Dimecron	ltr.	2147	3686	1996	3296	3432	3467	-
Malathion	ltr.	1329	1105	4481	2834	1857	4363	2817
Tamarone	ltr.	9643	1927	1058	1329	1613	-	-
Diabhane M45	kg.	385	-	-	810	3375	4157	2190
Warfarine	kg.	72	34	336	523	116	-	-
Perimore	kg.	931	1909	461	999	200	-	-
Diptrex	kg.	3672	4586	3802	176	85	-	149
Antracol	kg.	2951	4612	3040	423	-	-	-
Lannate	kg.	708	687	176	2049	4630	9678	6180

Source : as Table 3.3.3

in Table 3.3.7, and the raising of many of these trees is an important element in government farm production.

Table 3.3.7 Quantities of wind breaker trees distributed to farmers

Item	1980	1981	1982	1983	1984
Casuarina Equisetifolia	54000	99600	59500	82012	117513
Eucalyptus Sp.	66500	97000	44000	80632	115000
Ziziphus Jujuba	33500	25300	16200	16166	35893
Poinciana Regia	7000	17000	6000	5500	7534
Albezia Lebbek	7000	15500	3000	2000	4871

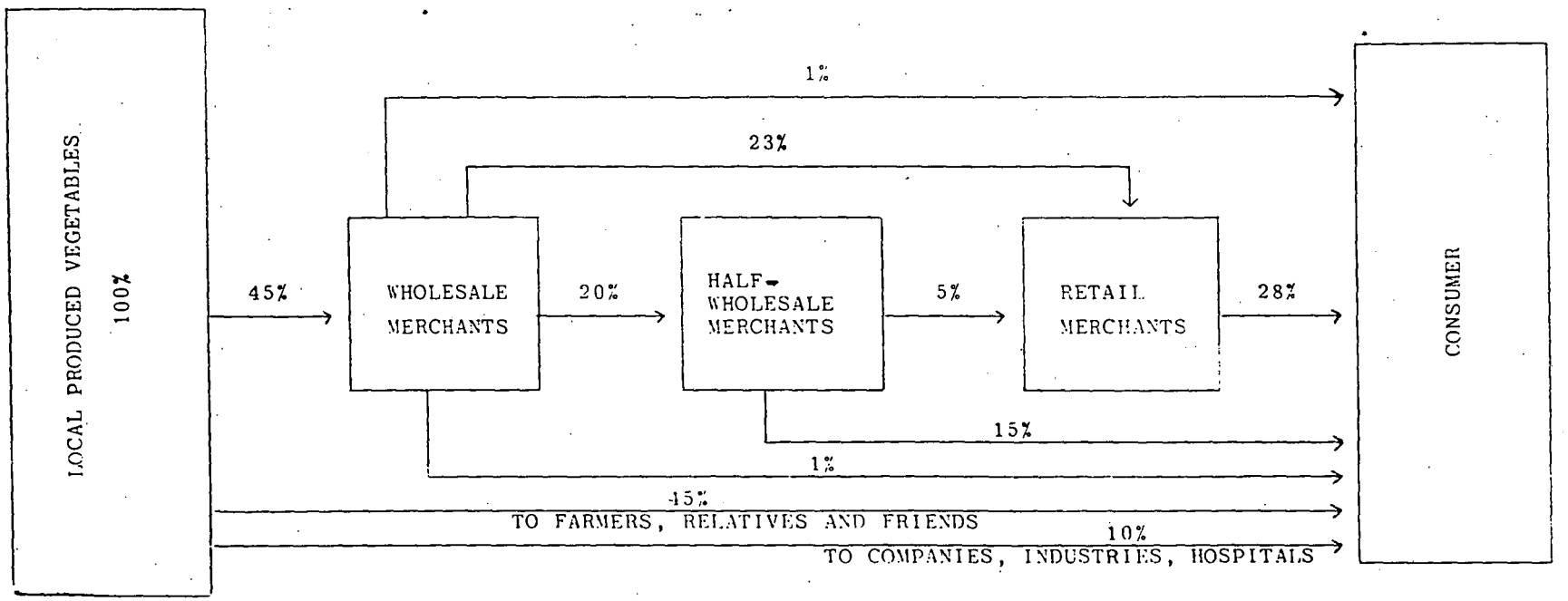
Source : as for Table 3.3.3.

3.4 The Market for Local Agricultural Products

As indicated in Figure 3.4.1, it is estimated that less than half of locally produced fruit and vegetables, by far the most important product groups, enter the commercial market. In this section attention is concentrated first on this segment of production.

The first point to note is that almost all local produce which is traded finds its way to the single central market for agricultural commodities locally called the Doha Central Market; it is located about 8 km to the west of the centre of Doha and is supervised by Doha Municipality. Although the consumers' taste, supply and demand play a vital role in determining the consumption range, the government applies a policy of controlling the agricultural commodities' prices, both local and imported, this being carried out to ensure that neither merchants nor consumers will not be affected adversely by trading fluctuations. The market is open to any one to

DIAGRAM 3.4.1 The Marketing of Locally Produced Fruit & Vegetables



Analysis Study : Abdul Kareem Taih

Source : Ministry of Industry & Agriculture p.46 (February 1983)

Table 3.4.2 Agricultural commodities produced in Qatar 1980-1983

Production in tons

Item	1980	1981	1982	1983	1984
Wheat	127	130	254	158	173
Barley	513	605	1113	718	954
Tomato	5128	5262	5233	3697	5691
Egg Plant	951	1191	899	411	576
Pepper	127	93	78	41	105
Onion	858	974	583	367	449
Radish	844	908	326	527	715
Lettuce	865	1096	378	689	528
Carrot	671	424	322	275	334
Parsley	122	155		64	153
Cabbage	634	558	556	273	288
Cauliflower .	355	236	467	232	226
Spinach	53	79	66	68	89
Beetroot	48	36	27	7	27
Turnip	276	140	131	137	136
Squash	947	875	1336	1028	1097
Cucumber	790	606	118	294	310
Melon	1692	1678	2099	1023	1600
Watermelon	995	1533	1766	598	879
Potatoes	110	159		172	112
Snake Cucumber	406	144	255	69	59
Gourd	250	400	1472	246	541
Pumpkin	226	132		89	226
Okra	269	246	141	70	168
Chorchorus	101	189	121	97	185
Chards	182	319		329	519
Guava	101	155	124	116	116
Pomegranates	146	148	163	153	208
Figs	96	111	109	102	145
Grapes	106	112	110	103	146
Mulberry	18	21	20	18	21
Alfalfa (Animal Fodder)	36400	38680	42003	38721	42744
Dates Palm	3060	5880	6614	6204	5312
Fruits	882	980	2920	2732	-
Fish	1762	2273	2315	2115	3124
Red Meat	1402	1235	1515	1590	1727
Poultry	700	776	928	1270	1675
Eggs	276 (5.5 million)	318	313	491 (8.9 million)	580
Milk & Milk Products	863	5575	6208	6642	7041

Source : as Table 3.3.3.

to bring vegetables and fruits for trading.

Producers bring their commodities to Doha Central market twice a day either in the morning or during the afternoon. Wholesalers buy goods by auctions organised by official commission agents, and the price is determined according to demand and supply. Agricultural commodities, in the hands of wholesalers generally pass through the hands of other smaller distribution merchants called "half-wholesale" merchants.

3.4.1 Marketing paths of the local produced vegetables

Figure 3.4.1 shows that about 45% of the local vegetables production is consumed by the farmers, their relatives and their friends, 10% of the local production is sold directly from farms to companies, industries and hospitals. The remaining 45% of the local vegetables production is alone the portion which goes through the Doha central market through the following paths :

a) 28% of the local vegetable production goes to retail sale merchants who get it either directly from the wholesale or from the half wholesale merchants.

b) 15% of the local production goes to the half wholesale merchants.

c) About 1% of the production is sold directly from farms to consumers, and about 1% of the production is exported to neighbouring countries.

3.4.2 Production and self-sufficiency

Table 3.4.2 shows the quantity and the quality of the agricultural commodities produced in Qatar during 1980-1983. In spite of the annual increment in the quantity of production, in almost every item shown in the table, these quantities are not enough to meet the requirement of the people in this country. The main reason for this has been the even larger annual increase of population as noted in section 3.1.

Table 3.4.3 shows the self-sufficiency of Qatar in some items of agricultural commodities during 1980-83 and it is clear that the country is a very long way from self-sufficiency especially for the staple grains, seeds and meat. Dependence on imports is high and, although seasonally there is a significant export of vegetables, overall the position remains that Qatar's policy of supporting the growth of agricultural production, as with all neighbouring Arab Gulf States has been paralleled by a continued growth in that demand for agricultural products which can only be met by imports and this was forecast in April 1985 by the Arab Organisation for Agricultural Development (AOAD)[8] to continue to develop until the year 2000.

3.5 Conclusion

The foregoing outline survey of the main internal socio-economic factors affecting agriculture in Qatar allows the preliminary identification of the critical phenomena concerned.

The first dominant fact is the enormous and rapid growth of the wealth of Qatar, derived from oil since the first oil royalties accrued in 1950. Between 1950 and 1970 oil revenues jumped from QR 5 million to QR 5,748 million;[10] in 1980/81 they totalled over QR 20,000 million to give Qatar the highest GNP per head of population in the world.[11] The effect on consumption was dramatic producing by 1980 a demand for food and beverages alone valued at QR 743.9 million, equal to 50% of all non-oil exports. The domestic production response to this demand was limited not only by the physical factors examined in Chapter 2 but also by the socio-economic attitudes outline above. The growth in national wealth and the appreciation by government that this was linked to the non-renewable resources of oil and gas made it financially

Table 3.4.3 Self-sufficiency degree of some agricultural output during 1980-1984

Item	% of self sufficiency			
	1980	1981	1982	1983
Pulses, nuts, oil, seeds	0.0	0.0	0.0	0.0
Sugar & sugar products	0.47	0.0	0.0	0.0
Potatoes	2.94	4.62	0.58	4.23
Cereal (wheat and wheat products)) Barley, bran)	0.44	8.90	9.94	6.95
Poultry	6.7	6.48	8.08	10.85
Red meat	20.9	17.70	28.93	11.10
Eggs	9.2	8.72	9.5	11.29
Fruits	5.92	5.29	10.32	13.66
Onions and garlic	13.7	34.85	15.54	13.82
Milk and milk products	5.9	37.82	36.13	39.03
Cucurbitacae	73.9	69.02	77.31	46.33
Other vegetables	63.8	58.84	84.77	48.94
Tomatoes	61.7	70.76	67.94	68.07
Dates, palms	37.25	53.33	78.84	77.55
Fish	80.00	86.03	82.88	83.46

Source : as for Table 3.3

possible and apparently desirable for the government to develop a policy of agricultural support tending towards the objective of lessening import dependence.

Population, manpower and labour are dually important from the point of view of potential market for and work inputs to agricultural production. Later analysis in Chapters 4 and 5 indicate the complexity of the demand/supply ratios for population and labour, including socio-technical aspects which affect the efficiency of the exploitation of a harsh and ecologically sensitive environment. The key significance of expatriate skilled and unskilled labour is apparent.

As for the management of physical factors, the Ministry of Industry and Agriculture is applying policies to conserve the country's natural resources for agriculture. However, these have to be indirectly applied through the management of private farms which are under the control of their owners. Concerning the market situation, state organisations are encouraging the production of a greater range and higher volume of agricultural commodities. Table 3.4.3 indicated that the self sufficiency degree of food varies between 0.0% for pulses, nuts and oil seeds and 83.4% for fish during 1983. This indicates the wide range of potential of the market to absorb agricultural commodities particularly if we take into consideration the high annual growth of population.

The conflict of socio-economic interests facing the government is basically between satisfying domestic demand for cheap agricultural products through allowing in low priced imports (and incidentally satisfying the Qatari merchants' interests)and, on the other hand, providing costly incentives to maximise local production by a private section (much of which is not primarily interested in commercial

farming). At the same time, at one extreme, the limitations and sensitivities of the resource endowment have to be recognised, whilst at the other the geopolitical fears for food security which prevailed in the 1970's were significant in influencing government policy.

In the next chapter (4) the resultant factor position in farming as observed in the field study sample survey is examined.

Chapter 3

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CHAPTER FOUR

LANDHOLDINGS AND FARMS

4.1 Since the establishment of a Department of Agriculture in 1956, but especially during the 1970s there evolved the registration of all units of land used for some form of agriculture. Such land units are all loosely classed as farms, although as indicated below this can be misleading, and each is given a unique registration number. The so-called public sector farms require separate examination (Fig. 4.1).

Table 4.1 Farms in Qatar

	North	Middle	South	Total
Government	9	28	3	40
Private	285	442	70	696
Total	294	470	73	837

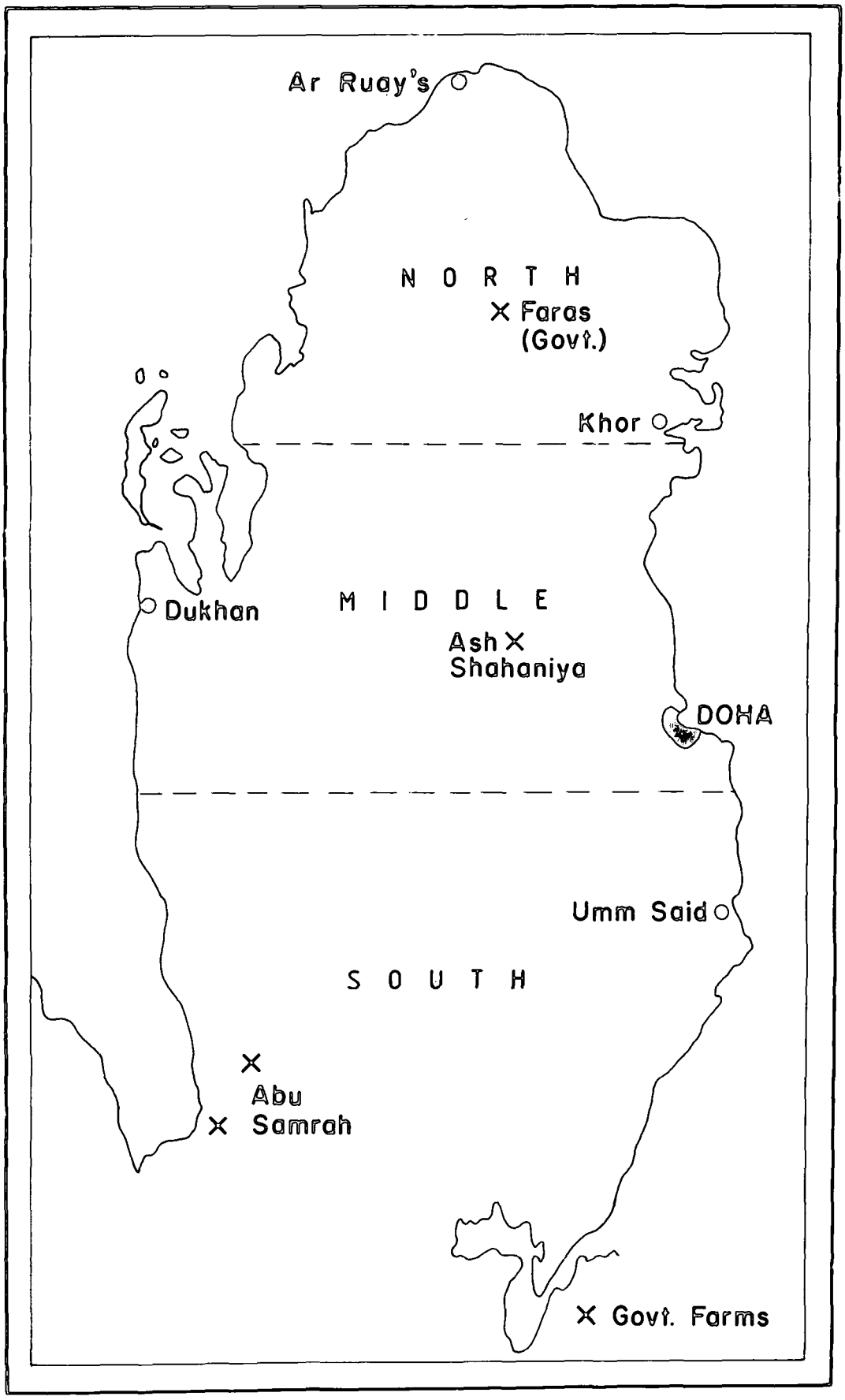
Source : Register of Farms in Qatar, Ministry of Industry and Agriculture, Doha, 1985.

4.2 Public Sector Farms

Table 4.2 Government farms

	Farms	Plantation	Parks	Experimental	Total
Ministry of Industry & Agriculture	5	7	3	4	19
The I.D.T.C.	2	-	-	-	2
The Municipality	-	-	1	1	2
Ministry of Electricity and water	17	-	-	-	17
	24	7	4	5	40

FIG 4.1 MINISTRY OF INDUSTRY AND AGRICULTURAL DIVISION OF QATAR



Land registered officially as farmland in the ownership of the Government can be regarded as falling into one or more of four categories:

1. Experimental purpose farms
2. Commercial production units
3. Land used mainly for public leisure use, i.e. parks
4. Plantations, mainly roadside windbreaks

The importance of the first group is very considerable to other public land categories as well as to the private sector. There are five experimental farms in all, four of them belonging to the Ministry of Industry, and Agriculture, while the fifth belongs to Doha Municipality [1] with the specialised purpose of developing and producing plants (including trees) for urban and municipality road decoration. The oldest of the Ministry's experimental farms is Rodat al-Faras established in the 1950's; their functions are examined below:

The first trials and production state farms were started in the mid-1960's but their effects were not significant until the late 1970's when greenhouses were introduced. There are now 24 governmental farms classified as crop production farms,[2] but in reality there are only 7 which are significant crop producers, the rest being attached to water wellfields and producing small quantities of crops for the employees of the Ministry of Electricity and Water working in the water fields.[3]

There are four public parks registered as farms, one in the north and three in the central regions. The ownership of such parks belongs to either the Ministry of Industry and Agriculture or

Doha Municipality, and their purpose is solely one of public amenity. Lastly, there are plantation areas run by the Ministry of Industry and Agriculture. Statistically, there are only seven farms registered as plantation areas but each one of these includes several planted localities.(4)

4.3 Private farms

Table 4.3 Private farms

	North	Middle	South	Total
Sheiks	114	234	47	395
Other holders	164	192	23	379
Unknown	7	16	-	23
Total	285	442	70	797

Source: as 4.1

The total number of registered privately owned farms in 1985 was 797, about 95 per cent of the total registrations. However, the register makes no distinction between private amenity estates, non commercial in character and land holdings used for commercial agricultural production.

The distribution of the private farms can be seen from Table 4.3, most of them being located in the central region, the northern region having 36% and the southern region 8% of the total.

We can further categorise the private sector farms by examining the variants of tenure which are present. The growth in the number of registered farms has been accompanied by a growth

of complexity in tenure of land holdings, but overall, one can distinguish in Qatar three main categories:(5)

a) Individual farm ownership and management

b) Sharecropping tenancy

c) Monetary rentals

It is necessary, in order to understand these forms of holding, to analyse each one separately, noting that in each and every case land ownership is vested in a particular individual.

a) Owner management

The owner, in this form of holding, undertakes full responsibility for how the land is to be used; he is the decision maker. There is, however, no case known to the writer where, in this category, the land is worked by the owner as owner-occupier in the conventional sense. In all cases actual farm operations are carried out by expatriate non-Qatari labourers, the nature and objectives of these operations being determined by the owner. At one extreme a shaikhly or merchant landowner may have the land worked solely to provide a pleasant, even luxurious, country residence sometimes used periodically rather than permanently. The emphasis will then be on trees, shade, greenery and a few fruit and vegetables for occasional personal consumption. At the other extreme is the large complex of arable, stock-housing and dairy factory land units which make up Qatar Dairy Company in which several farm units are managed and operated for commercial production and distribution.

Between the two extremes are the farms from which the owner may plan to get some financial return from off-farm sales to offset expenditure (particularly on labour) on the amenity estate aspect. This type of approach may evolve into the next type of tenure.

b) Share cropping

This type of holding is very common in Qatar, where the farm owner may arrange with a tenant occupier to work the land without any payment as such. The net profit accruing will be divided between the farmer-operative and the landowner in various proportions depending on relative input participation. The farmer's share of profits may reach as high as 65 per cent and as low as 20 per cent. The farmer usually carries most of the work load while the owner may visit the farm only to collect his share (if the farmer does not deliver it to him at his residence). This lack of supervision, as well as the eagerness of the farmer to have quick returns for his effort, has been seen typically to have adverse results on soil and water conditions on the farm.

c) Monetary renting

Renting is the last form of agricultural holding, the most common form being the letting of land for an agreed annual sum for short periods, generally three years. Some tenants sub-let part of rented farms to others (sub-tenants), and in most cases the actual owner rarely knows or cares how his land is used.

4.4 Tenure and land use

Private farms categorised above as type (a) are virtually market-ignoring since their main purpose is to satisfy their owners' varied non-commercial requirements. Types (b) and (c) however are strongly influenced by market forces. In each case the farm operator (known henceforward as the farmer) seeks to maximise financial returns during the period of tenancy or share-cropping

agreement, essentially a short-term objective. As with most forms of short tenancy, and strengthened here by the fact that the farmer is almost invariably non-Qatari with no legal rights to permanent residence in the country, all the factors combine to produce one basic and resource-destructive type of farming. The planting of treecrops is discouraged by the long lead-time before fruit and other crop-material may be harvested and the relative complexity of and investment expenditure needed for livestock raising is unattractive to short-term tenants. Concentration is very largely on the simplest forms of irrigated vegetable production. There is no incentive for the farmer to conserve groundwater supplies by using irrigation water in non-extravagant ways and the same is true of soil management. As long as land can produce cheaply saleable products for a few years the farmer is rarely concerned to improve let alone preserve soil texture or fertility or to avoid salinisation.

A large number of the farms registered as inactive or abandoned (Table 4.4) are comprised of holdings which have suffered ecological damage as the result of such a destructive approach to land use by landowners divorced from the land and farmers with no commitment to the land. There are exceptions and it is one of the most difficult tasks of the Department of Agriculture to encourage the spread of more responsible attitudes to agricultural resources.

Table 4.4 Abandoned Farms

	North	Middle	South	Total
Shaikhs	18	44	7	69
Other	40	45	4	89
Unknown	7	14	-	21
Total	65	103	11	179

Source : as 4.1

4.5 Private farm ownership

No land in Qatar may be owned by a non-Qatari, not even by a citizen of one of the other Gulf states. The ultimate responsibility for the land which has been enclosed for irrigated cultivation, almost all since 1950, rests mainly with Qatari landowners, among whom are, numerically the most significant, the Shaikhs. These have 393 farms, that is to say 49.6 per cent of the total of 797. Table 4.4 shows that most of the shaikhs' farms lie in the central region of the peninsula (about 59 per cent 395) as do the holdings of other Qataris, numbering 379 farms. Beside these holdings there are several farms registered with the Ministry of Industry and Agriculture but which have no registered owner. Such holdings have lapsed over time and now over 90 per cent of the total 23 farms are abandoned. Of the total of 179 registered abandoned farms in 193, proportionately the smallest belonged to shaikhs - 17.5 per cent of their total farms. Of other holdings, 23.5 per cent

out of 379 were abandoned. However, the number of abandoned farms is believed to be much higher than these figures suggest.

4.6 Sample Survey Data

In order to investigate more deeply the ways in which private farms were operated and the nature of the decision making processes involved, a random questionnaire sample survey was carried out as earlier described and the data produced is factually presented below. The Questionnaire is reproduced in the Appendix.

Questionnaire Survey - the Data

1. 41 farms

2. 40 farms private, normal active.
   (approx. 10% sample of active private farms in 1983)

3. Regional distribution

   3 - southern region

   13 - northern region

   24 - central region

4(a) Size range of property in donums
   (of 36 responses)

   of 36 - 4 less than 50 donums i.e. 5 ha - 11%

   18 less than 300 donums i.e. 30 ha - 50%

   26 less than 500 donums i.e. 50 ha - 65%

4(b) Area of registered farm holding actually used for crops is generally in inverse proportion to size of property

   a) largest properties belong to shaikhs who,

generally build large country residences and stables leading to a reduction in the area under crops.

(b) smallest properties generally most intensively used for production

5. Insignificant response

6. Only 6 farms had expanded since establishment.

7. Insignificant response.

8. Only 2 proprietors work on the land

9. Only 2 proprietors' families work on the land (same as 8)

10. 2 farms rented : one shaikh's farm of 3,270 donums and one shaikh's farm of unknown area but probably larger than 1,000 donums

11. Rents of 20,000and 12,000 Q.R. per annum respectively

12. Only 4 Qataris are employed in agriculture, all on the Government farm, employed as drivers and supervisors; 540 non-Qataris are employed in the Government farm . The number of farm workers employed per property is in reverse proportion to the size of the property (see 4b above).

13. All the farms have residential accommodation for their employees

14. The problems reported by the 21 respondents have the following numerical relative importance. Half the owners or their representatives did not answer this question, therefore the answers come from 20 farms

a. 16 farms have agricultural disease problems

b. 15 " " soil salinity problem

c. 13 " regard themselves as adversely affected by distance from the capital.

d. 13 farms have water salinity problem

e. 12 farms have marketing problem

f. 12 " " a lack of sufficient water supply

g. 9 " " a lack of skilled farm workers

h. 10 " noted other problems such as : poor feeder roads linking the farm to the main roads, stony soil, the unavailability of machinery, language difficulties with ethnically mixed labour force, rata, high summer incidence of sand bearing winds, high humidity, pests etc. Small number of wind break trees.

15. Only 16 farms answered this question.

Their suggestions were concentrated on the following

1. Improvement should be carried out in respect of irrigation water/soil improvement measures and advice in adopting new methods in agriculture.

2. Developing and adopting new irrigation methods

3. Improving the infrastructure, especially roads.

4. The Government should give the farmer protection against cheap imports and financial assistance for machinery and pesticides etc.

5. Improve the availability of more skilled farm workers

16. None of the farms had obtained any loans from local banks, not surprisingly as the government already subsidises farmers with fixed capital and several items of current expenditure.

17. The main crops are:

a. Green fodder and vegetables (20 farms)

b. Dates and melons (7 farms)

c. Barley (3 farms)

Only the government farm produces and supplies other farms with seeds and nursery plants.

18. The secondary crops are :

    a. vegetables (31 farms)

    b. green fodder (19 farms)

    c. fruits and dates (18 farms)

    d. melons and barley (2 farms)

19. a. 15 farms produce for private consumption

    b. 21 farms sell produce to wholesalers

    c. 1 farm sells its production to Qatar Dairy farm. This is essentially a flow of barley and alfalfa fodder within a single-owner enterprise.

20. All except one farmer transport their products by farm or the owner's vehicles

21. All farms which sell products find their market in the capital, Doha.

22. The government does not determine wholesale prices of products but does control retail prices in Doha.

23. Only 6 farms answered this question and expressed wishes for

    1. governmental encouragement for the export of local agricultural products as well as protection from imports and price supports.

    2. the establishment of a government company for marketing local products

    3. The government should arrange the collection, transportation and sale of local agricultural crops

    4. subsidising local production

24. Only one farm is connected by pipeline for water supply from outside the farm this being a small intensively and well worked farm. All others have their own supply.

25.&27. All the farms but one have pumped water wells for extracting water.

26. The number of wells on the farms:

No. of wells	No of farms
1 - 2	11
3 - 4	10
5 - 6	7
7 - 8	4
9 - 11	2
11 - 12	3
13 and over	3

27. All the farms but one have water pumps, one per well.

28. Only seven farms answered this question. They indicated that they have 30-35 m^3/hours water pumps working 12 hours daily (about 2920 m^3 daily).

29. The irrigation methods used by the farms are

a. 39 by surface gravity-flow channel

b. 2 by drip irrigation (including Govt. farm)

c. 1 by spray method (Govt. farm)

30. The most common machines on farms were spray irrigation units while alfalfa cutters, tracters and other heavy equipment are obtained from the Agriculture Department. Shovels, axes and manual spray pumps were found on only three farms.

31. a. 22 farms use the facilities of the Agriculture Department to repair machinery

b. 13 farms repair their machinery privately

c. 1.one farm repairs its machinery both privately and through the Department.

32. Only 3 farms are connected to the Government electricity supply

33. Nil response

34. 11 farms have telephones although not used mainly for mainly farm affairs

35. a. only 2 farms use green house technology, one being the government farm

b. two farms (including the government farm) also use other methods

36-39. All the farms answered questions 36 and 38 positively, but not all of them specified the quantity of fertilizer (either chemical or organic). Those which gave the quantity of fertilizers used on the farm utilised two types of measurement i.e. sack (50 kg) and the cubic metre. The quantity of the fertilizers used can be seen in this table.

Organic fertilizer by sack	No. of farms	Chemical fertilizer by sack	No. of farms
500	6	100	8
500 - 1000	2	100 - 200	3
1000	3	200	2

Two other farms (not included in this table) consume $5m^3$ and 743 m^3/annum of organic and chemical fertilizer respectively.

40. All farms were found to receive and use the following from the Agriculture Department free of charge.

a. seeds; b. machinery; c. pesticides; d. management assistant; e. assistance in understanding of new agricultural methods and c. assistance in adopting new irrigation systems.

38 farms out of 41 have obtained free water pumps from the Agriculture Department (according to the wells they have in the farms) and 28 farms receive free fertilizer from the Department. There are also 10 farms which receive other Government assistance and advice.

41. There are three common types of pests, dieases etc. which the farms suffer from, especially in the summer.

a. wild animals (rats, rabbits and dhabb (a type of lizard) aphids, red spiders.

b. caterpillars and insects

c. weed grasses

42. The answers to this question were similar to those received to question No.23.

The evidence from the sample survey as summarised above is the best which could be obtained given the fact that:

(a) even with the register of farms it is usually extremely difficult to identify and interview the"farmer", as defined earlier.

(b) farmers and landowners see little reason why they should divulge (or for that matter keep) operational details except for the most obvious i.e. the number of wells. In the absence of any personal taxation system there is no cultural acceptance of inquiries regarding financial activities.

What is extremely clear from this sample, which though random in selection (by.numbers on the register) may be skewed in favour of commercial producers, is the considerable dependance on government for subsidised or free inputs. At the same time, as shown by answers

29 and 35, there is almost no private investment in technologically advanced crop production. The picture which emerges is one of minimum input expenditure and an expectation of government support in all the sectors of farming, production, marketing and price support.

References

1. Ministry of Industry and Agriculture, Farms registered in Qatar, Qatar, 1985.

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3. Ibid.

4. Ibid and Personal Communication.

5. Personal Communication.

CHAPTER FIVE

PROBLEMS FACING AGRICULTURE

There are many problems facing agricultural development in Qatar, some of them are relatively easy to manage while others are extremely difficult to control. Attention is focussed in this chapter on six different groups of problems which can be listed as follows:

1. Technical problems.
2. Scale of production and market.
3. Import/Export balance.
4. Labour.
5. Return on investment.
6. Farming motivation.

There are other minor factors, but for the purpose of this thesis concentration will be made on the above mentioned allowing the minor to appear during discussion.

5.1 Technical Problems

There are several technical problems, all arising from the nature of Qatar's natural resourse endowment, hindering full scale agricultural development.

5.1.1 Soil

As noted in Chapter 2, whilst there are several types of soil, the most common being Lithosols, the only soil of significant utility for cultivation (but see E. below) is the soil of the rodha depressions.

Discussion can therefore be concentrated on this type of soil and its characteristics.

A. Scattered locations

The depression soils or rodha are scattered all over Qatar peninsula, with special concentration in the northern region, as illustrated by Figs. 2.2 & 2.3. These areas in all cases are surrounded by poor soil of Lithosol type. The absence of any great continuous area of cultivable soil and the natural fragmentation of farm land into non-contiguous pockets, often very small, clearly will tend to discourage many types of mechanised technology, tends to encourage reliance on manual work, and stands to increase the operational costs of farming.

B. Smallness of size of farming localities

As well as the spatial fragmentation of cultivable land, the problem of the small size of most rodha requires special emphasis. The total area of all rodha is about 276 sq. km [1] That is to say 2.4 per cent of total Qatar's area, this divided between over 400 active farms. The area of individual rodha vary considerably, some of them less than one donum, while a few extend over 100 donum. One consequence is that, apart from any other consideration, farm income is entirely related to intensity of land use rather than to size of farm.

The soil depth of rodha, in general, varies between 10 to 30 cm.[2] and the configuration of depressions are irregular. Within a farm property, therefore, soil quality varies extremely from place to place, and the area worth working may represent a small fraction

of the property. In these circumstances it is not easy to achieve good farm management nor to provide sound standard guidelines to farmers, for example where to recommend in situations of small holding size and shallow soil depth, the most suitable cultivation or irrigation equipment.

C. Salinity

Irrigated soil also suffers from the buildup of salinity. As in all arid areas, soluble salts are normally in high concentration in unleached soils; in addition most farms use rather brackish water for irrigation (typically about 2000 mmhos conductivity). The high evaporation rates noted in Chapter 2 lead to accelerated capillary action in the soil and high residual salinity in the surface layers. The virtual absence of leaching by precipitation, the general absence of artificial drainage and the extravagant application of water leads to the continuous buildup of salinity in the soil, which affects adversely the quantity and quality of the agricultural output.

D. High Carbonate Calcium Content

It is noticable that in all over Qatar peninsula there is high calcium carbonate content in the soil and this produces hazardous cultivation conditions. Generally the percentage by volume of calcium carbonate in the soil increases with depth, for instance at 0-15 cm and 30-45 cm depth respectively, soils have some 17.8 per cent and 19.5 per cent calcium carbonate concent.(4)

Whilst a high soil content of free carbonates can have a variety of effects on the availability of plants nutrients, one of the most serious problems in Qatar is the simple mechanical creation of hard crusts on the soil surface, the other long term problem being the

formation of sub-surface impermeable layers, caliche, which prevent free water movement particularly by impeding drainage. Such soils require very careful irrigation management and tillage techniques, if the soil is not to become extremely difficult to develop into tilth except at very great cost in labour, or even become unworkable because of impeded drainage.

Hypothetically field agriculture is technically possible on many of the sand areas of southern Qatar. Experiments and trials carried out by the Department of Agriculture near Wadi Lekwan[3] have confirmed that trickle and spray irrigation with nutrient-enriched water under near hydroponic conditions can in practice be used for fodder and vegetable production on stable sand but the costs are high and operations depend on easy access to groundwater.

5.1.2 Weather Factors

Climate and weather conditions in Qatar, as discussed in Chapter 2, have created several problems for agriculture. The generally high temperatures restrict the types of crops, whilst high evaporation from the soil and transpiration from plants force the farmers into high rates of irrigation water application, in addition to the high water duty required for leaching surface salts. High temperatures and high humidity in combination create an excellent atmospheric environment for plant pests and diseases. Periodic dry and strong winds also have a destructive effect on plants.

In order to throw more light on the effect of weather factors, Table 5.1 was compiled. The table shows clearly that no crop escaped the effect of all the weather elements. As can be seen, the climate and weather of Qatar is far from ideal and can very clearly increase the cost of production.

TABLE 5.1 Climatological Elements and efects on Agriculture

Vegetable	High sensitivity to high temperature	High sensitivity to low temperature	High sensitivity to high insolation	High sensitivity to low light condition	High sensitivity to wind destruction	High sensitivity to high humidity	High sensitivity to high intensity rain-fall
White beet	B	A	B	B	A	D	C
Turnip	B	A	B	D	A	B	B
Onion	D	C	D	D	B	C	B
Water melon	A	E	A	E	B	A	B
Spanish	D	A	D	D	B	B	A
Corn	A	D	A	B	C	D	D
Tomato	C	C	B	A	C	D	C
Cucumber	B	E	C	A	D	E	D
Beans	D	C	C	A	E	D	C
Peas	E	C	E	B	E	C	C
Cabbage Type 1	C	B	C	C	A	A	A
Cabbage Type 2	C	B	E	C	A	A	A
Cauliflower	C	B	D	C	B	A	-
Radish	B	A	A	D	A	B	B
Chard	B	B	C	B	B	B	A
Lettuce	E	A	E	C	C	C	-
Courgette	A	D	A	A	C	D	D
Pepper	D	D	D	E	D	B	A
Melon	A	D	A	A	D	E	D
Okra	A	C	B	B	D	C	B
Egg plant	D	D	B	D	D	C	C

A group is the least affected adversely by the various elements

E group is the most affected by the various elements

Source: Derived from: FAO, The Climatological Elements and effects on Agriculture, Qatar, 1979.

5.1.3 Water Resources

As noted in Chapter 2, agriculture has to depend entirely on irrigation, mainly utilising underground water resources. Groundwater resources have been utilized for centuries but only for the last thirty years or so has this resource been over-used. Abstraction for agriculture, domestic and industrial use began to exceed natural recharge of aquifers in about 1960 and it is not surprising that the FAO team predicted in the late 1970's that at the current abstraction rates the aquifers would be depleted in 20-30 years.(4)

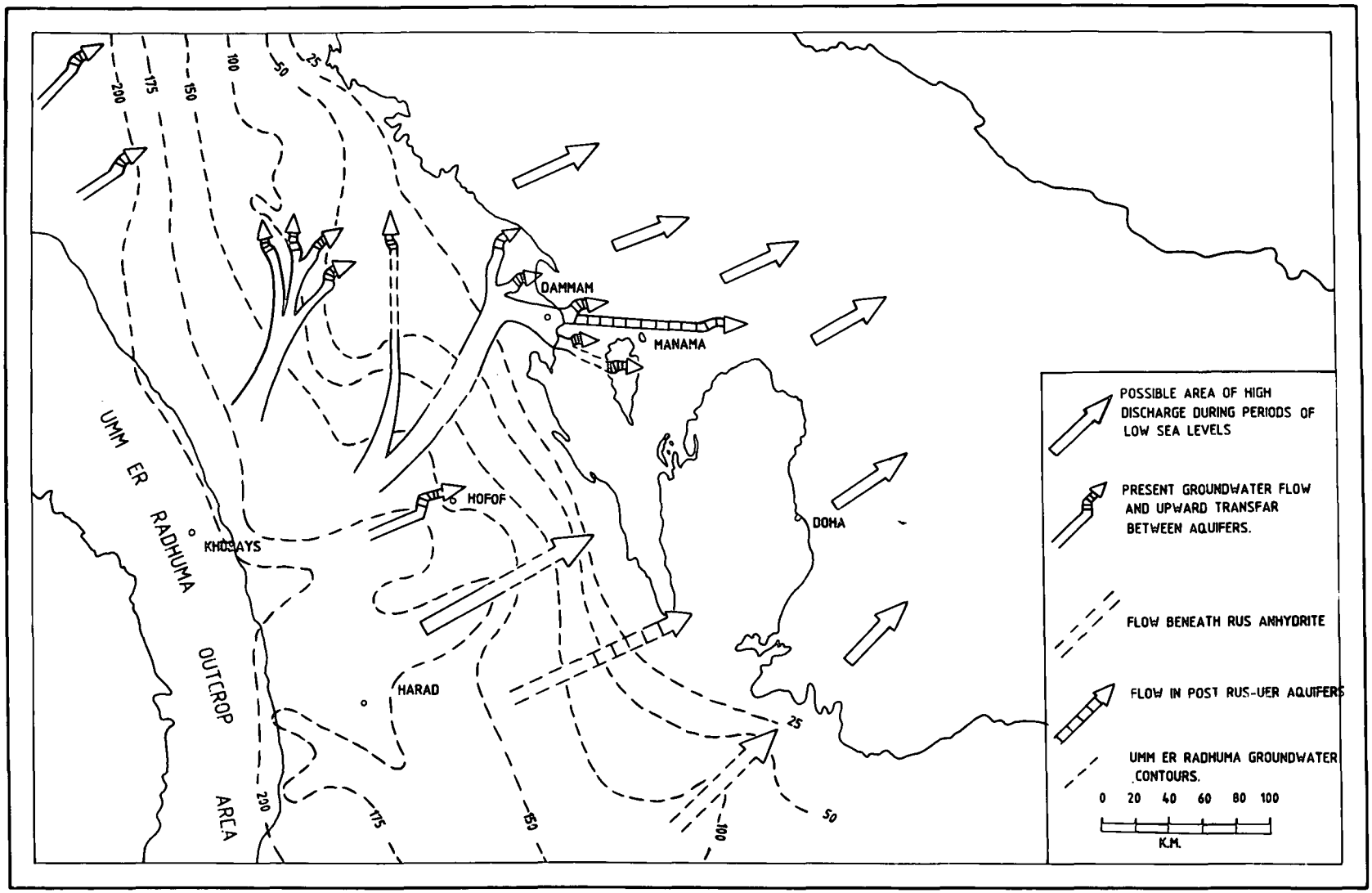
Another striking point is that any development of agriculture and/or growth of groundwater abstraction rates in the Eastern province of Saudi Arabia will directly affect the quality and quantity of groundwater in Qatar, a result of the groundwater flow pattern in the whole region (see Figure 5. 1).

The deterioration of water quality for irrigation itself brings other serious problems. In Qatar these are mainly (6):

- total salt concentration where salinity varies between 400 - 12,000 p.p.m t.d.s. (Fig. 5.2).
- sodium concentration
- bicarbonate hazards

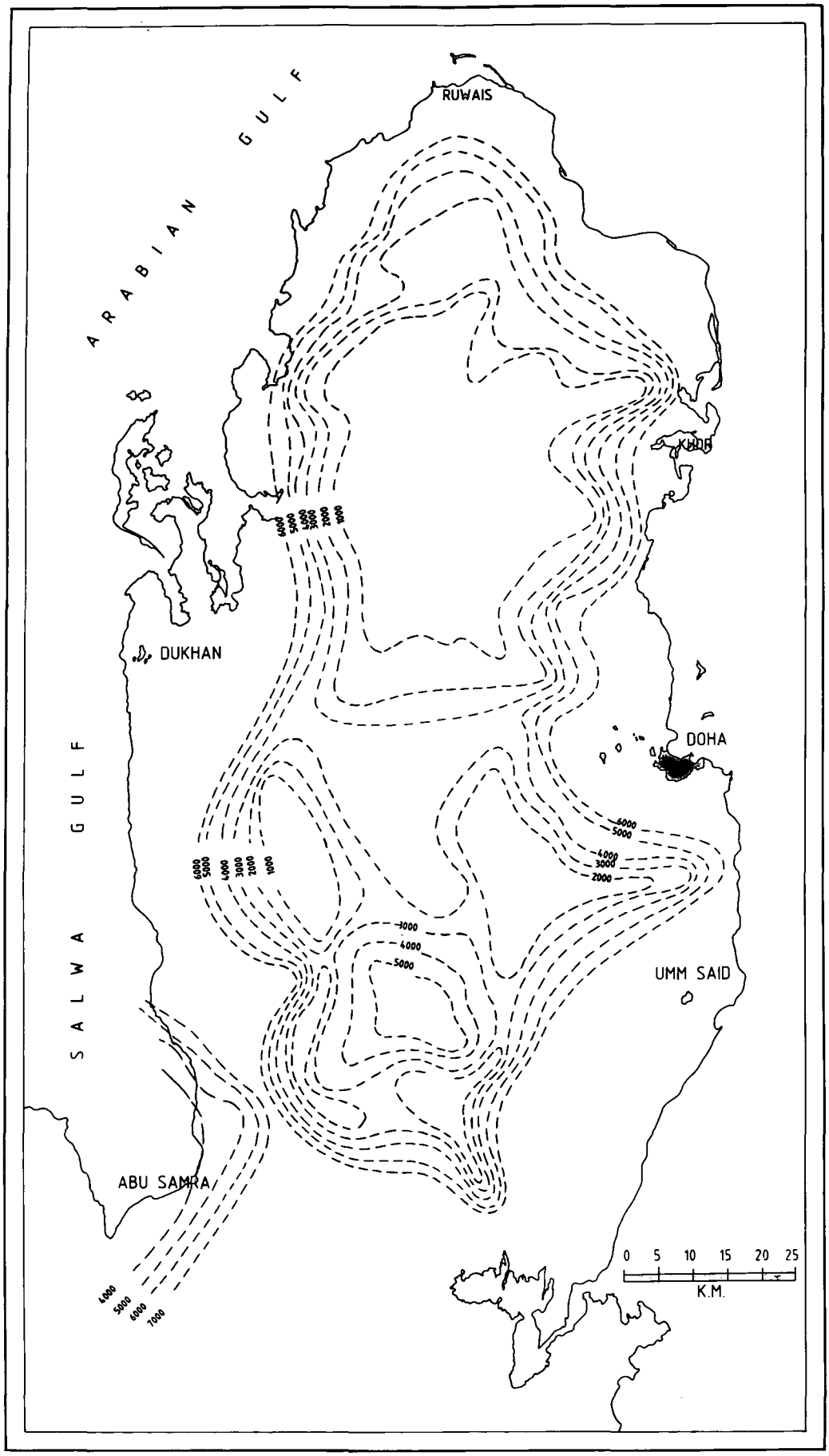
It is not necessary to repeat here the frequently stated facts that (a) the efficiency of irrigation water use is extremely low (30-40% average), (b) this results in the extravagant use of groundwater which is almost as irreplaceable a resource as oil. Recently the use of recycled urban effluent water for amenity tree-planting or fodder production has started but the scale is small given total agricultural consumption of water. The use of desalinated water

FIG. 5.1 CENTRAL ARABIAN GULF GROUNDWATER FLOW PATTERN.



SOURCE: FAO , QATAR: WATER RESOURCES AND THEIR DEVELOPMENT QATAR. 1981 . p10/8

FIG. 5.2 TOTAL DISSOLVED SOLIDS (ppm).



SOURCE: MINISTRY OF INDUSTRY AND AGRICULTURE: MAP OF SALINITY, DEPT. OF AGRICULTURE AND WATER RESEARCH SEPT. 1982.

for irrigation is not only a matter of cost of production but also becomes part of the complex issue of how best to use Qatar's exploited and potential energy resources. What is certain is that the question of water use in agriculture will have to be dealt with in the very near future.

5.2 Scale of Production and the Market

The scale of production and market characteristics are invariably critical factors affecting the development of agriculture, ranging from macro-relationships such as economies of scale to the relatively detailed aspects of demand. Some particular features of the situation in Qatar are of special significance.

The type and size of Qatar's farms, for example, affect directly agricultural gross income. Most of the farms in Qatar wholly or in large part serve as amenities in the private sector and as experimental/production trial units in the public sector, leaving only a small number which are truly commercial. Further, the predominant feature of this last small group of holdings is of smallness of area of individual properties, only a small proportion of which is actually cultivated, this last decreasing year by year because of deterioration in soils and water (partly man-induced). Farmers are forced to diversify production into a variety of crops to avoid the physical hazards described in Chapter 2 and almost all operations therefore tend to be on a very small scale. This diversification reduces the share of Qatar local production and makes economically viable competition with imported vegetables and fruits even more difficult than it would otherwise be.

The relative gross return to producer, wholesaler/broker and trader/retailer on sales of vegetables is indicated in Table 5.2. As a proportion of the retail price, the amount received by the farmer for his produce is not excessively low as sales margins go but the actual gross amount for the reasons outlined is small compared to other receipts for activity in Qatar.

Table 5.2 Doha market-prices and return on some vegetable crops in 1983

Crops	Average price		Return to			% of return to		
	Whole-sale	Retail	Farmer	Broker	Trader	Farmer	Broker	Trader
Tomato	1.9	3.2	1.8	0.1	1.3	56.3	3.1	40.6
Egg plant	1.9	3.4	1.8	0.1	1.5	52.9	2.9	44.1
Okra	4.1	8.1	3.9	0.2	4.0	48.1	2.4	49.4
Cucumber	3.4	5.5	3.2	0.2	2.1	58.1	3.6	38.2
Lettuce	2.8	5.1	2.7	0.1	2.3	52.9	2.0	45.1
Cauliflower	1.4	3.9	1.3	0.1	2.5	33.3	2.6	64.1
Courgette	2.8	5.9	2.7	0.1	3.1	45.8	1.7	52.5
Cabbage	1.5	2.8	1.4	0.1	1.3	50.0	3.6	46.4
Carrot	2.3	5.4	2.2	0.1	3.1	40.7	1.9	57.4
Snake Cucumber	1.5	3.3	1.4	0.1	1.8	42.4	3.0	54.6
Average	2.36	4.66	2.24	0.12	2.3	48.0	2.6	49.4

Source : Al-Nasr, B.A. Problems of Agricultural Development in Qatar, Qatar University, Qatar 1985, p.21.

For example, a hypothetical holding with 0.8 ha of land actually cropped commercially for vegetables (a reasonably typical situation) might have 2 donums of eggplant, 4 donums of tomato and 2 donums of lettuce. Taking the 1983 average yields for these crops as estimated by the Department of Agriculture,(5) the maximum gross receipts obtainable (assuming all production was sold at the prices shown

in Table 5.2) would be:	1990 kg	eggplant	QR 3,582
	6240 kg	tomato	QR 11,232
	7680 kg	cucumber	QR 7,680
		Total	QR 22,494

Table 5.7 below and other information obtained by personal interview would lead to the assumption that on such a holding gross production costs for these products would be of the order of QR 15,000, reduced to about QR 12,000 after deducting production subsidies. The maximum net receipts obtainable would then be about QR 10,000 and the probable actual outcome net annually as low as QR 6,000 (in 1983 £1,050 sterling). For a country which in 1981/82 had the highest world GNP per capita of over $22,000, farm incomes of the type indicated here are derisory, given other opportunities.

As Table 5.2 indicates the absolute size of the gross and net receipts obtainable by brokers, particularly if they also own retail outlets, is far higher, given the scale of products handled - including imports. It is therefore not surprising that whilst Qataris may own the registered landholdings they operate almost entirely in agricultural marketing and hardly at all in production. It is also hardly surprising that local production response to high local demand is low.

5.3 Import/Export trade in agricultural commodities

Qatar is in practice an open market, in particular insofar as other members of the Gulf Cooperative Council are concerned. This latter facet of importation has recently been perceived to be of importance particularly because of the nature of trade with Saudi

Arabia. The neighbouring Kingdom not only subsidises agricultural production far more heavily than does Qatar but this together with the sheer relative scale of Saudi production makes Qatari agriculture very vulnerable to this kind of competition. Thus imported Saudi alfalfa is sold at less than one-third of that previously obtained in Qatar and the threat of an export surplus of eggs from the Kingdom is a discouragement to potential Qatari producers.

The above is perhaps a special distortion (but none the less real) of the overall situation in which, due to the shortage of local supplies of vegetables and fruit in Qatar, the traders turn to outside countries for imports. Table 5.3 demonstrates that the local production of vegetables covers more than half of the aggregate demand but seasonal restrictions on production make it likely that this proportion will not rise. The local demand for fruit is still growing but local production of fruit has not yet reached 20 per cent of that demand. The seasonal restrictions imposed by climate are reinforced in their effects by the land tenure of short duration which does not encourage the lessee to indulge in planting crops with a long lead-time to harvest and income.

The volume of date production on the other hand shows that date palms are holding their own. The trend is however for an overall decline in consumption with a consequent drastic decline in imports because of a good level of government support for local growers.

There is now no significant export of Qatar agricultural crops, even though in the late 1970's various claims were made for future possibilities. Some small quantities, too small to appear in governmental statistics are seasonally shipped to neighbouring states and there is a good reputation of Qatar tomato products in Kuwait, Bahrain and the U.A.E.

Table 5.3 Local and Imported Vegetables (in tonne)

Year	Local	Imported	Total	% of Local
1981	18,132	12,644	30,776	58.9
1982	19,231	13,554	32,785	58.7
1983	13,217	18,388	31,605	41.8
1984	16,400	11,321	27,721	59.2
Total	66,980	55,907	122,887	54.5

Source : Ministry of Industry & Agriculture, Agricultural Statistics, 1984, Qatar, 1986. p.11.

Table 5.4 Local and Imported Fruits (Dates excepted) (in tonne)

Year	Local	Imported	Total	% of Local
1981	980	19,172	20,152	4.9
1982	2,920	20,805	23,725	12.3
1983	2,732	17,425	20,157	15.7
1984	3,336	20,038	23,374	14.3
Total	9,968	77,440	87,408	12.9

Source : Table 5.3 p.113.

Table 5,5 Local and Imported Dates (in tonne)

Year	Local	Imported	Total	% of Local
1981	5,880	6,569	12,449	47.2
1982	6,614	2,759	9,373	70.6
1983	6,204	640	6,844	90.7
1984	5,312	1,535	6,847	77.6
Total	24,010	11,503	35,513	67.6

Source : As Table 5.3 p.114.

The main problem of the import/export balance for the Qatari farmer is not primarily a matter of the aggregate volume of vegetables and fruits, but actually lies in the period or season of the imported crops. Unfortunately, at the times the most easily and cheaply produced local products reach the central market, they are faced with severe competition from imports, especially from Saudi Arabia.(6) This reduction of the profit margins to the local farmers at the normal time of main crop production due (a) to foreign, cheap large-scale production commodities and (b) heavily subsidised foreign exports raises particular difficulties. The logical production response of moving into high price out-of-season specialised products is no longer as easy as it was a decade or so ago because of the growth in competition for these particular markets worldwide. Even so there would be possibilities of competing successfully if so many of the local input factors were not so absolutely or relatively adverse i.e. labour, motivation - and linked with motivation, competition from other internal sectors and the resource difficulties outlined in Chapter 2.

5.4 Labour force

The total labour force in agriculture, hunting and husbandry was estimated at the time of the last survey in 1981 at 2,939, that is to say 2.4 per cent of 121,572 the total labour force in Qatar (see Chapter 3.1). The Qataris numbered only 500 almost entirely working in administration, transport etc.(7)

Most of the agricultural labour force, with the possible exception of some Egyptians and Palestinians found the special environmental conditions of farming in Qatar unfamiliar. Almost all were manual labourers, untrained in management or aspects of agriculture as a

business. Moreover the farm owners also tend to employ ordinary house servants to work on the farm. These limitations on the productive capability of the labour force together with deficiencies in motivation (see 5.6 below) not only decrease the productivity of agriculture but have destructive effects on land resource potential.

An absence of an understanding of the delicate water relationships in irrigation as practised in very arid conditions, even if motivation could be improved, will still make it difficult to reverse the building up of soil salinity, the destruction of groundwater resources and other deterioration typified by the recent spread of wild weed grasses.

A further serious problem is the lack of growth of any trained or organised group of agriculturalists in the private sector. This is partly a matter of scale but it is also clear that most landowners, on the one hand try to minimise direct expenditure by offering low salaries to employees, and, on the other, usually do not appreciate the productive value of skilled and responsible senior workers. Most Arab farmers with skills and some managerial experience leave the private sector and join the government sector. This usually leads to extemporary planning of farm operations and the disregarding both of technical possibilities and market possibilities.

Associated with this problem concerning the labour force is the fact that most of the expatriate farm workers do not speak Arabic language, coming as most of them do from south Asia. This results in poor communication and misunderstanding between workers and farm owners. There has also been, especially between 1979 and 1983 a general inflation of demand for labour, high turnover and a continuous increase of wages due to the high and rising living costs and a limited supply of labour force. Many landowners and tenants have tended to expand the

area under cultivation without increasing the labour force, but unfortunately also without investing in efficient labour-saving technology.

5.5 Capital return on investment

Unfortunately, there is no detailed official information available for farming accounts, investment and returns in the agricultural sector. Personal observation confirms the general belief that most tenants follow a hand-to-mouth system, whilst the actual owners of the farm care little whether the yield is profitable or not.

Table 5.6 below indicates that official estimates of receipts (gross) obtained from the production of various commodities approximating to total agriculture income rose from QR 166 million in 1980 and reached to a total of QR 251 million in 1984. That is an increase of 10.2 per cent per annum, about twice the general rate of inflation. But as noted earlier, net income to the agricultural sector is very different and as Table 5.2 shows, for the most important group of private sector products, the total gross value of vegetables in 1980 amounted to QR. 28 million while the gross cost of production was in the region of QR 19 million. After deducting and adding the pumping costs and subsidies the net value comes to only QR 7.7 million.

The comparison of Tables 5.6 and 5.7 is the nearest one can get under the conditions of data availability prevailing to understanding the levels of return possible on agriculture investment. Their low level in great part reflects poor land and water management as well as the non commercial approach to farming decisions by many land-owners. Qatar in the latter case may be tempted to re-evaluate the level of

Table 5.6 Development of Total Agriculture Income (1980-84)
(in Thousand QR)

Crops	1980	1981	1982	1983	1984
Vegetables	43,999	54,441	55,862	50,439	64,655
Dates	24,480	17,640	19,842	18,612	15,936
Fruits	3,528	3,775	6,110	5,732	5,000
Alfalfa	36,400	42,548	46,809	52,484	58,297
Cereals	570	667	1,239	604	777
Red Meat	14,020	15,240	13,760	14,440	17,270
Poultry	4,599	4,964	6,871	9,523	12,069
Milk and milk products	21,104	27,991	36,600	39,852	42,246
Eggs	1,926	2,329	2,624	3,572	4,173
Fish	15,506	22,578	22,516	21,994	30,900
Total	166,132	192,173	212,233	217,252	251,323

Source : Ministry of Industry and Agriculture, Agricultural Statistics 1984, Qatar 1980, p.18.

Table 5.7 Farm Production Economics (1980)

(in Thousand QR.)

Enterprise	Gross value	Gross costs	Pumping costs	Sub value	Subsidies	Net value
Vegetables	27,993	19,128	3,228*	5,637	2,104	7,741
Dates	3,280	3,280				
Fruits	2,880	3,672				
Alfalfa	4,800	4,160				
Cereals	428	960				
Sub Total	11,388	12,072	4,796*	-5,480	448	-5,032
Sheep/goats	2,944**	9,191				-6,247
Total	42,325	40,391	8,024	-6,090	2,552	-3,537

* pumping costed at QR 0.156 per cu.m

** sheepmeat valued at QR 1,657,500 per tonne

Source: Revised by the author from
FAO Qatar : Project Findings and Recommendations Water Resources and Agricultural Development Project, Rome 1981, p.39.

subsidies it is prepared to pay landowners on the farm to help the farmers

5.6 Farming motivation

The government, through the Ministry of ndustry and Agriculture, already provides a wide range of incentives i.e. seed, fertilizers, water pumps,...etc. The government also provide free of charge, soil and water testing as well as lending its own machinery to farmers. But there is no direct financial assistance offered as in Saudi Arabia through the provision of cheap or interest free credit through an agricultural bank or by government itself. The need of such assistance is apparently great in the context of a situation in which:

> "most tenant farmers in Qatar ... have available 3 and a half months supply of working capital whereas the majority of vegetable crops give a first yield only after 3-4 months" (8)

and because most of the tenant farmers being actually immigrant workers, it is difficult for them even to approach the commercial banks.

The question of financial support is however extremely complex quite apart from the basic assumption that there must be a wealth-creating sector somewhere in the economy if financial transfers between sectors can happen; in Qatar the only such source is that of the oil and gas export trade which already supports, directly and indirectly most consumption and the only other materially productive sector - manufacturing industry. In Chapter Six the question of government support for agriculture will be examined in more detail.

All else concerning farming motivation can be summarised thus. Since the mid 1950's the income generating opportunities available to every Qatari, through either direct government employment or through the tapping of the flow of very high and rising government expenditure

on infrastructure, development projects, goods and services, have been so high that neither manual employment in agriculture (in any case culturally distasteful) nor serious commercial exploitation of agricultural exploitation have been attractive. For the foreseeable future, given the wealth of Qatars offshore gas resources, no Qatari will be forced by survival factors to work the land. The only question that remains is whether the state is prepared to provide motivation by creating an attraction by subsidy (as do most industrialised countries) and if so, at what level, and in what ways appropriate to the nature of Qatar's physical endowment and society? This question in general is being asked everywhere in the Gulf region.(9)

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CHAPTER 6

SUMMARY AND CONCLUSIONS

It is clear from the analyses made in previous Chapters that severe physical conditions play a major role in curtailing the large scale development of agriculture in Qatar. The harsh climate combined with a poorly skilled labour force and unmotivated landowners are the main serious problems leading to the inefficient use of land and a low level of investment in agriculture, especially in the private sector.

It is also clear, from the field investigation, that any development of agriculture has to involve not only the Government sector but also the private sector. This fact becomes understandable once one accepts that the private sector includes most of the land with reasonable quality soil and is responsible for most of the inefficient and extravagant use of critically limited groundwater resources.

Discussion in this Chapter will concentrate on summarising findings and recommending ways forward for Qatar's future development in agriculture.

Physical factors

1. Soils (see Chp. 2)

Although the predominant soils in Qatar are very poor lithosols large areas of depression soils are still left untouched. There are also some ways of improving non-rodha soil conditions. For instance, clay soils can be improved in condition by mixing with sand and organic matter, while in order to improve the condition of sandy soil requires above all green manuring. Stony soils on the other hand, have to be cleared of large stones, not only surface, but also to a depth of at least 30 cm. However, even given these possibilities the total area of

land on which reasonable quality soils can be maintained without a too high input of manual labour (e.g. traditional Maltese style),[1] is still extremely small.

On the other hand dependence on natural soils in normal field agriculture can be avoided in the production of high value crops. The place of hydroponics and artificial environment systems of crop production is considered below.

Table 6.1 Salinitywise distribution of wells in Qatari farms 1982-83

Electrical Concuctivity micro-mhos/cm	North	Central	South	Total	%
500 - 1000	5	14	-	19	2
1000 - 2000	63	47	1	111	12
2000 - 3000	88	97	3	188	20
3000 - 4000	74	75	18	167	17
4000 - 5000	54	44	19	117	12
5000 - 6000	25	48	4	77	8
6000 - 8000	36	38	8	82	8
8000 - 10,000	30	23	2	55	6
10,000 - 12,000	8	23	3	34	4
12,000 - 16,000	14	45	6	65	7
16,000 - above	3	27	7	37	4
Total	400	481	71	952	100
%	42	51	7	100	

Source : State of Qatar Ministry of Industry and Agriculture - Dept. of Agriculture and Water Research. 1982/83 Water Survey in Qatari Farms (Feb. 1984.

Salinity build-up, in particular in field agriculture, requires special treatment on the increasing areas within farm units. (Fig. 6.1) The recommended standard leaching method which may account for almost 30% of total water applied in irrigation in Qatar has considerable drawbacks because of the limited availability of water and the development locally of waterlogging. What is required is much higher efficiency in wateruse, and therefore a much improved management of soil/water relationships. This is necessary because of the zonal concentration of silts and clays which gradually destroys the natural drainage and soil permeability; the high content of lime which forms crusts on the surface and subsurface pans, and the low content of organic matter in the soil which leads to poorly developed textures. Thus, these characteristics can and do very easily become critical when unwise irrigation methods are used.

Good soil development can only be monitored if the farm owners are prepared to employ technical skilled workers or let the land to skilled and motivated tenants. Everywhere in the arid lands the problem is the same : ecologically and pedologically stable irrigation critically requires skilled management and technical inputs.

2. Irrigation Water

As noted in Chapter 2.1 rainfall is hopelessly inadequate for farming. The extraction of water from aquifers through pumped wells is the alternative solution, but these wells have been sited to correspond to the pattern of depression soil distribution. The spatial location of soil and water is critical as the choice of location is restricted. Over-extraction in specific localities has led to rapidly deteriorating water quality, especially in a zone between 10 km and twenty km wide inland from the coastline where TDS in parts per million increased by more than 1000 between 1971 and 1983.[2]

The only hope of improving water quality lies with the possibility of recharging the upper aquifers or mixing with saline groundwater with desalinated sea or brackish water, possibly obtained through reverse osmosis plants, experiments on which are run under the supervision of IDTC. But the costs involved in such projects and the reliance on technical breakthrough, as well as the great slump in oil revenue, has made it difficult for the government, at least for the time being, to adopt such a method. Another approach which is being adopted is to recycle for agricultural use some of the large quantities available of effluent. Already 60,000 cu. m. a day of TSE (Treated Sewage Effluent) is available for selective use. No further development of groundwater resources is feasible[3] and all policies for agriculture have to accept this.

3. Climate

The main features of Qatar's climate are the high temperatures in summer associated with wide annual and daily ranges (see Table 2.1). High transpiration and insolation place great physiological strains on crops to be cultivated or livestock to be kept. High relative humidity with high temperature especially when associated with poor irrigation methods create endless problems for the plants and soil.

However, these inhibitive factors could be negated if sufficient capital was invested in appropriate agricultural technology. Even in conventional field agriculture the potential for improving production and productivity in Middle Eastern arid land irrigated agriculture is considerable as shown by Allan, Adams and Holt.[4] However, in Qatar as in the other Arab Gulf states many non-physical factors tend to negatively affect the development of such potential, and it is these factors (examined in Chapters 3 & 4) which now have to be evaluated.

Socio-economic factors

1. Finance

Finance in the form of governmental subsidies is generously given (see Chp. 3.3). Some of these subsidies are as fixed capital items, whilst a large proportion of current input expenditure is also given by the government free of charge; almost the only expense not met by government is the wage bill. The absence of significant private investment is noticeable and reliance on the government increases all the time. This is due mainly to the fact that many landowners consider agriculture as a social rather than an economic phenomenon. Consequently, investment for the purpose of obtaining a return on capital is not regarded as important. At the same time, since land is not regarded as an important economic asset, little regard is paid to its deterioration. Almost complete urbanisation has further diminished traditional though non-scientific ecological respect for the environment.

The isolating of government expenditure on agriculture is not possible and the budgets for government centres, price subsidies and other specific items are not published. Table 6.2 is the nearest measurement possible of relevant trends since the IDTC (Industrial Development Technical Centre) figures include the QR 20 million coolhouse project at Shahaniya and most technologically modern developments. 1402/03 AH, 1982 AD, represented the high point of total government expenditure since when there has been in the areas relevant to this study a fall.

Table 6.2

Government Current Expenditure (QR 000)

	1398	1399	1400	1401
Total	579,104	709,066	886,463	1,232,232
of which Ministry of Ind.& Agr.	24,545	22,451	28,533	32,859
IDTC	3,289	433	2,846	3,098

Government Capital Expenditure on Major Projects (QR million)

	1398	1399	1400	1401	1402/03*	1403/04
Total	2,415.3	2,328.1	3,088.5	3,618.3	5,614.0	2,728.1
of which Ministry of Ind.&. Agr.	18	8.3	8.4	12.1	30.1	9.3
IDTC	103.2	15.3	7.7	12.6	(--)	(--)

* 18 months

Government Capital Expenditure on Minor Projects (QR 000)

	1398	1399	1400	1401	1402/03*	1403/04
Total	121,062	102,257	171,432	197,293	2,823,184	130,248
of which Ministry of Ind.& Agr.	3,988	2,047	2,422	5,205	11,381	2,126
IDTC	485	121	301	468	(--)	(--)

* 18 months

2. The work force

It is shameful, in accordance to tribal teachings, to work physically on the land as a farmer. This traditional attitude which unfortunately still exists has long made it necessary to bring foreigners in to work on the land, and many of these workers have no previous farming experience and are basically unskilled labourers. Further, even at technical and white-collar level there is a shortage of native employees in agriculture while other governmental bodies suffer from being over-staffed. Overall there is a shortage of skilled technicians and managers. The Ministry of Industry and Agriculture has planned the setting up of an Agricultural Training School or Institution but this has not been put into effect and there seems little hope of attracting Qataris into this kind of vocational training.

3. Management

Appointed managers in the investigated farms were not easy to find and no organizational element in these and other farms is evident, with the exception of the government's new production units at Oturiyah and Abu Samra.

An Integrated Approach?

As we have seen, the physical environment and resources available for agriculture are such as to demand specifically appropriate human responses. In Chapter 1, the type of response made by traditional communities was outlined but the changing nature of these communities especially since the 1940's is equally obvious. The general nature of this change is apparent elsewhere in the Gulf, as for example shown by Heard-Bey for the United Arab Emirates.(5) However, in Qatar, as shown by Table 1.1, there was virtually no agriculture except for pastoralism before the 1940's and today's farms and landholdings as described in

Chapter 4 have been created by the same oil-wealth which now makes it unnecessary for any Qatari to rely on agriculture for income or employment. The design of an effective contemporary agricultural response to the physical and human context in which agriculture must fit also must itself be integrated and not fragmented.

For example, the effects of dust and sand blow, often aggravated by non-agricultural activities in a hot desert environment, are felt by urban dwellers as well as being damaging to crop production. Farmers do little to combat them because they are neither easy nor cheap to control in the relatively small and scattered farmed areas. The deterioration in groundwater quality and quantity is not merely an agricultural problem but indirectly, through phenomena such as the rising water-table under Doha and Umm Said and associated surface floods of contaminated water, an urban and national problem.(3)

Consequently, one possibility is that the government should impose not only specific soil and water policies which are appropriate, but also any other land use policies such as specific cropping patterns, methods of cultivation etc. Hypothetically this could be achieved as the government could be more selective in the free-of-charge inputs which it gives to the farmers for implementing its policies. Even so the government would have to find what at the moment it lacks, a proper management team to implement out its policies. The lack of experience of such operators on and off farm requires that, in spite of all the social difficulties outlined above, a training and recruitment programme be carried out as without a skilled work force no improvement is possible.

Social attitudes are not easy to change and old attitudes have been strengthened by the explosion in oil revenues which started in 1950, although the impact of oil has in some ways been positive, as everywhere in the Gulf region, because rapidly rising government revenues has made possible lavish governmental expenditure on agriculture. In the UAE, for example, it has been estimated that during the early 1980's the one per cent of the federal budget allocated to agriculture implied a direct subsidy of about QR2,000 per hectare; total direct and indirect support was of the order of QR 16,000 per ha.[6] Saudi Arabian financial and land grand incentives offered to agricultural producers and subsidies to consumers first fully described in 1979[7], are extremely lavish and very wide ranging. Their effect has been to produce surpluses of wheat and dates in Saudi Arabia. and cheap exports of eggs to the Gulf.

The general question that arises is : how far along the road of support and subsidies for agricultural production and food consumption is Qatar prepared to go? This is not a question that can be explored in this study but some pointers to possibilities can be suggested.

First, the physical and environmental difficulties facing farming, as noted above, are such that actual agricultural production costs are bound to be high. The Water Resources and Agricultural Development Project Terminal Report [8] suggested in 1981 that "to produce (annually) the maximum amount of food possible (67,500 tons) would require a total of 306 million cubic metres of water, 80% of which would need to be distilled seawater at an annual cost of QR 1580 million." It was estimated that total annual costs of QR 1940 million would be approximately ten times higher than the value of production at world prices. About 85% of these total costs represent the cost of physical resource difficulties and deficiencies.

Secondly, the cost of competing under Qatari conditions with non-farming economic sectors for the skilled management and technical labour inputs which farming in Qatar requires, is also high. Thirdly, if landholders are to be tempted into investing interest, energy and capital in farming as a profitable commercial enterprise (which is what has happened in Saudi Arabia)[6], then either relatively small production units have to achieve very high productivity or high prices for products have to be accepted by the consumer. The only alternative to such high prices is the subsidising of the consumer i.e. high support prices paid to producers diminished by direct government intervention subsidies to a retail level acceptable socially, economically and politically.

The government is already applying a price policy which aims to protect the consumers from high prices and at the same time encouraging the agricultural commodities production by subsidizing the farmers by reducing the price or the supply free of charge of inputs. Between the producer (farmers) and the consumers there are the commission agents, the wholesale and retail traders who are the largest beneficiaries, particularly the agents who are obtaining more than half the price the consumers pay. Consequently, it would be logical to take further measures, i.e. legislation to protect the farmers' returns and further encourage production. For example :

(a) the Government's Ministry of Industry and Agriculture (MIA) could regulate the quantity of agricultural commodities to be supplied to the central market in Doha, this in order to reduce the high fluctuation in prices.

(b) the MIA could prevent the importing of agricultural commodities where similar commodities are produced locally in sufficient quantities to supply the demand and, also to facilitate the export of seasonal surplus e.g. such as tomatoes and watermelons.

In any case there should be immediate action by the MIA to reduce the power which the commission agents have in the marketing system. On the production side it would be logical to establish cooperatives to carry out marketing (grading, storing, transporting of the product) and to carry out agricultural extension work.

Whatever is suggested along these lines by government intervention, whether by direct state-farming, price fixing or import control, must ultimately be justified by their appropriateness to the unique Qatari situation. The subsidising of food production and availability in order to protect the consumer is common and long established worldwide and there is no question that the State of Qatar can afford for a considerable period to indulge its inhabitants in this way. On the other hand as Sayigh has suggested[9] the very heavy use of oil/gas income on subsidising social expenditure can create a "disparity between effort and reward" which is deleterious to society. It is noticeable that measures to reduce the level of consumer food price subsidies are now being taken in the USSR to correct consequent social and economic distortions.

On the other hand state intervention in agriculture is frequently justified as necessary to protect rural communities even when these are in the minority, even at high cost to the consumer. For example, in Japan the 6% of the working population in full-time agriculture received in 1986 over US$7 billion in subsidies but the retail price of rice was allowed to rise to 8 times the world average level. [10] Most of the justification for the European Economic Community's Common Agricultural

Policy is also to protect rural communities in harsh environments. In Qatar, there is, strictly, no traditional indigenous rural community to protect, only a few hundred Qataris who now are engaged, non-manually, in farming activities which are usually subordinate to their other interests.

During the 1970's the question of food security, i.e. the possibility of actual food shortages, had a considerable impact on Gulf region attitudes to agricultural development. However, from the mid 1980's onward it is clear that new biological technology has apparently removed the threat of absolute deficits in world food supplies, at least for any market with the necessary purchasing power, e.g. Qatar.

One is forced to conclude, therefore, that there is no single clear justification for Qatar to spend hundreds of millions of QR's on food production and food subsidies while at the same time other social and economic requirements, from education and health to industrialisation also make heavy demands.

On the other hand, if one regards the proper development of agriculture in Qatar as bringing a great range of benefits across the whole face of the economy and society, then large scale and expensive intervention can be justified. Thus an efficient agriculture could employ at a highly skilled technical and managerial level both Qataris and non-Qataris, earning high salaries from their high productivity. An efficient agriculture could reduce its demands on groundwater by at least one half and so rectify the present destructive imbalance to the benefit of the whole country. An efficient agriculture by definition should provide opportunities for further scientific and technical advances in how to utilise and manage a desert environment. At the same

time, the desire of many Qataris, as everywhere in the Gulf, to keep contact with the land and growing things, is satisfied, while at the same time producing local commodities for which there is a premium demand. This is the true, general rather than specific justification and goal for agricultural development.

What is necessary then is an integrated set of policies which together will serve Qatar's own special situation. This implies that many government sectors have to cooperate in order to achieve the inter-related goals.

The simplest production approach would be to concentrate on a small number of artificial or controlled environment systems to produce a special range of high value crops. At Oturiyah and Shahania government centres tomatoes, cucumbers, many so-called salad crops, peppers, and strawberries are growing in hydroponic installations and drip-irrigated cool houses. Techniques and equipment are operating successfully under temperature controlled conditions, avoiding the problems caused by the weather. Also, no arable land is required as growth is either soil-less or in manufactured composts, and except in harvesting, not many labourers are required as most of the irrigation operations are carried out automatically according to a computerized programme. Technically these processes are successful but the comparison of total costs with those of improved conventional farming is not yet very favourable.

The main drawback is that further development along these lines would do nothing to improve existing land and water utilisation or encourage a feeling of human involvement in the conservation and improvement of the environment.

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APPENDIX

Questionnaire Survey

1. Name of the farm:
2. Registration No. with Ministry of Industry & Agriculture:
3. Location of the farm:
4. (a) Total area of the farm

   (b) Area used for crops
5. Date of the establishment of the farm
6. Since establishment has the farm expanded Yes..... No.....
7. Date(s) of Expansion
8. Does the owner work on the farm. Yes..... No.....
9. Is any of his family working on the farm Yes..... No.....
10. Is the land rented from other(s) Yes..... No.....
11. If yes, how much is the rent monthly.....annually.....
12. How many workers employed on the farm Qataris.....Non Qataris.....
13. Is there any residential accommodation for the farmer and for labourers on the farm Yes..... No.....
14. Which of the following problems has the farmer been facing:
    a. Lack of skilled farm workers
    b. Lack of farm labbürers
    c. Distance from the Capital
    d. Soil salinity
    e. Water salinity
    f. Lack of sufficient water supply
    g. Pests and diseases
    h. Marketing difficulties
    i. Please indicate others

15. Give your suggestion to solve these problems.

16. Has the farm obtained any loan from Local Banks. Yes.....No.....

17. What is the main crop of the farm

18. What are the other products the farm produces (Please indicate)

19. By what means does the farm sell its output

20. Are farm products transported by the farmer's or landowner's own vehicle(s) Yes..... No.....

21. In which area do you sell the products? In the capital or nearest town. Please indicate

22. Is there any fixed price for each crop? Does the government determine the prices?

23. What is your suggestions to solve the problems related to the transport, marketing and prices of crops?

24. Is the farm connected by pipeline for water supply from off-farm areas? Yes ..... No.....

25. Is there any water well on the farm?

Yes..... No.....

26. How many water wells on the farm?

27. Do you use a water pump for extracting water? Yes..... No.....

28. What is the daily quantity the farm uses? (Estimation)

29. By which method do you irrigate your plants:

1. Channel bed Yes..... No.....
2. Drip irrigation Yes..... No.....
3. Spray method Yes..... No.....

30. What machinery do you use on the farm and how many units?

Type of machine	Number
1.	.....
2.	.....
3.	.....

31. How do you repair, or have repaired, the farm machinery?

32. Is the farm connected to the government electricity supply?

Yes..... No.....

33. Is there any private generating plant? Yes..... No.....

34. Does the farm have a telephone? Yes..... No.....

35. Are modern methods of production used on the farm, for example:

1. Greenhouses Yes..... No.....

2. Others (please indicate)

36. Do you use organic fertilizers? Yes..... No.....

37. What quantity (by sack)?

38. Do you use chemical fertilizers? Yes..... No.....

39. What quantity (by sack)?

40. Which of the following are provided to the farm from the the Agriculture Department (please tick)

a. Seeds b. fertilizers c. water pump

d. machinery e. plant protection materials f. assistance in management

g. Assistance with the agricultural husbandry

h. Assistance in irrigation systems

i. Others (please indicate)

41. What are the common plant diseases affecting your farm/

42. What are your suggestions to meet agricultural production problems?