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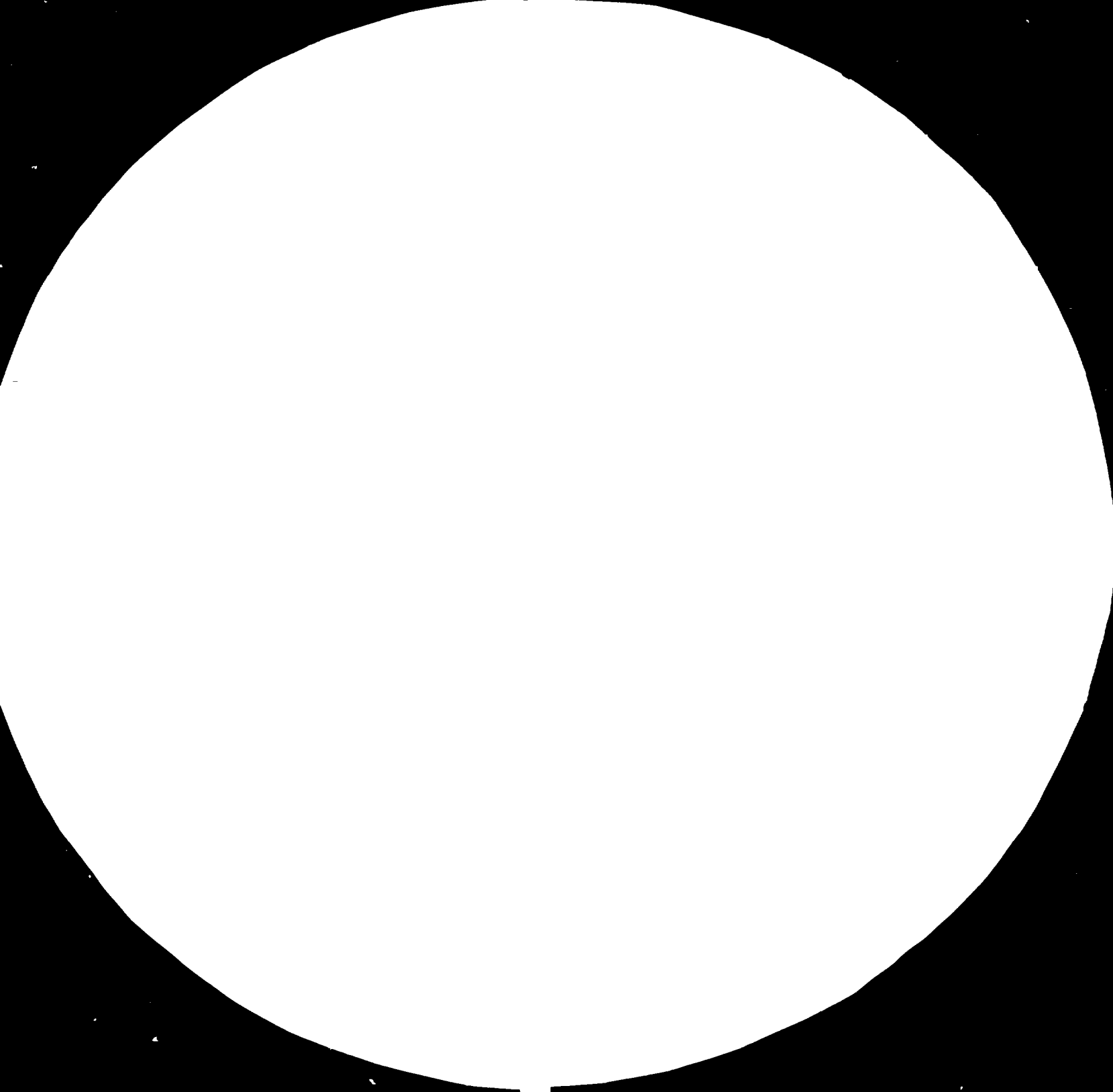
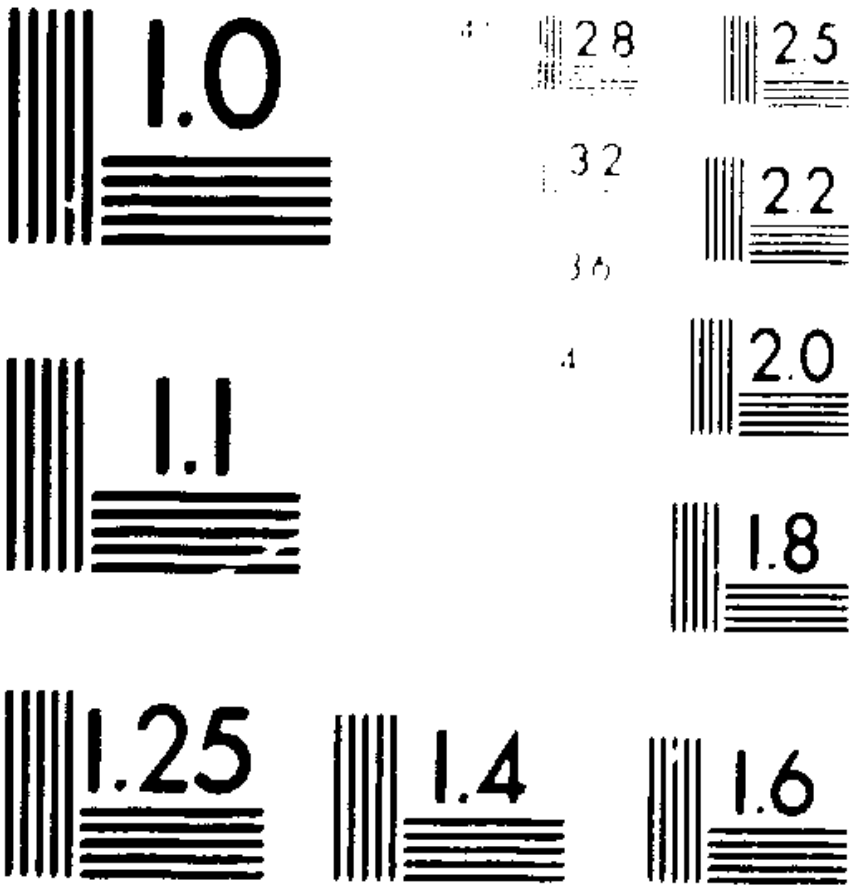
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org





Regional Cooperation Programme for the Development of

Fertilizer Production and Utilization in the Arab States

RAB/78/021 84/126

14494

Study on

Future N P K Joint-Venture Projects in the Arab Region

(Fertilizer industry).

DP/RAB/78/021

Mamoun Y. Abu-Khader

Talal Khalil

Kuwait, January, 1985

Aknowledgement

This Study was prepared By AFCFP on behalf of the United Nations Industrial Development Organization (UNIDO) for the Regional Cooperation Programme for the development of Fertilizer Production and Utilization in the Arab States.

The Study was prepared by:

* Dr. Mamoun Y. Abu-Khader

Secretary General-AFCFP

Kuwait

* Eng. Talal Khalil

Projects Analyst,

Arab Petroleum Investment Corporation.

Dammam-Saudi Arabia

List of Pertilizer Companies in th Arab Region

1- **Jordan:**

* Jordan Phosphate Mines Company	JMPC
* Jordan Fertilizer Industry Company	JFI
* Arab Potash Company	APC

2- **U.A.E:**

* Abu Dhabi National Oil Company	ADNOC
* Ruwais Ferrtilizer Industries	FERTIL

3- **Bahrain:**

* Gulf Petrochemical Industries Company	GPIC

4- **Tunisia:**

* Industries Chemiques Maghrebines	ICM
* Societe Industrielle D'Acide Phosphorique Et D'Engrais	SIAPE
* Compagnie Des Phosphate Des Gafsa	GAFSA
* Societe Arabe Des Engrais Phosphate Et Azote	SAEPA
* Engrais De Gabes	EG
* Societe Tunisienne D'Engrais Chemiques	STEC
* Industrie Chemiques De Gafsa	ICG

5- **Algeria:**

* Enterprise Nationale Des Engrais Et Produits Phytos	ASMIDAL
* Enterprise Nationale De Fer Et Du Phosphate	ENFP

6- **Saudi Arabia:**

* Saudi Arabian Fertilizer Company	SAFCO
* Saudi Arabian Basic Industries Corporation	SABIC

7- **Sudan:**

* Sudan - Ren Chemicals & Fertilizers	S-Ren

8- **Syria:**

* General Organization For Chemical Industries	GECI
* State Company For Fertilizers	FERT
* General Company For Phosphate and Mines	GECOPHAM

9- **Somalia:**

*	Urea Production Project	UPP

10- **Iraq:**

*	State Organization For Chemical Industries	SOCI
*	State Enterprise For Fertilizers	SEF
*	State Organization For Minerals	SOM
*	State Enterprise For Phosphates	SEP
*	State Enterprise For Mishraq Sulphur	SEMS

11- **Qatar:**

*	Qatar Fertilizer Company	QAFCO

12- **Kuwait:**

*	Petrochemical Industries Company	PIC

13- **Lebanon:**

*	Lebanon Chemicals Company	LCC

14- **Libya:**

*	National Petrochemical Company	NAPETCO

15- **Egypt:**

*	Societe ElNasr D'Engrais Et D'Industries Chemiques	SEEIC
*	ElNasr Company For Coke And Chemicals	ECCC
*	Egyptian Chemical Industries Company	KIMA
*	Abu-Ouir Company For Chemicals And Fertilizers	AOCCF
*	Societe Financiere Et Industrielle D'Egypt	SFIE
*	Abu-Zaabal Fertilizers And Chemicals Company	AZFCC
*	ElNasr Phosphate Company	EPC
*	Misr Phospahte Company	MPC
*	The Red Sea Phosphate Company	RSPC

16- **Morocco:**

*	Groupe Office Cherifien Des Phosphates	OCP
*	Societe Cherifienne D'Enrais	SEC

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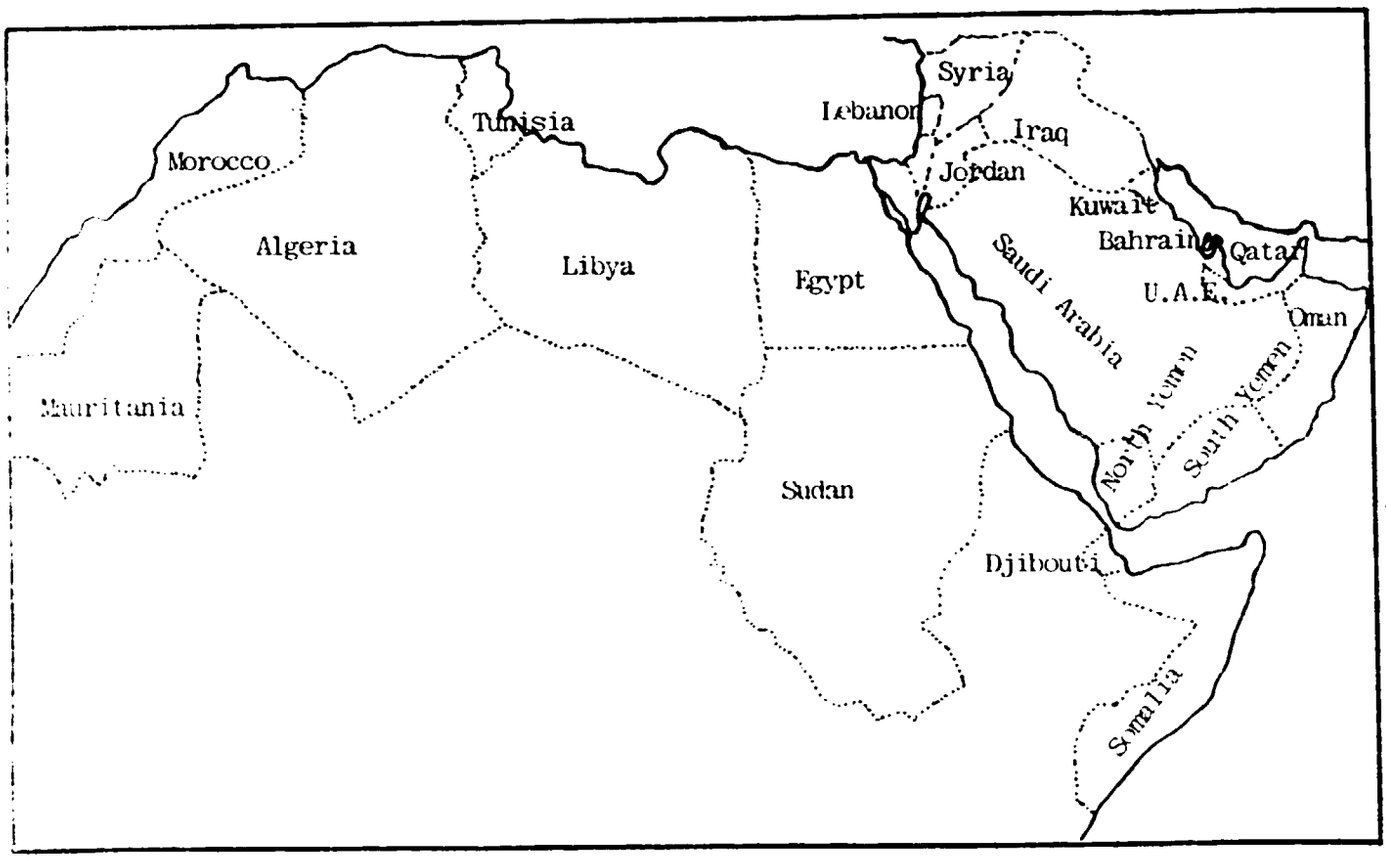

ARAB REGION*

1. JORDAN	8. SUDAN	15. LEBANON
2. U.A.E	9. SYRIA	16. LIBYA
3. BAHRAIN	10. SOMALIA	17. EGYPT
4. TUNISIA	11. IRAQ	18. MOROCCO
5. ALGERIA	12. OMAN	19. MAURITANIA
6. DJIBOUTI	13. QATAR	20. NORTH YEMEN
7. SAUDI ARABIA	14. KUWAIT	21. SOUTH YEMEN

* The Countries are listed according to the Arabic Alphabitical Order.

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Explanatory Notes

- The term "Compound Fertilizers" or "NPK Fertilizers of all types" as used in this study denotes all fertilizers containing more than one of the primary nutrient elements: N, P, K, and produced in granular form by processes in which chemical reaction is an essential part of the process. Accordingly, fertilizers produced by bulk blending, i.e physical mixing (without chemical reaction) of dry fertilizer materials are not considered in this study.

- The term "NPK Fertilizer Grades" or "NPK Fertilizer Formulations" excludes MAP and DAP.

- NPK Fertilizers include: NP, NK, PK, and NPK formulations.

- Reference to "dollars" ($) indicates U.S. Dollars.

- Reference to tonnes indicates metric tons.

ABBREVIATIONS

AN	: Ammonium Nitrates.
AS	: Ammonium Sulphate.
CN	: Calcium Nitrate.
SSP	: Single Superphosphate.
TSP	: Triple Superphosphate.
AP	: Ammonium Phosphates.
MAP	: Monoammonium Phosphate.
DAP	: Diammonium Phosphate.
ASP	: Ammonium Sulphate-Phosphate.
NP	: Compound Fertilizers containing Nitrogen and Phosphate.
NK	: Compound Fertilizers containing Nitrogen and Potassium.
PK	: Compound Fertilizers containing Phosphorus and Potassium.
tpd	: tonne per day.
tpy	: tonne per year.

1. INTRODUCTION

The Present Status of the Fertilizer Industry in the Arab Region 1983

The Arab Region has now reached an advanced stage of development in the fertilizer industry both in the raw materials sector and finished products. The Arab Region is endowed with huge reserves of all the fertilizer raw materials: Phosphate Rock, Sulphur, Natural Gas and Potash. On the other hand, Urea, TSP, and DAP production has increased considerably and the region is now one of the major exporting centers of these fertilizers to the international market. The following is a brief account of the fertilizer industry in the Arab Region in 1983.

A- Raw Materials:

1. Phosphate Rock:

The total reserves of phosphate rock in the Arab Region is estimated to be 63 billion tonnes, representing 80% of the World Total.

About 90% of the region reserves is located in Morocco. The rest is in Jordan, Tunisia, Egypt, Syria, Algeria, Iraq, Saudi Arabia and Mauritania.

The Production of phosphate rock in 1983 totalled 34 million tonnes, which represents about 25% of the World Total Production. About 32% of the production is consumed in the region in the production of phosphoric acid and phosphate fertilizers.

2. **Sulphur:**

The total reserves of sulphur in the region amounts to one billion tonnes, respresenting about 11% of the world total. The major quantity of these reserves is associated with oil and gas like in Saudi Arabia, Kuwait, Iraq and United Arab Emirates. Large quantities of Pyrrhotite also exist in Morocco.

The production of Sulphur in all forms in 1983 was 1.4 million tonnes while the consumption was double that amount. Thus the Arab Region suffered a shortage of 1.4 million tonnes of sulphur during the same year.

3. **Potash:**

The total reserves of Potash in the region is about two billion tonnes, mainly concentrated in the Dead Sea brines in Jordan, and this represents about 2% of the world total reserves.

The potash project in Jordan started production in late 1982 and the production reachhed 287 thousand tonnes in 1983. It is expected that production in 1984 would reach 480 thousand tonnes directed mainly for export to the international market.

The consumption of K2O in the Arab Region in 1983 reached 117 thousand tonnes.

4. **Natural Gas:**

The total reserves of natural gas in the region is about 15 trillion cubic meters, largely located in the Arab Gulf States. This quantity is about 16.5% of the world total reserves.

The commercial production of natural gas in the region amounted to 58 billion cubic meters in 1983. A high percentage of this quantity is associated gas.

The consumption of natural gas in the production of ammonia and nitrogen fertilizers was about 4 billion cubic meters which is about 7% of the total commercial production in 1983.

B- **Ammonia and Nitrogen Fertilizers:**

* **Ammonia:** The total ammonia capacities in 1983 reached 5.9 million tonnes, representing about 4.5% of the world total capacities. On the other hand, production of ammonia reached three million tonnes while consumption was about 2.6 million tonnes.

* **Urea:** The urea capacities in the region in 1983 totalled 5.2 million tonnes representing 7.5% of the world total capacities in 1983. The production and consumption of urea in the Arab region in 1983 were 3 million tonnes and 1.3 million tonnes respectively.

* **Ammonium Nitrates (AN):** The production of ammonium nitrates in the region reached in 1983 about one million tonnes while consumption of the region amounted to 1.3 million tonnes during the same year.

* **Ammonium Sulphate (AS):** The production of ammonium sulphate in the region in 1983 reached 80 thousand tonnes while conaumption amounted to 293 thousand tonnes in the same year. Egypt, Morocco and Libya are the main consumers of this product.

* **Calcium Nitrate (CN):** This fertilizer is produced only in Egypt with a capacity of 250,000 tpy (15.5% N).

C- **Phosphoric Acid and Phosphate / Compound Fertilizers:**

* **Phosphoric Acid:**

The capacities of phosphoric acid in the Arab Region totalled 3.7 million tonnes P_2O_5 in 1983 representing about 11.4% of the world total capacities.

The production of phosphoric acid in 1983 amounted to about 2.5 million tonnes of which 1.1 million tonnes were consumed in the production of phosphate/compound fertilizers. Morocco, Tunisia and Jordan are the major producers and comsumers of phosphoric acid in the region in 1983.

* **Single Superphosphate (SSP):**

The production of single superphosphate in 1983 in the Arab Region reached about 850 thousand tonnes, all of which was consumed in the region. Egypt is the largest producer and consumer of this product.

* **Triple Superphosphate (TSP):**

The capacities of Triple Superphosphate in the region totalled in 1983 about 2.7 million tonnes. The production of TSP in the region reached 1.6 million tonnes in 1983 while consumption was 648 thousand tonnes. On the other hand Morocco and Tunisia are the largest producers of TSP while Egypt, Algeria and Syria are the largest consumers.

* **Ammonium Phosphates (AP):**

The capacities of ammonium phosphates in the region totalled 2.1 million tonnes. The production of ammonium phosphates in 1983 reached 1.1 million tonnes and consumption was 216 thousand tonnes. Tunisia, Morocco, Jordan and recently Iraq are the producers of ammonium phosphates. Morocco, Libya and Saudi Arabia are the major consumers.

* **Compound Fertilizers (NPK):**

The capacities of NPK fertilizers in the region totalled 861 thousand tonnes. The production of NPK in 1983 reached 445 thousand tonnes, and consumption exceeded 500 thousand tonnes. Morocco, Algeria and Iraq

are the major producers. while Algeria. Saudi Arabia. Morocco. Iraq and Libya are the major consumers of NPK fertilizers.

D- The Consumption of Chemical Fertilizers in the Arab Region:*

Despite the fact that production of chemical fertilizers in the Arab Region has increased considerably in the last ten years, consumption of fertilizers is still relatively low. The average consumption of fertilizer nutrients (N+P2O5+K2O) was around 40 kg/ha compared to 45 kg/ha being the average for developing countries and 120 kg/ha for the developed countries in 1983.

E- Manpower in the Fertilizer Industry and its Raw Materials:*

The size of manpower working in the fertilizer sector in 1983 has reached about 100 thousand, of which 50% are in the field of raw materials (excluding natural gas). On the other hand 50% of the manpower in the fertilizer sector are skilled labour (technicians, process and maintenance operators).

F- Investments in the Fertilizer Industry and Its Raw Materials:*

The size of investments in the fertilizer sector in the Arab Region by 1983 has amounted to about 12 billion U.S. dollars. Of this total, about 23% being for raw materials (phosphate rock, frash sulphur and potash).

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* Sectoral Study: Fertilizer Industry in the Arab Region-Year 2000, AFCFP, January 1983.

Statistics Book: Fertilizer Industry and Its raw Materials, AFCFP, January 1984.

2. NPK Fertilizer Industry in the Arab States

The NPK fertilizer industry started in the Arab Region in early seventies in Morocco and Algeria. Then Lebanon and Tunisia started production in the second half of the seventies, while recently Jordan and Iraq became major producers. The start of this industry in Morocco was closely related to the development of the Agricultural Sector. NPK bulk blended fertilizers are produced in several formulations in many parts of the country, and both the public sector and private sector are involved in this industry.

On the other hand, the NPK compound fertilizers produced in Morocco (14:28:14 and 19:38:0) and Algeria (4:20:25 and 12:18:18) are manufactured for local consumption. while Tunisia and Jordan are at present major DAP producers and exporters.

The NPK fertilizer industry in each Arab producing Country will be discussed in detail as follows:

1- **MOROCCO:**

The Phosphate Rock industry in Morocco started in 1920.Production in 1983 totaled about 20 million tonnes while exports totaled 14.653 million tonnes. Morocco has the world's largest known phosphate rock reserves and is now the largest exporter to the world market. Groupe Office Cherifien Des Phosphates (OCP) is known worldwide. On the other hand, the phosphoric acid and phosphate fertilizer production started in Morocco in mid sixties at Safi in Maroc Chemie Complex. The first production line of phosphoric acid (165,000 tpy) with Rhone Poulenc Technology together with a TSP production line (396,000 tpy) started in 1965. Then, a production line for Ammonium Sulphate-phosphate (19:38:0) with a capacity of 132,000 tpy and NPK line (14:28:14)with Rhone Poulenc Technology started 1972 and 1973 respectively. In 1976, a second phosphoric acid production line (165,000 tpy) with Rhone Poulenc Technology together with a production line for MAP (396,000 tpy) using Fisons Technology came into stream.

Maroc Phosphore (1 , 2) project started production early seventies and the first phosphoric acid production line (495,000 tpy capacity) with Nissan Technology started in 1976, together with a sulphuric acid plant (1,485,000 tpy) using Polimix Technology. The rest of the production units of Maroc Phosphore were completed during the period 1981-1983.

The production figures of compound fertilizers in Morocco during the eighties were as follows (in thousand tonnes product):

	1980	1981	1982	1983
ASP (19:38:0) :	108.3	85.6	85.0	100.0
MAP (11:55:0) :	—	30.4	137.8	221.0
NPK (14:28:14):	112.0	47.8	65.7	100.0

The NPK fertilizers produced in Morocco (ASP and 14:28:14) are consumed locally, while MAP production is directed for export. Morocco imports Sulphur, Ammonia and Potash from the world market. In 1983, the imports have reached:

1,300,000	tonnes	Sulphur
84,000	tonnes	Ammonia
45,000	tonnes	Potassium Sulphate
27,000	tonnes	Potassium Chloride

On the other hand, Morocco exported 197,000 tonnes of MAP in 1983 from Safi Port, in addition to its exports of phosphoric acid and TSP.

Future projects for the production of NPK fertilizers in Morocco include units of one million tonnes per year of DAP and a unit of 200 thousand tonnes per year of ASP. These units are part of Maroc Phoshore (3 , 4) of Jorf Al-Asfar complex. The DAP product is intended for export to the international market.

The fertilizer complex at Jorf Al-Asfar includes also eight lines (500 tpd P2O5 each) phosphoric acid in addition to two units for production of superphosphoric acid (500 tpd P2O5 each) with 70% P2O5 using Rhone Poulenc. This complex will require the import of 1.32 million tonnes of sulphur and 180,000 tonnes ammonia. Jorf Al-Asfar is expected to become the largest industrial site for phosphoric acid and phosphate fertilizers in the world in two years time.

The phosphate rock and chemical fertilizers industry in Morocco generates a lagre flow of foreign exchange earnings into the country. The total manpower employed in this sector reached 29,000 in 1983.

The policy of OCP in the establishment of phosphoric acid and phosphatic fertilizer plants was to include different technologies in the production lines with the objective of training the technical staff to operate and maintain these plants and acquire complete knowlegde of these technologies. Therefore, small size production units were established (500 tpd capacity). This is in addition to the fact that the same line can be used to produce different products (MAP/DAP/NPK). which allows for a better flexibility in the production programme according to the requirements of the local market and the international markets.

Accordingly the engineers and technical staff of OCP are now actively engaged in engineering and construction of the Jorf Al-Asfar Complex owing to their long experience in this field since mid sixties.

The technologies used in Maroc Chimie and Maroc Phosphore (1,2) in NPK fertilizer production are: Rhone Poulenc and Fisons Technologies.

2- **ALGERRIA:**

The NPK fertilizer industry started in Algeria in Annaba as a part of phosphoric acid / phosphate fertilizer complex in 1972. The complex has the following production units:

Phosphoric Acid	=	165,000 tpy P205
TSP	=	490,000 tpy
DAP	=	132,000 tpy
NPK (4:20:25)	=	75,000 tpy
NPK (12:18:18)	=	150,000 tpy

The technology used in the production of NPK fertilizers is Rhone Progil. The production figures of NPK fertilizers during the past four years are as follows (thousand tonnes product):

	1980	1981	1982	1983
NPK (4:20:25) :	49.8	65.0	—	30.0
NPK (12:18:18):	84.0	54.0	62.0	86.0

Algeria has its phosphate deposits in Djebel Onk and the deposit is of the low-grade type. The production capacity is about one million tonnes per year

On the other hand, the nitrogen fertilizer industry in Algeria is now well-established. It started in late sixties in Arzew and early eighties in Annaba. The total capacities existing at present in both sites are:

Ammonia	= 990,000 tpy.
Urea	= 132,000 tpy.
Ammonium Nitrate	= 658,000 tpy.

SONATRACH is the Government Enterprise that constructed and operated all these projects. Recently, a new company was established to manage all fertilizer plants and projects. This company was named: Enterprise Nationale Des Engrais Et Produits Phytosanitaire (ASMIDAL), with headquarters in Annaba.

The NPk fertilizers produced in Algeria are consumed locally and that is why they have special specifications to suite the requirements of the agricultural sector in the country.

Algeria imports Sulphur and Potassium Sulphate. The quantities imported in 1983 were as follows:

Sulphur	= 55,000 tonnes.
Potassium Sulphate	= 43,000 tonnes.

The future plans in Algeria do not include any NPK fertilizer projects.

3- TUNISIA:

The phosphate rock and phosphatic fertilizer industry in Tunisia is well-established and advanced. It has started early in the beginning of this century. The production of phosphate rock reached about 6 million tonnes in 1983 of which about 66% was consumed locally.

Phosphoric Acid and phosphate fertilizers production started in Tunisia early fifties in SIAPE plants at Sfax, while MAP production started mid seventies at Gabes Plants of ICM (100,000 tpy) On the other hand, the DAP production started by SAEPA late seventies at Gabes (450,000 tpy). The phosphoric acid and phosphate fertilizers capacities existing in Tunisia at present are:

Phosphoric Acid = 1,089,000 tpy

TSP = 936,000 tpy.

The production of ammonium phosphates in the eighties in Tunisia was as follows (in thousand tonnes):

	1980	1981	1982	1983
MAP	67.0	57.0	68.2	80.0
DAP	220.0	350.0	360.3	405.0

At present MAP and DAP production is totally directed for the world market. The imports of Sulphur and Ammonia in 1983 were as follows:

Sulphur = 923,500 tonnes

Ammonia = 122,000 tonnes

The technology used in Tunisia for the production of DAP and phosphoric acid is SIAPE process, while the technology used for MAP production is Windmill

The future projects of NPK fertilizers in Tunisia include the production of a compound fertilizer (17:17:17) with a capacity of (495,000) tpy and DAP (330,000 tpy) in Gabes, expected to start 1986/87. The NPK fertilizer production (17:17:17) requires the exploitation of potassium salts available in Zarzis area or chott Djerid deposit.

Gabes and Sfax are the two major industrial sites for the production of fertilizers, and their exports to the World market.

Recently, Tunisia became self-sufficient in ammonium nitrate consumption with an additional quantity available for exports after the start of production in SAEPA plant in Gabes in 1983 (330,000 tpy capacity).

The phosphate rock and chemical fertilizer industry contributes materially to the national economy. The total manpower employed in this sector reached 18,200 in 1983. This industry has reached very high stage of develop ment at all levels. The SIAPE technology for phosphoric acid /DAP/TSP is now known worldwide. The technical staff in the fertilizer industry have acquired a very good experience so that they can handle future developments in this sector successfully.

4- LEBANON:

The compound fertilizer production started in Lebanon mid seventies at Salaa'ta location as part of the complex owned by Lebanon Chemicals Company. The production capacity of the NPK fertilizers is 100,000 tpy with different formulations for both the local market and for export to neighbouring countries.

Information on the production of NPK fertilizers since 1980 is not available. However, the present situation is that the company is producing small quantities of the fertilizer types required for the local market.

Lebanon imports all the raw materials and intermediates required for the fertilizer industry (phosphate rock. sulphur, ammonia, potash and potassium sulphate).

The Salaa'ta chemical ferilizer complex which started mid sixties comprises the following units (tonnes per year):

Sulphuric Acid	= 34,600
Phosphoric Acid	= 100,000
TSP	= 300,000
SSP	= 120,000
Nitric Acid	= 18,000
Ammonium Nitrate	= 22,000
Ammonium Sulphate	= 75,000.

5- **JORDAN:**

The phosphate rock industry in Jordan is well-established and started early fifties. The production in 1983 reached 4.8 million tonnes. On the other hand the production of chemical fertilizers started late 1982 in JFI phosphate complex located at Aqaba. The phosphoric acid unit has a capacity of 410,000 tpy used primarily in DAP production (capacity 740,000 tpy). In 1983, the production of DAP reached 337,400 tonnes.

The production of potash from the Dead Sea brines has started by the Arab Potash Company late 1982 and in 1983 reached 287,000 tonnes. The production of potash is expected to reach 1.2 million tonnes in 1986.

The imports of Sulphur and ammonia reached in 1983, about 190,000 tonnes and 85,300 tonnes. respectively. In the same year, Jordan production of DAP and potash was directed for exports. Until now, Jordan consumption of the locally produced fertilizers (DAP and Potash) is very small.

Future projects in the fertilizer industry in Jordan include the following (tonnes per year)

NPK Fertilizers = 330,000

Potassium Sulphate = 150,000

It is expected that both projects will be on-stream in 1988.

Aqaba port is becoming an important industrial site for both, fertilizer industry and phosphate rock exports. JFI has its own industrial jetty with facilities for unloading and storage of raw materials and intermediates in addition to facilities for storage and loading of DAP and Potash.

The technology used in DAP production at Aqaba fertilizer complex is that of Badger Gulf Corp.

6- **Iraq:**

Iraq has the three main raw materials required for the manufacture of chemical fertilizers. These are natural gas, sulphur and phosphate rock.Plants for the production of nitrogen, phosphate and compound fertilizers came on stream in Iraq in Basrah and Al-Qaim in 1971 and late 1982, respectively.

Al-Qaim Complex comprises the following production units:

Phosphoric Acid	= 400,000 tpy capacity
Ammonia	= 50.000 tpy capacity
TSP	= 600,000 tpy capacity
MAP	= 250,000 tpy capacity
NPK	= 272,000 tpy capacity

The technology used in MAP and NPK production is Fisons Technology.

In 1983, Iraq produced 50,000 tonnes of MAP and 74,000 tonnes of NPK of the following formulations:

(18:18:5), (27:27:0), (15:15:15), and (20:20:0).

For the production of NPK Iraq imported 15,000 tonnes of potash and imported urea as a nitrogen source. In the same year, Iraq consumption of NPK fertilizers reached about 74,000 tonnes while exported its output of MAP.

* **Arab Region:**

The total production capacities of compound fertilizers (NP and NPK) in the Arab Region in 1983 reached about 3 million tonnes, of which only 30% is NPK fertilizers. This is in comparison with about 1.5 million tonnes in 1980 (Table 1).

The production of NPK fertilizers of all types reached in 1983 about 1.54 million tonnes, compared to about 694,000 tonnes in 1980 (Table 2).

By 1990, the total NPK fertilizer capacities is expected to reach about 6.6 million tonnes of all types, a four-fold increase in just ten years time (Table 3). Libya, Syria, Kuwait and Saudi Arabia are expected to become NPK fertilizer producers.

It is worth noting that by 1990 the percentage of NPK fertilizers of different grades would increase and reach 39% of the total capacities of all types of compound fertilizers.

Table (1): Total Production Capacities of NPK Fertilizers of all types in the Arab Region (1980 - 1983)

(in thousand tonnes)

Country/Type	1980	1983
- Morocco:		
MAP (11:55:0)	396	396
ASP (19:38:0)	132	132
NPK (14:28:14)	132	132
- Algeria:		
DAP (18:46:0)	132	132
NPK (4:20:25)	75	75
NPK (12:18:18)	150	150
- Tunisia:		
MAP (11:55:0)	100	100
DAP (18:46:0)	330	450
- Lebanon:		
NPK (17:17:17)	100	100
- Jordan:		
DAP (18:46:0)	---	740
- Iraq:		
MAP (11:55:0)	---	250
NPK (27:27:0)	---	272
Total Arab Region:		
- MAP	496	746
- DAP	462	1322
- NPK	589	861
Grand Total	**1547**	**2929**

Table (2): Total Production of NPK Fertilizers of all types in the Arab Region (1980 - 1983)

(in thousand tonnes)

Country/Type	1980	1981	1982	1983
- Morocco:				
MAP	-.-	30.4	137.8	221.0
ASP	108.3	85.6	85.0	100.0
NPK	112.0	47.8	65.7	100.0
- Algeria				
DAP	-.-	-.-	-.-	-.-
NPK	133.8	119.0	62.0	116.0
- Tunisia:				
MAP	67.0	57.0	68.2	80.0
DAP	220.0	350.0	360.3	405.0
- Lebanon:				
NPK	53.3	26.7	51.0	55.0
- Jordan:				
DAP	-.-	-.-	118.0	337.4
- Iraq:				
MAP	-.-	-.-	-.-	50.0
NPK	-.-	-.-	-.-	73.9
Total Arab Region				
MAP	67.0	87.4	206.0	351.0
DAP	220.0	350.0	478.3	742.4
NPK	407.4	279.1	263.7	444.9
Grand Total	**694.4**	**716.5**	**948.0**	**1538.3**

Table (3): New Projects NPK Fertilizers of all types Expected by 1990 in the Arab Region

Country/Type	(in thousand tonnes)
- Morocco:	
DAP	1000
ASP	200
- Tunisia:	
DAP	330
NPK	495
- Jordan:	
NPK	330
- Libya:	
NPK	330
- Syria:	
DAP	330
- Kuwait:	
DAP	330
- Saudi Arabia:	
NPK	330
Total Arab States	
DAP	1990
NPK	1685
Grand Total	**3675**

* **NPK Fertilizer Production Technology in the Arab Region:**

The technology used in the production of various types of NPK fertilizers (MAP, DAP, NPK grades) in the Arab Regionn varies from one country to another.

Fisons technology is used in Morocco and Iraq for MAP production, while in Tunisia Windmill technology is used. The DAP technology used in Jordan is that of Gulf Badger while in Tunisia, indigenous SIAPE technology is used. On the other hand, French Technology, (Rhone-Poulenc and Rhone-Progil) is used in Morocco, Algeria and Lebanon for NPK production, Iraq uses Fisons technology.

It is worth mentioning that the only Arab technonlogy in this field used for DAP production is that of SIAPE process developed by Tunisian engineers in addition to the Worldwide known SIAPE process for phosphoric acid production, which has been licenced for several other countries.

The following tabulation summerizes the various types of NPK technologies used in the Arab Region in different plants together with the date of startup.

Country/Type	Plant/startup Date	Technology
Morocco:	MAROC CHIMIE	
- ASP (19:38:0)	1972	Rhone-Poulenc
- NPK (14:28:14)	1973	Rhone-Poulenc
- MAP (11:55:0)	1976	Fisons
Algeria:	Annaba	
- NPK (4:120:25)	1972	Rhone-Poulenc
- NPK (12:18:18)	1972	Rhone-Poulenc
- DAP (18:46:0)	1972	Rhone-Poulenc
Tunisia:	Gabes	
- MAP (11:55:0)	1978	Windmill
- DAP (18:46:0)	1979	SIAPE
Lebanon:	Sala'ata	
- NPK (17:17:17)	1977	Rhone Poulenc
Jordan:	Aqaba	
- DAP (18:46:0)	1982	Gulf Badger
Iraq:	Al-Qaim	
- MAP (11:55:0)	1983	Fisons
- NPK (27:27:0)	1983	Fisons

3. Past. Present and Future Prospects of the NPK Fertilizer Consumption in the Arab Region

1. Jordan:

The total agricultural land in Jordan is estimated to be 1.2 million ha (13% of the total area of the country). the cultivated area is about 530,000 ha of which only 8% is irrigated. The importance of the agricultural sector in Jordan appears in that a high percentage of the population of the country benefit from this sector which contributes about 10% to the GDP of the country.

The major crops in Jordan are:

- Cereals and field crops = 80% of the cultivated area.
- Productive Trees = 11% of the cultivated area.
- Vegetables = 9% of the cultivated area.

Fertilizer consumption in Jordan in 1983 reached about 55,000 tonnes of all types, compared to only 14,000 tonnes consumed in 1974. About 50% of the total consumption in 1983 was nitrogen fertilizers. On the other hand, the consumption of NPK fertilizers in 1983 was 6000 tonnes in addition to 2400 tonnes of DAP. The major NPK grades consumed are (18:18:6), (20:20:0), (23:23:0) and (15:15:15).

Jordan's consumption of NPK fertilizers during the period (1980-1983) was as follows (in tonnes product)·

Year	NPK	DAP
1980	12000	---
1981	8000	---
1982	5400	---
1983	6000	2400

The future consumption of NPK fertilizers in Jordan is projected as follows:

Year	NPK	DAP
1984	10000	4000
1985	12000	6000
1990	18000	12000

2. **U.A.E.:**

The total agricultural land in U.A.E. is estimiated at 260,000 ha (3.3% of the country total area). The total area available for agriculture is 60,000 ha, of which only about 45% is under cultivation mainly in the Emirate of Abu Dhabi and the Emirate of Ras Al-Khaimah.

The agricultural sector contributes very small percentage to the national economy. Actually, it is less than 1% of the GDP of the country.

The major crops in the U.A.E. are the following:

- Productivve trees = 50 % of the total cultivated area. (mainly dates)
- Vegetables = 29 % of the total cultivated area.
- Cereals, ornamentals and forage = 30 % of the total cultivated area.

The fertilizer consumption in U.A.E. reached 12,200 tonnes in 1983. Meanwhile, NPK fertilizers consumption amounted to 7000 tonnes compared with 1580 tonnes in 1978. This consumption is directed mainly for the fertilization of vegetables and city green areas.

The future consumption of NPK fertilizers in U.A.E. can be estimated as follows (tonne product):

1984	=	7500
1985	=	8000
1990	=	12000

3. **Bahrain:**

The total agricultural area in Bahrain is 6200 ha (9% of the country total area). The contribution of agricultural sector in national economy is minor. The fertilizer consumption in 1983 was about 1000 tonnes of all types.

The compound fertilizer (15:15:15) is the main fertilizer type and mainly

used for fertilization of vegetables, ornamentals and forage.

The prospects of NPK consumption in Bahrain is that it may reach about 2000 tonnes in 1990.

4. **Tunisia:**

The total agricultural area in Tunisia is estimated to be 5.9 million ha (36% of the country total area). The total cultivated area varies from year to year in the range of 5 million ha. The importance of the agricultural sector in the economy of the country is clear in that it contributes about 15% of the GDP of the country and that about 70% of the country population are involved and depend on agriculture.

The major crops in Tunisia are

- Cereals = 44% of the total cultivated area.
- Olive trees = 32% of the total cultivated area.
- Productive trees = 10% of the total cultivated area.
- Legumes, vegetables, forage and others = 13% of the total cultivated area.

It is worth mentioning that the well developed agricultural area is concentrated in the northwest, northeast and center of the country and that the total irrigated area is about 200,000 ha.

The total fertilizer consumption in the country in 1983 reached about 110,000 tonnes compared to about 88,000 tonnes in 1975. The major types used in the country are ammonium nitrate, TSP, SSP and potassium sulphate in addition to a small quantity of bulk blended fertilizers.

It is clear that the consumption of DAP and NPK compound fertilizer in Tunisia is minor. The Ministry of Agriculture and the Agicultural Research Centers are studying this situation. Therefore, the forecast of future DAP and NPK consumption in Tunisia in 1990, is as follows:

DAP	=	10,000
NPK	=	15,000

5. **Algeria:**

The total agricultural land in Algeria is 7 million ha, (about 3% of the country total area) concentrated in the northern part of the country. The cultivated area is estimated to be 4.5 million ha, with about 2 to 3 million ha fallow. In addition, about 30 million ha are considered good pastures and forests.

The total irrigated area reached 340 000 ha in 1983 while the potential area for irrigation can reach 1.8 million ha. The development of the agricultural sector in Algeria is most important because the population is over 20 million and Algeria self-sufficiency in food is now about 40% only. More intensive use of fertilizers is encouraged by the Government.

The major crops in Algeria are:

- Cereals = about 51% of the total cultivated area.
- Productive trees = about 14% of the total cultivated area.
- Vegetables, legumes, forage and others = about 35% of the total cultivated area.

The total fertilizer consumption in the country in 1983 reached 410,000 tonnes compared to about 375,000 tonnes in 1978.

The major types used in the country are, ammonium nitrate, TSP, DAP, and NPK fertilizers in addition to a small amount of ammonium sulphate and potassium sulphate.

The consumption of compound fertilizers in Algeria in the period from 1980 to 1983 was as follows (tonne product):

Year	DAP	NPK
1980	34,000	190,000
1981	26,000	167,500
1982	19,000	86,000
1983	2,000	147,000

The types of NPK fertilizer consumed in Algeria are (12:18:18), (4:20:25), and (0:23:23).

The future consumption of NPK fertilizers in Algeria is projected to reach the following levels (tonne product):

Year	DAP	NPK
1984	33,000	178,000
1985	45,000	200,000
1990	130,000	523,000

6. **Djibouti:**

The total land available for agricultural development in Djibouti is 300,000 ha (14% of the country total area). The area under cultivation in 1983 reached only 700 ha while food requirements of the population can be produced in approximately 50,000 ha. However, the agricultural sector contributes about 10% of the GDP of the country. The consumption of fertilizers in Djibouti in 1983, reached about 5,000 tonnes composed of urea, TSP and potassium sulphate.

The main crops in Djibouti are as follows:

- Vegetables = 80% of the total cultivated area.
- Fruits and Cereals = 20% of the total cultivated area.

At present, the consumption of NPK fertilizers in Djibouti is too small. It estimated that about 2,000 tonnes of NPK fertilizers would be consmued in 1990.

7. **Saudi Arabia:**

The total agricultural land in Saudi Arabia is estimated to be 4.2 million ha (about 1.8% of the country total area). About 1.2 million ha are considered a good agricultural land for cultivation and 3.0 million ha needs reclamation. In

addition, about 50 million ha are considered good pastures and forests.

In 1982/83, the cultivated area reached 818,000 ha and is expected to increase to 900,000 ha in 1984 and 1.2 million in 1990. In general, 80% of the agriculture in Saudi Arabia depends on irrigation and 20% on rainfall.

The major crops in the country are:

- Cereals = 75% of the total cultivated area.
- Vegetables = 10% of the total cultivated area.
- Productive Trees (dates mainly) = 15% of the total cultivated area.

The fertilizer consumption in Saudi Arabia in 1983 reached about 288,000 tonnes of all types compared with about 33,000 tonnes in 1978. The major types of fertilizer used in Saudi Arabia are, urea, TSP and compound fertilizers. The percentage of compound fertilizers (DAP and NPK) in 1983 was 42% of the total consumed tonnage. The major NPK formulations consumed in Saudi Arabia are:

(23:23:0), (18:18:5), (15:15:6), (24:24:0), (22:22:0) and (0:32:11).

The consumption of compound fertilizers in the period 1980-1983 was as follows (tonnes):

Year	DAP	NPK
1980	---	47,300
1981	2,300	72,100
1982	100	96,500
1983	21,000	100,000

The future consumption of compoud fertilizers in Saudi Arabia is expected to reach the following levels (tonnes):

Year	DAP	NPK
1984	30,000	120,000
1985	35.000	130,000
1990	50,000	200,000

8. **Sudan:**

The total agricultural area in Sudan is 8 million ha (3.2% of the country total area). In addition, about 70 million ha are considered potential agricultural land. The irrigated area reached 1.8 million ha in 1983 while the remaining agricultural area is rainfed. About 67% of the population are engaged in the agricultural sector which contributes about 40% of the GDP.

The major crops in Sudan are:

- Cash crops = 27% of the total cultivated area.
- Feed crops = 46% of the total cultivated area.
- Vegetables and others = 27% of the total cultivated area.

The fertilizer consumption in Sudan in 1983 reached 182,000 tonnes composed mainly of urea (99% of the total). The consumption of compound fertilizer in Sudan is minor.The future consumption of NPK fertilizers is visualized to reach in 1990 about 5,000 tonnes.

9. **Syria:**

The total agricultural land in Syria is about 6 million ha (32% of the country total area). The total cultivated area is about 4 million ha, of which about 0.7 million ha are irrigated, expected to increase to about One million ha by the year 1990.

The major crops in Syria are:

- Cereals = 50% of the total cultivated area.
- Productive Trees = 30% of the total cultivated area.
- Vegetables and others = 20% of the total cultivated area.

The agricultural sector in Syria is an important sector in the economy of the country and more than 60% of the population benefit directly or indirectly from this sector which contributes about 20% to the GDP.

The total fertilizer consumption in Syria reached in 1983 about 300,000 tonnes composed of urea, TSP, ammonium nitrate and potassium sulphate.

Syria, in the past few years, consumed considerable quantities of DAP but decreased gradually and seems that it didnot import any quantity of DAP during 1983. On the other hand, the consumption of NPK fertilizers is minor. The Ministry of Agriculture and the Agricultural Research Centers expect, that the consumption of DAP and NPK fertilizers is likely to increase in the coming few years (tonne product):

Year	DAP	NPK
1984	10,000	2,000
1985	15,000	3,000
1990	50,000	10,000

10. **Somalia:**

The total agricultural area is 8 million ha (about 13% of the country total area). The total cultivated area in Somalia is about 0.7 million ha, of which about 160,000 ha are irrigated. The agricultural sector is very important in the economy of the country.

The major crops are bananas and other equatorial trees in addition to vegetables and field crops.

The consumption of fertilizers in Somalia, in 1983, reached 14,000 tonnes mainly urea and NPK.

Prospects of NPK fertilizer future consumption is as follows (tonne product):

Year	NPK
1984	6,000
1985	7,000
1990	12,000

11. **Iraq:**

The total agricultural land in Iraq is about 12 million ha (27% of the country total area). The total cultivated area reached in 1983 about 5.8 million ha, of which 1.2 million ha are irrigated and 2.6 million ha rainfed. The potential area which can be cultivated by irrigation is about 6 million ha. The importance of the agricultural sector in the national economy is steadily increasing as a result of the policy of the Government for the development of this sector.

The major crops in Iraq are:

- Cereals = 71% of the total cultivated area.
- Productive trees = 15% of the total cultivated area.
- Vegetables and others = 14% of the total cultivated area.

The consumption of fertilizers in Iraq reached in 1983 about 246,000 tonnes of all types compared with 96,000 tonnes consumed in 1974. Urea, TSP and NPK fertilizers were the main fertilizer types consumed in Iraq in 1983. The NPK fertilizers consumed in Iraq are as follows (tonne product):

(27:27:0) = 43,800 tonnes

(15:15:15) = 14,400 tonnes

(20:20:0) = 8,100 tonnes

(18:18:6) = 7,700 tonnes.

The consumption of NPK fertilizers during the period 1980-1983 was as follows (tonne product):

1980	=	15,500 tonnes
1981	=	17,000 tonnes
1982	=	14,900 tonnes
1983	=	73,900 tonnes.

The future consumption of NPK fertilizers in Iraq is expected to reach the following levels (tonne product):

1984	=	150,000 tonnes
1985	=	200,000 tonnes
1990	=	250,000 tonnes.

12. **Oman:**

The total agricultural land in Oman is 83,000 ha (3.9% of the country total area). The total cultivated area in 1983 reached 44,000 ha, of which 80% is concentrated in the northern part of the country.The agricultural sector in Oman has received more attention in recent years. The total fertilizer consumption in 1983 reached about 12,300 tonnes (mainly ammonium sulphate and NPK fertilizers), compared with 2,000 tonnes in 1978.

The major crops in Oman are:

- Productive Trees (mainly dates) = 66% of the total cultivated area.
- Vegetables = 18% of the total cultivated area.
- Field crops = 16% of the total cultivated area.

The major NPK fertilizer type used in Oman is (20:10:10). The consumption in the past few years of NPK fertilizers was as follows:

1980	=	1,900 tonnes
1981	=	1,630 tonnes
1982	=	1,500 tonnes
1983	=	4,500 tonnes.

Prospects of NPK fertilizers future consumption is as follows:

1984	= 6,000	tonnes
1985	= 7,500	tonnes
1990	= 12,000	tonnes

13. **Qatar:**

The total agricultural area in Qatar is 36,000 ha (3.2% of the country total area). The cultivated area reached about 3,600 ha in 1983. The agricultural sector is minor in the economy of the country. The consumption of fertilizers in Qatar reached in 1983 about 1,500 tonnes, mainly urea.

14. **Kuwait:**

The total agricultural area in Kuwait is 17,000 ha (1% of the country total area). The cultivated area reached about 3,500 ha in 1983. The agricultural sector in the economy of the country is minor. The consumption of fertilizers in Kuwait reached in 1983 about 1,000-1,500 tonnes, mainly urea.

15. **Lebanon:**

The total agricultural land in Lebanon is 35,000 ha (34% of the country total area). The information on the agricultural sector and the consumption of fertilizers since 1980 is not available. The estimated consumption of fertilizers in 1983 was 107,000 tonnes, of which 50% was NPK fertilizers, this is in comparison with 133,000 tonnes in 1980.

Lebanon has a well developed agricultural sector which contributes materially to the national economy and a high percentage of the population depends on this sector. The major crops are citrus, fruits, vegetables and olives.

The future NPK fertilizers consumption is expected to reach the following levels (tonnes):

1984	= 60,000
1985	= 60,000
1990	= 85,000

16. **Libya:**

The total agricultural area in Libya is 2.5 million ha (1.4% of the country total area). The total cultivated land reached about 1.5 million ha in 1983, of which about 40% is irrigated. The agricultural sector has developed rapidly during the past few years and is becoming increasingly important in the national economy. As a result, the fertilizer consumption in Libya increased from 80,000 tonnes in 1978 to 190,000 tonnes in 1983. DAP, ammoniun sulphate, NPK, urea, superphosphate and potassium sulphate are the fertilizer types consumed in Libya. The NPK fertilizer grades used are:

(12:24:12), (17:17:17) and (18:18:6).

The major crops in Libya are, cereals, vegetables and productive trees.

The NPK fertilizer consumption in the past few years was as follows (tonne Product):

Year	DAP	NPK
1980	75,000	26,000
1981	76,000	25,000
1982	80,000	20,000
1983	85,000	30,000

The prospects of NPK fertilizer consumption in Libya is expected to be as follows (tonne product):

Year	DAP	NPK
1984	90,000	35,000
1985	100,000	40,000
1990	130,000	60,000

17. **Egypt:**

The total agricultural land in Egypt is about 2.5 million ha, all of which is irrigated. There is also about 0.5 million ha of available land for agriculture but needs reclamation. Therefore, only about 3% of the country total area can be considered as agricultural land. The agricultural sector in Egypt is well developed and it contributes a relatively high percentage to the national economy.

The major crops in Egypt are:

- Cereals and field crops = about 60% of the cultivated area.
- Cotton = 20% of the cultivated area.
- Productive trees = 8% of the cultivated area.

The consumption of fertilizers in Egypt reached in 1983 about 2.7 Million tonnes of which about two-third were nitrogen fertilizers. This is in comparison with about 0.8 million tonnes consumed in 1978 which clearly shows the huge development in the agricultural sector achieved during the past few years. The major types of fertilizers consumed in Egypt are, ammoniun nitrate, urea, calcium nitrate, ammonium sulphate, SSP, and potassium sulphate. On the other hand, DAP and NPK fertilizers consumption in Egypt is minor. However, future consumption can be projected as follows (tonne product):

Year	DAP	NPK
1984	2,000	5,000
1985	5,000	6,000
1990	10,000	15,000

18. **Morocco:**

The total agricultural land in Morocco is 7.7 million ha (about 15% ofthe country total area). The total cultivated area is about 5.7 million ha of which about 12% are irrigated and about 2.0 million ha left fallow. The agricultural sector in Morocco is well-developed and accounts for about 13% of the GDP of the country, employing 40% of the active population.

The major crops in MOrocco are:

- Cereals = 75% of the total cultivated area.
- Productive trees = 12% of the total cultivated area.
- Legumes and cash crops = 10% of the total cultivated area.
- Vegetables = 3% of the total cultivated area.

The consumption of fertilizers in Morocco in 1983 amounted to about 635,000 tonnes of all types, compared with about 0.5 million tonnes in 1978. The types of fertilizers consumed in Morocco are, urea, ammonium nitrate, ammonium sulphate, superphosphates, potassium chloride, potassium sulphate and NPK

fertilizers. The consumption of NPK fertilizers in the past few years was as follows (tonne product):

Year	ASP	NPK
1980	99,500	97,100
1981	83,700	66,100
1982	50,000	73,850
1983	106,000	99,000

The NPK types used in Morocco are (14:28:14) and (19:38:0) in addition to many formulations as bulk blended fertilizers.

The future prospects of NPK fertilzers consumption could reach the following levels (tonne product):

Year	ASP	NPK	DAP
1984	112,000	105,000	----
1985	115,000	115,000	----
1990	320,000	120,000	60,000

19. **Mauritania:**

The total agricultural land in Mauritania is 192,000 ha (about 0.2% of the country total area). About 20,000 ha are currently irrigated with prospects of an increase to 35,000 ha by 1990.

The major crops in Mauritania are, cereals, vegetables forage and productive trees (dates mainly). The agricultural sector contributes about 2 % of the GDP of the coutnry.

The consumption of fertilizers in Mauritania in 1983 reached about 1600 tonnes mainly urea, while the consumption of NPK ferrtilizer in the country is minor. The future consumption of NPK fertilizers can be estimated to reach 2000 tonnes by 1990.

20. **North Yemen:**

The total agricultural land in North Yemen is 3.5 million ha (17.5% of the country total area). The cultivated area in the country reached in 1983 about One million ha of which about 250,000 ha is irrigated. About 75% of the economically active population work in agriculture which contributes about 22% to the GDP of the country.

The major crops in North Yemen are:

- Cereals = 80% of the total cultivated area.
- Vegetables and Legumes = 13% of the total cultivated area.
- Productive trees and others = 7% of the total cultivated area.

The total fertilizers consumption in 1983 reached about 30,000 tonnes mainly urea. The use of compound fertilizers in 1983 was too small while in the past

few years it was ranging from 2000 to 3000 tonnes of the types (15:15:15) and (20:20:0).

The future consumption of NPK fertilizers in North Yemen is expected to reach the following levels (tonne product):

Year	NPK
1984	3,000
1985	5,000
1990	10,000

21. **South Yemen:**

The total agricultural land in South Yemen is 260,000 ha (0.8% of the country total area). The cultivated area is about 60,000 ha, of which about one third is arrigated. Agriculture is an important sector for the country and a high percentage of the population depends on it.

The major crops in South Yemen are:

- Cereals = 60% of the total cultivated area.
- Cotton = 10% of the total cultivated area.
- Forage = 6% of the total cultivated area.
- Vegetables = 4% of the total cultivated area.
- Productive trees and others = 20% of the total cultivated area.

The consumption of fertilizer in South Yemen reached in 1983 about 6,000 tonnes mainly urea which accounts for about 80% of the total. TSP and potassium sulphate are the other types. At present there is no consumption of compound fertilizers. Nevertheless, future prospects indicate that the country may consume about 5,000 tonnes of NPK fetilizers in 1990.

* **ARAB REGION:**

The consumption of NPK fertilizers of all forms (DAP and different NPK grades), in the Arab Region during the period (1980--1983), was in the range: 700,000 - 750,000 tonnes. In 1982, the NPK consumption dropped to about half a million tonnes mainly because of the decrease in the consumption of the two major consumers in the Region (Morocco and Algeria) while in 1983 the consumption of these two countries increased to higher levels. On the other hand, the increase of consumption in 1983 in the region compared to 1980 level was mainly due to the increase in the consumption of Saudi Arabia, Iraq and Libya. Table 4 gives the consumption data of NPK fertilizers of all types during the period (1980-1983) in the Arab Region.

The consumption of NPK fertilizers of all types in 1983, represented only 13.6% of the tonnage of all types of fertilizers consumed in the region.

The future prospects of NPK fertilizers consumption in the Region in the period (1985-1990) shows that the consumption may reach about 2 million tonnes by 1990 (Table 5). The major consumers of NPK fertilizers in the Arab Region are Algeria, Morocco, Saudi Arabia, Iraq and Libya, expected to account for about 85% of the total consumption in the region in 1990.

Table (4): Consumption of NPK Fertilizers of All Types in the Arab Region (DAP and NPK Different Grades)

(1980 - 1983)

(tonne product)

Country	1980	1981	1982	1983
Jordan	12000	8000	5400	8400
U.A.E	1600	5300	6800	7000
Bahrain	200	208	40	781
Tunisia	--	--	--	--
Algeria	22400	193500	105000	149000
Djibouti	--	--	--	--
Saudi Arabia	47300	74400	96600	121000
Sudan	--	--	--	--
Syria	52000	29300	6600	--
Somalia	2000	4500	4900	5000
Iraq	15500	17000	14900	73900
Oman	1900	1630	1500	4500
Oatar	560	400	300	500
Kuwait	1000	300	530	--
Lebanon	53300	26700	51000	55000
Libya	101000	101000	100000	115000
Egypt	--	--	--	--
Morocco	196600	149800	123850	205000
Mauritania	1000	1010	1100	1400
North Yemen	20	3300	30	6100
South Yemen	--	--	--	--
Total	709980	616348	518550	752581

Table (5): Estimated Consumption of NPK Fertilizers of All Types in the Arab Region (DAP and NPK of All Grades) (1984 - 1990)

(tonne product)

Country	1984	1985	1990
Jordan	14000	18000	30000
U.A.E.	7500	8000	12000
Bahrain	750	1000	2000
Tunisia	---	---	25000
Algeria	211000	245000	653000
Djibouti	---	---	2000
Saudi Arabia	150000	165000	250000
Sudan	---	---	5000
Syria	12000	18000	60000
Somalia	6000	7000	12000
Iraq	150000	200000	250000
Oman	6000	7500	12000
Qatar	500	700	1000
Kuwait	500	700	1000
Lebanon	60000	60000	85000
Libya	125000	140000	190000
Egypt	7000	11000	25000
Morocco	217000	230000	500000
Mauritania	1200	1500	2000
North Yemen	3000	5000	10000
South Yemen	500	1000	5000
Total	971950	1119400	2132000

4. Present Status of the NPK Fertilizer Industry Worldwide

The compound fertilizers (NP, NK, PK and NPK) are produced by reacting two or more raw materials, intemedialtes or finished straight fertilizers in solid or liquid forms. Thus NPK fertilizers contain two or three of the primary nutrients: Nitrogen, Phosphorous and Potassium, therefore, the advantage of the use of NPK fertilizers is that it provides the crops with their needs of nutrient elements at the sametime, resulting in a good agricultural yield. In actual fact, standard NPK formulations used in developed countries contain a certain percentage of secondary nutrient elements (magnesium, sulphur) and certain quantities of Micronutrients (Iron, Boron, Molybdenum, copper, Zinc and others).

It is obvious that the content of nutrient elements in a compound fertilizer is very important in relation to the type of soil and crops.

The NPK fertilizer producers worldwide are primarily concerned with supplying the local market and the needs of the agricultural sector in their countries while exporting standard grades to the international markets. Examples of common NPK fertilizer formulations are : (15:15:15), (17:17:17), (12:24:12), (16:20:0), (20:20:0) and (0:20:20).

* Production Capacities:

The NPK fertilizer industry started in the developed countries in a wide-scale in the second half of this century after their straight phosphate,

nitrogen and potash fertilizers became well established and the agronomy of optimum fertilization of crops and soil became well understood in relation to increasing agricultural production output per hectare.

Several West European Countries like, West Germany, France, Norway and Finland have changed a high percentage of their production capacities into compound NPK fertilizers. At present, in Norway, the fertilizer industry produces several standard NPK fertilizers to meet the requirements of soil and crops of the agricultural sector such that the farmer in Norway can easily compute his requirements of the types and quantities of NPK fertilizrs for his crops by using a special calculator. The most important formulations produced in Norway are: (22:11:11) and (16.5:16.5:16.5).

On the other hand, NPK fertilizer industry in U.S.A. has developed largely to include the production of bulk blended and liquid fertilizers with different formulations of the three main nutrients. There are about 5500 bulk blending units and 3100 fluid fertilizer plants, spread in various parts in the country. The leading US grades of granular fertilizers are (6:24:24), (10:10:10) and (13:13:13).

In Japan, the NPK fertilzer industry is well-developed. About 37 grades of NPK fertilizers are produced in the country both of the high analysis and ordinary grades mainly for local consumption.

The production in 1982 in Japan reached about 3.4 million tonnes of which 3.3 million tonnes were consumed locally, representing about 40% of the country total consumption of fertilizers. Exports of NPK fertilizers in 1982 reached about 120,000 tonnes mainly of grades (16:20:0) and (16:16:8).

On the other hand Romania started by mid-seventies to build-up a huge capacities of NPK fertilizers and the total capacities has reached about 4.0 million tonnes mainly of the grade (22:11:11). USSR also recently has started to develop its NPK fertilizer industry and the total capacities exceeded 3.0 million tonnes. The main type produced in USSR is (16.5:16.5:16.5).

The developing countries have started to pay attention during the seventies to the importance of NPK fertilizer consumption and production. In India for example the total production in 1983 reached about 3 million tonnes for local market consumption. The major grades produced are (17:17:17:), (12:32:16), (15:15:15) and (16:20:0).

NPK fertilzer production units and plants in the world are utilized to produce various types and formulations (NP, NK, PK, NPK), in addition to the fact that any NPK fertilizer production unit can be easily adapted to produce (MAP/DAP/NPK).

It is worth pointing out that ammonium phosphates constitute a high percentage of the world NPK fertilizer production trade. The major producers and exporters of diammonium phosphate (DAP) are USA, Jordan, Tunisia and South Korea. In 1983, the production of DAP is estimated to have reached about 4.0 million tonnes, of which about 70% was in USA.

* **Trade and Prices:**

Available data on world NPK fertilizer trade in 1983 show that about 8.5 million tonnes product entered the international market. Of this quantity, about 6.2 million tonnes were ammonium phosphate and 2.3 million tonnes of

NPK fertilizers of different grades. About 70% of the World NPK fertilizer exports came from West Europe, while the major importing regions in 1983 were: South East Asia (39%), Socialist Asia (15.7%), Near East (13.2%), Africa (11%) and East Europe (10%) as shown in Table (6). On the other hand, the major exporters of ammonium phosphates in 1983 were: U.S.A (75%), Tunisia (10%), South Korea (6.5%) and Jordan (6%). The major importing regions were: Asian Countries (40.2%), West Europe (28.7%), Socialist Asia (11%) and Latin America (10%), as shown in Table (7).

It is worth noting that the data in Tables (6) and (7) do not include inter-regional trade. Pk fertilizers are not traded inter-regionally and NK fer-tilizers represent small quantites. Ammonium phosphates include MAP and DAP.

The consumption of NPK fertilizers of all types (NP, PK, NK and NPK) worldwide totalled in 1982/83 about 18 million tonnes compared to 13 million tonnes in 1973/74 expressed in terms of tonnes of P_2O_5. The major consuming regions in 1982/83 were: East Europe (25%), West Europe (22.9%), North America (22%), South And East Asia (11.9%) and Latin America (5.9%), as shown in Table (8).

The prices of NPK fertilizers vary considerably from one grade to another, depending on the source and the destination and the condition of the deal. Therefore, the grade (15:15:15) is generally taken as a price reference. The price level of this grade during 1984 ranged US dollars 130-170/tonne bagged fob. Meanwhile, the prices of DAP in 1984 ranged US dollars 220-240 / tonne bagged fob.

Table (6): Ammonium Phosphates Trade

Worldwide 1983

(thousand tonnes product)

Destination	U.S.A.	Korea	Tunisia + Morocco + Jordan + S. Africa	
West Europe	1,179	--	588	
East Europe	67	—	16	
Latin America	595	--	--	
Oceania	275	—	43	
Africa	111	46	65	
Near East	90	219	183	
South Asia	816	95	132	
South East Asia	894	40	8	
Socialist Asia	588	--	107	
Total World	4,615	400	1,142	= **6,157**

Source: AFCFP Contacts with International Organizations.

Table (7): NPK Fertilizer Grades Trade

Worldwide 1983

(thousand tonnes product)

Destination	West Europe	North Africa	East Asia
West Europe	—	3	--
East Europe	221	--	--
Latine America	87	29	4
Oceania	17	33	5
Africa	241	--	6
Near East	287	8	--
South Asia	60	--	7
South East Asia	344	1	537
Socialist Asia	302	--	49
Total World	1,559	74	608 = **2,241**

Source: AFCFP Contacts with International Organizations.

Table (8): Consumption of NPK Fertilizers of All Types

Worldwide (1973/74 - 1982/83)

(in terms of 1000 tonnes P_2O_5)

Region	1973/74	1979/80	1982/83
West Europe	4268	4659	4193
East Europe	1401	3687	4581
North America	4533	4902	4039
Latin America	567	1269	1079
Oceania	84	159	260
Africa	431	595	709
Near East	304	703	854
South Asia	478	1068	1274
East Asia	985	1118	905
Socialist Asia	121	128	448
World total	**13172**	**18288**	**18342**

Source: AFCFP Contacts with International Organizations.

5. Techno-Economic Evaluation of an NPK Fertilizer Joint Venture Project in the Arab Region

The fertilizer industry in the Arab Region has developed rapidly in the past decade in many Arab Countries. Ammonia and urea in the Arab Gulf States is now a well-established industry while the Arab Maghreb is a world-wide leading region in phosphoric acid and phosphate fertilizer industry. On the other hand, East Mediterranean Arab Countries have now developed their resources and established both nitrogenous ard phosphatic fertilizer industries. The Arab countries in East Africa are the most potential in the Arab Region in fertilizers consumption.

For establishment of Joint Venture NPK projects among Arab Countries, one project for each sub-region will be considered in this study. The Arab Region can be divided into four sub-regions as follows:

A- **Arab Maghreb:**

Libya, Tunisia Algeria, Morocco and Mauritania.

B- **East Mediterranean:**

Lebanon, Syria, Jordan and Iraq.

C- **Arabian Peninsula:**

Kuwait, Bahrain, Saudi Arabia, United Arab Emirates, Oman, North Yemen and South Yemen.

D- **East Africa:**

Egypt, Sudan, Djibouti and Somalia.

A preliminary techno-economic evaluation for a possible NPK Joint Venture project in each of the sub-regions mentioned above will include: site selection, local consumption and export considerations, neighbouring market, process route, material consumption, investments and manufacturing cost and other considerations.

A- Arab Maghreb Sub-Region:

1. Libya:

* Local Market for NPK Fertilizers:

- The NPK fertilizer consumption in Libya is growing rapidly. Consumption reached 30,000 tonnes in 1983.
- At present, there is no production of NPK fertilizers. Therefore, consumption is completely met through imports.
- The major types of NPK fertilizers consumed in Libya are (12:24:12), (17:17:17) and (18:18:6).
- Future NPK fertilizer consumption in Libya is expected to reach 60,000 tonnes by 1990.

* Availbility of Raw Materials for NPK Fertilizer Industry:

- Ammonia and urea are produced in big quantities mainly for export. Ammonia production in 1983 reached 541,400 tonnes of which 341,000 tonnes were exported. Urea production in 1983 reached 330,100 tonnes of which 303,400 tonnes were exported.
- Phosphoric Acid/Phosphate industry does not exist in the country.
- Potash industry does not exist at present but, there are about 2-3 million tonnes of potash reserves in Libya located in Marada brines.

* NPK Fertilizer Production Projects:

- Future plans include a project of NPK fertilizers (330,000 tpy

capacity) to be located at Sirt Complex. The NPK fertilizer grade is expected to be (15:15:15).

- Sirt Complex will include the following units:

  - 2 ammonia production lines with a capcity of 445,000 tpy. each.
  - Urea production plant with a capacity of 574,000 tpy.
  - Nitric acid production line with a capacity of 264,000 tpy.
  - Ammonium nitrate plant with a capacity of 330,000 tpy.
  - Sulphuric acid production line with a capacity of 165,000 tpy.
  - Ammonium sulphate plant with a capacity of 165,000 tpy.

- NPK fertilizers available for exports by 1990 could reach 250,000 tonnes.
- The requirements of the NPK project from phosphoric acid and potash are about 45,000 tonnes P_2O_5 (available in the sub-region), and about 45,000 tonnes of K_2O.

* Site and Infrastructure:

The town of Sirt was selected to be a new industrial site for the fertilizer production and export. It is situated in the Gulf of Sirt Area on the Mediterranean coast, half way between the Eastern and Western parts of the country. Development of the site will proceed in parallel with the construction of the fertilizer complex. When completed, the site will include the following facilities:

- Utilities generation (electricity, water treatment, steam, etc..).
- A jetty for loading /unloading in addition to large storage facilities for products directed to export and imported raw

materials.

- A housing complex for about 15,000 persons expected to live there.
- A gas distribution network to feed the different plants and for electricity generation. The site will be connected with oil/gas fields through a 300 km long pipeline.

* Technical Capabilities in the Fertilizer Industry:

At present, the technical experience of Libyan nationals required for the NPK fertilizer project is not available. However, the available experienced staff are working in the ammonia/urea complex in Mersa El-Brega. At present 1520 staff of which 47% are Libyan nationals, are employed in that complex.

* Finanace and Investments for NPK Project:

The policy of Libya regarding the establishment of new chemical fertilizer projects is that the foreign contractor has to include in his offer for the project supply credit necessary to finance the cost of equipment and machinary (100%). On the other hand, Libya at present ecourages Arab joint venture projects in the country through various incentives of lower utilities cost, feedstock cost and tax holiday.

2. **Tunisia:**

* Local Market for NPK Fertilizers:

- The NPK fertilizers consumption in Tunisia at present is minor, but there are few bulk blending plants and the consumption of Tunisia from

these fertilizers in 1983 was about 5000 tonnes.

- At present, there is no production plants for NPK fertilizers, but Tunisia produces MAP and DAP for export, 1983 figures were as follows:

MAP production	=	80,000 tonnes
MAP exports	=	71,000 tonnes
DAP production	=	405,000 tonnes
DAP exports	=	407,000 tonnes

- The future consumption of NPK fertilizers in Tunisia is expected to reach 15,000 tonnes by 1990.

* Availability of Raw Materials for NPK Fertilizers Industry:

- Tunisia is a major producer and exporter of phosphoric acid. Phosphoric acid production in 1983 reached 900,000 tonnes of which 380,000 tonnes were exported.
- Ammonia/urea industry does not exist in Tunisia.
- Potash industry does not exist. At present Tunisia is planning for a potssium sulphate project of 150,000 tpy capacity by exploitng potassium salts in Zarzis brines with a reserve of about 25 million tonnes.

* NPK Fertilizer Production Projects:

- Future plans include a project of NPK fertilizers (495,00) tpy capacity) to be located at Gabes. The NPK fertilizer grade is (17:17:17).
- NPK fertilizer project will be associated with the MAP production plant

of Engrais De Gabes.

- NPK fertilizers available for export by 1990 is expected to reach 450,000 tonnes.
- The requirements of the NPK project from phosphoric acid and potash are about 75,000 tonnes of P_2O_5 and about 75,000 tonnes of K_2O.

* Site and Infrastructure:

Gabes site is one of the most developed industrial sites for the fertilizer industry, where Gabes Chemical Group fertilizer plants are located. The Group includes: ICM, EG, and SAEPA.

The NPK project will benefit from existing infrastructure (roads, port, headquarters, laboratories, general services, maintenance and engineering).

* Technical Experience and Capabilities:

Tunisia has developed a high-standard of expertise in the field of phosphoric acid/phosphate fertilizer industry during the past thirty years. The SIAPE process for phosphoric acid and DAP is known worldwide. The technical staff of the fertilizer industry have acquired extensive experience in the implementation and operation of projects for processing of the low-grade phosphate rock into high quality phosphoric and phosphate fertilizers. The workforce required for the NPK project can easily be made available. Also, Tunisia has built up its capabilities in phosphoric acid and fertilizers transport overseas by owning several tankers and vessels. On the other hand, the Group Chimie has acquired a very good experience in domestic and international marketing.

* Finance and Investments:

Tunisia is a favourate country for Arab Joint Venture Projects. At present, Kuwait, Saudi Arabia, and Abu Dhabi have invested heavily, in particular, in the phosphate and chemical fertilizers industry. Kuwait owns 49% of ICM and SIAPE while Abu Dhabi owns 40% of SAEPA. The Government of Tunisia encourages the establishment of an Arab joint venture NPK project.

3. **Algeria:**

* Local Market for NPK Fertilizers:

- The consumption of NPK fertilizers in 1983 reached 147,000 tonnes.
- The production of NPK fertilizers in Algeria in 1983 reached 116,000 tonnes. The produced grades were (4:20:25) and (12:18:18).
- The shortage in NPK fertilizers supply in 1983 reached 31,000 tonnes. This quantity was imported from international markets.
- Future consumption of NPK fertilizers in Algeria is expected to increase to about 523,000 tonnes by 1990.

* Availability of Raw Materials for NPK Fertilizers Industry:

- Phosphoric acid production in Algeria in 1983, reached 55,000 tonnes, all consumed in the production of NPK and phosphate fertilizers.
- Ammonia production in 1983 reached 154,000 tonnes, of which 70,000 tonnes were exported while the balance was used in the production of ammonium nitrate and NPK fertilizers.

- Potash industry does not exist in Algeria. Imports of potassium sulphate in 1983 reached 43,000 tonnes.

* NPK Fertilizers Production Projects:

- At present Algeria has no plan for the expansion of its NPK fertilizers production capacity. Consequently, the shortage in supply of NPK fertilizers in 1990, expected to reach 300,000 tonnes, has to be imported.

* Site and Infrastructure:

Annaba is at present a well developed site for the chemical fertilizer production in Algeria. It is the site of two existing fertilizer complexes: the phosphate and compound fertilizer complex which started production in 1972 and the ammonia/ammonium nitrate complex started in 1982. Annaba is situated on the Mediterranean coast in the Easten area of the country. It has an easy connection with other Algerian zones by sea, road and railway.

* Technical Experience and Capabilities:

Algeria in the past decade has developed a modest experience in the field of chemical fertilizer industry. A main emphasis of the Algerian Government is placed on improving national capabilities and increasing productivity of fertilizer existing plants. For this purpose, Algeria has created recently a seperate Establishent for fertilizer industry called (ASMIDAL).

* Finance and Investment:

The Algerian policy regarding Pan-Maghreb economic cooperation is obvious. Recently, Government's policy regarding Arab investments in Algeria has been extended to include new terms which encourage the movement of the Arab capital into Algeria. The down-stream industries, particularly those serving the local market, are one field opened to joint venture Arab investment activities.

4. **Morocco:**

* Local Market for NPK Fertilizers:

- The consumption of NPK fertilizers in Morocco reached 205,000 tonnes in 1983, in addition to about 200,000 tonnes of bulk blended fertilizers.
- The production of NPK fertilizers in Morocco reached in 1983 about 200,000 tonnes, all directed to local consumption. The main grades produced are (19:38:0) and (14:28:14).
- At present, Morocco consumes the quantities it produces of NPK fertilizers.
- Future consumption of NPK fertilizers in Morocco is expected to reach in 1990 about 440,000 tonnes.

* Availability of Raw Materials for NPK Future Industry:

- Morocco is one of the largest producers and exporters of phosphoric acid worldwide. In 1983, phosphoric acid production reached 1.235 million tonnes of which 860,000 tonnes were exported. In addition, Morocco in 1983 produced 221,000 tonnes of MAP and exported about

197,000 tonnes of MAP.

- At present, ammonia is not produced in Morocco, neither are ammonia-based straight fertilizers.
- Potash industry does not exist in Morocco. Imports in 1983 of potash and potassium sulphate reached 270,000 tonnes, 45,000 tonnes respectively.

* NPK Fertilizer Production Projects:

- Future projects for NPK fertilizers in Morocco include a plan for NPK fertilizer of the grade (19:38:0) with a capacity of 200,000 tonnes per year. This plant will be part of Maroc Phosphore complex in Jorf al-Asfar which comprises 8 production lines of phosphoric acid (each with 500 tpd P_2O_5 capacity) and a plant for DAP with a capacity of one million tpy.

- The production of the new NPK fertilizers plant will be directed for local consumption. It is also expected that a part of the DAP production would be consumed locally (60,000 tonne by 1990).

- The requirements of the new NPK fertilizer project from phosphoric acid and ammonia are about 70000 tonnes P_2O_5 and 42000 tonnes respectively. The requirement of the project from ammonia can be secured from within the sub-region.

* Site and Infrastructure:

The site of Jorf al-Asfar is becoming one of the most established centers for the production and export of phosphoric acid and phosphate

fertilizers. It is situated on the Atlantic Ocean coast at about 130 km to the South-West of Casablanca. At present, work for the development of the site is proceeding steadily in parallel with the construction of the phosphoric acid production lines known as Maroc Phosphore (3&4). Once completed, the industrial site of Jorf al-Asfar will be equipped with facilities for the production of utilities, a jetty with loading / unloading facilities and a storage area for products: phosphoric acid, superphosphoric acid and imported raw materials, sulphur and chemicals. On the other hand, the site of Jorf al-Asfar is linked with other Morocco cities and phosphate mines by roads, railways and maritime transportation.

* Technical Experience and Capabilities:

Phosphoric acid production at Safi started 20 years ago by OCP owned company, Maroc-Chimie. In the early Seventies, OCP expanded its industrial activities to include also the production of phosphate and compound fertilizers, both for export and local consumption. Since then, OCP has acquired strong technical expertise and capabilities through the exposure of its engineers and technicians to various production techniques.

Today, OCP proud of what has been achieved so far, is heavily expanding the capacities of processing phosphate rock in the country. Moreover, OCP has acquired a number of vessels for phosphoric acid shipment and established for itself a good reputation in the international market.

* Finance and Investments:

The policy of Morocco regarding Arab joint venture projects is that it favours and encourages the flow of Arab investments into Morocco's market.

There is every evidence that the phosphate sector is the most important among the different sectors of the country's economy. Therefore, projects aiming at the development of this sector through processing of phosphate rock into more valuable products are always given top priority and attention. On the other hand, Morocco has been successful in financing its ambitious projects through supply credits and soft loans from foreign sources.

5. **Mauritania:**

The consumption of NPK fertilizers in Mauritania reached only about 1400 tonnes, all imported or granted to the country. By 1990, it is expected that the consumption may increase and reach about 2000 tonnes.

On the other hand, there are no prospects for NPK fertilizer production in Mauritania, simply because its resources of fertilizer raw materials are very limited. Only a small quantity of phosphate reserves has been discovered in the country.

Discussions:

1. **Market:**

* Supply/Demand Situation of NPK Fertilizers in 1983:

- The production of NPK fertilizers of all types in 1983 reached in the Sub-Region about 1.022 million tonnes, of which NPK ferilizer grades accounted for about 31% while remaining percentage was ammonium phosphates (MAP and DAP). On country level, this quantity was produced in Tunisia (47.4%), Morocco (41.2%) and Algeria (11.4%). Further more, the production of NPK fertilizers in the Sub-Region accounted for about 66 % of the Arab Region production in 1983.

- The consumption of NPK fertilizers of all types in the Sub-Region reached in 1983 about 470,000 tonnes, of which NPK fertilizer grades represented 81% while the remaining percentage was DAP consumption. ON country level, the quantity consumed in Morocco was (43.6%), Algeria (31.7%) and Libya (24.5%), whereas, the consumption in Tunisia and Mauritania was minor. On the other hand, the Arab Maghreb Sub-Region accounted in 1983 for about 62% of the Arab Region consumption of NPK fertilizers of all types.

- While the quantities of NPK fertilizer grades produced was all consumed within the Sub-Region, the produced quantities of MAP and DAP was directed for export. The quantity of DAP consumed in the Sub-Region in 1983, was in countries with no production of DAP.

- The shortage in NPK fertilizers in 1983 in the Sub-Region amounted to about 62,000 tonnes distributed evenly between Algeria and Libya.

* Supply/Demand Situation of NPK Fertilizers in 1990:

- Based on the assumption that all the planned projects in the Sub-Region will be in operation by 1990 and that the average utilization rate of the production capacities is 90%, the total production of NPK fertilizers of all types will reach about 3.53 million tonnes in 1990. Of this quantity, NPK fertilizer grades will account for 39%, while DAP (49%) and MAP (12%). On country level, Morocco will account for about (47%), Tunisia (35%), Libya and Algeria (9% each). This production if compared with production of NPK fertilizers in 1990 in the Arab Region, the Arab Maghreb Sub-Region countries are leading with about 60%share.

- The expected total consumption of NPK fertilizers of all types in 1990 in the Sub-Region is about 1.37 million tonnes (Table 17), of which NPK fertilizer grades (Table 16) will account for (76%), while the remaining percentage is DAP (Table 15). On country level, Algeria will account for about (48%), Morocco (36%), and Libya (14%). The consumption of NPK fertilizers in Tunisia and Mauritania will account for about 2% of the Sub-Region total. Compared with the total NPK fertilizers consumption in the Arab Region, the Arab Maghreb Sub-Region is expected to account for about 64%.

- Based on the assumption mentioned above, it is expected that a surplus of about 2.176 million tonnes of NPK fertilizers of all types will develop in the Sub-Region in 199.. About 64% of this surplus will be DAP, while the remaining is: MAP ( ) and NPK fertilizer grades (16%).

- Algeria is the only country which will have a shortage of NPK fertilizer grades of about (320,000 tonnes), while Libya will also be short of about 130,000 tonnes DAP.

Table (9): Total Production Capacities of NPK Fertilizers of all type in the Arab Maghreb Sub-Region (1980 - 1983)

(in thousand tonnes)

Country/Type	1980	1983
- **Morocco:**		
MAP (11:55:0)	396	396
ASP (19:38:0)	132	132
NPK (14:28:14)	132	132
- **Algeria:**		
DAP (18:46:0)	132	132
NPK (4:20:25)	75	75
NPK (12:18:18)	150	150
- **Tunisia:**		
MAP (11:55:0)	100	100
DAP (18:46:0)	330	450
Total Arab Maghreb:		
MAP =	496	496
DAP =	462	582
NPK =	489	489
Grand Total =	**1447**	**1567**

Table (10) Total Production of NPK Fertilizers of all types in the Arab Maghreb Sub-Region (1980 - 1983)

(in thousand tonnes)

Country/Type	1980	1981	1982	1983
- **Morocco:**				
MAP:	----	30.4	137.8	221
ASP:	108.3	85.6	85.0	100
NPK:	112	47.8	65.7	100
- **Algeria:**				
DAP:	----	----	----	----
NPK:	133.8	119	62.0	116
- **Tunisia:**				
MAP:	67	57	68.2	80
DAP:	220	350	360.3	405
Total Arab Maghreb:				
MAP:	67	87.4	206	301
DAP:	220	350	360.3	405
NPK:	354.1	252.4	212.7	316
Grand Total	**641.1**	**689.9**	**779**	**1022**

Table (11): New Projects NPK Fertilizer of all types in the Arab Maghreb Sub-Region expected by 1990

Country/Type	(Thousand tonnes)
- Morocco:	
DAP:	1000
ASP:	200
- **Tunisia:**	
DAP:	330
NPK:	495
- **Libya:**	
NPK:	330
Total:	
DAP:	1330
NPK:	1025
Grand Total	**2355**

Table (12): Consumption of DAP in the Arab Maghreb Sub-Region (1980-1983)

Country	1980	1981	1982	1983
Libya:	75000	76000	80000	85000
Tunisia:	--	--	--	--
Algeria:	34000	26000	19000	2000
Morocco:	--	--	--	--
Mauritania:	--	--	--	--
Total	**109000**	**102000**	**99000**	**87000**

Table (13): Consumption of NPK Fertilizer Grades in the Arab Maghreb Sub-Region (1980 - 1983)

Country	1980	1981	1982	1983
Libya:	26000	25000	20000	30000
Tunisia:	—	—	—	—
Algeria:	190000	167500	86000	147000
MOrocco:	196600	149800	123850	205000
Mauritania:	1000	1010	1100	1400
Total	**413600**	**343310**	**230950**	**383400**

Table (14): Consumption of NPK Fertilizers of All Types in the Arab Maghreb Sub-Region (DAP and NPK Different Grades) (1980 - 1983)

Country	1980	1981	1982	1983
Libya:	101000	101000	100000	115000
Tunisia:	--	--	--	--
Algeria:	224000	193800	105000	149000
Morocco:	196600	149800	123850	205000
Mauritania:	1000	1010	1100	1400
Total	**522600**	**445310**	**329950**	**470400**

Table (15): Estimated Consumption of DAP in the Arab Maghreb Sub-Region (1984-1990)

Country	1984	1985	1990
Libya:	90000	100000	130000
Tunisia:	—	—	10000
Algeria:	33000	45000	130000
Morocco:	—	—	60000
Mauritania:	—	—	—
Total	**123000**	**145000**	**330000**

Table (16): Estimated Consumption of NPK Fertilizer Grades in the Arab Maghreb Sub-Region (1984 - 1990)

Country	1984	1985	1990
Libya:	35000	40000	60000
Tunisia:	--	—	15000
Algeria:	178000	200000	523000
Morocco:	217000	230000	440000
Mauritania:	1200	1500	2000
Total	**431200**	**471500**	**1040000**

Table (17): Estimated Consumption of NPK Fertilizers of All Types in the Arab Maghreb Sub-Region (DAP and NPK Different Grades) (1984 - 1990)

Country	1984	1985	1990
Libya:	125000	140000	190000
Tunisia:	--	--	25000
Algeria:	211000	245000	653000
Morocco:	217000	230000	500000
Mauritania:	1200	1500	2000
Total	**554200**	**616500**	**1370000**

2. Potential Aspects for an NPK Fertilizer Joint-Venture Project:

The Arab Maghreb possesses almost all the inputs necessary for the development of a successful NPK fertilizer joint-venture project. Among these inputs we can state the following:

* Raw Materials required for the development of NPK fertilizer industry is available in big quantities. At present, Morocco and Tunisia are developing a huge surplus of phosphoric acid for export, while Libya and Algeria are develping a big surplus of ammonia for export. Furthermore, at least one country in the Sub-Region has a firm plan for the exploitation of potash. As a result, the Sub-Region will become self-sufficient for NPK fertilizers basic raw materials.

* As mentioned previously, the consumption of NPK fertilizer grades in the Arab Maghreb Sub-Region reached about 0.38 million tonnes expected to increase to over one million tonnes in 1990. Taking into account the fact that in some countries in the Sub-Region, the consumption of NPK fertilizer grades is small and still at its early stage of development, while the potential markets for NPK fertilizers in the Sub-Region are very big, the production of a world-scale NPK fertilizer joint-venture project can easily be absorbed within the Sub-Region in addition to possible exports to neighbouring markets.

* Some of the countries in the Sub-Region have now well-developed industrial sites and infrastructure for the fertilizer industry, like Gabes in Tunisia, Safi and Jorf Al-Asfar in Morocco, Annaba and Arzew in Algeria, and Marsa Al-Brega in Libya.

* Over the past twenty years, four of the countries in the Arab Maghreb Sub-Region have developed a high level of experience and technical capabilities. Some of the countries are at present implenting the fertilizer projects by their experienced engineers and technicians. On the other hand, some of the existing fertilizer plants in the Sub-Region are operating at a high level of capacity utilization.

3. Technical Considerations and Production Cost:

There are several known processes for production of NPK fertilizers. Some of these process routes use nitric acid attack of phosphate rock, while others use phosphoric acid or ammonium phosphates as the P_2O_5 source. In actual fact, an NPK production unit can be designed to utilize any available or selected raw materials. Therefore, depending on the selected process route, the raw materials used as sources for the three nutrients in the NPK fertilizer product can be one of the following:

1. Nitrogen: Nitric Acid, Ammonia, Urea, MAP or DAP, AN, or AS.
2. P_2O_5 : Phosphate Rock, Phosphoric Acid, MAP or DAP, SSP or TSP.
3. K_2O : Muriate of Potash or Sulphate of Potash.

It is important to note that some of the raw materials used in the production are only added to adjust or makeup the correct nutrient content of the NPK fertilizer product.

In this study, the case of (1:1:1) NPK fertilizer grade will be considered, and only the calculated quantities of the three major raw materials: Ammonia, Phosphoric Acid, and Potash will be used in the production cost

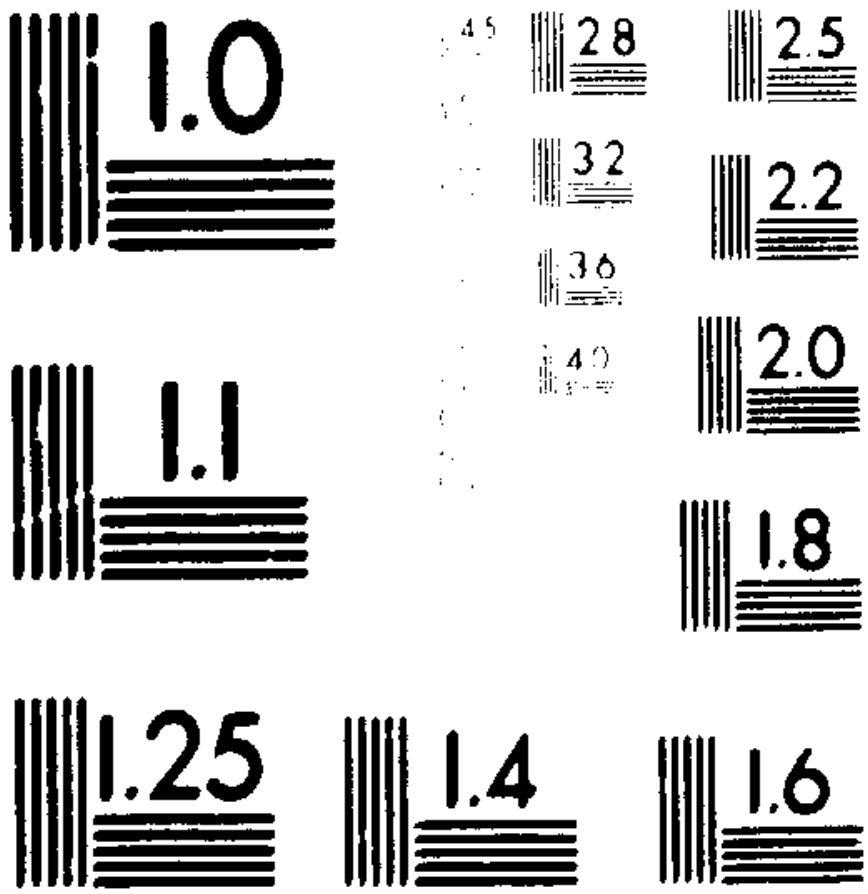
analysis. Also, for the sake of comparison among various sites in the Arab Region certain fixed set of parameters in the production cost analysis will be assumed.

The previous discussions on the Arab Maghreb Sub-Region regarding: market, raw materials, infrastructure and technical capabilities shows clearly that a joint-venture NPK fertilizer project is technically and economically viable if any of the planned projects in Tunisia or Libya is not implemented. Table (18) gives the production cost analysis of an NPK fertilizer plant producing grade (15:15:15) as a standard formulation with a capacity of 1500 tpd. The following assumptions were used:

* Process: Standard well-known process.
* Site : Well-developed site. The plant is associated with an existing fertilizer complex.
* Operation: 330 days per year.
* Capacity Utilization: 90%
* Labour: 40 staff for all shifts.
* Total Investment Cost: 50 million U.S. Dollars.
* Depreciation: 15 years (on straight line basis).
* Capital Charge: 15%
* Prices: The prices of the various components, like, plant cost, raw materials, utilities, bagging, etc..., are average 1984 Prices expressed in U.S. Dollars.

The calculated production cost of one tonne NPK product bagged Fob is about 133 U.S. dollars (Table 18). The main cost items are:

* Raw Materials : 78.86%



*	Bagging, Handling, Administration and Marketing	: 10.23%
*	Decpreciation	: 4.51%
*	Manpower	: 2.11%
*	Utilities	: 3.56%
*	Others	: 0.73%
	Total	100%

Assuming a capital charge 15%, the price of one tonne NPK bagged Fob Arab Maghreb Sub-Region would reach about 150 U.S. Dollars.

On the other hand, taking into consideration, the prices of NPK fertilizer grades (15:15:15) during 1984 which averaged 150 U.S. Dollars Fob bagged, the profit margin of a future joint-venture NPK fertilizer plant in Arab Maghreb Sub-Region will depend on the future market prices of the produced NPK fertilizer grades.

Table (18): Estimated Investment and Production Cost

for NPK Fertilizer Plant in

Arab Maghreb Sub-Region

(1984 U.S. Dollars)

Basic Data:

Capacity	:	1500 tpd bagged product
Product	:	NPK (15:15:15)
Operation	:	330 days per year
Utilization Rate	:	90 %
Production	:	445,500 tonnes product
Site	:	Well-developed site-Arab Maghreb.

Total Investment cost	:	U.S. $ 50 million
- Plant Cost	:	U.S. $ 40 million
- Working Capital	:	U.S. $ 10 million

1. **Raw Materials:**

	Quantity (Ton/Year)	Cost ($/Ton)	Total Cost ($)	$/Ton of NPK product
- Phosphoric Acid :	68,162	300	20,448,600	45.90
- Ammonia :	82,770	185	15,312,450	34.37
- Potash :	109,938	90	9,894,420	22.21
- Filler :	19,000	7	133,000	0.30
- Granulating Chemicals:	1,000	900	900,000	2.02
Sub-Total (1)			**46,688,470**	**104.8**

2. **Utilities:**

	Quantity /Ton Product	Cost ($/Unit)	Total Cost($)	$/Ton of NPK Product
- Electricity (kwh) :	35.0	0.1	1,559,250	3.500
- Industrial Water(ton):	0.015	0.5	3,341	0.007
- Cooling Water (ton) :	9.0	0.01	40,095	0.090
- Steam (ton) :	0.03	7.0	93,555	0.210
- Fuel Gas (Nm^3) :	6.2	0.15	414.315	0.930
Sub-Total (2)			**2,110,556**	**4.737**

3. **Other Items:**

	Total Cost ($)	$/Ton of NPK Product
- Labour cost (40 X 2000+30%):	1,248,000	2.80
- maitenance Cost	30,000	0.067
- Consumable Materials :	160,000	0.359
- Insurance and Others :	250,000	0.561
- Administration and marketing:	600,000	1.347
- Bagging :	4,455,000	10.000
- Handling :	1,000,000	2.245
Sub-Total (3)	**7,743,000**	**17.38**
Depreciation	2,666,666	5.99
Production Cost	**59,208,692**	**132.90**
Capital Charge	7,500,000	16.83
Grand Total	**66,708,692**	**149.73**

Price per tonne fob bagged **150**

(in U.S. 1984 Dollars)

B. East Mediterranean Sub-Region:

1. Lebanon:

* Local Market for NPK Fertilizers·

- The estimated consumption of NPK fertilizer grades in Lebanon was 55,000 tonnes in 1983.
- The estimated production of NPK fertilizer grades in Lebanon in 1983 was 55,000 tonnes.
- Several grades of NPK fertilizers are consumed in the country.
- Future NPK fertilizers consumption in Lebanon is expected to reach about 85,000 tonnes by 1990.

* Availability of Raw Materials for NPK Fertilizer Industry:

Lebanon has no fertilizer raw materials. Lebanon Chemical Company depends on imports of raw materials (Ammonia, Sulphur, Phosphate Rock and Potash) from Arab and foreign markets.

* NPK Fertilizer Production Projects:

The situation in the country is not favourable for the expansion of fertilizer industry. Actually, Lebanon Chemicals Company has limited its production of fertilizers to supply the local market only.

* Site and Infrastructure:

Sala'ata on the Mediterranean coast is the Site where the LCC fertilizer complex is located. The site is situated on the highway linking Beirut and Tripoli. In general, the site is a well-developed one.

* Technical Experience and Capabilities:

Lebanon Chemicals Company has developed a high technical capability in the field of fertilizer industry. The fertilizer industry in Lebanon started early Sixties and has expanded and diversified largely during the Seventies when it was producing several types of intermediates and finished fertilizers.

* Finance and Investment for NPK Fertilizer Projects:

The Private sector in Lebanon is among the most active in the Arab Region. Lebanese policy regarding Arab investments in the country is very encouraging and Lebanon used to be one of the best locations for investments. Furthermore, the level of banking services in Lebanon used to be among the best.

2. **Syria:**

* Local Market for NPK Fertilizers:

- Consumption of NPK fertilizers of all types in 1983 was minor although in 1980 it was 52000 tonnes of DAP.
- Production facilities for NPK fertilizers in Syria does not exist.
- Future consumption of NPK fertilizer of all types by 1990 is expeted to reach about 60,000 tonnes, primarily DAP.

* Availablity of Raw Materials for NPK Fertilizer Industry:

- Syria has an established phosphate rock industry.
- Production of ammonia and nitrogen fertilizers in Syria started early Seventies and at present a surplus of ammonia is available (about 100,000 tonnes).
- Production of phosphoric acid and phosphate fertilizers (super-phosphates) started recently.
- Potash is not available in the country.

* NPK Fertilizer Production Projects:

At present, Syria is studying the exploitation of the quantities of surplus ammonia available at Homs fertilizer complex. There are plans for the establishment of a production facility for DAP (330,000 tpy).

* Site and Infrastructure:

Homs fertilizer complex of the State Company for Fertilizers is considered a well-developed industrial site with necessary infrastructure. The site is situated close to the Homs Refinery and relatively close to the phosphate rock mines.

* Technical Experience and Capabilities:

The engineers and technical staff of the State Company for Fertilizers have acquired a good experience during the past fifteen years in the Ammonia and Nitrogen fertilizer industry. On the other hand, experience in phosphoric acid and phosphate fertilizers is still at an early stage of development.

* Finanace and Investments for NPK Fertilizer Project:

The policy in Syria regarding industrial projects is to cooperate with developing countries.

3. **Iraq:**

* Local Market for NPK Fertilizers:

- Consumption of NPK fertilizers in Iraq reached in 1983 about 74,000 tonnes.
- production of NPK fertilizers in Iraq reached in 1983 74,000 tonnes, which was consumed locally. The NPK fertilizers produced in Iraq are of the following grades:
  (27:27:0), (15:15:15), (20:20:0) and (18:18:6).
- The future consumption of NPK fertilizers in Iraq is expected to reach by 1990 about 250,000 tonnes.

* Availability of Raw Materials for NPK Fertilizers Industry:

- Ammonia and nitrogen fertilizers industry started in Iraq early Seventies in Basrah and huge capacities for the production of ammonia/urea was developed.
- Phosphoric acid and phosphate fertilizers industry started recently in Al-Qaim to exploit the phosphate rock deposit in Akashat. The phosphate complex in Al-Qaim comprises a production unit for MAP with a capacity of 250,000 tonnes per year and an NPK fertilizer unit with a capacity of 270,000 tonnes per year.
- Iraq has no potash resources.
- Iraq is unique in the Arab Region as producer of Frash Sulphur, in addition to the production of recovered sulphur from the oil and gas industry.

* NPK Fertilizer Production Projects:

At present, there are no plans for NPK fertilizer expansion in Iraq.

* Site and Infrastructure:

Al-Qaim industrial site has now become a developed site with all necessary infrastructure for the development of phosphoric acid and phosphate fertilizers industry. Al-Qaim is located in the Western part of the country, at about 370 km Northwest of Baghdad.

* Technical Experience and Capabilities:

In the field of ammonia/urea fertilizers industry. Iraq has developed in the past fifteen years good experience and technical capabilities gained through the policy of industrialization in the country tied up with the overall policy to develop the oil and gas sector. On the other hand, the experience in phosphoric acid and phosphate industry is still at its early stages of development.

* Finance and Investmants for NPK Fertilizer Project:

The policy of Iraq is geared to encourage Arab Joint Venture Projects and welcomes the Arab capital investments in the country through various incentives.

4. Jordan:

* Local Market for NPK Fertilizers:

- Consumption of NPK fertilizers in Jordan reached about 6000 tonnes, in addition to about 2400 tonnes DAP.
- Jordan produces at present huge quantities of DAP mainly for export, while NPK production does not exist.
- The grades of NPK fertilizers consumed in the country are (18:18:6), (20:20:0) and (15:15:15).
- The future consumption of NPK fertilizers is expected to reach 18,000 tonnes by 1990.

* Availability of Raw Materials for NPK Fertilizers Industry:

- The phosphate industry is very well established in Jordan.
- Phosphoric acid and ammonium phosphate complex started production recently. Jordan imports large quantities of ammonia and sulphur every year (about 180,000 tonnes and 370,000 tonnes respectively for 100% capacity utilization rate.
- The production of Potash from Dead Sea brines started recently in Jordan. The capacity of potash installation is expected to increase to 1.2 million tonnes by 1986. In addition, Arab Potash Company is planning for the production of 150,000 tonnes per year of potassium sulphate.
- Ammonia and nitrogen fertilizers industry does not exist in the country.

* NPK Fertilizers Production Projects:

A project for the production of 1000 tpd of NPK fertilizers is now in an advanced stage of planning. It is expected that the NPK project will use locally produced phosphoric acid/potash /potassium sulphate and imported ammonia.

* Site and Infrastructure:

The industrial site of JFI complex in Aqaba has become a well-developed site. Furthermore, the Government of Jordan is paying more attention to the build-up and improvement of infrastructure in the country, particularly that serving Aqaba port.

* Technical experience and capabilities:

In Jordan, JFI and APC both have their own programmes for the development of the capability of their staff. The JFI complex in Aqaba and the Potash Project in Ghor E-Safi have started production late 1982.

* Finance and Investments in NPK Fertilizer Projects:

The policy of Jordan strongly supports and encourages Joint Venture Projects with other Arab Countries. APC is a good example ot this policy.

Discussions:

1. **Market:**

* Supply/Demand Situation of NPK Fertilizers in 1983:

- The production of NPK fertilizers of all types in 1983 reached in the Sub-Region about half million tonnes (Table 20) of which NPK fertilizer grades accounted for about 25%, while ammonium phosphates (DAP + MAP) 75%. The major producers of NPK fertilizer grades are Iraq, (57%) and Lebanon (43%). Jordan on the other hand, is the only country in the Sub-Region producing DAP directd mainly for export.

- The consumption of NPK fertilizers of all types in the Sub-Region reached in 1983 about 137,000 tonnes, of which NPK fertilizer grades represented 98%. On country level, the quantity consumed in Iraq was (54%), Lebanon (40%) and Jordan (6%). On the other hand, the East Mediterranean Sub-Region accounted in 1983 for about 18% of the Arab Region consumption of NPK fertilizers of all types.

- In this Sub-Region the quantities of NPK fertilizer grades produced in 1983 (Iraq and Lebanon) was consumed locally, while DAP and MAP production was dierected for export to international markets.

- The Sub-Region in 1983 seemed to be self-sufficient in NPK fertiliers of all types.

* Supply/Demand Situation of NPK Fertilizers in 1990:

- Based on the assumption that the planned project in Jordan will be in operation before 1990 and that the average utilization rate of the production capacity is 90%, the total production of NPK fertilizers of all types will reach about 1.52 million tonnes in 1990, of this quantity NPK fertilizer grades will account for 41.4%, while DAP (44%) and MAP (14.6%). On country level, Jordan will account for about (63.3%), Iraq (30.7%), and Lebanon (6%). This production if compared with the expected production of NPK fertilizers in 1990 in the Arab Region, the East Mediterranean Sub-Region will have a share of 27.5%.

- The expected total consumption of NPK fertilizers of all types in 1990 in the Sub-Region is about 0.425 million tonnes, of which NPK fertilizer grades will account for (85%), while the remaining percentage is DAP. On country level, Iraq will account for (59%) of the consumption, Lebanon (20%), Syria (14%) and Jordan (7%). Compared with the total NPK fertilizers consumption in the Arab Region, the East Mediterranean Sub-Region is expected to account for 20%.

- It seems that in 1990, the East Mediterranean Sub-Region is expected to have a surplus of about 1.1 million tonnes of NPK fertilizers of all types. About 55% of this surplus will be DAP, 20% MAP, while NPK fertilizer grades will account for 25% of this surplus.

- Syria is the only country in the Sub-Region which will have a shortage of NPK fertilizers in 1990 (about 60,000 tonnes).

Table (19): Total Prodution Capacities of NPK Fertilizers of All types in the East Mediterranean Sub-Region (1980 - 1983)

(in Thousand Tonnes)

Country/Type	1980	1983
- Lebanon:		
NPK	100	100
- Syria:	---	---
- Iraq:		
MAP	---	250
NPK	---	270
- Jordan:		
DAP	---	740
Total East Mediterranean:		
MAP	---	250
DAP	---	740
NPK	100	370
Grand Total	**100**	**1360**

Table (20): Total Production of NPK Fertilizers of all types in the East Mediterranean Sub-Region (1980 - 1983)

(in Thousand Tonnes)

Country / Type	1980	1981	1982	1983
- Lebanon:				
NPK:	53.3	26.7	51.0	55
- Syria:	--	--	--	--
- Iraq:				
MAP:	--	--	--	50
NPK:	--	--	--	74
- Jordan:				
DAP:	--	--	118	337.4
Total East Mediterranean:				
MAP :	--	--	--	50
DAP :	--	--	118	337.4
NPK :	53.3	26.7	51.0	129
Grand Total:	**53.3**	**26.7**	**169**	**516.4**

Table (21): Consumption of DAP in the East Mediterranean Sub-Region (1980 - 1983)

Country	1980	1981	1982	1983
- **Lebanon:**	--	--	--	--
- **Syria:**	52,000	29,300	6,600	--
- **Iraq:**	--	--	--	--
- **Jordan:**	--	--	--	2,400
Total	**52,000**	**29,300**	**6,600**	**2,400**

Table (22): Consumption of NPK Fertilizer Grades in the East Mediterranean Sub-Region (1980 -1983)

Country	1980	1981	1982	1983
- **Lebanon:**	53,300	26,700	51,000	55,000
- **Syria:**	---	---	---	---
- **Iraq:**	15,000	17,000	14,900	73,900
- **Jordan:**	12,000	8,000	5,400	6,000
Total	**80,300**	**51,700**	**71,300**	**134,900**

Table (23): Consumption of NPK Fertilizers of all Types in the East Mediterranean Sub-Region (1980 - 1983)

Country	1980	1981	1982	1983
- **Lebanon:**	53,300	26,700	51,000	55,000
- **Syria:**	52,000	29,300	6,600	---
- **Iraq:**	15,000	17,000	14,900	73,900
- **Jordan:**	12,000	8,000	5,400	8,400
Total	**132,300**	**81,000**	**77,900**	**137,300**

Table (24): Estimated Consumption of DAP in the East Mediterranean Sub-Region (1984 - 1990)

Country	1984	1985	1990
- **Lebanon:**	--	--	--
- **Syria:**	10,000	15,000	50,000
- **Iraq:**	--	--	--
- **Jordan:**	4,000	6,000	12,000
Total	**14,000**	**21,000**	**62,000**

Table (25): Estimated Consumption of NPK Fertilizer Grades in the East Mediterranean Sub-Region (1984 - 1990)

Country	1984	1985	1990
- **Lebanon:**	60,000	60,000	85,000
- **Syria:**	2,000	3,000	10,000
- **Iraq:**	150,000	200,000	250,000
- **Jordan:**	10,000	12,000	18,000
Total	**222,000**	**275,000**	**363,000**

Table (26): Estimated Consumption of NPK Fertilizers of all types in the East Mediterranean Sub-Region (1984 - 1990)

Country	1984	1985	1990
- **Lebanon:**	60,000	60,000	85,000
- **Syria:**	12,000	18,000	60,000
- **Iraq:**	150,000	200,000	250,000
- **Jordan:**	14,000	18,000	30,000
Total	**236,000**	**29,600**	**425,000**

2. Potential Aspects for an NPK Fertilizer Joint-Venture Project:

The East Mediterranean Sub-Region possesses several potential aspects for the establishment of an NPK fertilizer Joint-Venture project. The following are some of the basic elements that favour the establishment of a joint NPK fertilizer project:

- The Sub-Region has huge resources of phosphate rock, potash and sulphur while ammonia is only available in limited quantities in Homs (Syria).

- The countries in the Sub-Region have now well-developed industrial sites and infrastructure for the fertilizer inudstry, like Aqaba in Jordan and Homs in Syria.

- The local market for NPK fertilizers in the Sub-Region is expected to develop favourably in the coming years because of the availability of huge agricultural areas and the policy of the governments of these countries to develop the agricultural sector in order to increase food production.

- The neighbouring Sub-Regions; Arabian Peninsula and East Africa are potential markets for any Joint-Venture project established in the East Mediterranean Sub-Region.

- Jordan has a firm plan for the construction of NPK fertilizer plant in Aqaba.

3. Technical Considerations and Production Cost:

The previous assumptions used to calculate the production cost for the Arab Maghreb Sub-Region are also taken into consideration here. According to Table (27) the production cost of one tonne NPK fertilizer bagged Fob in the East Mediterranean Sub-Region is about 134 U.S. Dollars, which is almost similar to that for the Arab Maghreb Sub-Region.

The percentage distribution of the cost items is as follows:

*	Raw Materials	:	77.80%
*	Bagging, Handling, Administration and Marketing	:	12.26%
*	Depreciation	:	4.45%
*	Manpower	:	2.08%
*	Utilities	:	2.66%
*	Others	:	0.75%
	Total	:	100%

Table (27): Estimated Investment and Production Cost

for NPK Fertilizer Plant in

East Mediterranean Sub-Region

(1984 U.S. Dollars)

Basic Data:

Capacity : 1500 tpd bagged product

Product : NPK (15:15:15)

Operation : 330 days per year

Utilization rate : 90%

Production : 445,500 tonnes product

Site : Well-developed site-East Mediterranean Sub-Region.

Total Investment Cost : 50 million U.S. Dollars.

- Plant Cost : 40 million U.S. Dollars.
- Working Capital: 10 million U.S. Dollars.

1. **Raw Materials:**	Quantity (tpy)	Cost ($ Tonne)	Total Cost ($)	$/Tonne of NPK Product
- Phosphoric Acid :	68,162	300	20,448,600	45.90
- Ammonia :	82,770	190	15,726,300	35.30
- Potash :	109,938	85	9,344,730	20.97
- Filler :	19,000	12	228,000	0.51
- Granulating chemicals :	1,000	900	900,000	2.02
Sub-Total (1) :			**46,647,630**	**104.70**

2. **Utilities:**	Quantity per tonne Product	Cost ($/Unit)	Total Cost ($)	$/Tonne of NPK Product
- Electricity (kwh) :	35.0	0.063	982,327	2.205
- Industrial Water(ton):	0.015	1.0	6,683	0.015
- Cooling Water (ton) :	9.0	0.025	100,238	0.225
- Steam (ton) :	0.03	15.0	200,475	0.450
- Fuel Oil (ton) :	0.005	138.0	307,395	0.69
Sub-Total (2) :			**1,597,118**	**3.585**

3. **Other Cost Items:**	Total Cost ($)	$/Tonne NPK Product
Labour Cost(40 X2000+30%) :	1,248,000	2.80
Maintenance Cost :	30,000	0.067
Consumable Materials :	160,000	0.359
Insurance and Others :	250,000	0.561
Administration and Marketing:	668,250	1.50
Bagging :	4,455,000	10.0
Handling :	2,227,500	5.0
Sub-Total (3)	**9,038,750**	**20.57**
Depreciation (15 years) :	2,666,666	5.99
Production Cost :	**59,950,164**	**134.57**
Capital Charge (15%) :	7,500,000	16.83
Grand Total	**67,450,164**	**151.397**

Price per tonne Fob bagged : **152**

(in U.S Dollars)

C. **Arabian Peninsula Sub-Region:**

1. **Kuwait:**

* Local Market for NPK Fertilizers:

The consumption of Kuwait of NPK fertilizers is minor.

* Availability of Raw Materials for NPK Fertilizer Industry:

- Kuwait has a well-established ammonia/urea industry which started mid Sixties.
- Kuwait owns 49% of the shares in ICM and SIAPE in Tunisia.
- Kuwait produces sulphur from oil and gas industry and the production is expected to increase considerably in 1986.

* NPK Fertilizer Production Projects:

A joint company between Kuwait and Tunisia for the production of NPK fertilizers was established recently. A project for the production of DAP is under planning in Kuwait with a capacity of 1000 tpd.

* Site and Infrastructure:

Shuaiba is considered one of the well-deveolped industrial sites in the world, with modern facilities and infrastructure. PIC of Kuwait has developed huge capacities of ammonia/urea in Shuaiba during the past twenty years.

* Technical Experience and Capabilities in the Fertilizer Industry:

The Petrochemical Industries Company (PIC) is now considered one of the internationally leading companies in the field of ammnia/urea industry and have developed a highly experienced group of engineers, technicians and management staff in the fertilizer industry during the past twenty years. In addition, the policy of Kuwait in investments abroad gave the company strong position in the international market. It is also worth mentioning that PIC is a sister company of Kuwait Petroleum Corporation (KPC). The relation between the fetilizer industry and the oil industry has also strengthened the position of PIC internationally. Kuwait owns the engineering company, C.F. Braun in U.S.A. and has 25% share in Hoechst and UHDE Engineering Company in W. Germany.

* Finance and Investments for NPK Fertilizer Projects:

The policy of PIC is to invest in the establishment of joint venture projects in the production of NPK fertilizers of all types both at home, in the Arab Region and Worldwide.

2. **Saudi Arabia:**

* Local Market for NPK Fertilizers:

- The consumption of NPK fertilizers in Saudi Arabia in 1983 reached about 100,000 tonnes of various grades, in addition, 21,000 tonnes DAP was also consumed during the same year.
- The consumption of NPK fertilizers is expected to reach about 200,000 tonnes by 1990, while DAP consumption may reach 50,000 tonnes.
- Saudi Arabia imports all its needs of NPK fertilizers and DAP.

* Availability of Raw Materials for NPK Fertilizer Industry:

- The ammonia/urea industry in Dammam, Saudi Arabia is a well-established industry and the Saudi Arabian Fertilizer Company (SAFCO) is known worldwide. The Saudi Arabian Basic Industries Corporation (SABIC) has also entered the field of fertilizer industry recently and their project SAMAD in Al-Jubail started production of urea in 1983. Both SAFCO and SABIC are now planning to establish a new plant for ammonia production.
- Saudi Arabia has become a major sulphur producer and the production in 1983 has reached about 782,000 tonnes.
- Phospahte deposits are available in Saudi Arabia but are not exploited at present.
- Potash deposits have been discoverd in different parts of the Kingdom.

* NPK Fertilizer Production Projects:

SAFCO and SABIC are both interested in the establishment of an NPK fertilizer plant to produce the requirements and needs of the agricultural sector which has developed very rapidly during the past five years. A project, with a capacity of 330,000 tonnes per year is envisaged.

* Site and Infrastructure:

Al-Jubail industrial site has become one of the well-developed sites in the world with all necessary infrastructure and modern facilities. In addition to SAMAD, several large petrochemical complexes have been constructed in Al-Jubail Industrial City.

* Technical Experience and Capabilities in the Fertilizer Industry:

SAFCO, over the past fifteen years, has formed a cadre of experienced engineers, technical staff and management in the field of ammonia/urea industry. SABIC and SAMAD are also heavily investing in the training of experienced engineers, technicians and management staff.

* Finance and Investments in NPK Fertilizer Projects:

There are firm plans that SAFCO and SABIC will invest in the establishment of an NPK fertilizer project in Al-Jubail industrial site.

3. **Qatar:**

* Local market for NPK Fertilizers:

The consumption of NPK fertilizers in Qatar is minor.

* Availability of Raw Materials for NPK Fertilizer Industry:

- Qatar has a well-established ammonia/urea industry which has started early Seventies in QAFCO plant at Umm-Said. Also, expansion of this industry is expected because of the availability of huge researves of natural gas.
- Qatar produces small quantities of sulphur from the oil and gas industry.

* NPK Fertilizer Production Projects:

There are no plans at present for NPK fertilizer production.

* Site and Infrastructure:

Umm-Said is one of the well-developed industrial sites in the Arabian Gulf Area, with modern infrastructure and facilities.

* Technical Capabilities in the Fertilizer Industry:

The policy of the Government of Qatar is to develop the technical capabilities of engineers, technicians, and management staff for the

various industries, in particular, Petrochemicals and Fertilizers industries.

* Finance and Investments for NPK Fertilizer Projects:

There are no plans to invest in an NPK fertilizer industry in the country.

4. United Arab Emirates:

* Local Market for NPK Fertilizers:

- The consumption of NPK fertilizers in U.A.E reached about 7000 tonnes in 1983, mainly of the grade (15:15:15).
- U.A.E. imports all its requirements of NPK fertilizers.
- It is expected that future consumption of NPK fertilizers in U.A.E. will reach in 199% about 12,000 tonnes.

* Availability of Raw Materials for NPK Fertilizer Industry:

- The first ammonia/urea plant has recently started production in Ruwais (FERTIL), Abu Dhabi.
- U.A.E. produces sulphur from its oil and gas industry. It is expected that the production of sulphur will increase considerably during 1985.

* NPK Fertilizer Production Projects:

At present, there are no plans for NPK fertilizer production in U.A.E.

* Site and Infrastructure:

Ruwais in the Emirate of Abu Dhabi has become a well-developed industrial site with the necessary infrastructure and facilities.

* Technical Experience and Capabilities:

ADNOC and FERTIL in Abu Dhabi have plans for the development of engineers, technicians and management staff for both, the oil and gas and fertilizer industry.

* Finance and Investments for NPK Fertilizer Projects:

The policy of ADNOC in Abu Dhabi is to support the establishment of Joint-Venture projects in this field. ADNOC has acquired 40% of the shares in SAEPA fertilizer complex in Gabes-Tunisia and 48% of PAK-ARAB fertilizer complex in Multan, Pakistan.

5. **Bahrain:**

* Local Market for NPK Fertilizers:

- Consumption of Bahrain of NPK fertilizers is minor.
- Consumption of NPK fertilizers in 1990 may reach 2000 tonnes.

* Availability of Raw Materials for NPK Fertilizer Industry:

- GPIC in Bahrain is at present establshing an ammonia plant (1000 tpd capacity), expected to start production in 1985. The production of ammonia will be exported to the international markets.
- Bahrain produces about 40,000 tonnes of sulphur from its oil and gas industry.

* NPK Fertilizer Production Projects:

At present, there are no plans for any project for NPK production.

* Site and Infrastructure:

Sitra in Bahrain is now becoming an industrial site with the necessary infrastructure for the ammonia and methanol industries.

* Technical Capabilities in the Fertilizer Industry:

The fertilizer industry in Bahrain will start in 1985 with the start of production of the ammonia plant GPIC at Sitra. The company has started to train and develop the tehnical capabilities of its

engineers, technicians and management staff.

* Finance and Investments for NPK Fertilizer Project:

The government of Bahrain encourages and supports the establishment of Joint-Venture projects in the fertilizer industry. GPIC is agood example for this cooperation, owned equally by Bahrain, Kuwait and Saudi Arabia.

6. **Oman, North Yemen and South Yemen:**

* Local Market for NPK Fertilizers:

- Consumption of Oman in 1983 from NPK fertilizers was about 4,500 tonnes. The grade (20:10:10) is the preferable fgrade. The consumption in 1990 may reach 12,000 tonnes.

- Consumption of North Yemen in 1983 from NPK fertilizers was minor, but the consumption in 1990 may reach 10,000 tonnes. The grades used in North Yemen are (15:15:15) and (20:20:0).

- Consumption of South Yemen in 1983 from NPK fertilizers was minor, but the country consumption may reach 5,000 tonnes by 1990.

* Raw Materials, Projects, Investments, etc...:

These countries do not have any type of fertilizer industry. Oman, may, in future, consider an ammonia/urea project.

Discussions:

1. **Market:**

* Supply/Demand Situation of NPK Fertilizers in 1983:

The Arabian Peninsula Sub-Region does not have any NPK fertilizer production plant at present. The Sub-Region imports its needs of NPK fertilizers of all types from the international markets. The consumption in 1983 reached about 139,880 tonnes, of which NPK fertilizer grades represented about 85% and the remaining was DAP consumption in Saudi Arabia. The consumption of the Sub-Region in 1983 was about 18% of the total consumption in the Arab Region.

On the country level, the major consumer of NPK fertilizers in the Sub-Region is Saudi Arabia (86.5%) of the total consumption in the Sub-Region, while the remaining quantity was consumed in U.A.E., North Yemen, Oman and Qatar.

* Supply/Demand Situation of NPK Fertilizers in 1990:

- The expected total consumption of NPK fertilizers of all types in the Sub-Region in 1990 may reach about 293,000 tonnes, with Saudi Arabia being the major market (85% of the quantity). The consumption in the Sub-Region in 1990 is expected to be about 13.7% of the total consumption in the Arab Region.

- Based on the assumption that the planned projects in the Sub-Region

will be in operation by 1990 and that the utilization rate of the production capacities is 90%, the total production of NPK fertilizers may reach 297,000 tonnes and that of DAP may reach 297,000 tonnes.

- The Sub-Region in 1990 is therefore expected to become self-sufficient in NPK fertilizers and exporter of DAP.

Table (28): Consumption of NPK Fertilizers of all Types in the Arabian Peninsula Sub-Region (1980 - 1983)

Country	1980	1983
Saudi Arabia :	47,300	121,000
Kuwait :	1,000	---
Bahrain :	200	780
Qatar :	560	500
U.A.E. :	1,600	7,000
Oman :	1,900	4,500
North Yemen :	20	6,100
South Yemen :	---	---
Total Sub-Region	**52,580**	**139,880**

Table (29): Estimated Consumption of NPK Fertilizers of all Types in the Arabian Peninsula Sub-Region (1984 - 1990)

Country		1984	1985	1990
Saudi Arabia	:	150,000	165,000	250,000
Kuwait	:	500	700	1,000
Bahrain	:	750	7000	2,000
Qatar	:	500	700	1,000
U.A.E.	:	7,500	8,000	12,000
Oman	:	6,000	7,500	12,000
North Yemen	:	3,000	5,000	10,000
South Yemen	:	500	1,000	5,000
Total Sub-Region		**168,750**	**188,900**	**293,000**

2. Potential Aspects for an NPK Fertilizer Joint-Venture Project:

The Arabian Peninsula Sub-Region has the potential and capabilities to establish a Joint-Venture NPK project in one of the well-developed industrial sites like: Shuaiba in Kuwait, Al-Jubail in Saudi Arabia or Sitra in Bahrain.

- Ammonia is Available.
- The local market is developing rapidly, especially in Saudi Arabia.
- Some of the countries in the Sub-Region have developed high technical capabilities and international reputation.

3. Technical Considerations and Production Cost:

Table (30) Shows the production cost analysis for an NPK fertilizer plant in the Arabian Peninsula Sub-Region. The assumptions mentioned under the Arab Maghreb Sub-Region are also taken into consideration here. It is quite clear that the cost of produccion of one tonne NPK fertilizer bagged fob is similar to that in the Arab Maghreb Sub-Region, about 134 U.S. Dollars (Table 30).

The percentage distribution of the cost elements is as follows:

*	Raw Materials	: 80.32%
*	Bagging, Handling, Adminstration and Marketing	: 10.77%
*	Depreciation	: 4.45%
*	Manpower	: 3.00%
*	Utilities	: 0.73%
*	Others	: 0.73%
	Total	100.00%

Table (30): Estimated Investment and Production Cost for

NPK Fertilizer Plant in

Arabian Peninsula Sub-Region

(1984 U.S. Dollars)

Basic Data:

Capacity	: 1500 tpd bagged product
Product	: NPK (15:15:15)
Operation	: 330 days per year
Utilization Rate	: 90%
Production	: 445,500 tonnes product
Site	: Well-developed site-Arabian Peninsula.
Total Investment	: 50 million U.S. dollars.
- Plant Cost	: 40 million U.S. dollars.
- Working Capital	: 10 million U.S. dollars.

1. **Raw Materials**	Quantity (tpy)	Cost ($/tonne)	Total Cost ($)	$/Tonne of NPK Product
- Phosphoric Acid:	68,162	330	22,493,460	50.49
- Ammonia :	82,770	170	14,070,900	31.58
- Potash :	109,938	95	10,444,110	23.44
- Filler :	19,000	15	285,000	0.64
- Granulating chamicals :	1,000	900	900,000	2.02
Sub-Total (1)			**48,193,470**	**108.17**

2. **Utilities**	Quantity (tonne Product)	Cost ($/Unit)	Total Cost ($)	$/Tonne of NPK Product
- Electricity(kwh) :	35	0.015	233,888	0.525
- Industrial Water(ton):	0.015	1.7	11,360	0.026
- Cooling Water(ton) :	9.0	0.019	76,181	0.171
- Steam (ton) :	0.03	5.0	66,825	0.15
- Gas (Nm^3) :	6.2	0.018	48.800	0.11
Sub-Total (2)			**437,054**	**0.98**

3. **Other Cost Items:**

		Total Cost ($)	$/Ton of NPK Product
Labour Cost (40X2500+50%)	:	1,800,000	4.04
Maintenance Cost	:	30,000	0.067
Consumable Materials	:	160,000	0.359
Insurance and Others	:	250,000	0.561
Administration and Marketing	:	668,250	1.5
Bagging	:	4,455,000	10.0
Handling	:	1,336,500	3.0
Sub-Total (3)		**7,699,750**	**19.52**
Depreciation (15 years)	:	2,666,666	5.99
Production cost	:	**59,996,940**	**134.66**
Capital Charge	:	7,500,000	16.83
Grand Total	:	**67,796,940**	**151.49**

Price per tonne Fob bagged : **152**

(in U.S. Dollars).

D. **East Africa Sub-Region:**

This Sub-Region includes: Egypt, Sudan. Somalia and Djibouti. The following facts do not favour the establishment of a Joint-Venture project for NPK fertilizers in this Sub-Region in the period (1985-1990):

* The consumption of NPK fertilizers of all types in the Sub-Region is minor. The consumption of the Sub-Region of NPK fertilizers was only 2% of the total consumption in the Arab Region in 1983.
* The future consumption of NPK fertilizers in the Sub-Region by 1990 will also remain small, about 2.3% of the total consumption in the Arab Region.
* The necessary raw materials needed for the NPK fertilizer industry, like, Phosphoric Acid, Ammonia and Potash are not available. Even though, phosphate rock deposits are present in Egypt, but they are of complex low-grade type, and sulphur is not available.
* Safaga site, in Egypt which is one of the possible future sites, on the Red Sea, for establishment of a fertilizer complex is not yet developed (grass-root project).
* It is worth mentioning that the phosphoric acid production has recently started in Egypt.

  Phosphate Rock deposits and assotiated natural gas are abundent in the Safaga Area. Therefore, consideration might be given, in future, to the production of ammonia, nitric acid and hence NP and NPK fertilizers by the nitrophosphate process. Potash needs would be imported. NPK production would be directed mainly for exports to neighbouring markets.

* **Comparison Among Various Sub-Regions:**

The production cost of one tonne NPK fertilizer bagged Fob as shown by the production cost analysis for an NPK fertilizer plant in the various Sub-Regions clearly shown that it is about 133-135 U.S. Dollars. The main differences in the production cost can be seen by comparison of the various components as shown below:

Component	Arab Maghreb Sub-Region	East Mediterranean Sub-Region	Arabian Peninsula Sub-Region
* Raw Materials	78.86%	77.80%	80.32%
* Bagging, Handling Administration and Marketing	10.23%	12.26%	10.77%
* Depreciation	4.51%	4.45%	4.45%
* Manpower	2.11%	2.08%	3.00%
* Utilities	3.56%	2.66%	0.73%
* Others	0.73%	0.75%	0.73%
Total	**100.00%**	**100.00%**	**100.00%**

The raw materials component is highest in the Arabian Peninsula Sub-Region because phosphoric acid and potash are to be imported, while in the other Sub-Regions only ammonia would be imported from within the region or from outside it. On the other hand, the utilities cost is lowest in the Arabian Peninsula Sub-Region so that it balances the higher cost of the raw materials component. This has resulted in that the cost of production being more or less the same in the three Sub-Regions.

It must be stressed however, that more detailed cost and financial analyses are needed for each project in certain chosen sites, which would result in more meaningful comparison.

the NPK fertilizers consumption in the four Sub-Regions in 1983 and 1990 can be shown as follows (percentage distribution):

Year	Arab Maghreb Sub-Region	East Mediterranean Sub-Region	Arabian Peninsula Sub-Region	East Africa Sub-Region
1983	62%	18%	18%	2.0%
1990	64%	20%	13.7%	2.5%

The results suggest the possibility of establishment of an NPK fertilizer Joint-Venture project in any of the three Sub-Regions:

Arab Maghreb, East Mediterranean, and Arabian Peninsula.

6. Summary and Conclusions

The Fertilizer industry in the Arab Region has now reached a high stage of development. Sixteen Arab Countries have established fertilizer production facilities of one type or another. The phosphate industry is well-developed in the Arab Maghreb, while the nitrogen fertilizer industry is now well-developed in the Arab Gulf States. The Arab Region possesses huge resources of all fertilizer raw materials: Phosphate Rock, Natural Gas, Sulphur and Potash.

The study has considered four Sub-Regions for discussion on the situation of the NPK fertilizer industry in the Arab States, as follows:

1. Arab Maghreb Sub-Region:
   Libya, Tunisia, Algeria, Morocco and Mauritania.

2. East Mediterranean Sub-Region:
   Lebanon, Syria, Jordan and Iraq.

3. Arabian Peninsula Sub-Region:
   Kuwait, Bahrain, Oatar, U.A.E., Oman and Saudi Arabia.

4. East Africa Sub-Region:
   Egypt, Sudan, Somalia and Djibouti.

* In 1983, the production capacities of NPK fertilizers of all types existing in the Arab Region totaled about 2.93 million tonnes, of which 2.07 million tonnes for Ammonium Phosphates (70%) and 0.86 million tonnes for NPK fertilizer grades (30%).

* The total production of NPK fertilizers of all types in 1983 reached about 1.538 million tonnes.

* The Arab Countries which have NPK fertilizer production facilities are: Morocco, Algeria, Lebanon, Jordan, and Iraq, i.e. the NPK fertilizer industry is concentrated in the Arab Maghreb Sub-Region (66% of the total production of the NPK fertilizers in the Arab Region) and the East Mediterranean Sub-Region (34% of the total production of NPK fertilizers in the Arab Region).

* The consumption of NPK fertilizers of all types in the Arab Region totaled in 1983 about 750 thousand tonnes, which is about 13.6% of the total fertilizer tonnage consumed in the Arab Region during the same year. The major consumers are: Morocco, Algeria, Libya, Lebanon, Iraq and Saudi Arabia.

* The consumption of NPK fertilizers in the Arab Maghreb Sub-Region was about 62% of the total consumption in the Arab Region, while the East Mediterranean Sub-Region accounted for 18% of the total consumption in the Arab Region.

* The future prospects of the NPK fertilizer industry in the Arab Region looks promising. By 1990, the total NPK fertilizer capacities of all types is expected to reach 6.6 million tonnes a four-fold increase in just ten years.

* The consumption of NPK fertilizers of all types in the Arab Region is expected to increase considerably and may reach 2.13 million tonnes by 1990,

more than three-fold increase in ten years. Algeria, Morocco, Libya, Tunisia Iraq and Saudi Arabia are expected to account for about 85% of the total consumption in the Arab Region.

* Preliminary Estimates of the production cost of one tonne of NPK fertilizer grade (15:15:15) of a 1500 tpd project in a well-developed site in one of the Arab Countries in the Region is about 133-135 U.S.dollars. The price per tonne Fob bagged would be about 150-152 U.S.Dollars when considering 15% capital charge. The price per tonne of NPK fertilizer grade (15:15:15) Fob bagged in the international market during 1984 ranged 130-170 U.S.Dollars depending on the origin and buyer of the fertilizer. This shows clearly that the establishment of an NPK fertilizer plant in the Arab Region is indeed viable.

* Several Arab Countries in the Arab Region have firm plans to establish NPK fertilizer facilities during the period (1985-1990): Tunisia, Libya, Jordan, Saudi Arabia, and Kuwait.

* The above facts support strongly the establishment of joint-venture NPK fertilizer projects in the Arab Maghreb and East Mediterranean Sub-Regions, in agreement with the recommendations of the conference of the Ministries of Industry held in Damascus October, 1984.

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7. Recommendations for Action

It is certain that the development of the fertilizer industry in any one country starts with the exploitation of the raw materials resources, production of intermediates and straight fertilizers and then NPK fertilizers as the last step in the development process. As previously stated, the NPK fertilizer industry in some of the developed countries has reached an advanced stage of development, such that high analysis grades and inclusion of secondary or micro-nutrients has now become a standard practice.

The development of agriculture and the optimum use of fertilizers lead to the increase of NPK fertilizers consumption, which certainly would lead to the establishment of production facilities of the required types of NPK fertilizers.

The development of the agricultural sector in the Arab Countries and the increase of the fertilizer consumpton is essential for increasing food production in the Arab Region. Several Arab Countries have reached a high stage of development of their raw materials resources, and fertilizer industry, so that the coming few years will witness the development of the NPK fertilizer industry in these countries.

Accordingly, the following recommendations are put forward:

1. As a followup of this study, it is appropriate to convene a regional consultation meeting on "the future prospects of the NPK Fertilizer Industry in the Arab Region", to be sponsored by UNIDO in cooperation with AIDO and AFCFP. Detailed studies on the various possible projects in the Sub-Regions

should be prepared for presentation to the meeting. These studies should discuss: NPK fertilizer grades, process routes, local and export markets, investment and production costs. Arab Investment Corporations can play an important role in the presentation of reports for this meeting to promote joint-venture projects in the NPK fertilizer industry.

Senior officials from the Ministries of Industry, Ministries of Agriculture, Agricultural Research Institutes and Fertilizer Companies in the Arab Countries should be invited to participate in this meeting.

2. The following studies and programmes are needed:

A- Field study on the optimum use of NPK fertilizer grades in relation to soil, crops, and availability of water in the Arab countries. Particular attention should be paid to the problem of potash-based or sulphate-based NPK fertilizers, to the inclusion of secondary and micronutrients, and to the type of material used as the source of P_2O_5 and nitrogen in the compound fertilizer products. FAO can provide assistance in this study.

B- Appraisal of the various NPK fertilizer production technologies with the object of recommending the process routes most suitable for the various Arab Countries in the Sub-Regions. UNIDO can provide assistance for this purpose.

C- Formulation of a regional programme for fertilizer consumption development in which all parties involved in the agricultural sector development should contribute: Ministries of Agriculture, Agricultural Research Centers, Fertilizer Industry and Regional and International

Organizations, such that particular attention in this programme should be paid to the activities which promote the use and application of NPK fertilizers in the Arab Region.

In this context, support to the AFCFP Campaign "The Week of the Farmer and Fertilizers" is essential in the process of fertilizer use development and optimization. The Campaign should include: distribution of information leaflets and booklets, holding meetings and seminars, visits to the farmers fields and demonstration plots.

3. It is essential for AFCFP to strengthen and further develop its information system, so that it can provide prompt, accurate and uptodate information on the fertilizer industry of the region to the relevant Arab and International Bodies.

UNIDO is requested to support the efforts of AFCFP in this field.

8. References

1- AFCFP Statistical Reports.

2- Information Available in the Documentation Unit of AFCFP.

3- Information collected from AFCFP Member Companies by direct Contact.

4- Technical Reports received from Observer Member Companies of AFCFP.

5- Information collected from International Organizations on World Trade of Ammonium Phosphates and NPK Fertilizers.