PRESENT FERTILIZER INDUSTRY IN TURKEY AND ITS DEMAND ANALYSIS

by

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ABSTRACT

In the economic and social development of Turkey the importance of Agricultural Sector is well known. The contribution of agricultural sector, which has high development potential in solving economic and social problems of the country, creating income and employment, value-added, rural development, preventing migration to big cities is no doubt considerable.

So the portion of agricultural sector in the fifth planned program must be longer than previous ones. Solutions to the problem of the sector with a precedence is required. Therefore one of the problems to be solved of the sector is the use of fertilizer and fertilizer industry. By the above mentioned reason the author has chosen the fertilizer industry and its demand analysis as a subject of study.

Chapter one gives purpose, content and methodology of the study. Chapter two gives developments in the Turkish fertilizer industry, present producers, then problems and suggested solutions to these problems. Chapter three gives demand analysis performed by several institutions. Chapter four examines the demand by regression analysis method, states a demand model and the demand projection according to the stated model. Chapter five summarizes the findings of the study and states conclusions and implications.

We conclude that; the future domestic fertilizer demand can not be satisfied by the domestic production possibilities, and the importation is indispensable. Realistic and permanant solutions must be found for the problems such as new production plant, must be established and state investments must be managed under stability and accelerated,

private sector must be oriented towards fertilizer industry by giving incentives and finally necessary precautions must be taken for raw material problem.

ÖZET

Türkiye'nin ekonomik ve sosyal kalkınmasında tarım sektörünün yeri ve önemi bilinmektedir. Kalkınma potensiyeli yüksek olan tarım sektörünün ülkenin ekonomik ve sosyal sorunlarının çözümünde, gelir ve istihdam yaratma, katma değer, kırsal gelişme, büyük kentlere göçün önlenmesi açısından katkısı tartışılamayacak derecede büyüktür. Bu nedenlerle tarım kesiminin önceki plan dönemlerine oranla daha ağırlıklı bir biçimde ele alınması gerekmektedir.

Bu gereklilik sektörün sorunlarını öncelikle çözüme kavuşturmasını zorunlu kılmaktadır. Sektörün çözüm bekleyen sorunlarından birisi de gübre kullanımı ve onun sanayisidir. Bu nedenledir ki yazar, gübre sektörünü ve onun talep analizini araştırma konusu yapmıştır.

Birinci bölümde çalışmanın amacı, kapsamı ve uygulanan metodoloji anlatılmıştır. İkinci bölüm, Türkiye'deki gübre sanayindeki gelişmeleri, mevcut üreticileri ve onların sorunlarıyla önerilen çözümleri kapsamaktadır. Üçüncü bölüm, halihazır yapılmış talep analizlerini vermekte ve bunların mukayesesini yapmaktadır.Dördüncü bölümde yazarın çoklu regrasyon analiziyle ortaya koyduğu talep modeli ve potansiyel pazarın istikbal tahminleri yer almaktadır. Beşinci bölümde sonuçlar ve öneriler belirtilmiştir.

Bu çalışmada, Türkiye'nin gelecekteki kimyevi gübre talebinin mevcut üretim olanaklarıyla karşılanamayacağı, ithalatın kaçınılmaz olduğu, yeni üretim tesislerinin kurulup faaliyete geçirilerek konuya kararlı, gerçekçi ve kalıcı bir çözüm bulunmasının gerektiği, bunun için de devlet yatırımlarının istikrarlı gitmesinin gerekliliği, özel sektörün gübre sektörüne teşvik edilmesinin elzem ol-

duğu hammadde sorununun iç kaynaklardan karşılanması için gerekli tedbirlerin alınması gerektiği kanaatine varılmıştır.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF CHARTS

CHARTS PAGE

LIST OF ABBREVIATIONS

TSP: triplet superphosphate
NSP: normal superphosphate
DAP: diammonium phosphate
CAN: calcium ammonium nitrate
N: nitrogen, used for nitrate content fertilizers
P_2O_5: used for phosphate content fertilizers
HNO_3: nitric acid
H_2SO_4: sulphuric acid
H_3PO_4: phosphoric acid
S: sulphur
NPK: nitrogen, potassium, phosphate content fertilizer
TZDK: Turkish Agricultural Equipment Institution
DSI: State Irrigation Affairs
DPT: State Planning Organization
DIE: State Institution of Statistics
TOBB: Turkish Anocation of Chambers
IGSAŞ: Istanbul Fertilizer Industry Incorporated
TŞFAŞ: Turkish Sugar Factories Incorporated

CHAPTER I

INTRODUCTION

I.I PURPOSE OF THE STUDY

The population of the world, which has increased at times slowly or quickly in the history, is expected to be 7 billion at the beginning of 21th century. In spite of the reasons of this increase, its consequences take the major importance. According to the FAO's report(1) it is estimated that 1/3 of the world's population, constituted by underdeveloped countries is poorly nourished.

Especially in the last years a correlation between the production increase of foods and population increase is noticed and it is wished that the production of food is to be increased in order to have a sufficient nourishment in world scale.

As most of the needs of the population (especially food) is provided by agricultural sector, to match the population increase and its needs, aggricultural production must be increased. This may be done by (1) increasing sowable lands and (2) increasing the efficiency of unit land.

Today in Turkey, all sowable lands are in cultivation, and huge amounts of money is required to open new cultivation areas, in other words it is not economical. Then the unique way of increasing the agricultural production is to increase unit land efficiency.(2) This may be performed by the

(1) TÜMAŞ, Gübre Rasyonalizasyon ve Enerji Tasarrufu Projesi, V$_2$, 1983.
(2) Doç. Dr. Habil Çolakoğlu, Gübre ve Gübreleme, Ege University, 1984.

use of efficiency in increasing inputs, such as fertilizers, agricultural chemicals such as insecticides and modern machinery.

But the effect of fertilizers is equal to the effect of all the other inputs. Fertilizer may be defined as "all the compounds taken by the plant from the spronting up to the harvesting, effecting the quality and the quantity of the crops by its absence and presens.(1) Chemical fertilizers, different from natural fertilizers, certain plant nutrition at high concentration and in a soluble form.

They may be classified in four groups:

-Nitrogen content fertilizers

-Phosphate content fertilizers

-Potassium content fertilizers and

-Compose fertilizers containing more than one element.

There are three major plant nutriment in agriculture, these are nitrogen, phosphorus and potassium. Nitrogen is required to develop green parts of the plant: stem and leaves. Phosphorus consists the main part of the cell nucleus and it is essential for flowering and quality of the crops. Potassium is for pollenification and it is present in sufficient amount in soils of our country. So fertilizers of interest are nitrogen content and phosphorus content fertilizers.

Every cultivation year takes these nutriments away from the soil and farmers have to add these nutriments externally to the soil in order to maintain a stable soil efficiency. This is done by giving fertilizers.

Three kinds of manure exists: farm manures

(1) Nurinissa Özbek, Toprak Verimliliği ve Gübreleme, Ankara, 1975, S.2.

which are animal excrements, their composts, green plants; rabish manure and chemical fertilizers which consist one subject. Chemical fertilizer differs from others in containing high concentration of plant nutriments in unit amount and no organic substances. Being inorganic and in concentrated form provides storage, transportation and usage facilities.

Nitrogen content fertilizers are present in the market in the form of Sodium Nitrate, Calcium Nitrate, Ammonia contents and urea. Phosphate content fertilizers are present in the market in Normal Superphosphate and Triplet Superphosphate form. The correct choice has to be made according to the chemical structure of the soil given by the soil analysis report.

As Turkey is still an agricultural country and more than 20 million people earn his money from agricultural activities the importance of fertilizers and its industry is easily understood. Taking all these aspects into consideration, analysis of fertilizer industry in Turkey has been chosen as the target of analysis of this thesis.

The study will be helpful for all the people of interest. So the purpose of this study is to investigate the fertilizer sector and its demand potential in Turkey.

1.2 CONTENT AND PROCEDURE

This study investigates fertilizer sector and its demand potential in Turkey.

Chapter one includes an introduction to the subject, purpose, content and procedure of the study, methodology and defination of key terms. Chapter two includes present producers in Turkey, their problems

and suggested solutions to these problems. Chapter three examines the demand analysis performed by several institutions, their projection and the summary of these findings. Chapter four includes the demand analysis performed by the author and its projections. Chapter five summarizes the material and states the conclusions and implications.

1.3 METHODOLOGY

Literature about fertilizer and its industry is not abandant. Most of the available ones have lost their relevancy to the present situation. Several sectoral reports about fertilizer industry including "Rationalization of Fertilizer and Energy Saving Project" of Tümaş, Seminars and master thesis about fertilizer and its usage, price policies and subvensions are examined.

In the study statistical data are gathered from secondary sources such as State Institute Statistics, Foreign Trade Statistics of Turkey, official journals, State Planning Organization and Economic Report of TOBB.

After surveying literature about Turkish fertilizer industry a model of demand function for both nitrate content fertilizers and phosphate content fertilizers is developed to forecast the future fertilizer demand. Each variable that will be influential in the demand amounts was tested to see them explanatory power.

CHAPTER II

DEVELOPMENTS IN FERTILIZER INDUSTRY IN TURKEY

The chemical fertilizer production has begun in Turkey in 1939 by putting into operation the first coke factory of Karabük Iron Steel Plant. The ammonium sulphate fertilizer which is produced using raw gas caming from coke factory happened to be the first chemical fertilizer in Turkey. Establishment of chemical fertilizer sector was at 1944 by the Superphosphate and sulphuric acid units which are in the same Iron-Steel complex but operating separately from the Iron-Steel production.

The first firm established directly for chemical fertilizer production is Gübre Fabrikaları T.A.Ş. The named firm put into operation in İskenderun Normal Super Phosphate plant in 1954 and Yarımca Normal Superphosphate plant in 1961. At the same years, a state society, Azot Sanayi T.A.Ş. Kütahya plant began to operate.(1)

After planned development periods, especially during second and third plans, huge increases in production capacity of chemical fertilizer sector are observed. In the fourth plan, it was planned to increase the nitrate fertilizer capacity to 1.1 million ton, phosphate fertilizer capacity to 987 thousand ton and potassium fertilizer capacity to 123 thousand ton by the end of 1983.

However, production capacities reached 966 thousand tons in nitrate and 987 thousand tons in phosphate by the end of 1982. This development is

(1) TÜMAŞ, Gübre Rasyonalizasyon ve Enerji Tasarrufu Projesi, V_2, 1983.

due not to the creation of new capacities, but to the better utilizations of present capacities.(2)

(2) DataBank, Konjonktür Raporu 7 Gübre Sanayi ve Sorunları, 15-30 September 1983, pp 1-5.

2.1 PRESENT PRODUCERS(3)

There are nine enterprises producing chemical fertilizer in Turkey. These are: Azot Sanayi TAŞ, Gübre Fabrikaları TAŞ, İstanbul Gübre Sanayi AŞ, Akdeniz Gübre Sanayi AŞ, Bandırma Gübre Sanayi AŞ, Ege Gübre Sanayi AŞ, Toros Gübre ve Kimya Endüstrisi AŞ, Karabük Plant and Petkim Petrokimya AŞ. In the fallowing paragraphs a brief description of each firm is provided.

2.1.1 Azot Sanayii T.A.Ş

Azot Sanayii T.A.Ş., which is a state enterprise was established in 1953 to provide the necessary fertilizer and nitric acid and ammonium nitrate which are the raw materials of explosives that are required in mining construction sector and defense industry. Its present capital is 7 billion TL and it has plants at Kütahya (I,II), Samsun, Elazığ, Gemlik, Yarımca-İzmit and Sarıeski-İskenderun.

Kütahya I, plant producing Ammonia (100%), Nitric Acid (100%), Ammonium Nitrate (21%N) and Ammonium Sulphate (21%N) was put into operation in 1961. (Its capacity is shown in table 1) Kütahya II plant producing ammonia (100% NH_3), Nitric Acid (100%) and Calcium Ammonium Nitrate (20% N) was put into operation at 1968. The intermediate products to obtain Ammonium Nitrate and Ammonium Sulphate, Ammonia and Nitric Acid are produced in the plant.

Lignite, the initial raw material of ammonia is provided from TKİ Garp Linyitleri İşletmesi, Seyitömer. At the other hand, gypsum, the raw

(3) This section has been summarized from a Report by TÜMAŞ, titled Gübre Rasyonalizasyon ve Enerji Tasarrufu Projesi, V_2, 1983.

Table 2.1

Capacity of Kütahya I Plant

Product	ton/year
Ammonia 100% NH_3	35 700
Nitric acid 100% HNO_3	26 700
Ammonium Nitrate 21% N	50 000
Ammonium Sulphate 21% N	60 000

Table 2.2

Capacity of Samsun Plant

Product	ton/year	
Sulphuric Acid 100%	214 500	Samsun I Plant
Phosphoric Acid 28% H_3PO_4	1 700	
TSP 43-45% P_2O_5	220 000	
Phosphoric Acid 54% H_3PO_4	108 800	Samsun II Plant
Diammonium Phosphate	227 200	

Source: TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi, V_2, 1983, pp 1-6, 1-10.

material of Ammonium Nitrate is provided from Azot Sanayii T.A.Ş., Ulukışla.

Samsun plant producing Sulphuric Acid (100%), Phosphoric Acid (28% H_3PO_4), TSP (43-45% P_2O_5) and DAP lies near the Samsun-Ordu highway, 14 km from Samsun. Samsun I plant was put into operation in 1970 and Samsun II plant was put into operation in 1974. The capacity of the plant is shown in table 2.2. Sulphuric Acid plant is designed according to Lurgi phocess, Phosphoric Acid unit and TSP unit are designed according to Siage-Chemibars process and DAP unit is designed according to Olin Mathleson process.

Phosphoric Acid and Sulphuric Acid, raw material of TSP are produced in the plant as intermediate products. The plant provides pirite, the raw material of H_2SO_4 importing from Cyprus, phosphorite, the raw material of H_3PO_4 importing from Jordan and Tunusia. Ammonia which is used in DAP production is imported from European Countries, USA and Kuveyt. As the Sulphuric Acid plant does not have enough capacity to supply the necessary amount for TSP and DAP production, a part of the H_2SO_4 is supplied by importation.

The main problem of the plant is import raw material dependence.

Elazığ plant producing 220 000ton/year Normal Super Phosphate (NSP) lies near the Elazığ-Diyarbakır highway, 4 km from Sivrice, on Hızlı Lake Shore. It is put into operation on 1970.

Phosphate, raw material of NSP is provided from Etibank Mazrolağı mines, and the other raw material, H_2SO_4 is provided from Etibank Maden H_2SO_4 factory.

The main problem of the plant is the low capacity operation, due to the wrong choice of the place.

Gemlik plant producing HNO_3, 360 000ton/year and Calcium Ammonium Nitrate (CAN), 594 000ton/year, 26% N lies near the Gemlik Bursa highway, 7 km from Gemlik. It is put into operation in 1979. Due to the delay in the construction of Gemlik-Ammonia plant which is planned to supply the required ammonium demand of Samsun plant, Petkim Aliağa plant and Gemlik plant, the necessary ammonium for the above named plants is imported from USA and URSS. From other raw materials H_2SO_4 is provided from Bandırma and Gypsum from Gemlik.

2.1.2 Gübre Fabrikaları T.A.Ş

It is established in 1950 with an initial capital of 200 million TL. TC Ziraat Bank, Azot Sanayii T.A.Ş and TZDK hold 34% of the capital and the rest of the capital is owned by agricultural cooperatives and public.

The enterprise put into operation İskenderun-Sarıeski plant in 1954 and İzmit-Yarımca plant in 1961.

Yarımca-İzmit plant producing NSP, TSP and compose fertilizer lies at Yarımca between Marmara Sea and İstanbul-İzmit railroad. The initial capacity was 100 000ton/year NSP, in 1974. H_3PO_4 unit was put into operation and the design capacity of the plant is revised as 185 000ton/year TSP and 73600ton/year H_3PO_4. On the other hand the capacity of the compose fertilizer unit which was put into operation in 1978 is 185 000ton/year. The raw material of H_3PO_4 production, 31-32% P_2O_5 phosphorite is importing as well as Sulphuric Acid. Ammonia and urea are supplied by IGSAŞ.

Sarıeski-İskenderun plant producing NSP and TSP lies at Sarıeski, between İskenderun-Adana railroad and seashore. The initial capacity of

the plant was 100 000ton/year NSP in 1954 and in 1968, the plant began to produce TSP besides NSP and in 1975 Sulphuric Acid and Phosphoric Acid units were put into operation. The present capacity of the plant is shown in table III.

Pirit (with 44-46% S) from Etibank Küre mine is used as raw material of H_2SO_4 production. Phosphorus rock is imported from Jordan, Morocco, Tunusie and Togo for Phosphorus acid production.

2.1.3 İstanbul Gübre Sanayii A.Ş (İÇSAŞ)

It is an incorporated company whose shares are hold by Türkiye Petrolleri A.O and İPRAŞ.

It has an urea plant at İzmit-Tütünçiftlik which was put ink operation in 1977. It has a capacity of 330 000ton/year 100% Ammonia and 511 500ton/year Urea (46% N).

HHDE process is used in Ammonia unit and ICI process is used for steam cracking. Urea production is conducting in accordance with Stamicarbon process.

The basic raw material of urea, ammonia and carbondioxide is provided from Ammonia plant, and ammonia is produced from Naphta supplied by İPRAŞ.

2.1.4 Akdeniz Gübre Sanayii A.Ş

It is the first and unique company having foreign capital in the fertilizer sector. It is established in 1968 with a capital of 162 million TL. The shareholders are as follows:

Azot Sanayii TAŞ	%47.254
Petrochemical Ind.Co KSC-Kuwait	%47.254
T. İş Bankası	%2.746
Şekerbank	%2.745
Ömer Sunar Successors	%0.001

Table 2.3

Capacity of İskenderun Sarıeski Plant

Product	ton/year
Sulphuric Acid	230 000
Phosphoric Acid	73 000
TSP	185 000

Table 2.4

Capacity of Akdeniz Gübre Sanayii, Mersin Plant

Product	ton/year
Sulphuric Acid	214 300
Phosphoric Acid	70 000
Nitric Acid	363 000
DAP	148 500
CAN	594 000

Source: TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi, V_2, 1983, pp 1-19, 1-26

As the company was in lies from the establishment upto 1980, the foreign shareholder PIC Kuwait remained indifferent for new investments and capital increases. But a rehabilitation in financial structure of the company is observed after 1980.

Mersin plant, 5 km from Mersin, on the Mersin-Adana highway was put into operation in 1972. The plant produces Sulphuric acid, Phosphoric acid, Nitric acid, DAP and CAN. The capacity of the plant is shown in table 2.4.

Ammonia a basic raw material for the plant is imported from USA, phosphate rock from Northern African Countries and pirite is provided from Etibank Ergani Copper plant. But as Etibank can not provide a continuous supply of pirite, the plant imports also pirite from Cyprus.

The major problem of the plant is raw material providing and financial problems.

2.1.5 Bandırma Gübre Fabrikaları A.Ş

It is a publicly owned company having a capital of 1 billion TL, established in 1969.

The plant lies between the Bandırma-Erdek highway and Marmara Sea, 10 km from Bandırma. TSP unit was put into operation in 1973, DAP and Ammonium Sulphate unit in 1980 and NPK/DAP unit in 1981. The capacity of the plant is shown in table 2.5.

Phosphate rock, phosphoric acid, and ammonia, which are the basic raw materials of the plant are imported. Phosphate rock is imported from Morocco, Tunusie and Israel, phosphoric acid from Morocco, Tunusie and USA and ammonia from USA and Russia. Sulphuric acid is supplied by Etibank Bandırma Sulphuric acid plant and from IŞKUR plant.

Table 2.5

Capacity of Bandırma Gübre Fabrikaları AŞ Plant

Product	ton/year
TSP/NSP	160 000
Ammonium Sulphate	180 000
NPK/DAP	165 000
DAP	165 000

Source: TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi, V 2, 1983, pp 1-30.

2.1.6 Ege Gübre Sanayii AŞ

It is an incorporated company of Yaşar Holding. The plant is at İzmir-Yeni Foça and put into operation in 1978 with a capacity of 300 000 ton/year compose fertilizer. Ammonia and phosphoric acid are imported and Urea is supplied by IGSAŞ.

The plant has a problem of capacity allocation.

2.1.7 Toros Gübre

Toros Gübre which is established in 1976 is a subsidiary of TEKFEN Holding. Company's initial capital is 1.2 billion TL and TC Ziraat Bank and Türkiye Tarım Kredi Kooperatifleri hold 25% and 15% of the capital respectively.

The plant is on Adana-Yumurtalık highway, it was put into operation in 1981. It produces NPK (20, 20, 0) and compose fertilizer (20, 20, 0), (15, 45, 0), (24, 24, 0).

Ammonia is imported from Libia, Algeria, URSS and USA and phosphoric acid from Spain and South Africa. On the other hand, urea is provided from IGSAŞ and sulphuric acid from domestic supplies.

2.1.8 Petkim Petrokimya AŞ

It is a state owned incorporated company.

The plant which is at Yarımca produces ammonium sulphate as a by-product of Caprolactam unit. It has a capacity of 100 000 ton/year. The raw material and their sources are as follows:

Benzene : import
Naphta : İpraş refinery
Sulphur : İpraş and TPAO refineries
Ammonia : IGSAŞ
Caustic-Soda : Petkim-Yarımca

Summing it up, there are nine fertilizer producers in Turkey, five of them owned by the state and the rest by the private sector. Ammonia, sulphuric acid, phosphoric acid and nitric acid are intermediate products, whereas ammonium sulphate, ammonium nitrate, urea, CAN, DAP, TSP and NSP are ultimate products of the sector.

2.2 Problems Encountered by Fertilizer Producers and Proposed Solutions

The problems of the sector are discussed in detail in "Gübre Sanayii ve Sorunları", a conjuncture report prepaired by EYA DATABANK and several solutions are suggested to these problems.(4)

The common problems of the fertilizer producers may be classified as importance and precedence problem, raw material problem, spare parts problem, electrical energy problem and financial problems.

(i) One of the basic problems of this sector is that importance and precedence of this sector is not well understand by decision authorities. Fertilizer industry, also called heavy chemical industry, has a very complex technology and its operation and service requirements need very much skill. The poor understanding of fertilizer sector problem will delay approaches and decisions to other problems of the sector.

(ii) Raw material availability is the problem, which is the most important one, of the sector. All plants, except Kütahya and Elazığ, are import dependant. For Elazığ plant there is a difficulty to provide raw material from domestic resources. The main inputs of the sector are ammonia, phosphate rock, pirite, sulphuric acid and phosphoric acid.

(4)DATABANK, Gübre Sanayii ve Sorunları Konjonktür Raporu, 15-30 September 1983, pp 77.

There is no consistent and stable policy and medium to provide these raw materials in our country. Ammonia is produced at Kütahya. In a small plant and at IGSAŞ, the rest of the required raw materials are imported. There is no phosphate rock in our country, and phosphate rock without H_2SO_4 is meaningless. At the other hand, H_2SO_4 production is not stable and consistent.

A solution is not developed for raw material problem yet.

(iii) The fertilizer industry requires very frequent spare part usage. These spareparts, specially made, are not available from domestic resources and foreign exchange bottlenecks make the import impossible and finally plants shot the operation.

(iv) Fertilizer industry requires a continuous and high quality electrical energy. Electricity shot downs, voltage fluctuations effect badly the production and create production losses.

(v) Fertilizer producers can not collect money in time from the distributers and this results in delay of raw material and spareparts payments.

The suggested solutions are grouped below.

(i) A policy must be developed for raw material production and it has to be put in practice. Ammonia, acid, phosphate, pirite production must be in stable conditions.

(ii) A continuous and high quality electrical energy is essential.

(iii) Instead of importing finished fertilizer, domestic fertilizer producers needs must be provided.

(iv) New investments must be accelerated and incentives must be given to these investments.

(v) Fertilizer producers association must be established to analyze and solve the problems of the sector.

(vi) Ministry of agriculture, and Ministry of Industry and Technology has to be interested on fertilizer industry problems.

The above solutions which are very round and general are far away to be specific to the problems . These are "musts" to be done in the sector, but the ways to perform these "musts" are absent.

After studying the present position of the sector demand potential of the sector will be investigated in the next chapter.

CHAPTER III

PREVIOUS DEMAND ANALYSIS STUDIES

Several institutions have developed various demand estimations of chemical fertilizers using different methods such as trend analysis and regression analysis.

But it is presumed that these methods which may give satisfactory results for various items may not give healthy results for fertilizer case. So only with the models which study the developments in the agricultural sector the most realistic estimates can be made.

3.1 SOME ESTIMATIONS PERFORMED BY STATE ORGANIZATIONS

In the programmed period state organization such as Ministry of Agriculture and Forestry, State Planning Organization (DPT), TZDK and IGSAŞ have performed independent researches to predict the future fertilizer consumption of Turkey.

3.1.1 Estimation of Ministry of Agriculture and Forestry

This is an old study performed in 1967 having an objective of very longrun planning (upto 2000) of agricultural production. In this study fertilizer requirement to reach agricultural production targets in the similiar countries are observed and observed and it is assumed that the yearly increase of chemical fertilizer consumption will be 3%.

In this study the following assumptions are made;

The cultivated land in 1966, 15.4 million hectar will be fertilized in the following 10 years.

1/3 of the uncultivated land in the same year will be cultivated until 1982 and will be fertilized.

332 000 hectar land which will be planted with trees will be fertilized.

Finally, all the fertilizer requrements will be provided by domestic sources.

With these assumptions, it is forecasted as 1.8 million ton N and 1.83 million ton PO_5 will be consumed in 1992.

3.1.2 Estimation of State Planning Organization

There are two estimations of DPT, Fertilizer

Main Plan and DPT-Special Expert Commission Report. The first plan is prepaired to analyze the main problems of the fertilizer sector, longrun production-demand positions, raw material problems and investment programs.

In this report calculating the fertilizer requirement the following assumptions are made:

to reach the target development rate

to realize the planned agricultural programs on time

to be effective on irrigation, mechanization and marketing

to use 1 kg N and 3 kg P_2O_5 per decare

to increase efficiency rather than cultivation area

Finally 1.290 million ton N and 1.109 ton P_2O_5 is expected to be consumed in 1992.

The second report is prepared for the preparation of the third five year plan. It includes longrun fertilizer production estimations. In this study longrun agricultural production targets are fixed and the necassary fertilizer amount to reach these targets are calculated. Economical factors (price, finance), irrigation possibilities, organization, farmer education, fertilizer utilization trend are taken into consideration.

As a result 1.513 million ton of N and 1.187 million ton of P_2O_5 are the estimated demand for 1992.

3.2 İGSAŞ STUDY

A study on fourth fertilizer complex, performed by İGSAŞ, is one of the detailed reports investigating the future fertilizer demand. Deterministic methods are used in this report and agricultural production targets have the main

importance.

Soil inputs, irrigation possibilities, plant-soil-fertilizer relations, agro-production targets and agricultural land are used as inputs in the model to calculate the fertilizer demand. The assumptions of the model may be summarized as:

The proportion of irrigated land and dry land will remain the same.

All the irrigated lands will be fertilized.

Unrised lands will remain the same.

Soil improvement studies have no effect within the period of investigation.

This deterministic method finds the future demand such as: N will be between 1.367 million ton and 1.307 million ton, P_2O_5 will be between 1.316 million ton and 1.270 million ton in 1992.

3.3 TÜMAŞ STUDİES

3.3.1 Trend Analysis

In this study, investigation the fertilizer demand of last year, the period between 1972 and 1981 is taken as a basis. Nitrogen and phosphate fertilizer consumption of these years are shown in table 3.1.

According to the data given in table 3.2, the projections are made by several trend analysis model such as linear, log-log, semilog and quadratic.

The first three equations developed for phosphate and nitrogen are formed economically and statistically significant. They are in x=0.01 range. However quadratic equations are not found statistically significant. The linear trend equation having the highest t and R^2 value is selected as a pre-estimation tool. According to these equations, projections are calculated and given in table 3.3.

Table 3.1

Equations for Fertilizer Consumption Estimation

Equation	R^2	F	
$Y=350.2+50.64t$	0.88	45	for nitrogen
$LnY=2.43+0.40Int$	0.78	21	
$LnY=2.41+0.22t$	0.88	43	
$Y=10.48+1.73t+0.07t^2$	0.88	19	

Equation	R^2	F	
$Y=256.6+41.55t$	0.88	44	for phosphate
$LnY=1.89+0.60Int$	0.76	19	
$LnY=1.87+0.18t$	0.85	33	
$Y=4.06+2.69t+0.59t^2$	0.88	18	

Table 3.2

Chemical Fertilizer Consumption of Turkey

YEAR	N 000 TON	Δ %	P_2O_5 000 TON	Δ %
1972	374.4		296.1	
1973	430.2	15	279.9	-5
1974	382.7	-11	217.6	-22
1975	367.5	-4	324.7	49
1976	590.6	61	521.9	61
1977	665.5	13	572.7	10
1978	776.4	17	635	11
1979	778.9	0	659.9	4
1980	638.1	-18	482.8	-27
1981	776.4	22	495.3	3
1982	847.2	9	569.6	15

Nitrogen fertilizer consumption shows a yearly decrease at 1974-75 and 1980 and yearly increases in the other years. The largest increases happened in 1976 by 61%.

At the other hand, phosphate fertilizer consumption shows a yearly decrease at 1973-74, 1980 and yearly increase in the other years. The largest increase happened in 1975 by 49%.

Source: TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi, V 2, 1983, pp iv-12.

Table 3.3

Fertilizer Demand Projections Obtained by Trend Analysis

YEARS	N DEMAND 000 TON[x]	Δ %	PHOSPHATE DEMAND 000 TON[xx]	Δ %
1984	1009		797	
1985	1059	5	838	5
1986	1110	5	880	5
1987	1160	5	921	5
1988	1211	4	963	5
1989	1262	4	1005	4
1990	1312	4	1046	4
1991	1363	4	1088	4
1992	1414	4	1129	4

[x] $Y=350.2+50.64t$

[xx] $Y=256.6+41.55t$

Both nitrogen fertilizer consumption and phosphate fertilizer consumption show a smooth yearly increase of 4-5%.

Source: TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi, V 2, 1983, pp iv-14.

3.3.2 Regression Analysis

In this analysis, dependent variable is the total phosphate and nitrogen fertilizer demand and independent variables are fertilizer prices, agricultural income, total irrigated land, total cultivated land and technological developments.

In Turkey, up to 1986, fertilizer prices were fixed and subvenced by the government. In June 1986 government set the prices free. As in the other countries natural income is selected to show the measure of the farmers' purchasing power.

Since 1960 huge increases happened in the amount of irrigated land. This increase has slowed in the last years and a significant change in the amount of irrigated land is not expected in the following years. Similarly there will be no significant change in the total of cultivated land. Finally, the regression equations are found for nitrogen and phosphate as follows:

$N: 32.08-4.00X_2+3.16X_3+150.12X_{10}$ $R^2=0.98$ $F=154$

$P=427.70-7.70X_2+5.56X_3+78.95X_{10}$ $R^2=0.93$ $F=52.85$

In these equations, N is the nitrogen fertilizer demand, P is the phosphate fertilizer demand, X_2 is the price, X_3 is the agricultural income and X_{10} is the trend variable. The projection obtained with these equations are given in table 3.4.

3.3.3 Projections Studying Developments in Agricultural Sector

This study investigates ecological conditions and agricultural potential of mine agricultural region, plant sowing areas, irrigations, soil efficiency, fertilizer consumption rates and fertilizer consumption versus efficiency.

Table 3.4

Fertilizer Demand Projection Obtained by Regression Analysis

YEARS	N 000 TON	Δ%	P_2O_5 000 TON	Δ%
1984	1028		751	
1985	1084	5	792	5
1986	1132	4	832	5
1987	1194	5	872	5
1988	1242	4	913	5
1989	1304	5	953	4
1990	1359	4	993	4
1991	1414	4	1034	4
1992	1520	7	1074	4

Both nitrogen fertilizer consumption and phosphate fertilizer consumption show smonth yearly increases, 4-5%. Only the yearly increase of nitrogen fertilizer happened to be 7% in 1992.

Source: TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi, V 2, 1983, pp iv-18.

It is the most realistic and fundamental study ever performed.

Sowable land potential is one of the important variables in estimating future fertilizer demand. In the last years, Turkey's total cultivated land is 20 million hectar and we have to add 8.2 million hectar which is out of cultivation every year to this amount. So, the total sowing potential is 28.2 million hectar.

In Turkey, where all sowable lands are in cultivation, irrigation has an importance in increasing the total crops. Irrigation, which may change the amount and the structure of the crops in agriculture, creates some possibilities and facilities in fertilizer consumption. Irrigation is done by DSI, TOPRAK SU and by farmers themselves. DSI irrigates 486 038 hectar, TOPRAK SU irrigates 649.493 hectar and farmers irrigate 1 786 107 hectar by their own possibilities.(1)

By the end of the sixth five year plan, 3 685 million hectar land is planned to be irrigated.

Irrigatable land potential, calculated taking into consideration the physical and chemical properties of soil, facilities of irrigation and economical factors such as pay back possibilities, is 85 million hectar.

In the expectation of irrigatable land, a systematic path is followed: first land potential and water potential is balanced and second future crops target are taken into consideration.

By the end of 1992, the total of irrigated land will be 4.3 million hectar. It is assumed that Atatürk Dam and Lower Fırat Irrigation will not in operation upto this date.

(1) TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi, V 2, 1983.

Calculating Turkey's crops projection Leontif Input-Output[2] method is used by DPT. In this method, the aquation is given as:

$X=AX+F$

X=Possibilities of production sector, (nx1) vector

A=Input-Output relation matrix (nxn)

F=(nx) column vector indicating final demand level

The study in this method is divided in two stages; at first, export projections are calculated according to the development of foreign markets in the last years, changes in the domestic demand trend, and using expect opinions. Second, domestic demand is calculated using household consumption expectations. Income increase and population increase are used in this part. Finally, total crops demand projections are calculated as seen in table 3.5.

The effect of chemical fertilizer on agricultural harvest is investigated by Soil and Fertilizer Research Institute, Agricultural Research Institute, Sugar Factories Research Institute and by Turkish Monopoly. The results of these investigations are published as "Regional Fertilizer Suggestions for Several Plants". These institutions conduct analysis of variances of several fertilizer efficiency experiments to find optimum fertilizer disage. The result of these analysis is given in table 3.6.

As described above, to reach total fertilizer demand the method studied step by step sowable lands and then the irrigation possibilities for these sowable lands. The target crops projection and optimum fertilizer disage to reach these target gives finally the total fertilizer demand seen in table 3.7.

(2)Chrang Alpha C, Matematiksel İktisadın Temel Yöntemleri, Teori, 1986, pp 110.

Table 3.5

Crops Demand Projections

Plant	1984	1988	1992
Wheat	18 210	20 100	21 900
Barley	6 050	6 690	7 500
Corn	1 620	2 215	2 790
Rice	195	270	370
Chick-pea	350	450	595
Lentil	300	445	700
Bean	230	330	500
Cotton	580	680	800
Tobacco	275	320	375
Sugar-beat	12 565	14 140	14 500
Potato	3 330	3 690	4 080
Olive	1 300	1 350	1 400
Tea	550	645	750
Sun flower	1 480	1 730	2 040
Vegetables	13 290	15 300	17 600
Grape	3 825	4 080	4 350
Hazelnut	270	315	400

Source: TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi, V 2, 1983, pp iv-39.

Table 3.6

Optimum Fertilizer Dosage

PLANT	NITRATE KG/Ha	P_2O_5 KG/Ha	EFFICIENCY 1/2
Wheat (D)	70	54.3	1135 2433
Barley (D)	68.4	51.2	1372 2790
Corn (D)	110.6	65.3	1690 3764
Sunflower (Ir)	104.0	75.8	1128 1409
Cotton (Ir)	129.2	65.7	660 1010

(D) Dry

(Ir) Irrigated

(1) Crops obtained from a land when fertilizer is not used

(2) Crops obtained from a land when fertilizer is used

Source: TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi, V 2, 1983, pp iv-46.

Table 3.7

Fertilizer Demand Obtained by Projections Studying Developments in Agricultural Sector

YEAR	NITRATE 000 TON	Δ%	P_2O_5 000 TON	Δ%
1985	1134		770	
1986	1237	9	904	17
1987	1296	5	999	11
1988	1355	5	1047	5
1989	1415	4	1095	5
1990	1474	4	1143	4
1991	1533	4	1191	4
1992	1591	4	1239	4

Both in nitrate and phosphoate fertilizer consumption yearly increases decrease gradually. That may be a sign of assymptotic function.

Source: TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi, V 2, 1983, pp iv-53.

3.4 EVALUTION OF PREVIOUS STUDIES

In the preceding paragraph, Turkey's chemical fertilizer demand is investigated by trend analysis, regression analysis and agricultural sector analysis. Agricultural sector analysis which investigates the fertilizer consumption in a deterministic manner from land and water potential, domestic and export agricultural market demand, so plant production targets and finally the necessary fertilizer amount to match this land-water potential and plant production targets is found the best model by the planning authorities. Other methods which are not so detailled and accurate may be used only for rough calculations. However because of the scale of the study and difficulty of obtaining and processing data the method used in agricultural sector analysis can not be chosen as a model in the study performed by the author. A more simple model, regression analysis is chosen as a research tool.

CHAPTER IV

A MODEL FOR ESTIMATING DEMAND AND PROJECTIONS

In the previous chapter, demand investigations such as trend analysis, regression analysis and agricultural plan analysis prepared by several institutions were given. In this part, the modal developed by the author will be explained and the application of the modal to a time series data will be presented.

4.1 DEMAND ANALYSIS

Multiple regression analysis is chosen for the study because of its practicality of processing data and its deterministic nature.

First, total fertilizer demand is divided as nitrate content fertilizer demand and phosphate content fertilizer demand because of their different usage by farmers. They constitute the dependent variables of the equations.

Assuming that the fertilizer consumption per unit area is fixed and knowing that the areas of cultivation increase every year in Turkey. The total areas of cultivation is the most important variable influencing the fertilizer demand.(1) So it is chosen as the independent variable.

Knowing the fact that the usage rate of fertilizer is higher in irrigated cultivation areas.(2) The tatol irrigated areas are chosen as the second independent variable.

(1) Agr. Eng. Ahmet Erdin, An Interview about the Usage of Fertilizer, Alaşehir, 1987.

(2) Ibid.

From economic point of view, the wealth of farmers and the price of fertilizers effect the fertilizer consumption(3), so agricultural income and fertilizer prices are chosen as the third and fourth independent variables.

The current fertilizer prices and current agricultural income figures are corrected by the deflator and 1969 fixed figures are obtained as shown in tables 4.1 and 4.2.

Because of the scarcity of data about agricultural sector only years between 1971 and 1984 could be taken as an investigation period. Full data is shown in table 4.2.

The initial regression equations are:

y NITRATE= f (LAND, IRRIG'D LAND, AGR. INCOME, $PRICE_{NITR}$)

y PHOSPHATE=f(LAND, IRRIG'D LAND, AGR. INCOME, $PRICE_{PHOSPH}$)

Land is the total sowable land in Turkey, in 000 Ha, Irrig'd land is the total irrigated land, by state and by farmers' own possibilities, in Ha.

Agricultural income is the total agricultural income of Turkey in 000 TL and finally price is the TL price per kg of nitrate and phosphate fertilizer respectively.

As a result of the multiple regression analysis the following equation with their confidency level are obtained.

Equation 1 y NITRATE=-7824.65+0.5142(LAND)

R^2	F	x
82	47	.05

t= 1.812
df= 11
x= .05

(3) Ibid.

Table 4.1

Current Figures and 1969 Fixed Figures of Fertilizer Prices

YEAR	NITRATE FERTILIZER CURRENT (TL/KG)	NITRATE FERTILIZER FIXED	PHOSPHATE FERTILIZER CURRENT (TL/KG)	PHOSPHATE FERTILIZER FIXED
1971	6.40	4.59	10.85	7.78
1972	6.40	3.95	10.85	6.69
1973	6.40	3.23	10.85	5.48
1974	6.40	2.52	10.85	4.26
1975	12.75	4.32	15.25	5.16
1976	12.75	3.72	15.25	4.45
1977	12.75	2.97	15.25	3.67
1978	12.75	2.07	15.25	2.47
1979	11.00	1.04	13.00	1.23
1980	57.50	2.47	112.50	5.23
1981	100.00	3.27	200.00	6.55
1982	100.00	2.57	200.00	5.14
1983	100.00	2.00	200.00	4.00
1984	190.00	2.54	380.00	5.07

Source: Akın Olgun, Agricultural Engineer (MS), Türkiye'de Gübre'ye Uygulanan Sübvansiyon Politikası ve Ortaya çıkan Sorunlar ile Çözüm yolları, Ege University, 1985.

Table 4.2

DATA USED IN THE REGRESSION ANALYSIS

YEAR	DEMAND[I] 000 TON	LAND II 000 Ha	IRRIG LAND[III] Ha	PRICE[(3)IV] TL/KG	AGR INCOME[V] 000 TL
1971					
1972	374.4(1) 296.1(2)	15 950	1 240 370	3.95 6.69	35 558.0
1973	430.2 279.9	16 030	1 427 061	3.23 5.48	31 394.1
1974	382.7 217.6	16 154	1 628 216	2.52 4.26	34 658.0
1975	367.5 324.7	16 241	1 670 185	4.32 5.16	38 352.3
1976	590.6 521.9	16 321	1 889 176	3.72 4.45	41 479.1
1977	665.5 572.7	16 531	2 013 988	2.97 3.67	41 000.3
1978	776.4 635	16 352	2 188 665	2.07 2.47	41 873.8
1979	778.9 659.8	16 607	2 265 747	1.04 1.23	42 985.2
1980	638.1 428.8	16 379	2 921 638	2.47 5.23	43 621.8
1981	776.4 495.3	16 711	2 992 902	3.27 6.55	43 556.9
1982	847.2 569.6	16 967	3 064 165	2.57 5.14	46 514.5
1983	975.7 655.5	17 164	3 174 973	2.00 4.00	46 329.8

(1) Nitrate demand

(2) Phosphate demand

(3) Fixed 1969 prices

Source: I, III TÜMAŞ
II, V İktisadi Rapor, TOBB several years
IV Akın Olgun, Agr. Eng (MS)

Equation 2: Y PHOSPH=-681.56+0.0285 (AG INC)

R^2	F	x	
.73	26.9	.05	t=5.186
			dy=.11
			x=.005

Regression figures obtained by Eq 1 and Eq 2 and real figures are combined in table 4.3.

Appendix I shows the output of the computer program.

4.2 FUTURE ESTIMATIONS OF TURKISH FERTILIZER DEMAND BASED ON THE REGRESSION ANALYSIS

While one purpose of regression analysis is to determine the variables explaining an event, the other purpose is to make inferences for the future. The latter use of regression analysis is more difficult than the former because one can not fully assure that the regression function which fits the past data will also be appropriate over the wider range of thi independent variables(1). We encounter another difficulty when we try to estimate the dependent variable bacause we need the estimated values of independent variables. So two kinds of errors, one coming from the function and the other coming from the estimated values of independent variables, will enter the analysis.

During the period of investigation of the study (1972-1983) and after the regulations about the distribution and price policy of fertilizer has changed several times. The distribution of fertilizer which was performed by TZDK and TŞFAŞ until 1 July 1986 is left now to the dealers of fertilizer factories. On the other hand, the price which was quoted by producers and distributor institutions,

(1) Neter, John and Wasserman, William, Applied Linear Statistical Model, Homewood, Illinous, Richard D. Inc., 1974.

Table 4.3

Comparison of Real and Regression Figures

YEAR	NITRATE REAL	NITRATE REGRESSION	NITRATE REAL	NITRATE REGRESSION
1972	374.4	376.8	296.1	331.8
1973	430.2	418.0	382.7	213.2
1974	382.7	481.7	217.6	306.2
1975	367.5	526.5	324.7	411.5
1976	590.6	567.6	521.9	500.6
1977	665.5	678.6	572.7	486.9
1978	776.4	583.6	635.0	511.8
1979	778.9	715.0	659.8	543.5
1980	638.1	597.0	482.8	561.7
1981	776.4	768.0	495.3	559.8
1982	874.2	899.8	569.6	644.1
1983	975.7	1001.1	655.5	638.8

Source: Calculated.

when there is no agreement between them by the Ministry of Food-Agriculture and Breedering, began to be quoted in dollar basis by the Money and Credit Assembly for 6 months periods after 1984. And finally from 1 July 1986 the government set the fertilizer prices free.

All these fluctautions in the agricultural environment show the difficulty in correct estimation of future fertilizer demand.

Estimating for both future land and agricultural income figures graphical extrapollation method is used. (Chart 1 and 2)

Total cultivation land, the independent variable of nitrate demand equation is expected to continue its increasing trend in the following years, being 17 800 in 1988 and 18 270 in 1992. (Table 4.5)

Short-run land improvements which will be realized by the state is taken into consideration.

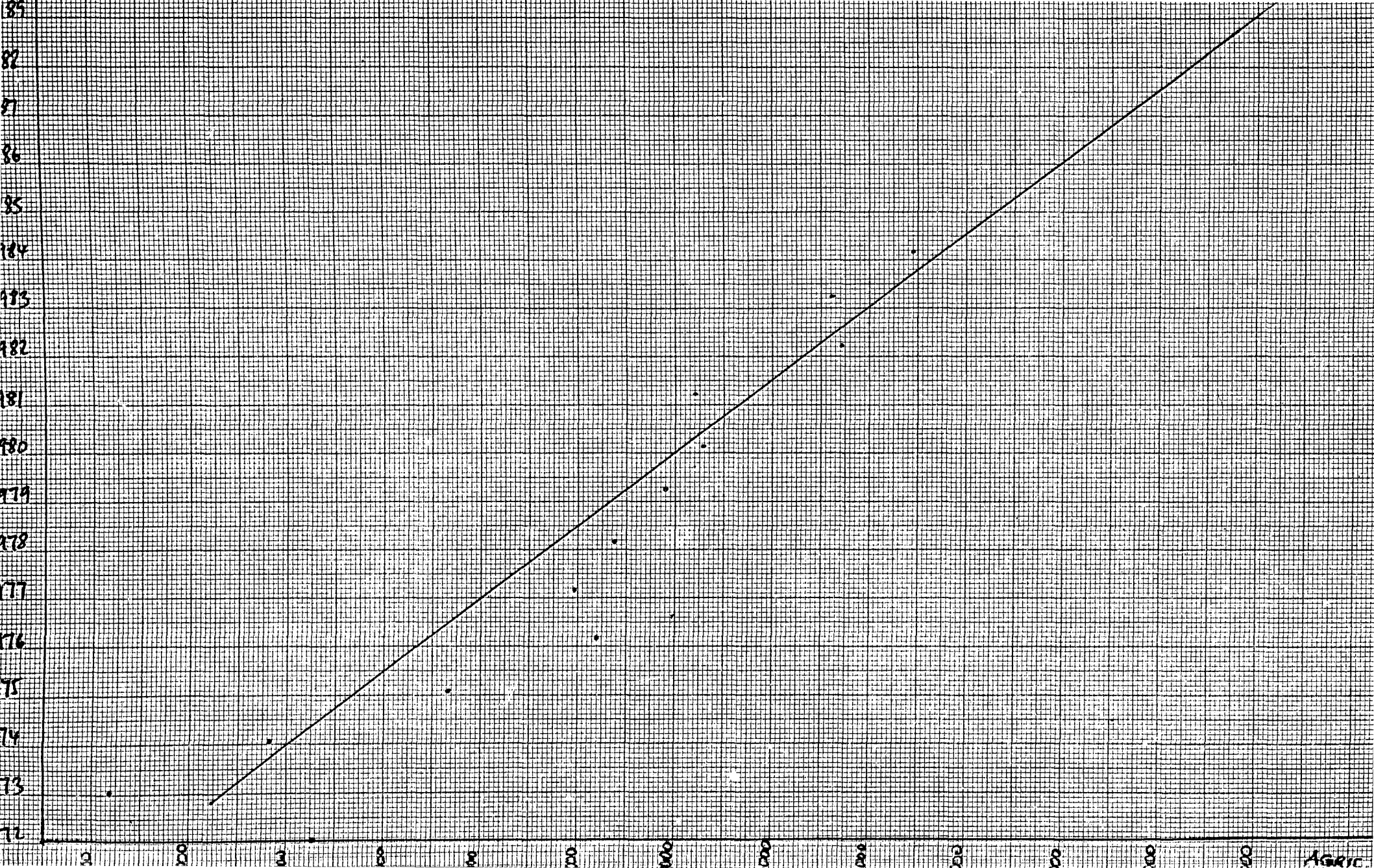
Agricultural income, the independent variable of phosphate demand equation is expected to increase also in the following years being 54 billion TL in 1988 and 59.5 billion TL in 1992. (Table 4.5)

The importance given to the agricultural sector and to the farmers by the government in the last year is expected to continue in the threshold of the elections.

The projections are based on these expectations, but many other political decisions will be effective on the future demand.

The regression analysis shows that nitrogen usage depends in the sowable land area and phosphate usage depends on the agricultural income.

Nitrogen, constituent of cellulose, the main substance of the plant is indispensible for the plant growth and development, so it's directly dependent to the sowable land area. The price level or agricultural income level do not effect very much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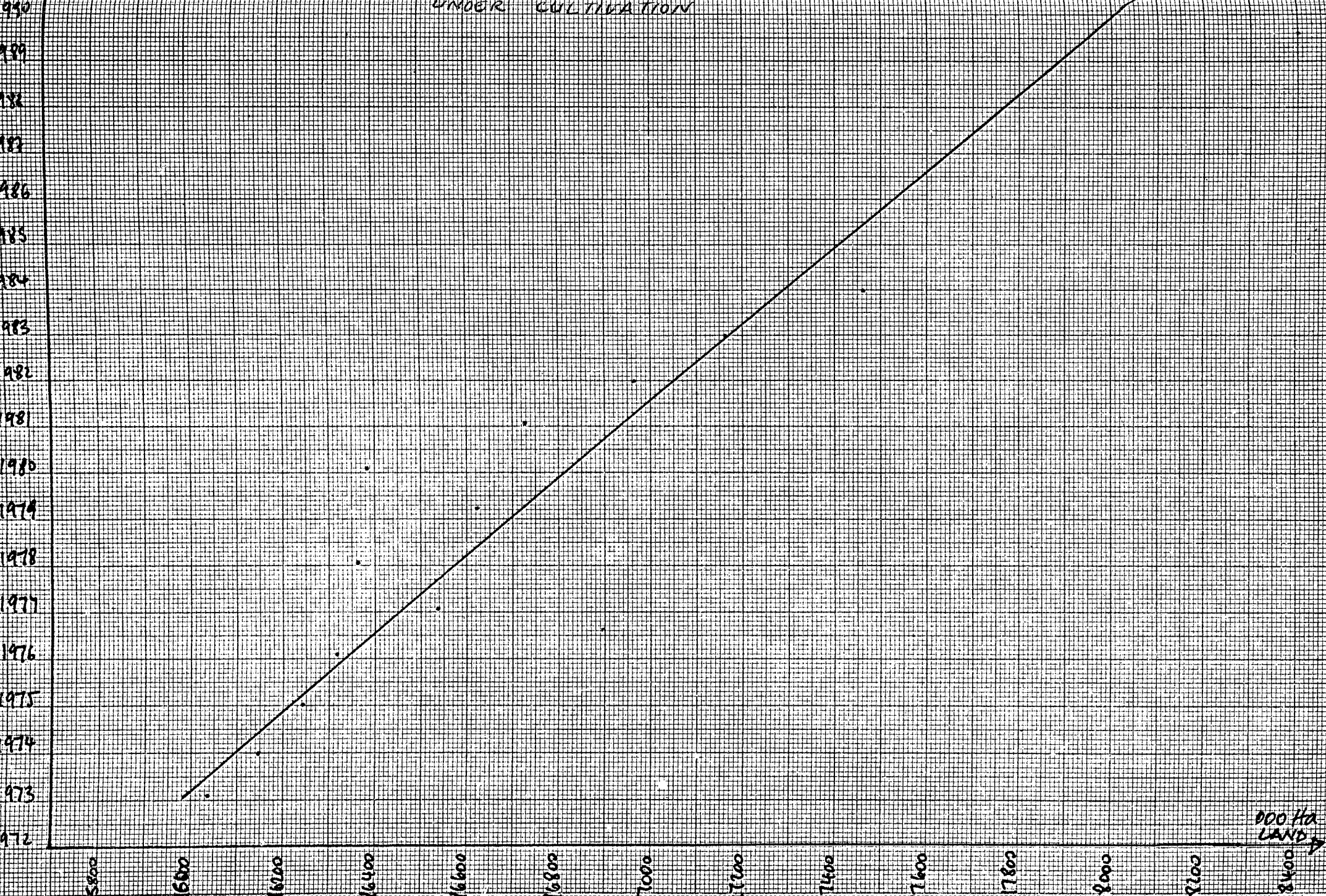

UNDER CULTIVATION
000 Ha
LAND

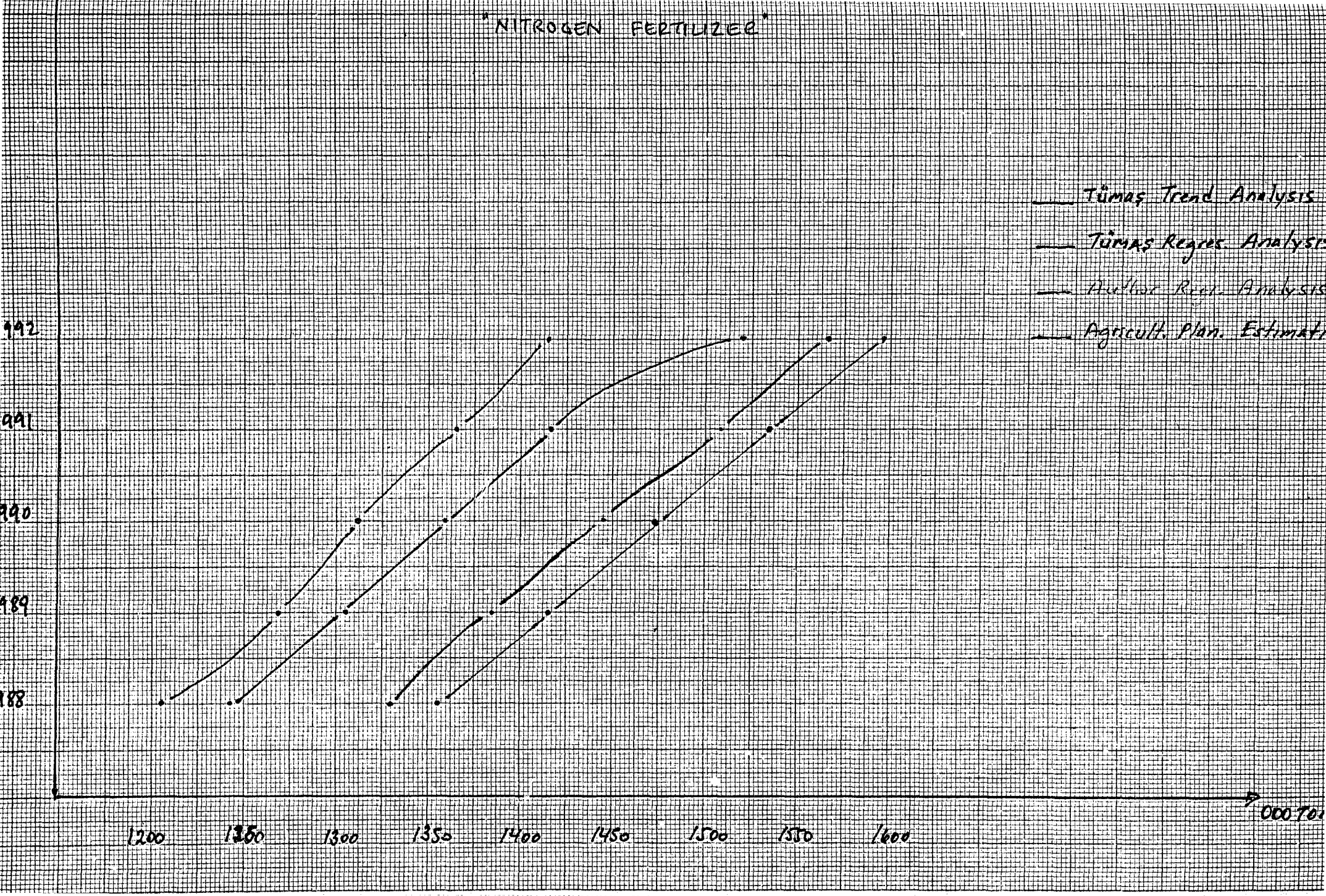
Table 4.4

Demand Projections by Using Chart 1 8.2 and EQ 1 and EQ 2

YEAR	LAND 000 Ha	NITRATE DEM 000 TON	AGR INCOME 000 TL (1969)	PHOSPH DEM 000 TON
1988	17 800	1 328	54 000	857
1989	17 910	1 385	55 400	897
1990	18 050	1 446	56 800	937
1991	18 150	1 508	58 000	972
1992	18 270	1 569	59 500	1015

Source: Calculated.

"NITROGEN FERTILIZER"



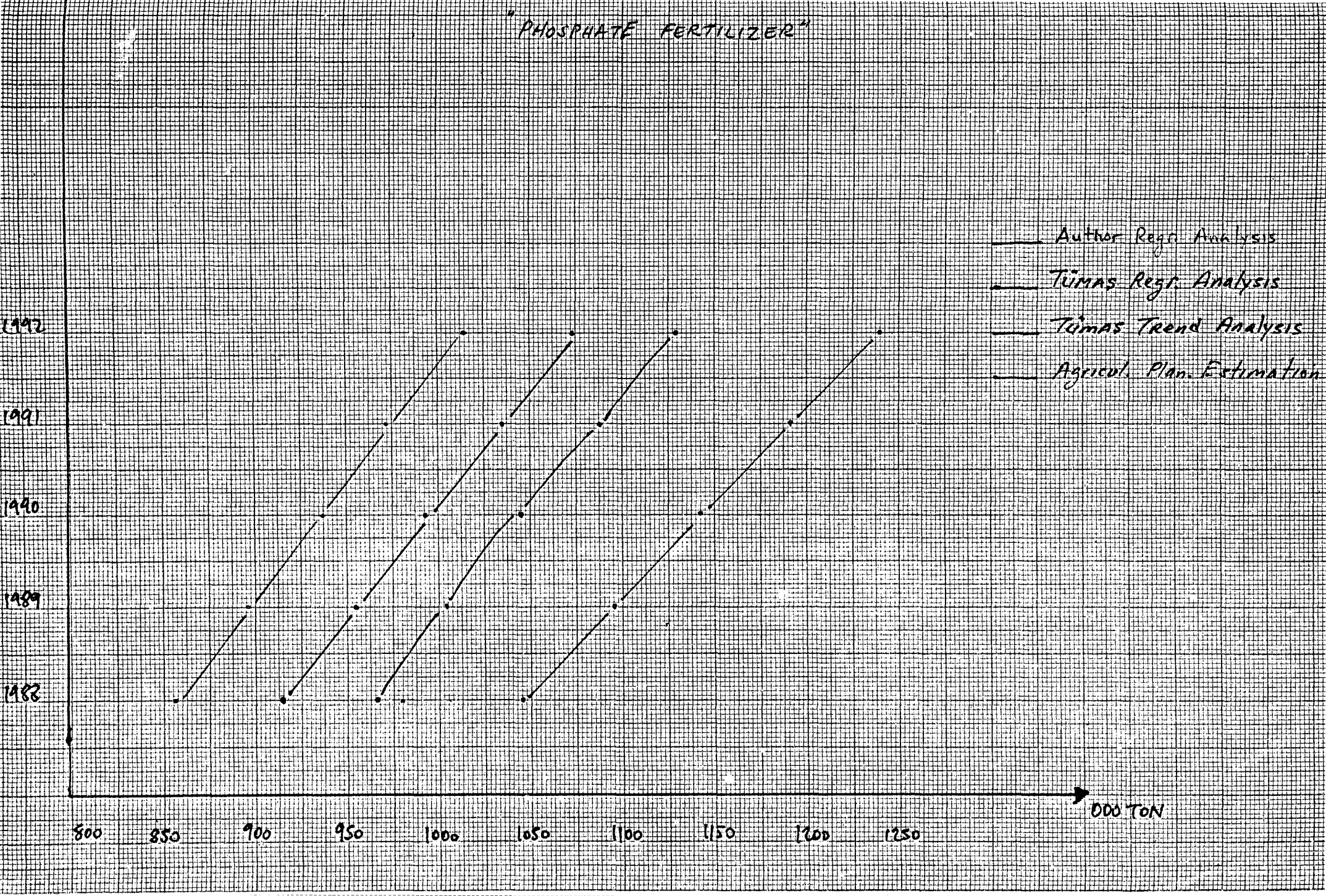

"PHOSPHATE FERTILIZER"
Author Regr. Analysis
Tümas Regr. Analysis
Tümas Trend Analysis
Agricul. Plan. Estimation
1992
1991
1990
1989
1988
800
850
900
950
1000
1050
1100
1150
1200
1250
000 TON

Table 4.5

RESULT OF VARIOUS DEMAND PROJECTIONS

YEAR	TÜMAŞ TREND ANALYSIS N 000 TON	TÜMAŞ TREND ANALYSIS P_2O_5 000 TON	TÜMAŞ REGRES ANALYSIS N 000 TON	TÜMAŞ REGRES ANALYSIS P_2O_5 000 TON	AGRIC PLAN ESTIMATION N 000 TON	AGRIC PLAN ESTIMATION P_2O_5 000 TON	AUTOR ESTIMATION N 000 TON	AUTOR ESTIMATION P_2O_5 000 TON
1988	1 211	963	1 242	913	1 355	1 047	1 328	857
1989	1 262	1 005	1 304	953	1 415	1 095	1 385	897
1990	1 312	1 046	1 359	993	1 474	1 143	1 446	937
1991	1 363	1 088	1 414	1 034	1 533	1 191	1 508	972
1992	1 414	1 129	1 520	1 074	1 591	1 239	1 569	1 015

Source: TÜMAŞ and CALCULATED

its usage because it is a "must".

On the other hand, as phosphorus effects only the quality of the crops, it is of secondary importance. It is used accordingly to the the farmers' purchase capacity in ther words to the agricultural income level.

Another important finding is that the demand appears independent from the pure changes in the result of the regression whereas it is dependent in actual life. This fact may be explained by the real (or 1969 fixed) prices are taken in the analysis in spite of actual prices. So inflation rate being higher than fertilizer price increases shows that a decrease in the real (1969 fixed) prices and no significant correlation between price and demand could obtained.

CHAPTER V

SUMMARY, CONCLUSION AND IMPLICATIONS

As described in the previous chapter, the domestic fertilizer demand will increase in the following years. The domestic demand of nitrate content fertilizer which was 1 236 000 ton, while the domestic production was 990 000 ton and the domestic demand of phosphate content fertilizer which was 904 000 ton , while the domestic production was 714 400 ton in 1986 is expected to be 1 591 000 ton with a domestic production of 989 000 ton and 1 238 000 ton with a domestic production of 722 900 ton in 1992 for nitrate and phosphate content fertilizers respectively. In other words the deficit increases from 274 000 ton to 602 000 ton in nitrate fertilizers and from 190 000 to 515 000 in phosphate fertilizers. Deficits are planned to be satisfied by import policies.

When the study estimation is compared with the other estimations, no huge differences are noticed. Author estimation has the second largest figures for nitrate fertilizer demand and the smallest figures for the phosphate demand in comparison with the other studies. Agricultural plan estimation has the largest figures for both nitrate and phosphate fertilizers.

Unfortunately there is no stable investment policy to decrease the supply deficit. Important deviations are noticed especially in state investment programs. The main investors and producers in the fertilizer sector are Azot Sanayii, IGSAŞ and İller Bankası, Urfa, Tekirdağ, Muğla-Aydın, Elbistan, Yozgat-Lorgun, Çanakkale-Çan with beginning dates of 1976 and which are in the 1980 Investment Program

Study Project are out of program now. (1)

Fourth fertilizer complex, which was in the 1980 Program with a project value of 29 billion TL is now in the study-project phase. Anadolu Fertilizer Complex entered in the program as a study with a value of 11 billion TL. Mazıdağı Fertilizer Plant continues as a Study-project since 1976. Trakya Fertilizer Complex project is in study stage from 1979.

As clearly noticed above, all these gigantic state owned projects develop very slowly and without stability. Investment could not be realized in the programmed period and huge changes arise in the investment decisions at the project stage.

Although that capacity allocation of the sector is increased from 30-40% (before 1980's) to 75-80% (1985) it is not still sufficient and importation become indispensible.

Besides the instability of the investments, the other major problem of the Turkish fertilizer industry is the import raw material dependence. Ammonia, phosphate rock, pirite, sulphuric acid and phosphoric acid are the basic inputs of the sector. Unfortunately there is not a secure and stable policy to provide these inputs in our country. If we neglect the small production of Kütahya and IGSAŞ there is no serious ammonia plant in the country. The presence of phosphate rock in our country is unknown and phosphate rock without H_2SO_4 is useless. On the other hand, sulphuric acid production fluctuates, a stable production can not be obtained. In short, there is no stable behaviour for the raw material problem.

As a result, state decision authorities must

(1) EYA DATABANK, Konjonktür Raporu, Gübre Sanayii ve Sorunları, 1983.

be more sensitive for fertilizer plant investments, creating more stable medium for them and accelerating their progress.

Incentives also must be given to the private sector to make the fertilizer sector attractive for new investments.

Realistic and permanent solutions for raw material problem is indispensible. Domestic stable sulphuric acid and ammonia production must be maintained. New plant establishments are required.

In conclusion, we state that this study will reach its purpose if it describes the present fertilizer producers and then problems, also the present and future demand potential of the sector and gives some guidelines to the government and corporate planners also to the researches of the subject.

BIBLIOGRAPHY

Çolakoğlu, Habil, Doç Dr, Gübre ve Gübreleme, Gübreler ve Gübreleme Yöntemleri, Agricultural Faculty, Ege University, Bornova, 1983.

Eya, Databank, Gübre Sanayii ve Sorunları, 1983.

Erdin, Ahmet, Agr. Eng., Interviews, Alaşehir, 1987.

Gübre Fabrikaları TAŞ, Several Publicities.

Olgun, Akın, Agr. Eng., MS, Türkiye'de Gübre'ye Uygulanan Sübvansiyon Politikası ve Ortaya Çıkan Sorunlar ile Çözüm Yolları, Seminar, Ege University, Bornova, 1985.

Teberler, Metin, Gübre Sanayii ve Bu Alandaki İki Kuruluşun Finansman Analizi, Finishing Project, Istanbul Technical University, Istanbul, 1984.

TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi Gübre Pazarlama ve Fiyatlandırma Etüdü, Cilt 1, Ozel Sonuç ve Tavsiyeleri, Istanbul, 1983.

TÜMAŞ, Gübre Rasyonalizasyonu ve Enerji Tasarrufu Projesi Gübre Pazarlama ve Fiyatlandırma Etüdü, Cilt 2, Kimyevi Gübre Uretim, Tüketim ve Talep Durumu, Istanbul, 1983.

Wasserman, William, Applied Linear Statistical Model, Homewood, Illinois, Richard D. Irwin Inc., 1974.

APPENDICES

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ATISTICAL LANGUAGE FOR MICROCOMPUTERS      V2.00                    PAGE 1

  1  RUN NAME
  2  RUN NAME          .                    M B A   THESIS
  3  RUN NAME
  4  RUN NAME        DEMAND ANALYSIS OF CHEMICAL FERTILIZER INDUSTRY IN TUR
  5  RUN NAME
  6  RUN NAME
  7  RUN NAME          .       SUBMITTED TO:DOC.DR. MUZAFFER BODUR
  8  RUN NAME          .       SUBMITTED BY:HALIM ALANYALI BS CHEM ENG
  9  RUN NAME
 10  RUN NAME
 11  RUN NAME          .              BOGAZICI UNIVERSITY
 12  RUN NAME          .          INSTITUTE OF SOCIAL SCIENCES
 13  RUN NAME          .              BEBEK-JUNE,1987
 14  RUN NAME        DEMAND ANALYSIS OF NITRATE FERTILIZER
 15  VARIABLE LIST   DEMAND,AGINC,LAND,IRRIG,PRICE
 16  INPUT FORMAT    FIXED(F5.1,F8.1,F6.0,F9.0,F5.0)

CORDING TO YOUR INPUT FORMAT, VARIABLES ARE TO BE READ AS FOLLOWS.

RIABLE                FORMAT   RECORD     COLUMNS

MAND                  F 5.0         1       1-  5
INC                   F 8.0         1       6- 13
ND                    F 6.0         1      14- 19
RIG                   F 9.0         1      20- 28
ICE                   F 5.0         1      29- 33

E INPUT FORMAT PROVIDES FOR 5 VARIABLES.
 PROVIDES FOR 1 RECORDS PER CASE.
MAXIMUM OF 33 COLUMNS ARE USED ON A RECORD.

 17  VAR LABELS      DEMAND,OOOTON/AGINC,OOOTL/LAND,OOOHa/IRRIG,Hs/PRICE,TL
 18  PEARSON         AGINC,LAND,IRRIG,PRICE/AGINC,LAND,IRRIG,PRICE

- - - - - - - P E A R S O N   C O R R E L A T I O N - - - - - - - - -

RR COEF
LID N
STATISTIC

              AGINC      LAND       IRRIG      PRICE

INC          1.0000    0.8713     0.8931    -0.4d47
                  0        12         12         12
              *****     5.614      6.278     -1.570

ND           0.8713    1.0000     0.88d3    -0.4966
                 12         0         12         12
```

	5.614	*****	5.988	-1.809
RIG	0.8931	0.8843	1.0000	-0.4840
	12	12	0	12
	6.278	5.988	*****	-1.749
ICE	-0.4447	-0.4966	-0.4840	1.0000
	12	12	12	0
	-1.570	-1.809	-1.749	*****

- - - - - - - - P E A R S O N C O R R E L A T I O N - - - - - - - - - -

RR COEF
LID N
STATISTIC

	AGINC	LAND	IRRIG	PRICE
INC	1.0000	0.8713	0.8931	-0.4447
	0	12	12	12
	*****	5.614	6.278	-1.570
ND	0.8713	1.0000	0.8843	-0.4966
	12	0	12	12
	5.614	*****	5.988	-1.809
RIG	0.8931	0.8843	1.0000	-0.4840
	12	12	0	12
	6.278	5.988	*****	-1.749
ICE	-0.4447	-0.4966	-0.4840	1.0000
	12	12	12	0
	-1.570	-1.809	-1.749	*****

D CELLS USED OF 815

- -

```
 19  OPTION          T-STATISTICS
 20  REGRESSION      VARIABLES=DEMAND,AGINC,LAND,IRRIG,PRICE
 21                  REGRESSION=DEMAND(3) WITH AGINC TO PRICE(1)
```

- - - - - - - - - - - - R E G R E S S I O N - - - - - - - - - - - - -

DEPENDENT VARIABLE DEMAND OOOTON
MEAN RESPONSE 633.633 STD. DEV. 206.6521

- -

VARIABLES ENTERED ON STEP 1

MAND ANALYSIS OF NITRATE FERTILIZER PAGE 3

.9080	MULTIPLE R
.8244	R SQUARE
.8069	ADJUSTED R SQUARE
.8147	STANDARD ERROR

ALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
GRESSION	1	387283.032	387283.032	46.959
SIDUAL	10	82473.175	8247.317	

RIABLES IN THE EQUATION :

RIABLE	B	STD ERROR B	F	BETA
ND	0.5142	0.0750	46.9587	0.9080
ONSTANT)	-7824.6530			

RIABLES NOT IN THE EQUATION :

RIABLE	PARTIAL	TOLERANCE	F
INC	0.4326	0.0000	2.0725
RIG	0.3188	0.0000	1.0185
ICE	0.5541	0.0000	3.9877

- - - - - - - - - - - - - - - - R E G R E S S I O N - - - - - - - - - - - - - - - -

DEPENDENT VARIABLE DEMAND OOOTON
MEAN RESPONSE 633.633 STD. DEV. 206.6521

- -

VARIABLES ENTERED ON STEP 2
LAND OOOHa
PRICE TL

9372	MULTIPLE R
8783	R SQUARE
8513	ADJUSTED R SQUARE
6876	STANDARD ERROR

EMAND ANALYSIS OF NITRATE FERTILIZER PAGE 4

NALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
EGRESSION	2	412605.143	206302.572	32.488
ESIDUAL	9	57151.063	6350.118	

ARIABLES IN THE EQUATION :

ARIABLE	B	STD ERROR B	F	BETA
AND	0.4389	0.0759	33.4878	0.7752
RICE	-0.5979	-0.2994	3.9877	-0.2675
CONSTANT)	-6417.2025			

ARIABLES NOT IN THE EQUATION :

ARIABLE	PARTIAL	TOLERANCE	F
RRIG	0.3113	0.0000	0.8583
GINC	0.5012	0.0000	2.6833

- - - - - - - - - - - - - - - - R E G R E S S I O N - - - - - - - - - - - - - - - -

DEPENDENT VARIABLE DEMAND OOOTON
MEAN RESPONSE 633.633 STD. DEV. 206.6521

- -

VARIABLES ENTERED ON STEP 3
LAND OOOHa
PRICE TL
AGINC OOOTL

0.953d	MULTIPLE R
0.9089	R SQUARE
0.8747	ADJUSTED R SQUARE
5.1408	STANDARD ERROR

IALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
GRESSION	3	426959.582	142319.861	26.60d
SIDUAL	8	42796.625	5349.578	

RIABLES IN THE EQUATION :

RIABLE	B	STD ERROR B	F	BETA
ND	0.2647	0.1271	4.3376	0.4675
ICE	-0.5852	-0.2749	4.5312	-0.2618
INC	0.0156	9.5356E-03	2.6833	0.3563

(CONSTANT) -4189.2827

EMAND ANALYSIS OF PHOSPHATE FERTILIZER IND. PAGE 2

0.8538	MULTIPLE R
0.7290	R SQUARE
0.7019	ADJUSTED R SQUARE
5.9158	STANDARD ERROR

NALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
EGRESSION	1	198587.282	198587.282	26.903
ESIDUAL	10	73815.167	7381.517	

ARIABLES IN THE EQUATION :

ARIABLE	B	STD ERROR B	F	BETA
GINC	0.0285	5.4950E-03	26.9033	0.8538
CONSTANT)	-681.5579			

ARIABLES NOT IN THE EQUATION :

ARIABLE	PARTIAL	TOLERANCE	F
AND	0.0410	0.0000	0.0151
RRIG	0.3375	0.0000	1.1569
RICE	0.7493	0.0000	11.5220

- - - - - - - - - - - - - - R E G R E S S I O N - - - - - - - - - - - - - -

DEPENDENT VARIABLE DEMAND
MEAN RESPONSE 475.908 STD. DEV. 157.3654

- -

VARIABLES ENTERED ON STEP 2
AGINC
PRICE

0.9387	MULTIPLE R
0.8812	R SQUARE
0.8548	ADJUSTED R SQUARE
9.9740	STANDARD ERROR

EMAND ANALYSIS OF PHOSPHATE FERTILIZER IND. PAGE 3

NALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
EGRESSION	2	240030.489	120015.244	33.366
ESIDUAL	9	32371.961	3596.885	

ARIABLES IN THE EQUATION :

ARIABLE	B	STD ERROR B	F	BETA
GINC	0.0250	3.9755E-03	39.4057	0.7476
RICE	-0.3952	-0.1164	11.5220	-0.4043
CONSTANT)	-360.6007			

ARIABLES NOT IN THE EQUATION :

ARIABLE	PARTIAL	TOLERANCE	F
RRIG	0.0682	0.0000	0.0374
AND	0.0397	0.0000	0.0126

- - - - - - - - - - - - - - - - R E G R E S S I O N - - - - - - - - - - - - - - - -

DEPENDENT VARIABLE DEMAND
MEAN RESPONSE 475.908 STD. DEV. 157.3654

- -

VARIABLES ENTERED ON STEP 3
AGINC
PRICE
IRRIG

0.9390	MULTIPLE R
0.8817	R SQUARE
0.8374	ADJUSTED R SQUARE
63.4640	STANDARD ERROR

NALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
EGRESSION	3	240180.980	80060.327	19.878
ESIDUAL	8	32221.469	4027.684	

ARIABLES IN THE EQUATION :

ARIABLE	B	STD ERROR B	F	BETA
AGINC	0.0267	0.0102	6.9301	0.8012
PRICE	-0.3850	-0.1341	8.2395	-0.3938
IRRIG	-1.3133E-05	-6.7945E-05	0.0374	-0.0569

(CONSTANT) -408.7954

ARIABLES NOT IN THE EQUATION :

ARIABLE	PARTIAL	TOLERANCE	F	
AND	0.0899	0.0000	0.0570	

UMBER OF VARIABLES CRITERION MET
20 FINISH

UN COMPLETED

UMBER OF COMMAND LINES READ 20
UMBER OF ERRORS DETECTED 0