CHAPTER - 1
INTRODUCTION OF FERTILIZER INDUSTRY

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1.1 Introduction

Indian Fertilizer Industry is one industry with immense scopes in future. India is primarily agriculture oriented country and its economy is highly based on the agrarian produce the agricultural sector and its other associated spheres provide employment to a large section at the country’s population and share about 25% to the GDP. The Indian fertilizer industry is one of the allied sectors of the agricultural sphere. India has emerged as the third largest producer of nitrogenous fertilizers. The adoption of book to break five year plan has paved the way for self sufficiency in the production of food grains. In recently production has gone up to an extent that there is scope for the export at food reins. The surplus has been foliated by the way of chemical fertilizers. The large scale use of chemical fertilizers has been instrumental in bringing about the green revolution in India. The fertilizer industry in India began its journey way back in 1906. During this period the first single super phosphate factory was established in Ranipat in Chennai. In the pre and post independence era a couple of large scale fertilizer units like as the Fertilizer Corporation of India in Sindri, Bihar and the Fertilizer and Chemical Travancore of India in Cochin, Kerala were established. At present there are 57 large scale fertilizer units. The units manufacture an extensive range of phosphate, nitrogenous and complex fertilizers 29 at these 57 units are engaged in the manufacturing of urea while is of them produce calcium ammonium nitrate and Ammonium Suhphate. The remaining 20 fertilizer plants produce complex fertilizer and DAP. There is also a member of medium and small scale industries in operation.

As per government of India records as on 31-1-2007 the Indian Fertilizer Industry has made a production at 120.61 MT of nitrogen (N) and 56.59 MT of phosphate (P) nutrient. The installed capacity of urban India is estimated to be 210.61 MT. These successes in the production
by fertilizer companies of India have groaned India, the 3rd largest fertilizer producer in the world.

The installed capacity of each sector private, public and co-operative sector is as follows:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Sector</th>
<th>Capacity (MT)</th>
<th>Percentage share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Private</td>
<td>53.94</td>
<td>35.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35.13</td>
<td>44.73</td>
</tr>
<tr>
<td>2</td>
<td>Public</td>
<td>34.98</td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.00</td>
<td>28.27</td>
</tr>
<tr>
<td>3</td>
<td>Co-operative</td>
<td>32.00</td>
<td>18.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18.00</td>
<td>27.00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>120.92</td>
<td>58.13</td>
</tr>
</tbody>
</table>

Agriculture is the backbone of the Indian Economy. It earns about 14% of the India’s foreign exchange. And its contribution is about 21% of GDP, and 65% of the population agriculture employs.

The development of industry, trade, commerce, infrastructure, transportation communication etc depends upon agriculture. Fertilizer plays an important role for increasing agricultural production and productivity of land. After green revolution the use of chemical fertilizer and insecticides are increased.

Indian economy is based on five year plan and the government gave adequate emphasis in all five year plan in the area of agriculture. The tenth plan has assessed that agriculture production in world grows at the rate of 4% but in the next 3 year of plan the country was able to ensure about 1.5% rate of growth. The use of chemical fertilizer is considered as the basic tool to increase the agricultural production.

Comparing the hectare wise agricultural production of India with other developed nation is very low. The use of chemical fertilizer is necessary to increase the productivity. For the purpose the central and
state government declared various scheme for the development of Indian agricultural production.

Due to Indian government highly support there is significant increase in production of chemical fertilizer.

The following table 1.2 shows the increase of the use fertilizer production during the period 2003-04 to 2007-08.³

**TABLE: 1.2**

<table>
<thead>
<tr>
<th>Year</th>
<th>MTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-04</td>
<td>1275764</td>
</tr>
<tr>
<td>2004-05</td>
<td>1392018</td>
</tr>
<tr>
<td>2005-06</td>
<td>1528265</td>
</tr>
<tr>
<td>2006-07</td>
<td>1778070</td>
</tr>
<tr>
<td>2007-08</td>
<td>1594703</td>
</tr>
</tbody>
</table>

Sources 46th annual report of 2007-08 (GSFC)

To analyze the above table 1.2 it seems 9.11%, 19.79%, 39.37% and 24.99% rise respectively during the period of 2005-06 to 2007-08. It shows the growth rate of production of fertilizers in the GSFC.

In the year 2004-05 the production of chemical fertilizer of all the fertilizer companies in Gujarat was 33947.9 thousand tones which increased to 34969.3 thousand tones in 2005-06. The rate of increase in the production of chemical fertilizer was nearly 3% in which two corporate units named GSPC and GNFC’s contribution is more.⁴ In the production of chemical Industries IFFCO and KIBHCO are working in co-operative sector in Gujarat.

The Indian fertilizer industry has helped in the growth of the Indian economy. The fertilizer sector by enhancing the agriculture productivity has in turn resulted in providing a major support to the farmers who are primarily depend on agriculture. Fertilizers have played a pivotal role in Indian food security.
1.2 List of Fertilizer Industry in India

CFL : Coromandal Fertilizer Limited
DMCC : Dharmsi Morarji Chemicals Company Limited
FACT : Fertilizers and chemical Travancore Limited
FCI : Fertilizer Corporation of India Limited
GFC : Godavari Fertilizers and Chemical
GNFC : Gujarat Narmada Valley Fertilizer Company Limited
GSPC : Gujarat State Fertilizer Company Limited
HCL : Hindustan Copper Limited
HFCL : Hindustan Fertilizer Corporation Limited
IFFCO : Indian Farmers Fertilizer Co-operation Limited
IISCO : Indian Iron steel Company Limited
JCF : Jayshree Chemicals and Fertilizers
KKIBHCO : Krishak Bharti Co-operative Limited
MCFL : Mangalore Chemical and Fertilizer Limited
MFL : Madras Fertilizer Limited
MMTC : Minerals and Metals Trading Corporation
NFL : National Fertilizers Limited
RCFL : Rashtriya Chemical and Fertilizers Limited
SAIL : Steel Authority of India Limited
SFC : Shriram Fertilizers and Chemical
SPIC : Southern Petrochemicals Industries Co-operative Limited
TISCO : Tata Iron and Steel Company Limited
JAEL : Juari Agro Chemicals Limited

1.3 Need for fertilizers in India:

Fertilizer is a substance to soil to improve plants’ growth and yield. First used by ancient farmers fertilizer technology developed significantly as the chemical needs of growing plants were discovered. Modern synthetic fertilizers are composed mainly of nitrogen,
phosphorous and potassium compounds as the secondary nutrients added. The use of synthetic fertilizers has significantly improved the quality and quantity of food available today but their long-term use is debated by environmentalists.

Following points shows need for fertilizers in India:

1. It is universally accepted that the use of chemical fertilizer in an integral of the package of practice for raising the agricultural production to a higher place. Studies continued by the Food and Agricultural Organization of the United Nations (FAO) have established beyond doubt that there is a close relationship between the Gerry crop yields and fertilizer consumption level. Moreover, the nutritional requirement of different crops could not be fully met with the use of organic manures like FYM and other bulky organic manures like neem cake, castor cake, groundnut cake etc. for want of their availability in adequate quantities.

2. Increasing agriculture production in India by area increasing process is no longer possible as cultivable and left over is only marginal. Further, a considerable cultivable land is being diverted year after year for housing and industrial etc. Hence self-sufficiency in food lies in increasing the field per unit area per unit time through adoption of modern agricultural technology.

3. Fertilizer have the advantages of smaller bulk, easy transport relatively quick in an availability at plan- food constituents and the facility of their application in proportion suited to the actual requirements of crops and soils.

4. There is need for an efficient use of fertilizers as major plant nutrient resource in enhancing the farm productivity.

5. Other resource of plant nutrients like organic manures bio-fertilizers etc. also should be integrated to get the maximum agriculture output term every kilogram of applied nutrient in the form of fertilizers.
To improve our agriculture output India needs more fertilizers.

1.4 Growth of Indian fertilizer industries in India

The Indian fertilizer industry has come a long way since the setting up of the manufacturing unit of Single Super Phosphate (SSP) near Chennai in 1906. A new impetus to the growth of Indian fertilizer Industry was provided by the set up the two fertilizer plants -Fertilizer and Chemicals Travancore of Indian Limited (FACT) in Kerala and the Fertilizer Corporation of India (FCI) in Bihar. This was during the forties and the fifties. The aim was to create an Industrial base that would provide India with self reliability in food grains.

With the effect from 25th July 1991, the government implemented three major policy decisions (1) decontrol of Ammonium Sulphate CAN and ammonium chloride (2) Increase in the selling prices of all other fertilizer by 40% and (3) Introduction of a subsidy ceiling on SSP. However within a span of three weeks, the government revised the extent of the price like to 30% with effect from 14th august 1991 and exempted the small and marginal farmers from it completely.

With effect from 25th August 1952, the government decontrolled all phosphate and potassic fertilizers and abolished the RPS covering the farmers brought back ammonium sulphate. An ammonium chloride with the purview of the control and subsidy and rescued the selling price of urea by 10% while returning this under control of the RPS. These policy changes were expected to achieve (1) Reduction in subsidy (2) Continued growth in food grain production and (3) keeping healthy soil intact. Unfortunately none of these could be achieved.

India witnessed significant growth of the fertilizer Industry during the sixties and the seventies. By 2003, India has an installed capacity of 12.11 million MT of nitrogen and 5.36 million MT of phosphate. Today with 57 large sized fertilizer plants manufacturing a wide variety of the nitrogen, complex phosphate. Fertilizers the India fertilizer industry is
the 3rd largest producer in the world. One of the major factors that have led to the rapid increase in the production capacity of fertilizers in India is the policy environment. With the formulation and implementation of investor friendly policies large investment poured in to the private public and co-operative sector’s and this and this propelled the growth of the Indian fertilizer industry.

Reports showed the total installed capacity of fertilizer production in 2004 to be 119.60 LMT of nitrogen and 53.60 LMT of phosphate. These figures went up to 120.61 LMT of nitrogen and 56.59 LMT of phosphate in 2007. The production of fertilizers was 113.54 LMT of nitrogen and 42.21 LMT of phosphate during 2005-06. The target of production for 2006-07 was set of 114.48 LMT of nitrogen and 48.20 LMT of phosphate. Though the target production was not met, there was a growth in production during 2006-07 as compared to the production during 2005-06. Indian fertilizer has reached international levels of capacity utilization by adopting various strategies for increasing the productions of fertilizers. These includes as under:

- Expansion and increase in efficiency through modernization and revamping of existing fertilizer units.
- Using alternative source such as coal or liquefied natural gas for the production of fertilizer especially urea.
- Reviving some of the closed fertilizers plants.
- Establishing joint venture projects with companies in countries.

In order to meet the demand for gas this is one of the prime requirement for the production of nitrogenous fertilizers. India has entered into joint ventures with foreign companies in number of countries. Joint ventures have also been established for the supply of phosphoric acid. Indian fertilizer manufacturing companies has joined hands with companies in Senegal Oman, Jordan, Morocco, Egypt, Tunisia and other countries. It is therefore evident that the Indian
fertilizer industry has witnessed extensive growth and development in a short span of time. With such extensive growth it is not surprising that the India ranks Germany, the leading fertilizer manufacturing countries of the world.

The India government has devised policies conducive to the manufacture and consumption of fertilizers. Numerous committees have been formed by the Indian government to formulate and determine fertilizer policies. The dramatic development of the fertilizer industry and the rise in its production capacity has largely been attributed to the favorable policies. This has resulted in large scale investment in all three sector viz. public, private and co-operative.

At present there are 57 large scale fertilizer units. These manufacture an extensive large of phosphates, nitrogenous and complex fertilizers. 29 of these 57 units are engaged in the manufacturing of urea, while 13 of them produce calcium ammonium nitrate and ammonium sulphate. The remaining 20 fertilizer plants manufacture complex fertilizer and DAP. There are also about 12 medium and small scale industries in operation.

The department of fertilizer is responsible for the planning promotion and development of the fertilizer industry. It also takes into account the import and distribution of the fertilizer and also the financial aspect. There are four main divisions of the department. These include fertilizer imports, movement and distribution, finance and accounts fertilizers projects and planning and administration and vigilance. It makes an assessment of the individual requirements of the States and Union Territories and those lays out an elaborate supply plan. Though the soil of India is rich slit, it lacks chief plant nutrients like potassium nitrogen and phosphate. The increase in the production of fertilizer and its consumption acts as a major contributor to overall agricultural development.
The Indian fertilizer industry started operating in a big scale since 1940, when the Fertilizer and Chemical Travancore of India Limited and the Fertilizer Corporation of India were set up in Kerala and Bihar respectively. The fertilizers industry in India increased to a considerable extent in 1970 and 1980 after the mergence of the green revolution in the late sixties.

India has reached self reliance in the food-grain production. The country also generates surpluses to an extent that it can export. This massive production owes largely to the public sector as well as the co-operative sector of the fertilizer industry. Under the administrative control of the department of fertilizers there are 9 public sector undertakings. The co-operative societies count two in number. The private sector has also contributed to the Indian fertilizer industry. Some of the notable private companies to contribute to the production are Chambal Fertilizer and Chemicals Limited and Tata Chemical Limited. The private sector produced 44.73% of nitrogenous fertilizers and 62.08% of phosphate fertilizers in 2006-07.

The Indian large size fertilizer units manufacture wide varieties of nitrogenous and phosphate complex fertilizers. In 2005-06 large fertilizer units were 56. In addition to the nitrogenous and phosphates complex fertilizers the large scale units produce urea and ammonium Sulphate as by product. The single super phosphate is produced in India by 9 units. These are 72 small and medium scale fertilizer units. These unites operate mainly to produce SSP. The production of urea in India has reached near self-sufficiency. The requirement of the nitrogenous fertilizers is met through the indigenous industry. In the case of phosphate fertilizer the raw materials and intermediates are imported in large scale. With the aid of the imported raw material prophetic fertilizers are produced to meet the requirements for the domestic market. The requirement of potash (K) is met entirely through imports. No fertilizer unit of India has any reserve of potash. The growth
of the fertilizer industry was at its peak in the 1970s and 1980s. The growth was a bit stagnant in the last decade of the 20th century. With many radical steps been taken by the government of India the industry is expected to grow again.

1.5 Meaning and Types of Fertilizer

1.5.1 Meaning of Fertilizer

Any on of large number of natural and synthetic material including manure and compounds containing nitrogen, phosphorus and potassium spread on of worked into soil to increase its capacity to support plant growth synthetic fertilizer can greatly increase the productivity of soil but have high energy costs since fossil fuels are required as a source of hydrogen which is necessary to fix Nitrogen Ammonia Fertilizer.5 Any substance such as manure added to soil to increase its productivity is called fertilizer6.

1.5.2. Types of Fertilizer

Indian agriculture is based on rain because irrigation facility is very limited so the farmers have to use fertilizers. This fertilizer can be distributed mainly on two bases.

1.5.3 Fertilizer on the Basis of Consumption (Use)

(I) Direct Fertilizer:

The direct fertilizers are those which the green plants directly absorb from the land like nitrogen phosphorous etc. the green plants may take all nutrients from those fertilizers.

(II) Indirect Fertilizers:

The indirect fertilizers provides not only necessary nutrients to land but also it provides the fertilizer which increases the fertility of land
by mixing potash and hydrogen inside the land and it is necessary for the development of plant. That type of fertilizers is termed as indirect fertilizer. Line, silicone and boron are main examples of these fertilizers.

(III) **Complete Fertilizer:**

The fertilizer which provides necessary every elements like Carbon, Hydrogen, Oxygen etc for the healthy development of plants is termed as complete fertilizer.

(IV) **Incomplete Fertilizer:**

The fertilizer which consist only one of two necessary nutrients elements is called incomplete fertilizers. Ammonia phosphate is one of the best examples of this fertilizer.

1.5.4 **Fertilizer on the Basis of Source:**

The fertilizers which are used in the farming are included in this type there are mainly two types of fertilizers as below:

(I) **Natural Fertilizes:**

It is also called traditional fertilizers. This fertilizer is obtained normally by the way of naturally. In which human beings and animal dung and urine is used. Besides this oil cake fertilizer, fish fertilizers chilly salt fertilizers and potassium fertilizers are also included. In this fertilizers chemical are not added.

(II) **Artificial (Chemical) Fertilizer:**

In this fertilizer many chemical are included. This fertilizer mainly created in factories. Many material combines together to form mix fertilizers. But in practice the fertilizer contain nitrogen phosphorus and potash used widely.
1.8 Natural Fertilizers:

In this manure no chemicals are added. It is consists of waste product of human being and animal. In natural fertilizer substance are less fertile than artificial fertilizers. Natural fertilizers can be used in abundant quality. This fertilizers increase fertility and physical condition of land. The natural fertilizers divided into two sub division viz organic fertilizers and inorganic fertilizers.

The explanation of various types of natural fertilizers and its sub parts are as under:

1. Organic Fertilizers:

It is home made fertilizers. The use of this fertilizer does not affect the structure of land. This fertilizers needs in excess quantity and it takes five to mix with land. This fertilizer induces all types of organic elements which hold the fertility of the land for longer period of time. This fertilizer also called the complete fertilizer. This fertilizer includes cow dung, manure of human being urine, manure of various types of cake, fish manure bone, mill manure and bio-fertilizer.

2. Inorganic Fertilizer:

The fertilizer which obtains as a mineral from the land and which obtains from the wooden ash is called as in organic fertilizer. It is insoluble in water. So it can be used directly into the land. The main benefit of this fertilizer is that, after using this fertilizers there is no need of giving water to land so it is used extensively an Gujarat and other States of India where there is always in irrigation problem. This fertilizer includes Chile squat pitter rock phosphate manure of wooden ash and potassium squat.
1.8.1 Benefits of Natural Fertilizers:

Natural fertilizer is counted golden or complete fertilizer. The merits of these fertilizers are given as under:

1. It is receptively cheaper than chemical fertilizer.
2. There is no side effect of this fertilizer.
3. Fertility and productive capacity of soil will increase.
4. Natural fertilizer is easily available there is no requirement of large investment.
5. Plant holds nutrients for the longer period of time.
6. It increases the structure of the land.
7. Moisture holding capacity of the soil increase.
8. The effect of natural fertilizer remains for longer time. It has not to be used frequently.
9. Plant holds nutrients for the longer period of time.

1.6.2 Limitations of Natural Fertilizer:

Natural fertilizer counted as complete fertilizer but it has me limitations. Natural fertilizer must be used in accepts quantity. The hectar wise production is less by using the fertilizer. Development of plants is remains low. The resistance power is also remains low. Cow dung and other wastage are used in this fertilizer. The chemical fertilizer may be in solid liquid or grouse form. It is not enough to give chemical fertilizer only for better growth of plants as well as better productivity of land but it is equally necessary to protect plants by using insecticides into to field.

1.6.3 Characteristics of Chemical Fertilizer:

Chemical fertilizers are those which add chemical elements into the land. By using this fertilizer into the land both productivity and fertility can be increased. Minerals are the basic elements for al type of chemical fertilizer. There is also classification in the use of chemical
fertilizer. Some of the chemical fertilizer used before the plantation and others must be used little growth of plants there are as many as 60 types of chemical elements needed for better production.

It will increase fly and mosquitoes and there is a chance for epidemic. Green plant does not get necessary all nutrients from this fertilizer. The plant does not get nutrients at proper time because it takes time to mix with land. Yet there are some limitations of this natural fertilizer. So many farmers used this in their farms.

1.9 **Chemical Fertilizer:**

In the ancient time the farmers were totally depends only on natural fertilizer. But today is the time of mass production so the farmer has to use chemical fertilizer along with natural fertilizer. The chemical fertilizer is also called the man-made or artificial fertilizer. After the green revaluation the use of chemical fertilizer would be increased. After the industrial revolution the development of chemical fertilizer industry increased.

1.7.1 **Meaning of Chemical Fertilizer:**

Green plants are considered as living beings as they prepare their food in the presence of sun light and it grows day by day. For the healthy development of plants farmers have to give proper fertilizer in appropriate quantity. By providing proper fertilizer the soil can hold its nutrients and the growth of green plants is relatively faster. All chemical fertilizers are not good for the land and plants. Main key elements which a plant takes while preparing food are given in the following table:
Table 1.3
Per centage of Nutrient Elements of Food

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Percentage</th>
<th>Nutrients elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90% food</td>
<td>Carbon, oxygen, hydrogen, phosphorus, potash</td>
</tr>
<tr>
<td>2</td>
<td>8 to 9 %</td>
<td>Magnesium, Sulphar calcium</td>
</tr>
<tr>
<td>3</td>
<td>1 to 2 %</td>
<td>Boron, iron, copper, mannose, chlorine etc</td>
</tr>
</tbody>
</table>

(Source: Elements of Farming -2 by Rodya Misal)

Above given table 1.3 shows percentage of nutrients elements in food. It revels that nutrients elements like carbon oxygen hydrogen phosphorus and potash acquire 90% in the food. Elements like magnesium sulphate and calcium acquire 8 to 9% in the food. While elements like boron irons copper, manganese and clorin has acquire the least portion in food. And it is to 2% only. In this way above given all elements combine together to produce food for plants and ultimately growth and development of plant becomes possible.

1.7.2 Types of Chemical Fertilizer:

Four types of chemical fertilizers available in the market chemical fertilizer include elements like nitrogen, phosphorus and potash. They are used to increase the productivity of land. For better growth and development mixed fertilizer are prepared. Nitrogen fertilizer, phosphate fertilizer, potassium fertilizer and mixed fertilizer are chemical fertilizer. Brief explanation about these fertilizers is as under:

(1) Nitrogenous Fertilizer:

This fertilizer is used to meet the deficiency of nitrogen in the land. For the plant this is the most useful fertilizer. It will provide nutrients to both land and plants.

There are mainly two types of nitrogen fertilizer viz in organic fertilizer and organic fertilizer. The in organic nitrogenous fertilizer divided into sub parts. They are nitrate containing ammonia and mixed
nitrate and ammonia contrition. The nitrate containing fertilizer includes nitrate of soda, nitrate of potash and calcium nitrate. The ammonia containing nitrogenous fertilizer includes ammonium sulphate, ammonium phosphate aqueous chloride mixed nitrate and ammonia containing fertilizer includes ammonium nitrate calcium ammonium nitrate and ammonium sulphate nitrate.

The organic nitrogenous fertilizer is also divided into sub group viz; animal and vegetables source and synthetic or amide constrains. The animal and vegetable sores included dried blood, meat, meal, horn and hoof slaughter house waste bone meal and oil cakes while synthetic or amide containing fertilizer includes calcium cyanide and urea. Proportion of nutrients and main elements nitrogenous fertilizer are shown in the below table³.

### Table 1.4

Proportion of Nutrients and Main Elements of Nitrogenous Fertilizer

<table>
<thead>
<tr>
<th>Name of Fertilizer</th>
<th>Proportion of Nutrients (in %)</th>
<th>Main Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>40 to 46.5</td>
<td>(NH₂)₂ CO</td>
</tr>
<tr>
<td>Urea Formula derail</td>
<td>33 to 42</td>
<td>NH₂ CONHCH₂</td>
</tr>
<tr>
<td>Liquid Ammonia</td>
<td>82.3</td>
<td>NH₃</td>
</tr>
<tr>
<td>Aqueous Ammonia</td>
<td>16.5 to 20.5</td>
<td>NH₂ NO₃</td>
</tr>
<tr>
<td>Ammonium Nitrate</td>
<td>32 to 35</td>
<td>NH₄ NO₃</td>
</tr>
<tr>
<td>Sodium Nitrate</td>
<td>15 to 16</td>
<td>NaNO₃</td>
</tr>
<tr>
<td>Calcium Nitrate</td>
<td>13 to 15</td>
<td>Ca (Nae)₂ 3H₂O</td>
</tr>
<tr>
<td>Ammonium Soleplate</td>
<td>19.9 to 21</td>
<td>(NH₄) SO₄</td>
</tr>
</tbody>
</table>

Source: Fertilizer Manufactures Porin M.E. P-16

It is seen from the above table that Liquid Ammonia contains highest nutrients 82.3% Aqueous Ammonia contains 16.5 to 20.5% nutrients Ammonium nitrate contains 32 to 35% nutrients. Ammonium
sulphate contains 19.9 to 21% nutrients sodium nitrate contains 15 to 16% nutrients calcium nitrate contains the least nutrients and it is 13 to 15% urea contains 46 to 46.5% nutrients and urea formuladiraid contains 33 to 42% nutrients. Though all nitrogenous fertilizer have nutrients in different proportions, they all are useful for the better productivity and production.

1.7.3 Elements of Nitrogenous Fertilizer:
(A) The effectiveness of ammonium sulphate is somewhat more than urea due to its wastage at the primary level.
(B) Nitric Nitrogen fertilizer is found to be more effective when applied as top dressing during the commencement of reproductive phase of paddy pant.
(C) The paddy plant can absorb 30-35% of total nitrogen when the land is ploughed after application of ammonium nitrogen. But the nutrient becomes more available when the fertilizers are applied at a depth of 5.10 cm.
(D) In acid soil or calcium deficient soil continuous of ammonium sulphate urea ammonium chloride and ammonium sulphate nitrate should be avoided as they are acid forming fertilizers or lime should be applied at least 15 days before the sowing at the crop to reclaim the acidity of the soil.
(E) The nitrogenous fertilizer is easily soluble in water and move rapidly in all directions from the place of its application. The nitrogenous fertilizer should be applied as per the demand of the crop.
(F) All nitrogenous fertilizers are equally effective in rainy season. The nitrogenous fertilizers should be selected on the basis of cost availability and easier in application.
(G) The nitrogen should be applied in more quantity as TOP dressing in long duration variety of proudly.
Phosphate Fertilizer:

Phosphate fertilizer is an essential fertilizer for the land. The need of this fertilizer is low in comparison to nitrogenous fertilizer. In the early age of plant this fertilizer is used for the health of green plants. There are three sub types of phosphate fertilizer viz: Water Soubise Phosphoric Acid, Citric Acid Soluble Phosphoric Acid and Insoluble in Water or Citric Acid. Super phosphate is the main example of water soubise phosphates acid. Di-calcium phosphate is the main example of citric acid soluble phosphoric acid. The main examples of insoluble phosphoric fertilizer in water are rock phosphate raw Bone meal, steamed bone meal and by product of basic slag.

1.8 Characteristics of Phosphate Fertilizer:

(A) Jointly use of nitrogenous and phosphate fertilizer increases the uptake capacity of the plant.

(B) Rock phosphate basic slag phosphates fertilizer is most suitable for application in acidic soils.

(C) Low paddy shorts considerable less response to phosphate fertilizers.

(D) The phosphate fertilizer like as superphosphate should be applied near the root zone of the crop or in soil layer.

(E) The phosphate fertilizer namely super phosphate should be used in neutral to alkaline soil.

(F) The phosphate fertilizer should be placed deep with deep cultivator in fruit trees like guava, citrus, apple etc.

1.8.1 Proportion of Nutrients & Elements of Phosphate Fertilizer:

Common super phosphate, Triple calcium phosphate, Di-calcium phosphate, Ground phosphate rock, Phosphate Slag, Diphloriented phosphate are the phosphate fertilizer. Its main elements are Ca(H₂PO₄)₂ H₂O + H₃PO₄ + CaSO₄, Ca(CH₂PO₄)₂ H₂O + H₃PO₄, CaHPO₄
2H₂O, Ca₅ F(PO₄)₃, 4CaO. P₂O₅ + 5CaO. P₂O₅ + SiO₂, 3CaO. P₂O₅ + 3CaO. P₂O₅ respectively. And proportion of nutrients (in%) are respectively 14 to 21% 40 to 52, 27 to 40, 16 to 35, 14 to 20 and 20 to 38. It is seen that triple calcium phosphate fertilizer contains highest nutrients and it is 40 to 52% while phosphate slag contains the least nutrients and it is 14 to 20%.

1.8.2 Potassic Fertilizer:

Potassium Sulphate is a potassic fertilizer. It is very essential for the healthy development of plants. With the help of potassium preparation of carbohydrate in the plants is possible. It increases resistance power of green plants. Classification of Potassic fertilizer is divided in two way viz, pouts and chloride from and potash in non-chloride from. Marinate of potash is the best example of potash in chloride from and sulphate of potash is the only example of potash in non-chloride nature.

1.8.3.1 Proportion of nutrients and main elements of potassic fertilizer is as under:

<table>
<thead>
<tr>
<th>Name of fertilizer</th>
<th>Proportion of Nutrient (in %)</th>
<th>Main Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium chloride M</td>
<td>50 to 62</td>
<td>KCL</td>
</tr>
<tr>
<td>Mix potassium salt</td>
<td>30 to 42</td>
<td>KCL + NaCL</td>
</tr>
<tr>
<td>Sulfuric of Potash</td>
<td>48 to 52</td>
<td>K₂ SO₄</td>
</tr>
</tbody>
</table>

It is seen from the above table that out of all potassic fertilizer potassium chloride contains the highest nutrients and it is 50 to 62% mix potassium salt, the least nutrients and it is 30 to 42% sulphate of potash contains 48 to 52% nutrients.
1.8.3.2 Characteristics of Potassic Fertilizer:

(A) It can be used for all crops and for all types of soils.
(B) In potassic fertilizer named potassium sulphate is better than nitrate of potash for crops like tobacco, potatoes, fruit trees etc.
(C) Now a days the application of potassic fertilizer namely potassium chloride or nitrate of potash as top creasing is considered good as nitrogenous fertilizer.
(D) The potassic fertilizer are water soluble but not hydrosopic in nature and potassium is readily available to plant.
(E) On application of potassic fertilizer it dissociates to K\(^i\) ions and get absorbed in the soil and absorbed by growing plant.

1.8.4 Mixed Fertilizer:

In mix fertilizer nitrogen potash and phosphorus are included. All types of mixed fertilizer:

(A) Open Formula Fertilizer Mixture.
(B) Closed Formula Fertilizer Mixture.

(A) Open Formula Fertilizer Mixture:

The ingredients mixed in this type of fertilizer mixture in forms of kinds and quantity is disclosed by the manufactures. This will be helpful for the cultivators to know the ingredients of fertilizer for the use of the same in particular crop in satiable amounts.

(B) Closed Formula Fertilizer Mixture:

The ingredients or straight fertilizer used in these fertilizer mixtures are not disclosed. It is called as a trade secret of the industry. So it is not possible for farmers to know the type and quantity of ingredients used in this fertilizer mixture. The farmer cannot select a correct mixture for their use in production of crops.
Some of mixed chemical fertilizer main elements and proportion of nutrients are under:

### Table 1.6
Proportion of Nutrients & Main Elements of Mixed Fertilizer

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Fertilizers</th>
<th>Main Elements</th>
<th>Proportion of Nutrients (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ammonium Super Phosphate</td>
<td>CaHPO₄ + NH₄H₂PO₄ + CaCO₄</td>
<td>1.5 to 3 Nitrogen 19 to Phosphorus</td>
</tr>
<tr>
<td>2</td>
<td>Ammonium Phosphate</td>
<td>NH₄H₂PO₄ + (NH₄)₂HPO₄</td>
<td>11 to 4 Nitrogen 46 to 55 Phosphorus</td>
</tr>
<tr>
<td>3</td>
<td>Di-Ammonium Phosphate</td>
<td>(NH₄)₂HPO₄ + NH₄H₂PO₄</td>
<td>16 to 18 Nitrogen 46 to 48 Phosphorus</td>
</tr>
<tr>
<td>4</td>
<td>Ammonium Phosphate Nitrate</td>
<td>NH₄NO₃ + NH₄H₂PO₄</td>
<td>21 to 25 Nitrogen 20 to Phosphorus</td>
</tr>
<tr>
<td>5</td>
<td>Potassium Nitrate</td>
<td>KNO₃</td>
<td>13.5 Nitrogen 46.5 Potash</td>
</tr>
<tr>
<td>6</td>
<td>Ammonium Potassium Phosphate</td>
<td>(NH₄)₂HPO₄ + (NH₄)₂SO₄ + KNO₃ + NH₄CL</td>
<td>8 to 12 Nitrogen 10 to 24 Phosphorus 15 to 24 Potash</td>
</tr>
<tr>
<td>7</td>
<td>Ammonium Potassium Phosphate Nitrate</td>
<td>NH₄NO₃ + NH₄H₂PO₄ + KNO₃ + NH₄CL</td>
<td>17 to 18.5 Nitrogen 17 to 18.5 Phosphorus 17 to 18.5 Potash</td>
</tr>
<tr>
<td>8</td>
<td>Urea Potassium Ammonium Phosphate</td>
<td>(NH₂)₂CO+(NH₄)₂HPO₄ +KNO₃ + NH₄CL</td>
<td>18 to 20 Nitrogen 18 to 20 Phosphorus 18 to 20 Potash</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Name of Fertilizers</td>
<td>Main Elements</td>
<td>Proportion of Nutrients (in %)</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>9</td>
<td>Potassium Nitrate Phosphate</td>
<td>NH$_4$NO$_3$ + CaHPO$_4$ + KnO$_3$+NH$_4$Cl or (NH$_4$)$_2$HPO$_4$ or NH$_2$H$_2$PO$_4$ + CaSO$_4$ 2H$_2$O or CaCO$_3$</td>
<td>11 to 20 Nitrogen 8 to 16 Phosphorus 10 to 21 Potash</td>
</tr>
<tr>
<td>10</td>
<td>Magnesium Ammonium Phosphate</td>
<td>MgNH$_4$Po$_4$ H$_2$O</td>
<td>34 to 36 Phosphorus 17 to 19 Magnesium</td>
</tr>
<tr>
<td>11</td>
<td>Ammonium Meta Phosphate</td>
<td>(NH$_4$PO$_3$)$^n$</td>
<td>17 Nitrogen 80 Phosphorus</td>
</tr>
<tr>
<td>12</td>
<td>Ammonium Poly Phosphate</td>
<td>(NH$_4$) P$<em>3$O$</em>{10+}$ (NH$_4$)$_4$ P$_2$O$_7$+ (NH$_3$) 3HP$_2$O + NH$_4$H$_2$ PO$_4$</td>
<td>12 to 25 Nitrogen 53 to 61 Phosphorus</td>
</tr>
</tbody>
</table>

Source: Fertilizer Manufactures Porin M.F. P. 19

By annualizing of above table it is seen that the proportion of nutrients and main elements of mixed chemical fertilizer. The elements like nitrogen phosphorus and potash are the main chemical elements of mixed fertilizer and land receives most of nutrients from it and it is also seen that proportion of nitrogen is relatively higher than other chemical in the fertilizer. Only mixed fertilizer which does not consists nitrogen is magnesium ammonium phosphate. Phosphate is available in all mixed chemical fertilizer except potassium nitrate proportion of phosphate is reactively less than nitrogen. Potash is not available in mixed chemical fertilizer proportion of potash is as the proportion of nitrogen and phosphorus in some mixed fertilizer.

The mixed fertilizer like Ammonium, Potassium Phosphate, Ammonium Potassium Nitrate, Urea Potassium Phosphate consist nitrogen phosphorous and Potash in equal proportion. Chemical fertilizer as like Ammoniated Super Phosphate, Ammonium Phosphate,
Di- Ammonium Phosphate and Ammonium Phosphate Nitrate did not contain Potash.

1.8.5 Advantages of Chemical Fertilizer:

To gain lands’ fertility back chemical fertilizer are used. Land losses its fertility due to more crops are cultivated during the year. The soils become more fertilizer and development speed of plants is increase by using chemical fertilizer. Advantages of chemical fertilizer are as under:

1) The resistance power to plants will increase.
2) The hectar wise production will increase.
3) Qualitative crop will be produced.
4) The growth of plant becomes faster / speedy.
5) Plants get all nutrients in equal proportion from chemical fertilizer.
6) Growth of plant and development of plant become accurate.
7) The soil absorbs chemical fertilizer easily as it is soluble in water.
8) The chemical fertilizer does not contain unnecessary element.

1.8.6 Disadvantages of Chemical Fertilizer:

The excess use of chemical fertilizer will become harmful for the plants and soil. It will increase nitrate pollution. The main disadvantages are as under:

1. Some elements of the artificial fertilizer damage the soil.
2. For small farmers artificial fertilizers become more expensive.
3. Growth of crops is not proper so the production of crop decrease.
4. Some times crop gets destroyed especially in regions of less rain fall due to insufficient supply of water.
5. When the nitrogen fertilizer is used in the field nitrate will convert into nitrate by the bacteria presented in the land.
6. The constitution of the soil spoils as they do not contain the organic substance.
7. On the expensive use of Artificial fertilizer, organized like earthworm which make the soil fertile get destroyed.

8. The nitrogen fertilizer is harmful for the both human being and also animals.

1.9 Challenges Before Indian Fertilizer Industry:

Indian fertilizer industry is facing so many overhanging challenges now a day. Growth and development of agriculture in India derives a significant motivation from the fertilizer industry. Agricultural milled in India could be jeopardized by the uncertainties in the fertilizer industry. The government is faced with the piquant situation, which demands a balance between the requirement of farmers and the manufactures of the fertilizer. The challenges before the India fertilizer industry relate to the incertitude in the supply of fertilizers. There has been a surge in the requirement for fertilizers in the past few years. Good monsoonal showers have led to the growth in agriculture in advertently increasing the consumption rate of fertilizers.

The healthy growth in consumption propensity has not been met with the required surge in fertilizer production. This situation has widened the gap between the demand and supply of fertilizer which has led to an increase in the dependence of the country on imports. Another very important key factor that led to the shunted growth of the fertilizer industry is the rise in prices of the feedstock. The fertilizer industry is based on gas for the production of urea and phosphoric acid for the production of phosphoric fertilizer and DAP. The country imports its inputs from other countries. The overseas suppliers of raw materials realize the predicament of the Indian fertilizer industry and have started exploiting the shortly through clever pricing. In recent years, some of the private companies, dedicated to the production of fertilizer have effectively taken stakes in the overseas sources of raw materials. This
has helped the industry and it has been unable to reduce the government's burden of subsidizing the rates.

The fertilizer industry is remained protected under the umbrella of the retention pricing scheme of the Indian government. The government has farmed policies to decontrol the prices but delayed the implementation of the parameters that have not augured in favor of the industry. As a result, fertilizer subsidies continue to mount and are expected to cross 125 crore in the year 2008.

The pricing of the fertilizers are also based on the freight charges. A small size of the older plants and the low efficiency of the public sectors pose as drawbacks of the industry. Now a day's present policies of the government are directed towards revamping of these industries and restoring them to health. The fertilizer industry is facing with other challenges like as the uncertainties in government policies.

The delay in decision making and obscurity in setting parameters are among some of the major draw backs of the policies of government against the industry. For the healthy growth of the fertilizer industry long term realistic policies is needed and that would help the industry to overcome the challenges and survive the fertilizer industry.

1.10 India’s Current Government Policies for Fertilizer Industry:

Production growth and consumption of fertilizer industry are directly based on the government policies. The government policies for the fertilizer industry are devised to ensure a sustainable growth and development direction in one of the most intensive sectors of the Indian fertilizer. From the fertilizer industry for production of food grain and its growth in India derives the main stimulus.

The policies farmed by the government are devised in response the recommend action of the high powered committees of the country\textsuperscript{11}. The Sivaraman Committee Report – 1966 highlighted the significant of the balanced use of fertilizers along with providing
adequate credit support for its distribution and usage. The committee also provided inputs for realizing the importance of liberation of fertilizer marketing that would promote the output of the domestic companies. Marathe Committee gave the Retention Price Scheme (RPS) and latter government introduced the scheme. This would enable to maintain prices of the fertilizers during the crisis time.

The first decontrol policies of the government were adopted in 1992 on the recommendation of the Joint Parliamentary Committee (JPC). The government decontrolled the phosphoric and potassic fertilizer industries and under subsidized rates the urea. Industry is continued to produce the urea after the modification of the 1998, Farritt Commission. The complex fertilizer industries were subdivided in to two categories. Group I: Comprised of imported ammonia or industrial units using gas while group II: Includes industries using naphtha or fuel oil. Other Committee provided its recommendation on the methods of promotional marketing distribution and pricing of the fertilizers in India. Change in government policies is often responsible for hampering new investment in the fertilizer industry. Due to government motivational policies the investment in this area was Rs. 20,667 crore in 2007.

The present objective of the government polices is to develop a long term program that would protect the interests of the domestic producers and reduce the dependence on foreign imports. The health of the fertilizer industry can be restored with more realistic policy adopted by the government.

At present the government has unlauted a New Pricing Scheme (NPS) replacing the RPS. The fertilizer industry of India is not same in terms of stock. To reduced them from being divers and inoperable under the NPS scheme. The NPS has been modified, promoting further investment in the Indian fertilizer sectors.

On an overall basis some salient feature policies should be the following:
(1) The close relationship of the crop produce and the fertilizer should from the very basis of all fertilizer policies, particularly because this relationship is long lasting and neither temporary nor referable. A ratio based on low input and low output prices is preferable over the same ratio derived from high input and low output. Price pattern considering that significant proportion of population is below the subsistence level and the vast majority of farmers are resource poor.

(2) The general ratio of procurement price of food grains of fertilizer nutrients should be such that not more than 3 kg cereals and millets are needed to pay for 1 kg nutrient wider than this ratio have been observed to lower the growth rates in fertilizer consumption as in the case of N application on wheat.

(3) Balanced fertilizer use should extend beyond N.P.K. and cover all those nutrients which are deficient and whose application is necessary for sustaining agriculture production at requital levels. The ideal nutrient consumption ratio for the country it one figure is needed at all should come out of ratios determined for each ecological zone taking into accounts the natural soil fertilizer.

(4) The goal of self – sufficiency in fertilizers in the case of N should be such that there is no more than one million tone gap between long term demand and supply. In the case of phosphate this aim can be to produce 85% of the quantities required within the country.

(5) In order to promote fertilizer use on dry land food grains, particularly sorghum and millets the minimum support price for coarse grains should be on par with paddy, which was the use in the mid 1970.

(6) The phosphate issue is more complex and in many ways similar to potash than to N. Barring the 5-6% contribution made by indigenous phosphate rock the remainder 94-95% of the
requirement has to be imported either as phosphate rock, phosphoric acid and or finished phosphate future phosphate policy should have three faults: (i) Maximization of the use of indigenous rock both as raw material and for direct application (ii) importing part of the phosphate requirement in the form of reactive rocks specially for direct application without any further treatment except grinding to the required size for the substantial area under acid soil much of which is dong the lasts and closer to parts (iii) Participation in joint ventures for the production of phosphoric acid and or DAP in countries having phosphate rock and increasing captive phosphoric acid capacity based on imported rock phosphate and Sulphar a route which has been formal to entail the least out of foreign exchange.

(7) In the interest of balanced fertilizer use and sustained crop productivity, the production and distribution of micronutrients should be brought into the mainstream of fertilizer use. If nothing else, this will safeguard improve the efficiency of 18-20 M.T. of N+P205 +K2 O Which the country is planning to use manually by the turn of the century. All fertilizers once they enter the FCO should receive uniform all India treatment whether these are products containing major nutrients of micronutrients.

(8) In the dry lands, fertilizer distribution outlets should essentially be developed into composite input distribution and advisory centers. Prototypes such service centers should be developed in the form of bankable enter prices to be offered to agricultural graduates. Such centers should receive a certain incentive for operating in interior area and also for some promotional activities.

(9) Fertilizer allocation plans should be gradually start using the information on the extent of nutrient deficiencies in different areas and the fertilizer basket allocated for an area should be fully capable of taking care of all major nutrient deficiency in that area.
This will be a positive step forwards and in all probability will lead to judicious and efficient use of fertilizers.

1.11 Packing, Storage and Distribution System of Fertilizer:

(i) Packing of Fertilizer:
Gunny bag polyphone bags having limning with pitch are the materials used for packing of fertilizer. As per kind of fertilized types of container is also used for fertilizer packing. Hygroscopic fertilizer is packed in the gunny bag. For packing of super phosphate the polythene bag is used. For packing marinate of potash gunny bag is used. Due to increasing gunny bag now alloys polythene bag is used for packing of fertilizer.

For straight fertilizer name of the manufactures trade link, name of fertilizer, nutrient percentage and not weight in kilogram is Indicated and for mix fertilizer packing registered name of fertilizer producer, trade name, general name, total organic and inorganic nitrogen water soluble phosphate amount of water soluble potassium name of the crop suitable for fertilizer and gross net weight in kilogram is shown.

(ii) Storage of Fertilizer

The fertilizer should be stored in cool drag and damp proof go down. The bays used for fertilizer should not be piled together in a raw of 8-10 bags. And it should not touch the weight of the go dawn. For convenience of listing the fertilizer proper space should be allowed between two groups of piled fertilizer. Hygroscopic type’s fertilizer like as urea ammonium nitrate, ammonium sulphate nitrate and calcium ammonium nitrate must be stored in water proof bag and in on lot the entre bag should be used. The wooden roofs should be used for pilling the fertilizer bags. The rain water must not get entered in the go down where fertilizer is stored. And go dawn should have proper ventilation for regulating for exit at the gases from the storage. Five hazardous type of fertilizer like as Ammonium sulphate must be stored carefully.
Fertilizers such as nitrogenous phosphatic and potassic fertilizer should not be piled together. Home mixed fertilizer should be used promptly after mixing of various fertilizers. Prolonged storage of fertilizer should be avoided.

(iii) Distribution of Fertilizer:

By the way of railways wagon truck and container the fertilizer are taken in different places. Marketing of fertilizer is controlled as per the prescribed rules and regulations of central government. To supply the fertilizer among the farmers at a reasonable price in all parts of the country, To increase the balanced use of fertilizers, to distribute the fertilizer in all places of the country as per the essential commodities act of the government and to develop suitable measure for the distribution of the fertilizer are the main principles of distribution of fertilizers.

For the benefit of distribution of fertilizer country have been divided into four regions like as eastern region, western region, north region and southern region. In Eastern region states includes Assam, Arunachal, Andaman and Nicobar island, Bihar, Meghalaya, Manipur, Mizoram, Nagaland, Orissa, Sikkim, Tripura, West Bengal etc. In Western region Dadra and Nagar Haveli, Gujarat, Goa, Madhya Pradesh, Maharashtra, Rajasthan are included. Chandigarh, Delhi, Haryana, Himachal Pradesh, Uttar Pradesh etc states are included in Northern region for the purpose of distribution of fertilizer. In Southern region Andhra, Karnataka, Kerala, Pondicherry, Tamil Nadu is included.

1.12 Development of Fertilizer Industry in Gujarat:

There are main four companies which produce chemical fertilizer in Gujarat. Out of them the Gujarat State Fertilizer Chemical Limited established the first ever chemical fertilizer factory in Gujarat at Baroda in 1967. GSFC was first joint sector industrial unit in India with equity capital of State government 49% and public 51%. It was also first unit to manufacture DAP. Fertilizer in India them in nine years later, in 1976
the Gujarat Narmada Valley Fertilizer Company Limited popularly known as GNFC established a chemical fertilizer factory at Barouche. GNFC promoted by the government of Gujarat and GSFC.

After the establishment of these two companies in Gujarat, in 1975 Indian Farmers Fertilizer Co-operative Limited (IFFCO) set up its plants at Kalol and Kandla in Gujarat.

Krushak Bharti Co-operative Limited (KRIBHCO) established its manufacturing unit in Gujarat. First used by ancient farmers fertilizer technology developed significantly as the chemical needs of growing plants were discovered. The use of synthetic fertilizer has significantly improved the quality and quantity of the food available today. Their long term use is harmful the environmentalists.

1.13 History and Development of GSFC

GSFC has its vast network of plants and infrastructure which took its first step in 1967 with the setting up of six plants with the beginning investment of Rs. 40 Corers. These six nitrogenous and phosphatic fertilizer plants for the production of Ammonia Urea, Ammonium Sulphate, Di-Ammonium Phosphate (DAP), Sulphar Acid and Phosphoric Acid.

The expansion of ammonia and urea production began with phase – II- in 1969 and an investment of Rs. 23 crores was made to meet the increase demand for nitrogenous fertilizer. Phase – III- began in 1974 when diversification of product occurred plants to manufacture Melamine Nylon-6, Oleum-50 and Oxon. Synthesis Gas unit and pure Gas recovery unit were set up with phase – III. GFC become India’s first and only melamine producer. This provided the boost for further diversification to Nylons, Fibers, Melamine and industrial Gases like Argon Gas and Oxon Synthesis Gas.

In 1989 GSFC began more expansion and diversification Phase – IV- which saw the company increasing its self reliance while also
conserving energy needs. Three co-generation unit using LSHS and Natural Gas were set up. Further expansion of Ammonium coprol actum production was initiated. Diversification into Fibers Nylons and Acrylic were complete and DAP plant was also setup.

GSFC is in the area of 1600 acres of land which spread four various locations at Baroda known as Fertilizernagar, Sikka, Kosamba and Nandesari with 34% i.e. 543 acres of green belt, with 30 different plants 20 different products, 170 farm information centers cum depots and 32 regional and are office through out India to provide sales support services with capital investment of Rs. 2874 crores and turnover of Rs. 2001 crores. GSFC is a symbol of culture heritage and development with its deep strong roots and well defined branches to serve the mother land better.

The following table of financial highlights of ten years shows the development GSFC:
Above table 1.7 presents the financial highlights of GSFC during the period of 1998-99 to 2007-08. During the year 1998-99 to 2007-08, it can be seen from the above table that there is positive profit after tax and exceptional items. In comparison to 1998-99 it seems the increase of 80.30% in the year 2007-08. Retaining earning of the GSFC is also presents significant increase during the last four years.

The company is exporting mainly MFN oxeye and coprolite. During the year 2007-08 export of coprolite was only 12 MTs as against 4014 MTs in 2006-07. This was manly due to higher sales in the domestic market coupled with better realization. MEK-Oxeye has been
exported to 40 countries and has registered 7% increase in the export quality from 3574 MTs during FY 2006-07 to 3831 MTS during FY 2007-08.

Net sales of the company also increase during the period of 2003-04 to 2007-08. Company’s net sales (in crores) are respectively 2106, 2607, 2831, 3319 and 3558, in compression to base year 2003-04. Percentage increase in net sales is 23.78%, 34.42% 57.59% and 68.94% respectively.

In the year 2007-08 net sales turnover of the company including trading activities was Rs. 3557.69 crores as against Rs. 3318.72 crores in 2006-07 thus registering an increase of Rs. 238.97 crores. The sale of fertilizer was higher by Rs. 229.74 Crores. For industrial products the company has registered net sales of Rs. 1117.64 crores in 2007-08 as compared to Rs. 1188.40 crores in the previous year.

The following table depicts the proposition to fertilizer products segment and industrial products segment in the net sales of the company during the last two year.

<table>
<thead>
<tr>
<th>Table 1.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposition to Fertilizer Products Segment and Industrial Products</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Particular</th>
<th>2006-07</th>
<th>2007-08</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rs. Crores</td>
<td>%</td>
</tr>
<tr>
<td>Fertilizer segment</td>
<td>213.32</td>
<td>64.19</td>
</tr>
<tr>
<td>Industrial product segment</td>
<td>1188.40</td>
<td>35.81</td>
</tr>
<tr>
<td>Total</td>
<td>3318.72</td>
<td>100.00</td>
</tr>
</tbody>
</table>

(Source: Annual Report of GSFC – 2007-08)

The Company continues to give priority to safety health and environment the company has been awarded caaffeinate of merit for continuous two million accident free man hours without any lost time accident for the year 2006. This award is given jointly by Gujarat Safety Council and Directorate of Industrial Safety and Health, Gujarat State.
GSFC holds consolidated consent and authorization from Gujarat Pollution Control Board which has validity up to 30th May 2011. The company has received the environment clearance for 1500 MT per annum urea phosphate project on March 2008 from Ministry of Environment & Forest (MOEF) New Delhi. The company has received the Gold Award in fertilizer sector for outstanding performance in environment achievement (Greentech Environment Excellence Award 2007) from Greentech Foundation New Delhi.

For the best performance, GSFC is given various types of award and certificate. In the year 2005-06, an award is given by FAI for best production performance complex (P205) fertilizer plant. An award in the field to production promotion and marketing of Bio - Fertilizer is also given in the year 2005-06 by FAI. An award is also given the 2005-06 for increase in fertilizer use efficiency through micro irrigation system by FAI. In 2006 National Award for the best employers of disabled persons is given. National Productivity Council Award for second best productivity performance in Bio-Fertilizer producers sectors for 2005-06 is given. IEWAL third best National Award for excellence in management is given in the year 2006. International Safety Award 2007, Greentech Award in 2007 and ISO 9001 for Quality Certificate are given to GSFC. Certificate for Environment by ISO 14001 is also given to the company Gujarat safety council of Baroda has given certificate of honor in 2004. s
Table 1.9  
Ratio of operating profit to Net Sales

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Sales (crores)</th>
<th>Op. Profit (EBITA) in Rs.</th>
<th>Ratio of OP. profit to net sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-04</td>
<td>2106</td>
<td>329</td>
<td>15.62</td>
</tr>
<tr>
<td>2004-05</td>
<td>2007</td>
<td>502</td>
<td>19.25</td>
</tr>
<tr>
<td>2005-06</td>
<td>2831</td>
<td>661</td>
<td>23.34</td>
</tr>
<tr>
<td>2006-07</td>
<td>3319</td>
<td>581</td>
<td>17.50</td>
</tr>
<tr>
<td>2007-08</td>
<td>3538</td>
<td>543</td>
<td>15.26</td>
</tr>
</tbody>
</table>

Source: 46th Annual Report of 2007-08

Table No: 1.9 shows that, during the period of 2003-04 to 2007-08, company’s operating profit (EBIDT) 329 crores, 502 crores, 661 crores, 581 Crores, and 543 crores respectively. Company’s operational efficiency is also increased in 2003-04, 2004-05 and 2005-06. Ratio of operating profit to net sales is 15.62% 19.25 % and 23.34%. It seems significant decline in the efficiency during the last two year 2006-07 and 2007-08 as the ratio of operating profit to net sales is declined. It was of 17.5% and 15.26% during this year.

1.14 History and Growth of GNFC

Gujarat Narmada valley Fertilizer Company Limited (GNFC) was promoted by the government of Gujarat and Gujarat State Fertilizer and Chemicals Limited and was launched on 10th May, 1976.

GNFC created history in 1981 by issuing a share capital of Rs. 436.1 million of 4.89000 shareholders, majority of them individual farmers from Gujarat. The company established in fuel oil based ammonia and urea plant along with offsite facilities of Barouche a backward district of South Gujarat. GNFC has used the best available and the world renewed process technologies for all its plants.
The capacity of Ammonia and Urea plants is 4, 45,000 tones and 6, 36,000 tones respectively. Subsequently the commissioning of the Ammonia – Urea complex in early 80s. Company has been active from 1985 and onwards for a major diversification into industrial chemicals such as methanol. Formic Acid, Acetic Acid, Weak Nitric Acid, Concentrated Nitric Acid etc. The company also worked on the revamp cool expansion of capacities for high demand Chemical Methanol Concentrated Nitric Acid and Acetic Acid. Company also established fertilizers such as Ammonium Nitro Phosphate and Calcium Ammonium Nitrates having capacity of 1,42, 800 tones each plant.

The company has its own 50 MV captive power plant. GNFC also markets it intermediate products such as Liquid Ammonia Methyl Formal Ammonium Nitrate and other products by best utilizing the waste gaseous and liquid effluents. Company also diversified it functions in the field of information technology. It functions include international gateway. Internet service provider and complete infrastructure facilities required by IT companies of Govt. into tower. GNFC has recently started the activity of digital signature certificate along with required application development for the secured business. There for GNFC is growth nucleus for the country.

GNFC in addition to marketing of its own three fertilizer Narmada Urea Narmada Phos and Narmada Can is also engaged in marketing of traded fertilizers like Single Super Phosphate (SSP), Di- Ammonium Phosphate (DAP) and import fertilizer like Muriatic of Potash, DAP and Urea through 9 network of regional officers and 20 urea officers spread all over the country.

State wise portion on sales of manufactured fertilizer in 2004-05 reveals that GNFC sold 48.9% manufactured fertilizer in Gujarat, sold 9.7% fertilizer in Maharashtra, sold 9.2% fertilizer in Madhya Pradesh and Chhattisgarh, sold 8.2% fertilizer in Uttar Pradesh, sold 6.8% fertilizer in Rajasthan, sold 6% fertilizer in Punjab, sold 5.8% fertilizer in
Andhra Pradesh, sold 2.9% fertilizer in Haryana and sold 2.4% fertilizer in Karnataka. Above percentage of selling shows that GNFC sold its most of fertilizer in Gujarat and sold the least fertilizer in Karnataka.

GNFC undertakes various integrated rural development programs like fertilizer demonstration farmers meeting, crop seminars, veterinary camps and distribution of fruit tree grafts, women welfare programmes, school children motivational programmes and distribution of sports items to them. These education programmes helps the farmers in there day to day activities. These activities are carried out in 18 villages of Barouche district every year.

The company has 57 Narmada Khedut Sahay Kendra spread all over the Gujarat manned by agriculture graduates. There is considerable increase in the sales of GNFC during the study period except the year 2002-03. This positive trend can be shown with the following table as under:

**Table 1.10**

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-04</td>
<td>1553</td>
</tr>
<tr>
<td>2004-05</td>
<td>1936</td>
</tr>
<tr>
<td>2005-06</td>
<td>2281</td>
</tr>
<tr>
<td>2006-07</td>
<td>2739</td>
</tr>
<tr>
<td>2007-08</td>
<td>3434</td>
</tr>
</tbody>
</table>

Source: Published Annual Report - 2003-04 to 2007-08

From the above table it is seen that net sales of GNFC was Rs. 1553 crores in 2003-04 and after the year there was continuous increasing trend in net sales of GNFC. It was Rs. 1936 crores in 2004-05 it increases in 2005-06. And reached at Rs. 2281 crores and in the year 2006-07 there was increasing trend in net sales of GNFC. It was
Rs. 2739 Crores in 2006-07 and finally it reached its highest level of Rs. 3434 Crores in 2007-08.

GNFC received various types of award and reorganization during the study period of 2003-04 to 2007-08. In the year 2003-04 the company won the Golden Peacock Eco-innovation Award - 2003 from the World Environment Foundation Hyderabad for CATSOL, the first indigenous technology developed by company for H2 S removal. In 2005 GSFC won the FAI Golden Jubilee Award for best work done in the field of transfer of improved farm technologies.

In the year 2002-03 the company has won the prestigious award from FAI for the best Overall Performance in the country for and operating at P2O5 in complex fertilizer category. FAI awarded for Production Performance Award for Nitrogen in 2002.

1.15 Marketing Network of GSFC

The company is marketing area as DAP, ASP and Gypsum since 1967. Recently by taking into account the need for potash along with N and P, GSFC has introduced 12-32-16 (mixed chemical fertilizer). The company has on extensive marketing net work to promoted use of fertilizer. In several states company field force conducts various types of promotional programs at the grass roots level not only to promoted use of fertilizer but also package of scientific agricultural practices to boost up agricultural production. GSFC is one of the major supplies of fertilizer in the state of Gujarat, Rajasthan, Madhya Pradesh, Maharashtra, Punjab, Haryana, Uttar Pradesh, Andhra Pradesh and Karnataka. The following given table indicates the marketing network of GSFC:
Agricultural Development and Agro Services:

To promote the fertilizer use and bring the technology from lab to field GSFC has setup separate department called Agricultural Development and Agro Service where by the farmers are provided with the latest agricultural know – how. This division formulates action oriented plans and programmes to achieve the short term as well as long term objectives in term of the national imperatives such as generation and promotion of scientific agro technologies, orientation of farmers training farm youths, raising their standard of living and enriching their lives with meaning full future. In the implementation of these agro promotional programmes development of farming community is achieved on a full scale with the ultimate objective of creating confidence in them for absorbing the impact of transfer of modern and high tech agricultural technology. GSFC motto is “Nourish the land and Harish the future”. Major activities of agricultural services are as under:

2. Farm Management Practices.
4. Training Farm Youths.
5. Research and development of Hybrid Seeds.
6. Publication of Magazine Krishi Jivan.
8. Crop Demonstrations.
10. Soil and Water Sample Testing.

Nutritional needs of soil, other subsidiary activities like as micro irrigation system production and marketing of Banana Tissue Culture production and marketing of bio-pesticides and marketing of micro mix and water soluble fertilizer etc. are the area of these activities.

**GSFC’s Contribution Toward Rural Development**

GSFC adopted the slogan, “GSFC progress with rural prospect”. Its marketing is backed with strong rural and agricultural programmes designed with the sole concept of modern farming disseminating technical know-how and undertaking various plans and programmes for ensnaring rural prospering to popularize the sue of fertilizer among farming communication to educate these rural folk on scientific agriculture by adopting package of practices. GSFC started the unique channel of distribution namely form information centers cum depots. GSFC progressively established nearly 230 such centers, practical one of each taluka in Gujarat state. Today GSFC has about 133 depots which are manned by agricultural graduates who work as friends and philosophy of farming community. The depots sell seeds pesticides bio-fertilizers water soluble fertilizers, banana tissue etc.

**(ii) 4P Scheme**

During the year 1970 – 71 GSFC introduced 4 Plan- Package of Practices for Productivity and Prosperity in the district like; Kheda, Banaskatha and Baroda for potato and for control crops. This project provide agricultural inputs besides pays attention that they are applied
scientifically under the supervision of experienced technical field staff to improve the fertilizer use efficiency and hence higher productivity.

(iv) Crop Insurance Project

This project was undertaken from the year 1972-73 to 1975 – 76 in various cotton glowing districts of Gujarat under different climatic conditions. The insurance was provided to them with minor insurance premium by 2 to 3 % of cost of cultivation.

(v) Dry Farming Project

For developing dry land areas GSFC launched Dry Farming Project in 7 villages of Lakhtar and Vadhavan taluka of Surendranagar district from the year 1985 on 393 farmers’ field. In project area the average increase in the field of cotton was by 42% as compared to the non project areas which accepted the local practices. Latter the project was extended to Bhavnagar and Rajkot district in Gujarat, Dhar district in Madhya Pradesh and Dungarpur in Rajasthan state from 1987.

(vi) Bio- Fertilizer

GSFC is one of the leading companies in India producing bio-fertilizer after isolation and experimentation for 3 years. GSFC has commercialized bio- fertilizer under the brand name of Sardar, way back in 1984. GSFC is having about 135 different bacterial clusters which are checked for their efficiency in every season. 66 strains are of our own isolated while remaining has been procured from remounted institutions.

(V) From Youth Training Programme

GSFC is conducting the farm youth training programmes four times in a year since 1986 to train the youth farmers regarding the latest agro techniques and to expedite their hidden potential.
In collaboration with Gujarat Agricultural University, GSFC has conducted 74 programmes and covered 2317 participants belonging to 2125 villages. For ex-participants the refresher programmes is also conducted after going in their village. Therefore, youths from Sukh Club (Sardar Yuva Krishak Harmayee) for undertaking overall development of their village this can be shown in following table:

<table>
<thead>
<tr>
<th>Table 1.12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Farm Youth Training Programmes conducted by GSFC</strong></td>
</tr>
<tr>
<td>Number of programmes conducted till January-2006</td>
</tr>
<tr>
<td>Number of Farm Youth Trained</td>
</tr>
<tr>
<td>Number of Villages Covered</td>
</tr>
<tr>
<td>Number of Reorientation Programmes conducted</td>
</tr>
<tr>
<td>Number of Active Club</td>
</tr>
</tbody>
</table>

Source: Indian Journal of Fertilizer, April-2006

(VI) **Bio-Technology Product**

In order to promote organic farming GSFC has also entered into marketing of bio-pesticides. To save the farming community GSFC is coming with Sardar Ecogreen a bio-fungicide with control the soil born diseases caused by fungal pathogens. The know-how has been obtained from National Botanical Research Institute (NBRI) with a view to keep pace the with latest development in bio-technology field and to serve the farming community by providing them the latest available products. GSFC has started to procure various bio-tech products like Gibberalic Acid, Sardar Neem Protein product from suppliers. It has also been planned to produce Hydrolysis etc at GSFC.
(VII) Leap Forward Project

To uplift the rural and backward Adivasi farmers of Chhota Udepur taluka GSFC started leap forward project in the year 1972-73. The Rathwa Tribal farmers of this taluka used to do their farming by age old methods. GSFC provided those fertilizers and inputs free of cost in the first year with technical know – how which enhanced their yield by four times. This project covered over 500 farmers belonging to 100 villages. This project has a social economic impact also. Their living of standard improved significantly and the number of school going children also increased. Fertilizer consumption increased from 260 tons in 1972-73 to 2500 tons in the year 1984-85.

Conclusions:

Fertilizer industry is one of the key industries in India. It plays a very important role in the national economy. India’s fertilizer industry is the third largest in the world. The production and consumption of fertilizer to large extent indicates a country’s progress. In a developing country like India the need for a well established fertilizer industry is of paramount importance. It is also important from the point of view of employment generation and revenues to the government in the form of taxes and duties.

When the Indian economic reforms programmes were launched in 1991 the liberalization and macro economic stabilization was high on the government agenda. The fertilizer sector was also affected because of reforms which resulted in increase prices of fertilizers.

The first ever fertilizer factory in Gujarat state was established in 1967 by Gujarat State Fertilizer and Chemical Limited at Baroda. GSFC was the first joint sector industrial complex in India having equity capital of State government 49 % and public 51%. The performance of the company on production front was increasing during the period of the
study. Sales of the GSFC also showed continuous increasing every year. The operating profit of GSFC before three year it was continuously increased and then after it decreased. Gujarat Narmada valley Fertilizer Company Limited (GNFC) promoted by the government of Gujarat and GSFC was formed on 10th May, 1976. GNFC sold its fertilizers in 9 states of India. The company has its own 50 MV captive power plant. The sales of GNFC recorded constant increasing during the study time. The operating profits (EBIDT) of GNFC also recorded an increasing trend during the study period.
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