Chapter - II :

GROWTH OF FERTILISER INDUSTRY IN INDIA

The development of an industry is determined by various factors such as availability of raw materials, infrastructural facilities, demand for its products, Government's industrial policy, etc. Of all these, the policy of the Government - agricultural as well as industrial - has played a crucial role in the development of fertiliser industry in India.

Since the initiation of 'Grow More Food' campaign in India, in 1943 emphasis has been laid on the improvement of agricultural system in order to attain self-sufficiency in food production. Since Indian soils are deficient in plant nutrients and organic manures do not supply the required quantum of these nutrients, the application of chemical fertilisers is essential to bridge this gap. As the final product of fertiliser industry goes to the agricultural sector, agricultural policy of the Government also has a significant impact on the growth of fertiliser industry.

Demand for Fertilisers

Although chemical fertiliser was introduced in 1864[1], its

1 Report of the Royal Commission on Agriculture in India, Published by His Majesty's Stationary Office, London, 1928, pp.22-23.

use could not gain much popularity due to economic backwardness of farming community.[2] In 1893, J.A. Voelcker pointed out that the manufacture of fertilisers in India was uneconomical due to high costs of acid (sulphuric acid or oil of vitriol) required for its production.[3] Commenting on the use of fertilisers he stated, "The day is still distant, I believe when artificial manures can be profitably used in India. Some great change either in the cost of manufacture or in the conditions of agricultural class must take place first."[4]

However, fertilisers were profitably used for plantations and cash crops even during the late 19th century. In 1905 the Agricultural Department of the Government of India was reorganised and soil research started in all agricultural institutes in the country. Since it was found that Indian soils were deficient in plant nutrients, the promotion of fertiliser use was considered to be one of the prime objectives of the Department. It was realised that the farmers would use fertiliser only if their application yielded fair returns. Hence in the initial stages when the distribution of ammonium sulphate

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2 Imperial Gazetteer of India, Vol.VI, India, Second Edition, Trübner & Co., London, 1886, p.483.

3 Report on the Improvement of Indian Agriculture, by Voelcker, J.A. Printed by Eyre and Spottiswoode, London, 1893, p.117.

4 Ibid, p.117.

was taken up for the first time in Deccan in 1908, it was distributed free of cost for sometimes, and thereafter at a subsidised price.[5] (Under the "Grow More Food" campaign initiated in the early 1940's also ammonium sulphate was distributed freely for food crops for sometime in certain areas.[6] As a result of the efforts of the Department of Agriculture for popularising the use of fertilisers, its demand increased significantly. However, its use at a significant level was confined only to plantations and cash crops until the beginning of 1940's. The use of fertilisers for other crops was not encouraged because much needed research in this field and in the method of fertiliser use was not done and there was a general belief that "fertilisers if applied in excess may do much harm instead of good. Even if applied by an expert continuously for several years, a time will come when it will not give any result as the soil will be lacking for want of other ingredients required for the healthy growth of the plants which artificial fertilisers do not contain."[7] This belief was prevalent until recently. In 1952, a political worker who visited Pilot Development Project, Etawah (U.P.) felt so bitter that he wrote a booklet ~~let~~ entitled

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5 Royal Commission on Agriculture in India, Vol.II, Pt.I (Evidence taken in the Bombay Presidency), p.514.

6 Handbook on Fertiliser Marketing, Fertiliser Association of of India, New Delhi, 1980, p.23.

7 Royal Commission on Agriculture in India, Vol.VII. (Evidence taken in the United Province), 1927, p.647.

"Ghar Phoonk Tamasha" ("The fun of burning your own house") and published it at his own cost. The theme of the booklet was that the use of chemical fertilisers would simply exhaust the soil fertility."[8] During the late 1950's the soil testing laboratories in India revealed the shocking situation regarding the widespread deficiency of phosphate, medium to high status of potash and universal deficiency of nitrogen in most of the districts from which soil samples were tested.[9] It was realised that low yield in India is due to deficiency of plant nutrients in the soil, therefore, fertiliser promotion programme was intensified at the national level. The introduction of fertiliser responsive dwarf high yielding varieties of crops in the country by the mid of 1960's and the initiation of high yielding variety promotion programme in 1966-67 at the national level gave an impetus to the demand for fertilisers.

Table 2.1 shows that the consumption of nutrients nitrogen (N), phosphorus (P_2O_5) and potash (K_2O) increased from mere 737.8 thousand tonnes, 248.6 thousand tonnes and 114.2 thousand tonnes respectively in 1966-67 to 3419.5 thousand tonnes, 1106.0 thousand tonnes and 591.5 thousand tonnes respectively

8 Singh, D.P. Improved seeds and their impact on the consumption of fertilisers and other inputs, Fertiliser Association of India Seminar, 1970, p.234.

9 Kanwar, J.S. "Fertiliser Use Research in India", Fertiliser News, December 1972, FAI, New Delhi, p.29.

Table 2.1 : Consumption of fertiliser nutrients in India.

(Figures in '000 tonnes)

Year	Nutrient nitrogen (N)	Nutrient Phosphorus (P_2O_5)	Nutrient Potash (K_2O)	Total ($N+P_2O_5+K_2O$)	% of imports to total consumption
1951-52	58.7	6.9	-	65.6	79.27
1952-53	57.8	4.6	3.3	65.7	71.54
1953-54	89.3	8.3	7.5	105.0	24.76
1954-55	94.8	15.0	11.1	120.9	25.64
1955-56	107.5	13.0	10.3	130.8	48.17
1956-57	123.1	15.9	14.8	153.8	46.81
1957-58	149.0	21.9	12.8	183.7	66.96
1958-59	172.0	29.5	22.4	223.9	53.15
1959-60	229.3	53.9	21.3	304.5	58.78
1960-61	211.7	53.1	29.0	293.8	143.00
1961-62	249.8	60.5	28.0	338.3	112.92
1962-63	333.0	82.8	36.4	452.2	65.24
1963-64	376.8	116.5	50.6	543.9	51.66
1964-65	555.2	148.7	69.3	773.2	38.93
1965-66	574.8	132.7	77.3	784.3	52.62
1966-67	737.8	248.6	114.2	1100.6	81.59
1967-68	1034.6	334.8	169.6	1539.0	96.56
1968-69	1208.6	382.1	170.0	1760.7	67.87
1969-70	1356.0	416.0	210.0	1982.0	44.45
1970-71	1479.0	541.0	236.3	2256.3	27.88
1971-72	1798.0	558.2	300.0	2656.2	37.53
1972-73	1839.0	581.3	347.5	2767.8	43.14
1973-74	1829.9	649.7	359.8	2839.4	43.74
1974-75	1765.7	471.5	336.1	2573.3	62.45
1975-76	2148.6	466.8	278.3	2893.7	56.50
1976-77	2457.1	635.3	318.6	3411.0	30.98
1977-78	2913.1	866.8	506.2	4285.9	35.49
1978-79	3419.5	1106.0	591.5	5117.0	38.97
Annual Rate of growth					
1951-52 to 1978-79	15.68%	20.25%	18.55%	16.61%	
1966-67 to 1978-79	10.42%	8.13%	10.76%	10.14%	

Source: Fertiliser Statistics, Fertiliser Association of India, New Delhi, 1979-80.

in 1978-79. The annual rate of growth in the consumption of fertiliser nutrientg~~ients~~ during 1966-67 to 1978-79 was : nitrogen 10.42%, phosphorus 8.13%, potash 10.76% and all nutrients ($N+P_2O_5+K_2O$) 10.14%.

During 1951-52 to 1978-79 the consumption of fertiliser nutrients increased at the rate of 15.68% N, 20.25% P_2O_5, 18.55% K_2O and 16.61% all nutrients ($N+P_2O_5+K_2O$). Although the consumption of fertiliser nutrients has increased remarkably since 1966-67, the annual rate of growth during 1966-67 to 1978-79 was lower than the growth rate during 1951-52 to 1978-79. This is due to the fact that prior to 1966-67 fertilisers were consumed in very small quantities in the country and thereafter the consumption has increased very fastly. The difference in the absolute values of consumption figures has directly affected the rate of growth.

Table 2.1 also shows that all the imports of fertilisers during a particular year are not distributed for final consumption in that year, hence a part of that is kept aside for future distribution. During 1960-61 and 1961-62 the quantity of imports exceeded total consumption. The last column of Table 2.1 shows that imported fertilisers constituted 143% and 112.92% of total consumption of fertilisers in the country during 1960-61 and 1961-62 respectively. Similarly for

many other years the distribution of imported fertilisers might have exceeded the total quantity of imports during those years. An important point which emerges from Table 2.1 is that imported fertilisers still constitute a significant part of total consumption of fertilisers in the country.

Table 2.2 shows gross cropped area and fertiliser consumption per hectare of gross cropped area in India. The gross cropped area increased from 133.2 million hectares in 1951-52 to 173.3 million hectares in 1978-79. Per hectare consumption of fertiliser nutrients N and P_2O_5 increased from mere 0.44 kg and 0.05 kg. respectively in 1951-52 to 19.73 kg. and 6.38 kg. respectively in 1978-79. Nutrient K_2O was not consumed before 1952-53. Per hectare consumption of K_2O increased from 0.02 kg. in 1952-53 to 3.41 kg. in 1978-79. Per hectare consumption of all nutrients ($N+P_2O_5+K_2O$) increased from 0.49 kg. in 1951-52 to 29.52 kg. in 1978-79. Table 2.2 also shows that per hectare consumption of fertilisers has increased significantly since 1966-67.

Industrial Policy of the Government

Before independence fertilisers were produced at small-scale in India. This infant industry did not receive any support from the British Government and had to develop under

Table 2.2 : Gross cropped area and fertiliser consumption per hectare of gross cropped area in India.

Year	Gross cropped area ('000 hectares)	Fertiliser consumption per hectare of Gross cropped area			
		N (kg)	P_2O_5 (kg)	K_2O (kg)	$N_2+P_2O_5+K_2O$ (kg)
1951-52	133,234	00.44	00.05	-	00.49
1952-53	137,675	00.42	00.03	00.02	00.47
1953-54	142,480	00.63	00.06	00.05	00.74
1954-55	144,087	00.66	00.10	00.08	00.84
1955-56	147,311	00.73	00.09	00.07	00.89
1956-57	149,492	00.82	00.11	00.10	01.03
1957-58	145,832	01.02	00.15	00.09	01.26
1958-59	151,629	01.13	00.19	00.15	01.47
1959-60	152,824	01.50	00.35	00.14	01.99
1960-61	152,772	01.39	00.35	00.19	01.93
1961-62	156,209	01.60	00.39	00.18	02.17
1962-63	156,760	02.12	00.53	00.23	02.88
1963-64	156,963	02.40	00.74	00.32	03.46
1964-65	159,229	03.49	00.93	00.44	04.86
1965-66	155,276	03.70	00.85	00.50	05.05
1966-67	157,355	04.69	01.58	00.73	07.00
1967-68	163,736	06.32	02.04	01.04	09.40
1968-69	159,529	07.58	02.40	01.07	11.05
1969-70	162.265	08.36	02.56	01.29	12.21
1970-71	165,791	08.92	03.26	01.43	13.61
1971-72	165,194	10.88	03.38	01.82	16.08
1972-73	162,150	11.34	03.58	02.14	17.06
1973-74	169,870	10.77	03.82	02.12	16.71
1974-75	164,190	10.75	02.87	02.05	15.67
1975-76	170,904	12.57	02.73	01.63	16.93
1976-77	167,070	14.71	03.80	01.91	20.42
1977-78	172,306*	16.91*	05.03*	02.94*	24.88*
1978-79	173,300*	19.73*	06.38*	03.41*	29.52*

* Provisional estimates.

Note: Per hectare consumption of fertilisers is computed on the basis of figures given in Table 2.1.

Source: Fertiliser Statistics,1979-80, Fertiliser Association of India, New Delhi,p.II-2-3.

stiff competition with giant companies of England which were provided effective protection against their competitors abroad.[10] As a result of competition Messrs Dharamsi Morarji Chemical Company, Bombay, which commenced manufacture of superphosphate in 1924 had to close down in 1929 due to lack of demand for its products and the company could restart production only in 1945[11] when the demand for fertilisers picked up in the country and the fear of competition had allayed due to shipping difficulties caused by World War II. Since the use of fertilisers received prime importance under the "Grow More Food" campaign, the seeds for the growth of fertiliser industry in the country were sown along with this campaign.

The industrial policy resolution of April 7, 1948 had two layer approach. Firstly, it included the fertiliser industry in the list of basic industries of importance which were to be regulated by the Central Government in consultation with the State and Provincial Governments. Secondly, it also opened the door for private and co-operative sector to participate in the production of fertilisers. The Industrial Development and Regulation Act (IDRA) 1951 brought the fertiliser industry under purview which empowered the Central Government to

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10 Adarkar, Balachandra P. The Indian Fiscal Policy, Allahabad, Kitabisthan, 1941, p.335.

11 Government of India, Tariff Board. Report on the fair ex-works prices of superphosphate, 1949, p.2.

establish development council for this industry. The important functions of the Development Councils are (a) to recommend targets of production and measures for increasing capacity utilisation, (b) to import and distribute raw materials, (c) to promote training of industrial workers, (d) to promote or undertake scientific and industrial research and the collection and formulation of statistics and (e) to undertake enquiries for the purpose of tendering advice to the Government on matters referred to the Development Council.

The industrial policy resolution of 1956 conceived the roles of public and private sectors as supplementary and complementary to each other in fertiliser industry. With a view to accelerate the development of fertiliser industry it was decided that fertiliser plants which required substantial capital investment, i.e., nitrogenous fertiliser plants would be set-up in the public sector, although, the doors were kept open for the participation of private as well as co-operative sectors. Since single superphosphate (SSP) fertilisers are produced at small scale due to limitations imposed by raw-material availability and process technology, capital requirements are low for setting up SSP factory. Therefore, private entrepreneurship has been encouraged in this sphere.

Pattern of Growth

Fertiliser industry came into being in the first decade of this century when Messrs EID Parry Ltd. established their superphosphate factory at Ranipet near Madras in 1906. The production was carried on at small-scale and until 1945 the raw-material used was bone meal. Since the production of superphosphate from rock-phosphate was economical, in 1945 Messrs EID Parry Ltd. switched over to raw-material rock-phosphate. The production of nitrogenous fertiliser, ammonium sulphate, (AS), started in India during the First World War. Ammonia, the basic intermediate for the production of nitrogenous fertilisers, was produced from coke oven gas at Tata Iron & Steel Co.Ltd., Jamshedpur (Bihar) and at Coal fields of Bengal, Bihar and Orissa.[12] During the war period ammonia was produced for the manufacture of ammunition and thereafter, the production of ammonium sulphate started for agricultural purposes. TISCO started the manufacture of ammonium sulphate in 1916. In 1919, only 4.4 thousand tonnes of ammonium sulphate was produced in India.[13] The production of AS increased more than three times within a decade and it reached the level of 15.1 thousand tonnes in 1928.[14] Thereafter, the industry

12 Pascoe, Sir Edwin: "India's Resources in Mineral Fertilisers", Bulletin of Indian Industries and Labour, No.42, Govt. of India, Central Publication Branch, Calcutta, 1929, pp.10-14.
13 op.cit. Royal Commission on Agriculture, 1929, pp.10-14.
14 Report of the Indian Tariff Board on Heavy Chemical Industry, 1929, p.60.

did not make significant progress and in 1946 the production of AS was only 22.7 thousand tonnes.[15] The main causes for stagnation were (i) the fertiliser plants were of small size and the technology adopted was conventional, and (ii) in spite of Indian Tariff Board's recommendations in 1929 for the provision of protection,[16] the industry had to develop under stiff competition from abroad. The British Government's policy was not favourable for this industry. The Industrial Survey Committee's recommendation in the late 1930's for the setting up of a fertiliser manufacturing unit in the public sector[17] was also overlooked. Soon after that the circumstances changed. The availability of fertilizers in the international market dwindled due to shipping difficulties as well as diversion of ammonia for the production of ammunition instead of fertilisers during the World War II. During those years India faced acute shortage of foodgrains. Since the importance of fertilisers use for the increase in food-grains production was realised, it was decided to manufacture fertilisers at large-scale within the country. Thus, FACT (Fertilisers and Chemicals Travancore Ltd.), Alwaye (Kerala) was incorporated in 1943. During the same year the Food Grains Policy Committee recommended

15 Reserve Bank of India. Report on Currency & Finance for the year 1948-49, p.69.

16 Op.cit. Report of the Indian Tariff Board on Heavy Chemical Industry, 1929, p.58.

17 Report of the Industrial Survey Committee, 1939, p.8.

the setting up of a plant capable of manufacturing 350,000 tonnes of AS per annum. Based on these recommendations Sindri Fertilisers and Chemicals Ltd. was incorporated in 1945.[18]

The intermediate ammonia required for the manufacture of nitrogenous fertilisers can be produced from any raw-material which generates hydrogen gas. Mysore chemicals & Fertilisers, which was set-up at Belagala in 1938, commenced manufacture of AS in 1941 using electrolysis of water process. The installed capacity of AS was 20 tonnes per day.[19] FACT, Alwaye commenced production of AS on June 26th, 1947. The raw material used in FACT was unique in the history of fertiliser industry. Since electricity and coal were not available, ammonia was produced from hydrogen gas generated from firewood (Charcoal) which till then was a laboratory process.[20] The capacity of AS production at FACT Alwaye was 10,000 tonnes per annum and this was the largest fertiliser producing factory in India till the end of 1940's. In 1963 FACT Alwaye switched over to electrolysis of water process and in 1966 it switched over to raw material naphtha.[21] In 1950 there were four nitrogenous

18 The Famine Enquiry Committee, Final Report, 1945, printed by Superintendent, Government Press, Madras, p.147.

19 Krishnaswami, S. Nitrogenous feedstock status - conventional and alternative feedstock - Indian situation. FAI-IFDC Fertiliser Seminar, 1977, p.Tech-I/22.

20 Fertiliser Transport Study, Planning Commission, FAI, 1968, p.56

21 Sharma, P.C. Case study of synthesis gas production at FACT. FAI Seminar, 1969, p.165.

fertiliser plants and seven single superphosphate fertiliser plants in India. The installed capacity in terms of fertiliser nutrients was 16.7 thousand tonnes of nutrient nitrogen (N) and 20.5 thousand tonnes of nutrient phosphate (P_2O_5). Thus, in the initial stages of development the progress was slow due to small size of plants and lack of incentives.

A new era in the history of India's fertiliser industry began when Sindri Fertiliser Factory was commissioned in October 1951. The capacity of AS production jumped up from mere 81 thousand tonnes to 430.8 thousand tonnes per annum. In terms of nutrient nitrogen the capacity increased from mere 16.7 thousand tonnes to 88.7 thousand tonnes per annum. Thus, there was an increase to the tune of 431% in the production capacity of nutrient nitrogen. The production of Sindri Factory was also based on raw material coke.

Until 1959, AS was the only nitrogenous fertiliser being produced in India. Since the demand for nitrogenous fertilisers was expected to increase very sharply in future and indigenous supply of sulphur or gypsum which is required for the production of AS was not adequate and also AS being a low analysis fertiliser, it was decided to produce high analysis fertilisers from alternate raw-materials which were available indigenously.

In 1954 the Government of India appointed a 'Fertiliser Production Committee' to examine the entire position and advise the Government on the manufacture of suitable forms of alternative nitrogenous fertilisers. As a result of the recommendations of this committee it was decided to set up production plants at Nangal (Punjab), Neyveli (Tamil Nadu) or failing Neyveli at Vijayawada (Andhra Pradesh), and Bombay (provided the gases from the oil refineries could be obtained at reasonable prices at Bombay). When matters were at this stage a decision was taken by the Government of India to put up a steel plant at Rourkela (Orissa) and it was considered desirable to produce some nitrogenous fertiliser from Coke over gas, there also.[22] Thereafter various fertiliser plants, one after another, were set up and the progress achieved is very significant. Even in the Five Year Plans high priority has been accorded for the creation of additional capacity through the establishment of new factories and expansion of existing factories. Table 2.3 shows the planned targets for the production of fertiliser nutrients and the extent to which they have been achieved. This table shows that although the targets have not been achieved, even then, the production has increased very significantly. Table 2.4 shows the installed capacity and actual production of fertiliser nutrients in India. Installed

22 Satyanarayana, P. "The nitrogenous fertilisers of tomorrow". Fertiliser News, May 1957, p.4.

Table 2.3 : Planned and actual production of fertilisers in India.

(Figures in '000 tonnes)

Year	Nutrient Nitrogen (N)		Nutrient Posphate (P_2O_5)	
	Target	Achievement	Target	Achievement
First Five Year Plan				
1955-56	83	76.9	20	12.4
Second Five YearPlan				
1960-61	290	112.0	120	53.7
Third Five Year Plan				
1966-67	500	309.0	250	145.7
Annual Plan				
1967-68	800	402.6	357	207.1
Annual Plan				
1968-69	1080	563.0	520	213.2
Annual Plan				
1969-70	1400	730.6	700	223.7
Fourth Five Year Plan				
1973-74	2500	1049.9	900	324.5
Fifth Five Year Plan				
1978-79	2900	1999.8	770	778.0
Sixth Five Year Plan				
1982-83	4100	-	1125	-

Source: Fertiliser Statistics, Fertiliser Association of India, New Delhi.

Table 2.4 : Nutrient-wise installed capacity and production of fertilisers in India.

(Figures in '000 tonnes)

Year	Nutrient Nitrogen (N)			Nutrient Phosphate (P_2O_5)		
	Installed capacity	Production	% of capacity utilisation	Installed capacity	Production	% of capacity utilisation
1951-52	88.7	28.9	32.58	27.7	9.8	35.38
1952-53	88.7	53.1	59.86	31.7	7.4	23.34
1953-54	88.7	52.9	59.64	31.7	13.8	43.53
1954-55	88.7	68.5	77.23	34.6	14.3	41.33
1955-56	88.7	76.9	86.70	43.2	12.4	28.70
1956-57	88.7	78.8	88.84	43.2	17.6	40.74
1957-58	88.7	81.1	91.43	49.6	25.8	52.02
1958-59	88.7	80.8	91.09	53.5	31.0	57.94
1959-60	148.6	83.7	56.33	80.8	51.4	63.61
1960-61	162.2	112.0	69.05	95.6	53.7	56.17
1961-62	246.3	154.3	62.65	107.2	65.4	61.01
1962-63	246.3	194.2	78.85	107.2	88.3	82.37
1963-64	326.7	219.1	67.06	146.5	107.8	73.58
1964-65	324.0	243.2	75.06	175.1	131.0	74.81
1965-66	324.0	237.9	73.43	187.5	118.8	63.36
1966-67	524.9	309.0	58.87	263.6	145.7	55.27
1967-68	632.4	402.6	63.66	316.7	207.1	65.46
1968-69	904.5	563.0	62.24	431.2	213.2	49.44
1969-70	1136.4	730.6	64.29	431.2	223.7	51.88
1970-71	1349.3	832.5	61.70	433.5	228.1	52.62
1971-72	1514.7	949.2	62.67	532.0	290.3	54.57
1972-73	1471.2	1054.5	71.68	502.6	330.3	65.72
1973-74	1933.5	1049.9	54.30	534.2	324.5	60.75
1974-75	2162.1	1186.6	54.88	666.2	331.2	49.71
1975-76	2625.1	1508.0	57.45	737.6	319.7	43.34
1976-77	3024.1	1862.4	61.59	927.5	478.5	51.57
1977-78	3068.8	1999.8	65.17	1192.6	669.9	56.17
1978-79	3295.8	2173.0	65.93	1278.5	778.0	60.85
1979-80	3901.8	2224.3	57.01	1309.5	763.1	58.27
Rate of Growth (% per annum)						
1951-52 to 1979-80	15.95%	15.62%		14.78%	16.62%	
1966-67 to 1979-80	14.52%	10.07%		11.89%	11.82%	

Source: Fertiliser Statistics, Fertiliser Association of India, New Delhi.

capacity for the production of nutrient N has increased at the rate of 15.95% per annum during 1951-52 to 1979-80 and at the rate of 14.52% per annum during 1966-67 to 1979-80. Similarly the compound rate of growth in the capacity of nutrient P_2O_5 was 14.78% per annum during 1951-52 to 1979-80 and 11.89% per-annum, during 1966-67 to 1979-80. The rate of growth for the production of fertiliser nutrients is also very significant. The production of nutrient N increased at the rate of 15.62% per annum during 1951-52 to 1979-80 and 10.07% per annum during 1966-67 to 1979-80. Similarly, the production of nutrient P_2O_5 increased at the rate of 16.62% per annum during 1951-52 to 1979-80 and 11.82% per annum during 1966-67 to 1979-80.

In absolute terms the installed capacity of nutrient N increased from 88.7 thousand tonnes in 1951-52 to 3901.8 thousand tonnes in 1979-80. The production of nutrient N increased from 28.9 thousand tonnes in 1951-52 ~~309.0~~ to 2224.3 thousand tonnes in 1979-80. Similarly the installed capacity for the manufacture of nutrient P_2O_5 in 1951-52, and 1979-80 was 27.7 thousand tonnes and 1309.5 thousand tonnes respectively, and the production of this nutrient during the same years was 9.8 thousand tonnes and 763.1 thousand tonnes respectively. During 1951-52 to 1979-80 the capacity and production of nutrient N increased at almost the same rate whereas in the case of nutrient P_2O_5 growth of production was

higher than the growth rate in installed capacity during the same period of time. During 1966-67 to 1979-80 the growth rate of production of nutrients N and P_2O_5 was lower than the growth rates of their respective capacities. Table 2.4 clearly shows that the fall in the growth rate of production was due to the fact that in 1966 there was a sudden slump in capacity utilisation of N and P_2O_5 fertilisers and since then it has not increased significantly.

Tables 2.5 and 2.6 show respectively the existing and planned capacity of nutrient N and P_2O_5 according to sources of raw materials. Table 2.5 shows that 51.7% of the existing capacity for the production of nutrient N is based on raw material naphtha whereas only 4.7% of the future capacity of projects under implementation will be based on this raw material. 72.7% of the capacity of projects which are under implementation will be based on natural gas and all the projects which are under consideration will be based on natural gas. At present only 13% capacity is based on natural gas. Projects which have been approved in principle would be based on natural gas, coal, fuel oil and imported ammonia and their share in the capacity to be created will be 27.2% natural gas, 16% imported ammonia, 28.4% coal, and 28.4% fuel oil. Thus it is evident from the above discussion that in future,

Table 2.5 : Capacity of Nitrogen (N) according to sources of feedstock (as on 1st Sept.1980)

(Figures in tonnes of nutrient N per annum)

Stage of Production	Naphtha		Natural gas		Electric power*		Coke/coke oven gas	
	Capacity	% to total	Capacity	% to total	Capacity	% to total	Capacity	% to total
I. Factories in production	23,70,000	51.7	5,94,000	13.0	80,000	1.7	64,840	1.4
II. Projects under implementation	1,00,000	4.7	15,32,000	72.7	-	-	-	-
III. Projects approved in principle	-	-	2,18,000	27.2	-	-	-	-
IV. Projects under consideration.	-	-	21,20,000	100.0	-	-	-	-
Total	24,70,000	25.7	44,64,000	46.4	80,000	0.8	64,840	0.7

	Imported Ammonia		Coal		Fuel Oil		Total capacity
	Capacity	% to total	Capacity	% to total	Capacity	% to total	
I.	1,20,000	2.6	4,56,000	9.9	9,01,000	19.7	45,85,840
II.	50,000	2.4	-	-	4,25,000	20.2	21,07,000
III.	1,28,600	16.0	2,28,000	28.4	2,28,000	28.4	8,02,600
IV.	-	-	-	-	-	-	21,20,000
Total	2,98,600	3.1	6,84,000	7.1	15,54,000	16.2	96,15,440

* Only a part of the capacity is based on electrolysis process.

Source: Fertiliser Statistics,1979-80, Fertiliser Association of India, New Delhi.

Table 2.6 : Capacity of phosphate (P_2O_5) according to raw-materials (as on 1st Sept.1980)

(Figures in '000 tonnes per annum)

Types of fertiliser and stage of production	Sulphur	Pyrites	Smelter gases	By-product sulphuric acid	Nitric acid	Imported phosphoric acid	Total capacity
I. Factories in Production							
Single superphosphate(SSP)	221.1 + 26.0	-	12.0	27.4	-	-	287.5
Triple superphosphate(TSP)	12.2	150.0**	90.0	-	-	-	252.2
Pelofos	7.6	-	-	-	-	-	7.6
NP/NPK complex fertiliser	365.5	-	-	-	120.0	281.0*	766.5
Others	+19.5	-	-	-	-	-	19.5
Total	652.9	150.0	102.0	27.4	120.0	281.0	1333.3
Percentage capacity to total	(49.0)	(11.2)	(7.6)	(2.1)	(9.0)	(21.1)	(100.0)
II. Projects under Implementation:							
SSP	59.1	-	-	-	-	-	59.1
NP/NPK complex fertilisers	-	-	-	-	75.0	125.0	200.0
Total	59.1	-	-	-	75.0	125.0	259.1
Percentage capacity to total	(22.8)	-	-	-	(28.9)	(48.3)	(100.0)
III. Projects approved in Principle							
SSP	106.6	-	-	-	-	-	106.6
NP/NPK complex fertiliser	380.0	-	-	-	-	-	380.0
Others*	+50.0	-	-	-	-	-	50.0
Total	536.6	-	-	-	-	-	536.6
Percentage capacity to total	(100.0)	-	-	-	-	-	(100.0)

cont...

Table 2.6 (contd.)

Types of fertiliser and stage of production	Sulphur	Pyrites	Smelter gases	By-product sulphuric acid	Nitric acid	Imported phosphoric acid	Total capacity
IV. Projects under consideration :							
TSP	225.3 +127.0	-	-	-	-	-	352.3
NP/NPK complex fertilisers	323.0	-	-	-	-	42.0	365.0
Total	675.3	-	-	-	-	42.0	717.3
Percentage capacity to total	(94.1)					(5.9)	(100.0)
TOTAL OF I to IV :							
SSP	413.8	-	12.0	27.4	-	-	453.2
TSP	364.5	150.0	90.0	-	-	-	604.5
Pelofos	7.6	-	-	-	-	-	7.6
NP/NPK Complex fertiliser	1068.5	-	-	-	195.0	448.0	1711.5
Others	69.5	-	-	-	-	-	69.5
Grand Total	1923.9	150.0	102.0	27.4	195.0	448.0	2846.0
Percentage capacity to Total	(67.6)	(5.3)	(3.6)	(1.0)	(6.8)	(15.7)	(100.0)

Note: * one of the factories uses imported monoammonium phosphate occasionally. During Sixth Plan period it will have its own phosphoric acid plant.
** It would use both pyrites and sulphur.
+ This part of the phosphoric acid is planned to be marketed.

Source: Fertiliser Statistics, 1979-80, Fertiliser Association of India, New Delhi.

natural gas will contribute significantly for the creation of additional capacity of nitrogenous fertiliser production in the country.

Sulphur/pyrites and rockphosphate are important raw-materials for the production of phosphatic fertilisers.[23] Sulphuric acid which is produced from sulphur/pyrites is the basic intermediate in the superphosphate industry. Table 2.6 shows that 49% of the existing P_2O_5 capacity in India is based on raw-material sulphur and in future also much of the P_2O_5 capacity will be based on this raw material. It is important to note here that phosphoric acid, which is an important intermediate for the production of NP/NPK complex fertilisers, is also produced from sulphur/pyrites.

The period between 1959 and 1969 is another landmark in the history of fertiliser production in India. The production of various types of new fertilisers started in India during this period. Table 2.7 shows the chronology of fertiliser manufacture in India. Prior to 1959 only two types of fertilisers, i.e. AS and SSP, were being produced in India. The number of fertiliser types increased to 12 in 1968. It should be noted here that the NPK complex fertilisers contain various grades of fertilisers, hence, it refers to a group of fertilisers which

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23 If rock-phosphate is acidulated with nitric acid, the resulting product is called nitrophosphate and it contains both nutrients N and P_2O_5.

Table 2.7 : Chronology of fertiliser manufacture in India.

Approximate year of first manufacture	Fertilizer material manufactured	Factory which first manufactured	Total No.of units licenced to manufacture (as on 1-9-1980)
1906	Single super phosphate	E.I.D.Parry(India)	42
1916	Ammonium sulphate as a by-product of steel industry.	Tata Iron & Steel Co.Ltd.,Jamshedpur.	6
1941	Ammonium sulphate by using sulphuric acid.	Mysore chemicals & Fertilisers Ltd., Belagula.	1*
1947	Ammonium sulphate by using gypsum as a raw material.	FACT, Alwaye.	5
1959	Ammonium sulphate nitrate	FCI Ltd.,Sindri	1**
1959	Urea	FCI Ltd.,Sindri	22
1959	Ammonium Chloride	New Central Jute Mills Co.Ltd.,Varanasi	3
1960	Ammonium phosphate	FACT, Alwaye	2
1961	Calcium ammonium nitrate	NFL,Nangal	2
1965	Nitrophosphate	RCFL,Trombay	1
1967	Diammonium phosphate	GSFC,Baroda	3
1968	Urea ammonium phosphate	CFL,Vizag.	3
1968	Triple superphosphate	DMCC,Ambernath	4
1968	NPK Complex fertilisers	RCFL,Trombay	4
1973	Pelofos	Orissa Fertilisers & Chemicals,Rourkela	1

Note: * Closed in 1965.
** Now not manufactured.

Source: Fertiliser Statistics,1979-80, Fertiliser Association of India, New Delhi.

Table 2.8 : Nutrient-wise and sector-wise share of fertiliser capacity under various stages of implementation (as on 1st September 1980) (Figures in '000 tonnes per annum)

Stage of production	Public Sector Capacity	Public Sector % to total	Private Sector Capacity	Private Sector % to total	Co-Op.Sector Capacity	Co-Op.Sector % to total	Total
			Nutrient Nitrogen (N)				
1. Factories in production	2843.1	62.0	1299.3	28.3	443.0	9.7	4585.9
2. Projects under implementation	994.0	47.2	373.0	17.7	740.0	35.1	2107.0
3. Projects approved in principle	500.0	62.3	302.6	37.7	-	-	802.6
4. Projects under consideration	-	-	-	-	-	-	2120.0*
Total	4337.1	45.1	1975.4	20.5	1183.0	12.3	7495.5 +2120.0*
			Nutrient Phosphorus (P_2O_5)				
1. Factories in production	690.4	51.8	515.9	38.7	127.0	9.5	1333.3
2. Projects under implementation	75.0	28.9	59.1	22.8	125.0	48.3	259.1
3. Projects approved in principle	321.1	59.8	215.5	40.2	-	-	536.6
4. Projects under consideration	289.3	40.3	176.0	24.5	127.0	17.7	592.3 + 125.0*
Total	1375.8	48.3	966.5	34.0	379.0	13.3	2721.3 + 125.0*

* Sector-wise distribution pattern of few projects are not yet determined.

Source: Fertiliser Statistics, Fertiliser Association of India, New Delhi.

contain two or more plant nutrients. Table 2.8 shows the nutrient-wise and sector-wise share of fertiliser capacity under various stages. It is apparent from the table that significant part of the installed capacity of both nutrients N and P_2O_5 is in the public sector. In case of nutrient N, 62% of the existing capacity, 47.2% of the capacity of projects approved in principle will be set up in the public sector. Similarly the share of public sector in the installed capacity of nutrient P_2O_5 is 51.8% of the already existing capacity, 28% of the capacity of projects under implementation, 59.8% of the capacity of projects approved in principle and 40.3% of the capacity of projects under consideration. Table 2.8 also shows that private sector and co-operative sector have also contributed significantly in the creation of additional capacity in India.

Table 2.9 shows the share of different types of fertilisers in the capacity under various stages of implementation in India. The share of urea and NP/NPK complex fertilisers is quite significant. In the case of nutrient N, 80.2% of the existing capacity, 94.1% of the capacity of projects under implementation and 80.6% of the capacity of projects approved in principle has been planned for the production of fertiliser urea. The contribution of NP/NPK fertilisers for the supply of nutrient P_2O_5 is remarkable. The capacity for the production of this

Table 2.9 : Share of different fertilisers in the capacity under various stages of implementation in India (as on 1st September 1980)

(Figures in tonnes of nutrient per annum)

Fertiliser	In Production (I)				Under implementation(II)				Approved in Principle(III)				Under consideration(V)				Grand Total(I+II+III+IV)			
	CNN	PCT	CNP	PCT	CNN	PCT	CNP	PCT	CNN	PCT	CNP	PCT	CNN	PCT	CNP	PCT	CNN	PCT	CNP	PCT
1.Ammonium Sulphate	199620	4.4	-	-	-	-	-	-	2100	0.3	-	-	-	-	-	-	201720	2.1	-	-
2.Calcium ammonium nitrate	200000	4.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200000	2.1	-	-
3.Urea	3679340	80.2	-	-	1982000	94.1	-	-	647000	80.6	-	-	-	-	-	-	6308340	65.6	-	-
4.Ammonium chloride	21190	0.5	-	-	-	-	-	-	6500	0.8	-	-	-	-	-	-	27690	0.3	-	-
5.Single superphosphate	-	-	261500	19.6	-	-	59140	22.8	-	-	106560	19.9	-	-	-	-	-	-	427200	15.0
6.Triple superphosphate	-	-	252150 +45500**	18.9 3.4	-	-	-	-	-	-	50000**	9.3	-	-	225300 +127000*	31.4 17.7	-	-	477450* +222500**	16.8 7.8
7.Pelofos	-	-	7600	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7600	0.3
8.Ammonium phosphate sulphate	39160	0.9	46500	3.5	-	-	-	-	-	-	-	-	-	-	-	-	39160	0.4	46500	1.6
9.Diammonium phosphate	24480	0.5	62560	4.7	-	-	-	-	-	-	-	-	-	-	-	-	24480	0.3	62560	2.2
10.Nitrophosphate	120000	2.6	120000	9.0	75000	3.5	75000	28.9	-	-	-	-	-	-	-	-	195000	2.0	195000	6.9
11.Urea ammonium phosphate	117800	2.5	145800	10.9	-	-	-	-	-	-	-	-	-	-	-	-	117800	1.2	145800	5.1
12.NP/NPK fertilisers	184250	4.0	391670	29.4	50000	2.4	125000	48.3	147000	18.3	380000	70.8	50000	2.4	365000	50.9	431250	4.5	1261670	44.3
13.Urea and NP/NPK Fertilisers*	-	-	-	-	-	-	-	-	-	-	-	-	2070000	97.6	-	-	2070000	21.5	-	-
Total	4585840	100	1333280	100	2107000	100	259140	100	802600	100	536560	100	2120000	100	717300	100	9615440	100	2846280	100

Note: CNN = Capacity of nutrient nitrogen (N)
PCT = Percentage to total
CNP = Capacity of nutrient phosphate (P_2O_5)

* End product capacity is not yet decided.
** Phosphoric acid as P_2O_5.

Source: Fertiliser Statistics, Fertiliser Association of India, New Delhi, 1979-80.

nutrient will increased substantially in future. For example the share of NP/NPK fertilisers in the installed capacity of P_2O_5 in India at present is 29.4%, and its share in projects under implementation is 48.3%. The increase in the capacity of NP/NPK complex fertiliser production is due to the importance given to the balanced use of fertilisers which to a certain extent is provided by NPK fertilisers and also due to advancement in the process technology of complex fertilisers. In September 1980, there were 35 nitrogenous fertiliser producing units and 42 superphosphate fertiliser producing units in India.

India's Place in The World Fertiliser Scene

Since fertiliser industry has recently developed in India, we have not made much progress in the process technology and hence, in this field we have to depend on foreign collaboration. Although the process technology for the production of nitrogenous and NP/NPK complex fertilisers have made remarkable progress since 1950's in some of the advanced countries, the process technology for the production of superphosphate fertiliser (i.e. SSP) is still conventional. The only achievement in this field is the progress in the process technology of phosphoric acid production which is used for the production of high analysis superphosphates[24] and complex fertilisers.[25]

24 When rockphosphate is reacted with sulphuric acid, the resulting product is known as 'single superphosphate' (SSP) and it contains 16% water soluble P_2O_5 (WS P_2O_5), and on the other hand, when rock phosphate is reacted with phosphoric acid, the resulting product is known as 'triple superphosphate' (TSP) and it contains 46% WS P_2O_5.

25 Complex fertiliser may be defined as the fertiliser produced

In the field of fertiliser production, India has made a remarkable progress in the world. Table 2.10 shows India's share and rank in the world production of fertiliser nutrients since 1967-68. Although U.S.A. and U.S.S.R. continue to hold First and Second ranks respectively in the production of both nutrients N and P_2O_5, India had to strive hard to capture a respectable rank. During 1967-68 India ranked 14th in the production of nutrient N and 18th in the production of nutrient P_2O_5. Various new fertiliser plants were set-up and many already existing units expanded their capacities in India, between 1968-69 to 1978-79, as a result of which the production of nutrients N and P_2O_5 increased at the compound rate of 7.8% and 11.28% respectively during 1967-68 to 1978-79. During this period the world production of nutrient N and P_2O_5 increased at the rate of 6.44% and 5.34% respectively. Thus the rate of growth of fertiliser production in India was higher than the rate of growth of World fertiliser production. India's major achievement in the field of fertiliser production is evident from the fact that in 1978-79 we attained fourth rank in the production of nutrient N and eighth rank in the production of nutrient P_2O_5 in the world. India's share in the total production of nutrient N in the world increased from 1.6% in 1967-68 to 4% in 1978-79. Similarly, Indias share in the total

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through chemical process which contains two or more primary plant nutrients.

Table 2.10 : India's share and rank in the world production of fertiliser nutrients. (Figures in '000 tonnes)

Year	Nutrient Nitrogen (N) World production			Nutrient phosphate (P_2O_5) world production		
	Total	India's share(%)	India's rank	Total	India's share(%)	India's rank
1967-68	25,567.7	1.6	14	18,011.1	1.1	18
1968-69	28,388.8	2.0	11	18,493.8	1.2	18
1969-70	30,181.2	2.4	10	19,196.5	1.2	18
1970-71	32,971.8	2.5	10	20,698.8	1.1	20
1971-72	34,961.7	2.7	10	22,365.6	1.3	18
1972-73	37,824.9	2.8	9	23,811.7	1.4	18
1973-74	40,437.3	2.6	10	24,878.7	1.3	19
1974-75	42,513.7	2.8	9	27,059.7	1.2	19
1975-76	43,896.0	3.4	6	26,125.9	1.2	22
1976-77	46,240.2	4.0	4	28,185.4	1.7	14
1977-78	49,331.9	4.0	4	29,995.7	2.2	10
1978-79	53,795.7	4.0	4	32,363.1	2.4	8

Note: Production of Fertilisers in India is given in Table 2.4

Source: Fertiliser Statistics, 1979-80, Fertiliser Association of India, New Delhi, p.III-4-7.

production of nutrient P_2O_5 in the world increased from 1.1% in 1967-68 to 2.4% in 1978-79.

Process Technology

Another factor which has influenced the growth of fertiliser industry in India is the advancement in fertiliser technology. Since last two decades there is a remarkable progress in the improvement of process technology of nitrogenous and complex fertilisers in some of the advanced countries. Ammonia, urea and complex fertiliser plants with the installed capacity of lakhs of tonnes per annum are not uncommon at present. Even in India each one of the two new fertiliser plants, to be based on Bombay High gas will have the capacity to produce 345x2 thousand tonnes of nutrient nitrogen per annum. Thus the advancement in process technology has given impetus to the growth of fertiliser industry in India. Since the single superphosphate technology has not made any significant progress, the single superphosphate fertiliser plants continue to adopt conventional technology and, hence, are of small-size.

The availability of raw materials have also played an important role in the development of fertiliser industry in India. As a result of commissioning of new refineries in the early 1960's in India, naphtha was available in large

quantities. Hence, much of the nitrogen capacity planned in the early sixties was based on raw material naphtha. In the late sixties, it was realised that the use of naphtha would be more profitable for the manufacture of petrochemicals. Therefore, in 1969 a study of various alternative feedstocks for future fertiliser production was undertaken with reference to the following aspects:[26]

(a) Assessment of the requirements of feedstocks for the new fertiliser plants, which may be set-up in the country during the next 10 years having regard to the estimated requirement of fertiliser for the same period.

(b) In the context of the shortage of availability of hydrocarbon feedstock locally, the possibility of using alternative feedstocks for new fertiliser projects and their relative economics with reference to location, product pattern, marketability etc.

The study initiated at that time covered the economics of manufacture of fertilisers making use of naphtha, imported fuel oil, coal, imported liquified natural gas, imported ammonia and electricity, and the conclusions derived from that study were :

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26 Krishnaswami, S. Nitrogenous Feedstock Status - conventional and alternative feedstock - Indian situation, FAI-IFDC seminar 1977, pp.Tech-I/2-3 and 4.

I. The plants to be based on electrolysis process are not viable.

II. Indigenous availability of natural gas and coke oven gas is limited and import of LNG is not viable.

III. Import of ammonia is costlier than naphtha or fuel oil required for its production. Hence, its imports should be restricted only to NPK complex fertiliser plants in special circumstances.

IV. Raw material coal should be used for future fertiliser plants only if fertiliser plants at Ramagundam and Talcher run successfully.

V. Of the two refinery products naphtha and fuel oil, the latter be given preference for fertiliser production due to limited supply of the former for meeting the committed requirements of petrochemical projects and already existing naphtha based fertiliser plants.

On the basis of this study many new fertiliser plants such as NFL Bhatinda (Punjab), NFL Panipat (Haryana), GNFC Bmoach (Gujarat), RCFL Nangal-Expansion (Punjab), FCI Sindri-expansion (Bihar), and RCFL Trombay, Phase-V (Maharashtra) were sanctioned to be based on raw-material fuel oil/LSHS. Another point which is important to note is that almost all the nitrogenous fertiliser plants which were set-up until the end of 1960's were located near the sources of raw materials.

The new feedstock policy which the Government of India

has adopted in the Sixth Five Year Plan states that the future nitrogenous fertiliser projects should preferably be based on natural gas. The use of fuel oil for all new fertiliser projects should be excluded and the use of naphtha for new plants should be considered only in case of a long-term disposal problem in an inland location after taking into consideration the requirements of petrochemical projects. Consideration should be given to use of coal for new plants on the basis of the viability of coal based plants at Talcher and Ramagundam.

Scale and Concentration

Over the period of time, the share of the largest fertiliser manufacturing unit in the total installed capacity of fertiliser nutrients has decreased substantially, although, average installed capacity per unit shows substantial increase. This is apparent from Table 2.11. Until 1950, the average installed capacity in terms of fertiliser nutrients varied around one thousand tonnes per annum due to small size of the plants. After the commissioning of Sindri Fertiliser Plant the average installed capacity increased to 8.79 thousand tonnes per annum. The increase in the total installed capacity was remarkable. It increased from mere 12.22 thousand tonnes per annum in 1950 to 131.90 thousand tonnes per annum in 1955. The contribution of

Table 2.11 : Scale of fertiliser manufacture in fertiliser industry in India.

(Capacity in '000 tonnes)

Year	Total nutrient capacity ($N+P_2O_5+K_2O$) (per annum)	Total No.of manufacturing units	Average capacity per unit (per annum)	Single largest unit		Two largest units		Three largest units		Four Largest units		Five largest units	
				Annual capacity	% to total capacity	Annual capacity	% to total capacity	Annual capacity	% to total capacity	Annual capacity	% to total capacity	Annual capacity	% to total capacity
1906	1.02	1	1.02	1.02	100.00								
1915	1.18	2	0.59	1.02	94.92	1.18	100.00						
1925	3.06	3	1.02	1.87	61.11	2.90	94.77	3.06	100.00				
1935	3.06	3	1.02	1.87	61.11	2.90	94.77	3.06	100.00				
1945	3.92	4	0.98	1.87	47.70	2.90	73.98	3.76	95.92	3.92	100.00		
1950	12.22	11	1.11	3.21	26.27	5.08	41.57	6.92	56.63	7.99	65.38	9.01	73.75
1955	131.90	15	8.79	72.00	54.59	75.21	57.02	77.08	58.44	78.92	59.83	79.99	60.64
1960	257.60	20	12.89	117.00	45.38	120.21	46.63	122.71	47.60	124.66	48.36	126.53	49.08
1965*	511.30	34	15.04	193.50	37.83	310.50	60.70	370.50	72.43	381.76	74.64	388.24	75.90
1970*	1782.80	48	37.14	265.81	14.91	459.31	25.76	604.01	33.93	721.91	40.49	838.28	47.02
1975**	3485.67	60	58.09	265.81	7.63	510.21	14.87	753.73	21.63	984.70	28.25	1178.20	33.80
1980***	9265.05	78	118.78	347.08	3.75	668.62	7.22	980.62	10.58	1266.62	13.67	1519.02	16.40

* Ist October. ** Ist November. *** Ist September.

Note: Figures upto 1945 indicate the installed capacity of nutrient P_2O_5 only, as the capacity of nitrigenous fertiliser (nutrient N) is not known. Hence until 1950, the units producing by-product nitrogenous fertiliser (nutrient N) are also not taken into consideration for computation purpose.

Source: Indian Fertiliser Statistics 1975-76 , Economics and Statistics Division, Ministry of Chemicals and Fertilisers, Government of India, New Delhi, pp.32-33.

2. Fertiliser Statistics, 1979-80, The Fertiliser Association of India, New Delhi, pp.I/2-I/12 and I/2-3.

Sindri Plant was to the extent of 72 thousand tonnes. Thus the share of the largest unit which was declining continuously with the commissioning of more and more units showed a sudden increase. The share of single largest unit, two largest units and three largest units, in the total installed capacity increased from 26.27%, 41.57% and 56.63%, respectively in 1950 to 54.59%, 57.02% and 58.44% respectively in 1955. The share of four largest and five largest units in the total installed capacity was lower in 1955 than their respective shares in 1950. This was due to the fact that, the units producing fertilisers before 1950 were small in number as well as in size.

After the commissioning of Sindri fertiliser plant, a number of fertiliser plants were established in the country which adopted latest fertiliser technology. With the advancement in technology the size of the units went on increasing due to economies of scale.

Another important point which emerges from Table 2.11 is, that, although, the scale of fertiliser manufacture has increased substantially, but due to the fast growth in total production, the degree of concentration has declined remarkably. Annual installed capacity of the largest fertiliser plant in 1906, 1945, 1960 and 1980 was respectively 1.02 thousand tonnes, 1.87 thousand tonnes, 117.00 thousand tonnes and

347.08 thousand tonnes of fertiliser nutrients, whereas the share of the largest plant in the total installed capacity during the same years was 100%, 47.70%, 45.38% and 3.75% respectively. Similarly, the share of installed capacity of two largest units, three largest units, four largest units and five largest units has also declined substantially over the period of time.

However, the average capacity of fertiliser manufacturing units has increased significantly after 1955. During 1950, 1960, 1970 and 1980 the average capacity of fertiliser units was respectively 1.11 thousand tonnes, 12.89 thousand tonnes, 37.14 thousand tonnes and 118.78 thousand tonnes per annum. During the same years the total installed capacity of fertiliser production in terms of nutrients was 12.22 thousand tonnes, 257.80 thousand tonnes, 1782.80 thousand tonnes and 9265.05 thousand tonnes respectively.

Conclusion

The growth of fertiliser industry in the country was governed by various factors such as demand for fertilisers, Governments policies - industrial as well as agricultural - technological progresse etc. The growth of this industry was very slow prior to 1950 as the fertilisers were produced as well as demanded in small quantities in the country. Since the

initiation of 'Grow More Food' campaign in the early 1940's, the Government of India has emphasised more on the achievement of self-sufficiency in food production. As chemical fertilisers contribute substantially in raising the yield of crops, various fertiliser promotion campaigns were initiated at the national level for increasing the use of fertilisers in the country. Consequently, the fertiliser consumption per hectare of gross cropped area in the country has increased from 0.49 kg. in 1951-52 to 29.52 kg. in 1978-79.

The Government of India has taken a keen interest in making arrangements for supplying the required quantities of fertilisers, the demand for which is increasing very rapidly. The short-run arrangements are made through imports of fertilisers and the long-run measures are through creation of additional capacity for fertiliser manufacture within the country itself. Since substantial amount of capital is required for the establishment of large-size fertiliser plants (especially nitrogenous and complex fertilisers) and the private entrepreneurs find it difficult to make financial arrangements, the Government of India has actively participated in making investments in this industry. With the commissioning of large number of fertiliser plants in the country, the capacity as well as production of fertilisers has increased substantially. Consequently, in 1978-79 India attained fourth rank in the production of nutrient N and

eighth rank in the production of nutrient P_2O_5 in the world.

The process technology of fertiliser has progressed remarkably in the world as a consequence of which the size of the plants has increased too. However, with the establishment of large number of fertiliser plants in the country, total production is expanding at much faster rate as a consequence of which the share of large plants in the total production is declining. This means that the industrial concentration in this industry has shown a declining trend.