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THE FERTILIZER INDUSTRY OF INDIA[1/]

by

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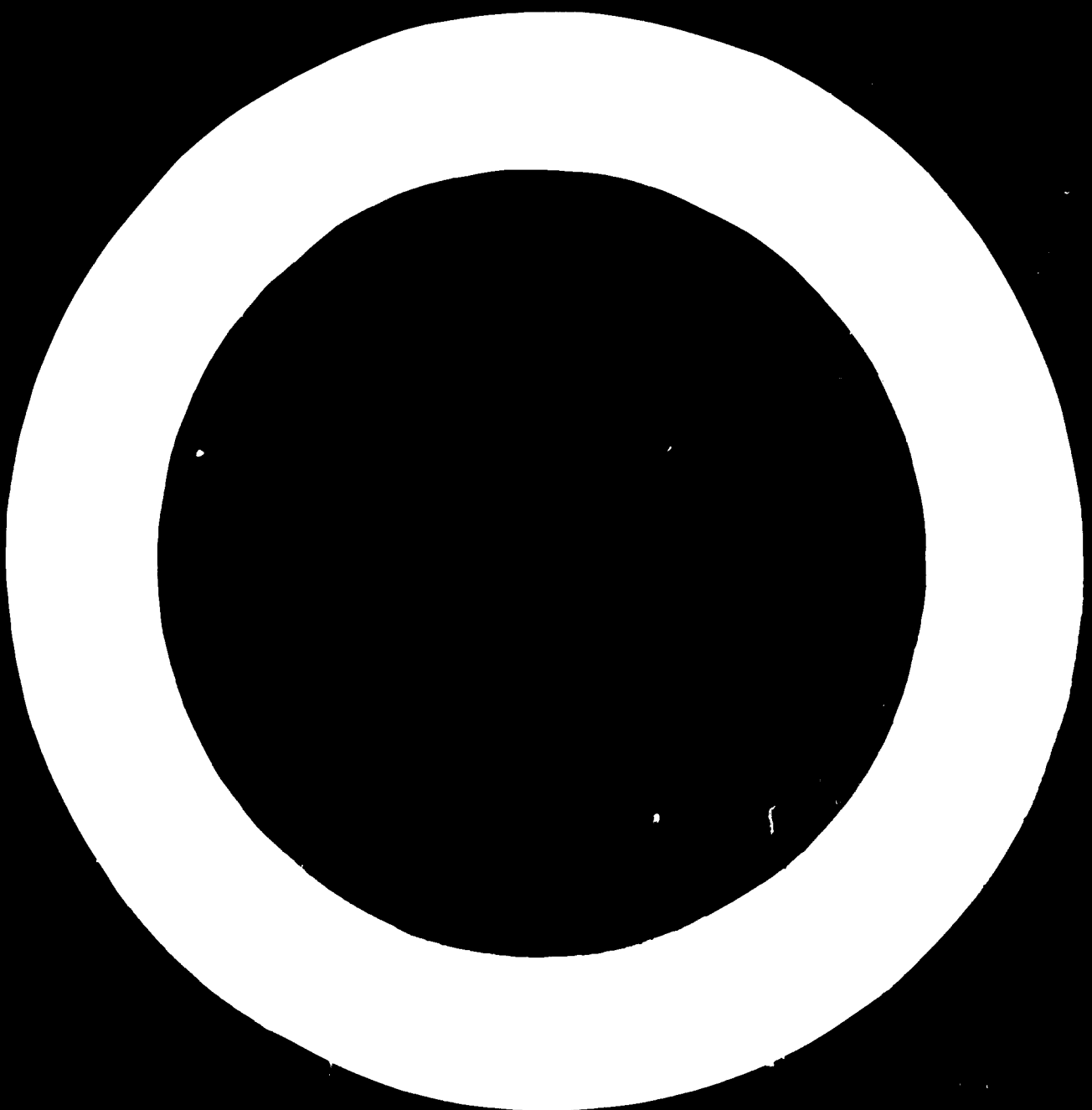


INDIAN FERTILIZER GROWTH - PROBLEMS AND PROSPECTS

1. Nature has been kind to India having blessed this sub-continent with abundant rainfall, evergreen tropical forests and perennial rivers. From the antiquity of the region supplemented by nature's bounties has stemmed a rapid population growth expected to touch six hundred millions very soon. Realizing the urgency for self-sufficiency in foodgrains to feed the large population, Independent India has adopted several measures to increase productivity on the farm land. Increased application of chemical fertilizers to the soil has been the chief weapon in this drive, along with adequate emphasis to all other agricultural inputs such as better seeds, improved implements, sufficient irrigation, timely weed & pest-eradication etc.

PROMOTIONAL WORK:

2. In any scheme of such vast development, promotion is a vital factor. The first stage of the fertiliser development programme rightly concentrated on intensive measures to popularize chemical fertilisers among the farmer by making him aware of the gains he could obtain by the application of optimum dosage of fertilisers to the soil. A chain of 100 soil-testing laboratories has been established, whose field staff take soil samples, analyse and give advice (all free of charge) to the farmer on the correct dosage of fertilizers suited to the particular soil and crop and on the correct and most profitable manner of using them on the farm. When the popularisation programme started, demonstration plots in tne farmers' own fields were marked off, which received the very same type of cultivation and seeds, the

only difference being that the marked plot received the required fertilizers at the proper stage. By harvest time, the healthy crop with enhanced yield witnessed in the demonstration plot was its own advertisement and did not call for any other form of publicity. All farmers who were interested spectators of the growth of the healthy crop and higher yields became convinced users of fertiliser. These and other measure like the "package of inputs and practices programme", propagating good husbandary practices (including fertilizer usage) and farmer-education in the Community Development Blocks have helped in stepping up the consumption of fertilizers. The success of these measures are proved by the figures in Table 1, which register the steadily rising demand.

TABLE 1.

DISTRIBUTION OF FERTILISERS 1952-53 TO 1969-70

Year	Nitrogen(N)	Phosphoric acid (P_2O_5)1	Potash (K_2O)
1952-53	57,822	4,552	-
1953-54	89,237	8,261	-
1954-55	94,310	15,027	-
1955-56	107,495	13,018	-
1956-57	123,054	15,874	-
1957-58	149,019	21,922	-
1958-59	171,988	29,490	-
1959-60	229,326	53,930	21,342
1960-61	211,685	53,134	29,052
1961-62	291,536	63,932	27,982
1962-63	360,033	81,385	36,503
1963-64	425,872	120,947	51,860
1964-65	492,249	149,530	71,640
1965-66	532,583	134,075	89,631
1966-67	330,171	274,601	133,666
1967-68	1,135,655	438,168	205,750
1968-69	1,253,953	318,351	177,567
1969-70	1,040,198	234,989	151,227

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

SCOPE TO INCREASE INPUTS :

3. No doubt the Table 1 shows a fast rising growth curve of fertiliser demand but also indicates that over India's vast area the consumption per unit area is quite small. Nevertheless, the current low level (10 kgs. per hectare) points to the immense growth potential open for fertiliser development, for reaching the goal of food self-sufficiency. When it is remembered that the country has an arable area of 175 million hectares the quantum of fertiliser requirements for reaching the dosage level of 200 to 400 kgs. per hectare is common in several countries, opens up huge vistas for the growth of the Indian fertiliser industry.

HIGH FOREIGN CURRENCY OUTFLOW:

4. Having generated farmer interest for fertilisers and with the demands rising continuously attention has been focussed on the local production of fertilisers. The nation's economy(India is a developing country) is naturally stretched by the demands for huge sums of foreign currency payments to be made simultaneously for the import of the following three essentials:

1) Import of foodgrains (U.S. $ 400 million annually with a peak $ 700 million in 1967.)

2) Import of fertilisers (U.S. $ 1200 million annually: see Table 2)

3) Import of plant and machinery for new fertiliser factories being established.

TABLE 2.

IMPORTS OF FERTILISER MATERIALS 1960-61 TO 1969-70
(JULY-JUNE)

(TONNES)

Year	Ammonium sulphate	Ammonium sulphate nitrate	Urea	Calcium ammonium nitrate	Ammonium chloride	Ammonium phosphate (20-20-0)	Nitrophosphate (20-20-0)	Diammonium phosphate 18-46-0
1960-61	416,995	49,511	123,243	80,258 14,650	-	-	994	-
1961-62	337,128	160	115,135	48,775 11,281	-	-	5,000	-
1962-63	596,778	-	219,448	12,560	-	30,065	48,235	-
1963-64	429,738	418	205,309	6,165	27,175	15,034	20,311	-
1964-65	568,667	25,553	285,496	6,000	2,000	48,526	30,167	-
1965-66	981,320	25,553 -	315,329	5,248	29,000	103,200	-	-
1966-67	1,110,605	19,433	491,344	113,050	20,000	200,391	-	-
1967-68	1,192,314	20,573	1,048,263	151,121	84,230	231,300	3,698	261,787
19-68-69	1,153,389	3,000	1,016,004	66,793	13,000	49,694	21,638	660,629
1969-70	524,150	-	874,009	74,583	-	-	21,782	117,025 125,096

Notes: 1. April-March basis
2. Chilean natural nitrate of soda
3. Basic slag
4. Kemex: 38-42% K_2O
5. Ammonium nitrate
6. Other nitrogenous fertilisers for which the break up is not available
7. Of grade 61% K_2O

TABLE 2(continued)

(TONNES)

Year	N.P.K. Mixtures				Super phosphate	Muriate of potash			Sulphate of potash
	14-14-14	12-24-12	14-28-14	15-15-15		60% K_2O	50% K_2O	40% K_2O	
1960-61					668	30,946	-	-	12,555
1961-62					783	41,137	5,251	-	6,146
1962-63					2,133	65,900	5,970	-	3,502
1963-64					508	85,095	20,189	-	5,316
1964-65					358	73,804	16,964	-	3,325
1965-66					7,028	145,398	4,280	200	7,765
1966-67	19,394				51	195,337	29,597	-	24,652
1967-68	89,398	10,427		17,168	1, 541	418,857	17,617	-	-
1968-69	57,533	6,135	25,916	39,636	92	237,542	-	9,612	-
1969-70	11,400	-	42,206	70,929	116	101,157 27,282	-	-	8,896

DESIGN AND ENGINEERING:

5. Encouraged by the sustained demand growth for fertilisers and spurred by scarcity of foreign exchange, projects for the local production of fertilisers have received high priority. In this programme of development, realising the importance of securing advanced technology, the earlier projects were contracted to overseas specialised organizations on turn-key basis. These assignments involved not only the procurement of know-how but of detailed design and engineering, and quite often most of the equipment also from overseas suppliers. In other words, since no distinction was made between the different functions of project planning and construction, even servicing equipment obtainable from domestic sources had to be imported. Normally, the expenditure incurred on the purchase of know-how is only a small fraction of the total cost of the project, while the bulk of the foreign exchange expenditure is charged for the design, engineering and purchase of equipment from abroad. Having separated these two disciplines, while modern technology is purchased from advanced countries and paid in foreign currency, the design, engineering and procurement of equipment is increasingly assigned to domestic agencies. By operating in this pattern, considerable progress has been made in acquiring and developing indigenous know-how for the design and engineering of fertiliser plants.

The Planning and Development Division of the Fertiliser Corporation of India and FACT's Engineering and Design Organization (FEDO) are now able to design and engineer between them, plants for the production of ammonia, urea,

sulphuric acid, phosphoric acid and ammonium sulphate; technical know-how for processes for the production of nitro-phosphate, urea, DAP/TSP, complex, sulphuric acid from gypsum, gassification of coal for synthesis gas etc. have not yet been developed in the country. As the technology for fertiliser production is fast changing, it is well recognised that national interests are best served by supplementing domestic efforts with collaboration of specialist consultancy organizations from overseas countries. Such co-operation has proved extremely fruitful as a result of which the Indian fertiliser industry has progressed steadily bringing the installed capacity in 1972 to 2,339,000 tonnes N and 567,000 tonnes P_2O_5 (Table 3). Several additional units are now under construction or in advanced state of planning (Table 5).

The target of the Fourth Five-Year Plan is capacity of 3.0 million tonnes N and 2.5 million tonnes P_2O_5 in 1973/74.

TABLE 2

PRODUCTION CAPACITY IN OPERATION

(1,000 tons per year)

Unit	Installed capacity (N)	Installed capacity (P_2O_5)	Product
Sindri	117	--	AS
Nangal	80	--	CAN
Trombay	90	36	Urea, NP
Gorakhpur	80	--	Urea
Namrup	45	--	AS, Urea
FACT/Alwaye	92	46	AS, AP, AC
Rourkela	120	--	CAN
Neyveli	70	--	Urea
Varanasi	10	--	AC
Ennore	16	10	AS, AP
Vizag	80	73	Urea,AP
Gujerat	216	52	AS, Urea, AP
Kota	130	--	Urea
Kanpur	200	--	Urea
Madras	190	85	Urea, AP
FACT/Cochin	152	--	Urea
Durgapur	152	--	Urea
Namrup expansion	152	--	Urea
Goa	175	45	Urea,AP
Barauni	152	--	Urea
By-product	20	--	AS
Superphosphate plants	--	220	SSP, TSP
	2,339	567	

DIVERSE FEED STOCKS USED:

6. It is interesting to note that Indian fertiliser factories have been established for the production of nitrogen fertilisers on (besides coke) liquid and gaseous feed stocks like naphtha, cokeoven gas, refinery off gas, associated and natural gas. The earlier plants adopted partial oxidation process of naphtha but with the development of reformer catalysts, synthesis gas production is based upon the steam reforming process of naphtha; the latter does not require the high cost air liquifaction plant to produce oxygen and thus helps to substantially reduce investment costs. Along with the development of technology, more and more Indian plants are being established in large size single steam units.

MANPOWER AND TRAINING:

7. For manning the fertiliser projects to be completed during the Fourth Plan (1969-74) the requirements of additional technical/managerial/skilled man-power are estimated to be of the following order:

Technical/management	..	5,000
Skilled	..	15,000

Large industrial establishments have well-organized programmes for training of technicians and engineers but as these programmes by themselves may not be able to cater to the full requirements of the country, a well co-ordinated programme of training for managers, foremen, skilled operators and technicians has been formulated.

PLANT & EQUIPMENT MANUFACTURE:

8. The balance of payment difficulties confronting this

developing country which is faced with the difficult task of having to simultaneously import foodgrains, fertilisers and fertiliser plant and machinery has already been referred to in an earlier paragraph. Fertiliser industry being highly capital intensive, a large part of the investment is taken up for the purchase of plant and machinery and, therefore, the limiting factor for the industry's growth in India has often been the lack of funds for importing the equipment. Sustained efforts have, therefore, been directed to organize local production of many items of machinery and the achievements towards this objective have been fairly satisfactory.

With the necessary fabrication facilities having been established, most of the low and medium pressure vassels, tanks and heat exchangers are now produced in Indian workshops. The completion of the Bharat Heavy Plate and Vassels (BHPV) at Vishakhapatnam has been a land-mark in this field, as they would be in a position to meet the demands in full for low and medium pressure vassels, tanks and heat exchangers. The following types of equipment continue to be imported, as facilities for their production have not yet come up in the country:-

High pressure vessels requiring forged, multilayer construction;

High pressure compressors of large capacity;

Seamless pipes; and

Specialized instruments.

Facilities for the farbication of high pressure vassels are proposed to be created at BHPV in the near future. The manufacture of centrifugal and reciprocating compressors

will be undertaken at a new project - Bharat Pumps and Compressors coming -up at Naini. The manufacture of chemical fertilisers involves processing of highly corrosive liquids and mixtures at high temperatures, which demand the use of equipment made of special steels. As these types of special alloys are not produced in India, they have to be imported. With the completion of the Alloys steel plant at Durgapur, the position with regard to the availability of these special alloys will be vastly improved. For the fertiliser projects now under construction, 30 to 35% of the investment is required in foreign currency for the payment of imported plant and machinery. As a result of more and more equipment being produced locally, by 1974 the foreign exchange component is expected to down down to 20/25% of the project cost.

RESEARCH AND DEVELOPMENT:

9. Apart from the development activities in equipment manufacture, Fertiliser Corporation of India (FCI) and Fertilisers and Chemicals, Travancore (FACT) are engaged in research and development work on process technology as well as on development of products related to fertiliser raw-materials. The FCI have set up their own plant (designed by them) for the manufacture of ammonium bicarbonate. They are also carrying out trial production of sodium nitrite and sodium nitrate from the tail gases of the nitric acid plant. Another R&D activity is related to the sulphate recycle process for the production of nitro- phosphate FACT is carrying out pilot scale

production of fluorine chemicals (cryolite, aluminium fluoride etc.) by working up bye-product fluorine gas released during the acidulation of phosphate rock in the manufacture of super-phosphate and phosphoric acid. FCI has started commercial scale production of catalysts, e.g. de-sulphurization catalyst and H.T. Co-shift conversion catalyst after testing these catalysts in some of their own production plants. Their reformation catalysts have been used and proved in the Namrup Fertiliser Plant.

PLANT MAINTENANCE:

10. The change in new plant construction from parallel operating lines to a single large-capacity train in which spare equipment and surge tanks have been curtailed, has resulted in lowering operation costs. These advances in operating efficiency have, however, enhanced the problems of maintenance, for the failure of a single practical piece of equipment could shut down the entire plant. In large plants such failure would result in an enormous loss of the order of $ 30,000 or more for each day of production loss. This situation naturally results in enormous pressure on maintenance staff to effect repairs. The experience in India points to preventive maintenance as the safest form of avoiding crash shut down. Preventive maintenance aims at minimising breakdowns and excessive depreciation of equipment resulting from inadequate periodic inspections. In India, experience has proved that properly conducted preventive maintenance is an effective cost-reduction tool, as it saves money both in process costs as well as

maintenance charges. Care should be taken to ensure that preventive maintenance programmes are drawn up to suit the size of the plant. Where the plant is small, it may consist of regular inspection by the plant manager. On the other hand some large plants are using automatically controlled equipment that shuts down machines after a specific number of working hours. Regardless of how it is done the preventive maintenance programme essentially consists of periodic inspection with the facilities of equipment to verify that the machine is safe for prolonged operation till the next planned inspection.

FUTURE PROGRAMME:

11. Backed by the above experience of the past two decades in the construction and operation of fertiliser factories, the country has set its targets high and aims at self-sufficiency for her needs of nitrogen and phosphorus nutrients.. India's Fourth Development Plan (1969-74) aims at an output of the following quantities of some principal products of agriculture:-

129 million tonnes of foodgrains;

10.50 million tonnes oil seeds;

1.5 million tonnes of sugarcane (gur);

8 million bales of cotton;

7.4 million bales of jute besides substantial increases in production of other agricultural crops. Estimates show that for achieving these yields, the fertiliser consumption should be stepped up three-fold as given in table 4.

TABLE 4.

ESTIMATED FUTURE DEMAND

(Unit million tonnes)

Nutrient	1968-69	1973-74
Nitrogen(N)	1.21	3.20
P_2O_5	0.38	1.40
K_2O	0.17	0.90

As explained in the previous pages, the use of chemical fertilisers in India has increased substantially during the last two decades. Total consumption of all types of fertilisers taken together in 1969-70 in terms of nutrients is estimated at 2.011 million tonnes as against 0.755 million tonnes in 1965-66, 0.306 million tonnes in 1960-61 and only 69 thousand tonnes in 1950-51. The consumption of nitrogen has increased by 10 times, that of phosphate by 15 times and of potash by 13 times in the last 10 years. The increase in fertiliser consumption in the five year period from 1965 was of the order of 150%. For raising the consumption to the levels in Table 4, the rate of increase has to be maintained on the much larger base.

PROJECTS IN THE PIPELINE:

12. In order to meet the anticipated demands shown in Table 4 above, several new production units are being planned and built. These projects are listed in Table 5.

TABLE 5 - NEW FERTILIZER PROJECTS

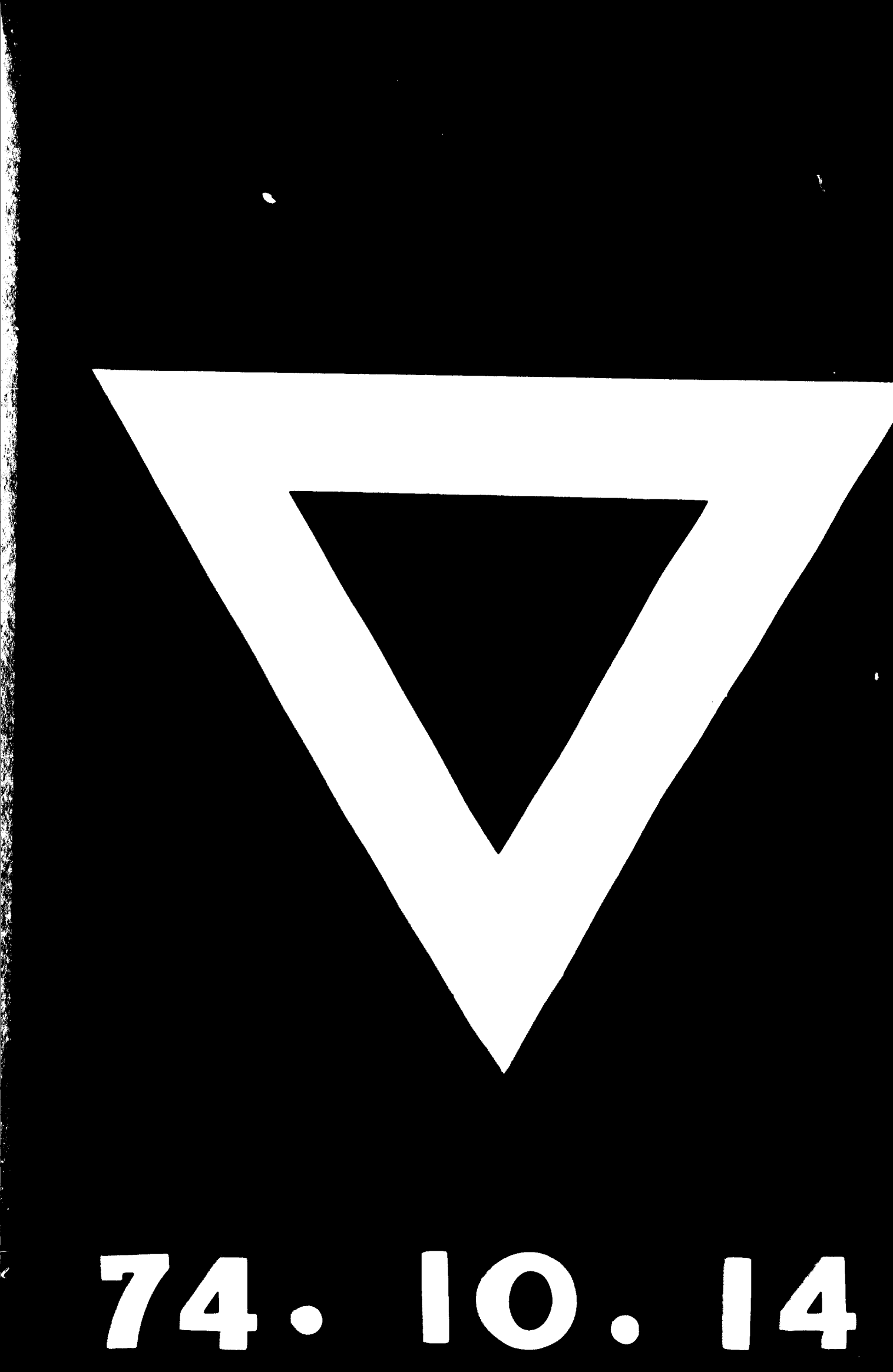
(Expected to be completed after 1972)

Production unit	Location	Capacity '000 tonnes/yr. 'N'	Capacity '000 tonnes/yr. P_2O_5	Products	Expected start up date
1. F.C.I.	Sindri	--	156	TSP	1973/74
	Trombay	132	132	NPK complex	1974
	Haldia	152	70	Urea, NP	1974
2. Indian Farmers Cooperative Ltd.	Kandla/Kalol	215	127	Urea DAP	1974
3. Malabar Chemicals & Fertilisers Ltd.	Mangalore	160	--	Urea	1974
4. Coromandel Fertilizers Ltd.	Vizag Exp.Phase I	30	8	Urea, Urea-Am. phosphate	1973-74
5. Coromandel Fertilizers Ltd.	Vizag Exp.Phase II	125	47	-do-	1974-75
6. Southern Petrochemical Industries Corporation	Tuticorin	255	53	Urea DAP	1974
7. Hindustan Copper Ltd.	Khetri	--	100	-do-	1973-74
8. Shriram Fertilizers	Kota	42	--	Urea	1973-74
9. FACT	Cochin PhaseII	48	115	Urea	1974
10. F.C.I.	Talcher	229	--	Urea	5th plan
	Ramagundam	229	--	Urea	-do-
	Korba	229	--	Urea	-do-
	Gorakhpur	40	--	Urea	-do-
	Nangal exp.	229	--	Urea	-do-
	Sindri	138	--	Urea, AS	-do-
11. Tata Chemicals	Mithapur	166	138	Urea, DAP	-do-
12. Maharashtra Agro-Industries Corp.	Bombay	--	8	SSP	-do-
13. Dharamsi Morarji Chemicals Co.	Sheva Nova	45	115	DAP	-do-
14. Sahu Chemicals	Varanasi	27	--	AC	-do-
	Total:	2,491	1,069		
	Capacity in 1972:	2,339	567		
	Grand total:	4,830	1,636		

PROGRESS REVIEW:

For successful fruition of the above plans and projects in the form of live production units, much well co-ordinated effort on the part of several teams of scientists, engineers, technologists and managers is essential. The task of creating additional fresh capacity for 5 million tonnes of plant nutrients is no small job, but the progress so far achieved certainly inspires confidence. The fertiliser plants at Cochin, Madras, Durgapur and the 4th stage expansion of FACT have completed plant erection and are in the process of trial runs of equipment. With the running in of these plants, commercial production is expected to be achieved before the end of this year and thereby bring in additional 1/2 million tonnes of fertiliser nitrogen capacity. Construction is proceeding fast at the projects in Goa, Barauni and Namrup (expansion) and these are slated to reach production next year. Process licence arrangements, inclusive of detailed engineering, have already been entered into with leading international specialist organizations for synthesis gas generation, gas purification, ammonia synthesis and urea plants of the coal based projects at Talcher and Ramgundam. Detailed engineering is in progress and construction work will commence shortly. FCI has selected the process for N.P.K. manufacture and successfully negotiated for adopting a well-proven process in the Trombay plant. The Kalol plant having already placed orders and made arrangements for supply of all equipment, construction work will start shortly. For the Kota plant expansion, the management has finalised agreements for technical assistance and equipment supply from Japan.

The above activity proceeding along with the develcpment of equipment fabrication industry is aimed to make the country self-sufficient not only in fertiliser production but also in achieving near self-sufficiency in fertiliser equipment manufacture, before the end of this decade.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