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Workshop on Pesticides

Vienna, Austria, 28 May - 1 June 1973

INDIA'S POTENTIAL IN A REGIONAL COOPERATION OF PESTICIDES  
INDUSTRIES IN SOUTH-EAST ASIA

by

V. S. Bhatia  
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Calcutta, India

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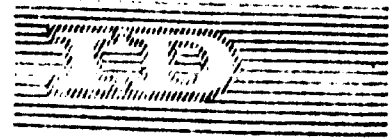
INDIA'S POTENTIAL IN A REGIONAL COOPERATION OF PESTICIDES  
INDUSTRIES IN SOUTH-EAST ASIA 1/

Addendum

by

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INDIA'S POTENTIAL IN A REGIONAL CO-OPERATION  
OF PESTICIDES INDUSTRIES IN SOUTH-EAST ASIA

V.S. Bhatia

Corrigendum

Page 5, paragraph 1, line 5

Delete "mobilise" and replace with "mobilize".

Page 13, paragraph 30, line 9

Delete "progmatcally" and replace with "pragmatically".

Page 18, paragraph 44, line 10

Delete "variagated" and replace with "variegeted".

Page 19, paragraph 48, line 1

Delete "soperate" and replace with "separate".

Page 23, sub-paragraph 5, line 8

Delete "appratus" and replace with "apparatus".

Annex I, continuation sheet 2, item no. 17

Delete "product No. 1 - 2,4,5 etc." and allot No. 1  
to "Chlorobenzene".

Annex II, line 1

Delete "refregeration" and replace with "refrigeration".

Annex II, line 23

Delete "fithting" and replace with "fighting".

Annex II, page 2 contd., line 18

Delete "Triplers" and replace with "Tipplers".

id.73-3829

ADDE DUE

Annex IV Contd.: iv. Sea Freight from India

Annex V - Diluent -- Talc Supply

Annex VI - India's Fifth Plan Terminal Year 1978/79

- i. Cropwise Area to be Treated
- ii. Estimated Demand for important products.

ANNEX IV CONTD.

(iv) SEA FREIGHTS FROM INDIA

<u>destination</u>	<u>ex India cutta</u>		<u>to Singapore</u>	
	<u>class</u>	<u>US\$</u> <u>1000 kg.</u>	<u>class</u>	<u>US\$</u> <u>1000 kg.</u>
Rangoon	general cargo rate	21.10	-	-
	Semi-hazardous chemical			
	insecticides	30.55	-	-
	hazardous	40.75	-	-
Singapore	non-hazardous	27.05	Insecticides packed in drums/cases	28.35
	hazardous	59.75		
Djakarta	non-hazardous	33.15	- do -	43.60
	hazardous	65.85		
Pt. Kelang	Singapore rate applies		- do -	28.35
Bangkok	non-hazardous	36.45	general cargo	39.70
	hazardous	84.00		
Hongkong	non-hazardous	34.75	general cargo	32.30
	hazardous	80.40	hazardous	48.00
Manila	general cargo rate	49.50	general cargo	49.45
	(special rates for others on application)	per 700 kg.		(surcharge for hazardous products)
Colombo	rates on application			
Phnom Penh	hazardous	59.75	general cargo	43.90
		per 1000 kg.		per 1000 kg.
	plus transshipment charges ex Singapore			

Notes:

- (1) Technical pesticides, diluents and formulations are offered by manufacturers from around Calcutta and Bombay.
- (2) Sailings are more frequent from Bombay, with 8/9 opportunities monthly, but prior notice is required in view of Bombay being an intermediate port between the Persian Gulf and the Far East; minimum two sailings offered monthly from Calcutta.
- (3) Because of the absence of large regular business some ad-hocism is practised in terms of freight structures, but special rates can be negotiated.

**Source:** Sinclair Freight and Chartering Consultants  
Private Limited  
Wellesley House, 7, Wellesley Place,  
Calcutta - 1.



DILUENT - TALC SUPPLY

India has rich deposits (in Rajasthan, Orissa and in Western India) and separate qualities are offered suitable for pesticides, cosmetics, paints, rubber, paper, textiles and ceramics.

Prices vary with colour and mesh (200 to 300 or even more); current (May 1973) f.o.b. prices in bags, range from \$32 to \$47 per m. ton with freights to South East Asian ports quoted at \$15 to \$22 per m. ton from Calcutta and Bombay.

Bespoke business is undertaken to suit customer specification.

Typical Analysis:

SiO <sub>2</sub>	.....	62.35 %
MgO	.....	30.60 %
Fe <sub>2</sub> O <sub>3</sub>	.....	0.69 %
Al <sub>2</sub> O <sub>3</sub>	.....	1.78 %
Loss on ignition		4.5 %

Exports:

<u>Year</u>	<u>Rs. lacs</u>	<u>\$ 000</u>
1968/69	27	360
1969/70	38	373
1970/71	32	426

bought by: Australia, Belgium, Ceylon, Cambodia, Denmark,  
France, West Germany, Hongkong, Philippines,  
Singapore, Sweden, Thailand, U.S.A., Yugoslavia,  
and 20 other countries.

Source: Tatemex India Limited  
Export Department  
34 Chowringhee  
Calcutta - 700016.

INDIA'S FIFTH PLAN -  
FISCAL YEAR 1978/79

(1) Cropwise Area to be Treated:

<u>C r o p</u>		<u>Area in m. hectares</u>
Wheat	..	11.00
Paddy	..	46.00
Maize	..	1.75
Millets	..	13.25
Pulses	..	1.10
Cotton	..	10.25
Jute	..	1.15
Potato	..	0.65
Oil seeds	..	5.20
Sugarcane	..	6.15
Tobacco	..	0.90
Other Crops, including Fruit and Plantation crops/vegetables		2.60
		<u>100.00</u>

(ii) Estimated Demand for Important Products:

(a) Insecticides:

		<u>'00 tonnes</u>
BHC	..	260
DDT	..	50
Aldrin/Heptachlor/Dieldrin		5
Endosulfan	..	18
Texaphene	..	12
Carbaryl	..	85
Malathion	..	35
Parathion (ethyl and methyl)		30
Dimethoate	..	5
Phosphamidon	..	6
Monocrotophos	..	5
Phorate	..	5
Miscellaneous	..	20
New Products	..	12
		<hr/>
		548
		<hr/>

(b) Fungicides:

Copper oxychloride	..	6
Thiocarbamates		
(Zineb, Maneb etc.)	..	50
Dithiocarbamates		
(Thiram, Ziram, etc)	..	6
Copper sulphate	..	35
Sulphur wettable	..	10
Sulphur dust	..	35
Others	..	7
		<hr/>
		149
		<hr/>

.... contd.

(c)	<u>Weedicides:</u>		<u>'00 tonnes</u>
	2,4-D and 2,4,5-T group		10
	Paraquat ..		5
	Dalapon ..		8
	Triallate/Alachlor/ Butachlor/Propachlor ..		8
	MSMA/DSMA ..		8
	Nitrofen (T k) etc. ..		5
	Others and miscellaneous new herbicides ..		12
			<u>56</u>
(d)	<u>Rodenticides:</u>		
	Zinc phosphide/Warfarin/ Coumafuryl/Cynodust ..		3
(e)	<u>Fumigants:</u>		
	Al. phosphide ..		10
	MB/EDB/etc. ..		<u>8</u>
			<u>18</u>
		Grand Total	= <u>77400 tonnes</u>

See paragraph 37.

CONTENTS.

<u>Chapter</u>		<u>Paragraphs</u>
I.	INTRODUCTION	1 - 7
II.	INDIAN PROFILE	
	- a. Pesticides & Indian Agriculture	8 - 19
	- b. Chemical Industry - an outline	20 - 31
	- c. A resume of the Indian Pesticides Industry	32 - 48
III.	INTRA-REGIONAL COOPERATION IN S.E.ASIA.	
	- a. Need for a common plan	49 & 50
	- b. Scope of a techno-economic survey	51 - 55
	-	
IV.	CONCLUSION	56 - 62

Annexes

- I. Indian base of Chemical Raw materials.
- II. Local Engineering Materials.
- III.
  - 1 Progressive Increase in local make
  - 2 Products in regular manufacture
  - 3 Licenced capacities
  - 4 Present position of Pesticides Industry
- IV. Exports of Pesticides from India

## CHAPTER I.

### INTRODUCTION

1 Modernisation of agriculture has been receiving attention from all developing countries, and India shares with them the basic problems of providing economic and social dynamics to increase income, employment and career opportunity. The new agricultural strategy, focussed on improved farm technology and management to mobilise resources in relation to the psychological, technical, strategic and organisational needs, has become a declared policy of all Governments in South East Asia.

2 The new thinking has no doubt been helped by the experience of Japan, America and Europe during the last 25 years where quite a large element of their growth was contributed by agriculture through support given to it by the rapid use of new technology that led to commercial farms producing large outputs. In view of this historical experience of others, it is no longer disputed that agriculture must absorb certain essential features of industry if the full benefits of the current philosophy are to be obtained; in other words, some application of systems in place of an ad-hoc approach has become vital.

3 There is no gainsaying that the under-developed countries of South East Asia are thrown back largely on their own resources, and in their drive for economic development they are handicapped in the way of technology; being late comers, they also missed the opportunity to establish markets outside each national State. In the modern age accumulated scientific and technical knowledge is a precious raw material, and fresh research time and resource consuming.

The developing countries must utilise all existing knowledge, but be prepared to work out individual specific techniques to suit one's values and actual conditions.

4 An essential realisation is that the adoption of modern agricultural practices must be related to economic costs/benefit functions linked with the use of :-

Pesticides  
Improved Seeds  
Fertilisers  
Irrigation  
Farm equipment

5 Pesticides are thus an important component of any campaign for better agricultural productivity, and these are derived from modern chemical industries i.e. the inorganic and petro-chemical sources. The role of the chemical industry in a particular location is, therefore, relevant for promotion of modern agriculture.

6 The availability of pesticides has some relationship with the pace of progress in the manufacture of dyes, rubber chemicals, plastics, paints, resins, etc. The growth of pesticide manufacture can thus be co-terminus with the other sophisticated product areas of modern chemical manufacture.

7 India has gained considerable experience in areas of technology and commerce during the last twenty years. The object of this paper is to indicate the various elements of growth of the pesticide industry in India, and to suggest an approach on cooperation between India and other countries in South East Asia with a view to a pooling of resources.



## CHAPTER II

### THE INDIAN PROFILE

#### - n. Pesticides and Indian Agriculture

8 Broad features of Indian Agriculture in relation to pesticidal use are linked to the progress of cultivation of the fertiliser responsive High Yielding Varieties of crops. It is, however, necessary to trace certain historical events.

9 Although pesticides have been in use for over 25 years, India opted for the new strategy for agriculture based on science and technology eight or ten years ago. The full scope of the new methodology became visible only recently. Unexpected drought conditions from 1965/67 impeded the full use of technological inputs, including pesticides, but, thanks to the footwork during subsequent years, the harmful impact of the drought in 1972 was substantially minimised, thus re-enforcing India's faith in the earlier objective of prosperity through the 'Green Revolution'.

10 The new strategy covered High Yielding Varieties of wheat, rice, maize, etc, with increased application of fertilisers and pesticides. Also, Crash agricultural programmes were launched on food, as well as cash crops like cotton, oil seeds and paddy. All this increased consumption of pesticides from 11,000 tonnes in 1963/64 to 30,000 tonnes in 1971/72, expressed as technical grades.

11 Whereas the total output of crops has increased significantly, the loss of output because of pests and disease has also increased, with the new High Yielding Varieties showing greater proneness to pest attack. Also a change in the relative incidence of pests is noticeable in that relatively unknown pests are now posing a problem in terms of protection of crops.

12 The larger use of fertilisers has had another connotation in that weed control has already assumed a much greater importance.

13 The Indian experience has thus confirmed the observations elsewhere that greater use of fertilisers can lead to a fundamental shift in problems in regard to the demand and market for pesticides which are no longer confined to a fixed pattern of action and behaviour. Furthermore, with the passage of time there will be need for possibly newer types of materials with their own spectrum of application and optimal benefit, immediate or potential.

14 India's Fifth Plan is now on the anvil and envisages large expansion of cotton, sugarcane, oil seeds and pulses, in addition to improvement in productivity of foodcrops i.e. wheat, rice, maize and millets.

15 A larger area with emphasis on acreage under dry farming is also forecast. Even with a low fertiliser usage consequent to absence of large irrigation sources, selected pesticides have been found to have a perceptible role in the output from a large complement of cultivatable lands (60% of the total arable area).

16 As far as pesticides are concerned, therefore, India has accepted hopefully a situation where the extension of the present measures and projections of the new steps have necessitated a fixation of a high enough target of a total consumption of 77000 tonnes in 1978/79.

These will comprise :

- insecticides
- fungicides
- herbicides
- fumigants
- disinfectants

17 It is also projected that plant protection will cover not only pest control but also seed treatment, weed control and para agricultural usage over an area of 100 million hectares by the end of the Fifth Plan 1978/79 (45 million hectares achieved by 1971/72). The targets are no doubt ambitious but considering the 'values' which the new agriculture must subservise these appear reasonable. A larger use of pesticides, old and new, will be an important aspect of the programmes.

18 To assist the pesticide industry to travel towards its objectives, direct help is rendered by the Government, and the important means are :-

- (i) availability of infrastructure in the way of research, development and advice on agricultural applications. This service is available from 12 central research and commodity stations, as well as State Departments of Agriculture manned by technocrats qualified in agriculture and related disciplines.
- (ii) a policy acceptance of the need for continued import of new technical materials and constant dialogues with pesticide manufacturers to assess their problems relating to foreign exchange for raw materials, plant and equipment, e.g. in 1971/72 foreign exchange equivalent to \$ 15 million (Rs. 10 crores) was allocated for raw materials alone, of this 80% was for technical materials not produced in India and required for formulations. It is expected that in 1973/74 the bill may go up by at least 50%.
- (iii) a statutory classification of the pesticides industry as a priority sector, within the core of the National Plans for undertaking of manufacture of new technical pesticides and expansion of existing capacities, where called for.

- (iv) simultaneous emphasis on extension of formulation capacities over a wide area in the country, and preferential supply of indigenous raw materials and their movement to consuming centres.

19 The cumulative effect of the above measures is a rapid growth of the consciousness in relation to pesticides and their increased demand. The ball is thus thrown back at the chemical industry!

\*Ten important agricultural Universities have also been established which are patterned on the lines of Land Grant Foundations in the U.S.A.

- b. Chemical Industry - an outline

20 Since 1947 there has been a spectacular growth of the chemical industry in India, as elsewhere in the world. Rapid developments in the industry helped the concept of agriculture growth through new technology.

21 Following the emphasis through Government's Five Year Plans the annual production index for chemical and allied products has been rising fast at 10 to 15% with expansion in heavy and fine chemicals, fertilizers, pesticides, polymers, dyestuffs, pharmaceuticals, etc. As the components of the chemical industry are wide and various the above average growth rate has been gratifying. A significant landmark is not only the total output, but also improvement in scale economies and the positive influence of diversification. Running fourth among the top manufacturing industries after textiles, iron/steel and engineering, new frontiers of inorganics and petro-chemistry are being crossed with progressive increases in volumes of intermediate chemicals and finished products.

- 22 Productive capital employed in the chemical industry increased to \$ 650 million in 1965 and is now estimated at just under \$ 1 billion, yielding base materials and finished goods to the value of \$ 1.3 billion covering bulk and derived products like agricultural specialities and pharmaceuticals.
- 23 Government of India's Fifth Plan to end 1978/79 is now under formulation, and the first estimate for total new investment is put at Rs 500 crores (\$ 670 million) with appropriate stress on all sectors of the chemical industry. It is expected that agricultural inputs like fertilizers and pesticides will receive added emphasis with the former taking atleast 50% of the new investment.
- 24 Understandably it is not possible to go into the full list of products available and/or forecast for availability in the next few years from Indian manufacture, both for domestic and export sales. A separate booklet is available entitled "Export Horizons for Indian Chemicals". This was prepared in 1970 by the Indian Chemical Manufacturers Association, Calcutta, and is being brought up to date after incorporating the new products which have since arisen from local manufacture.
- 25 Some of the locally manufactured chemicals acting as "feedstock" for pesticides are listed in Annexo I. This list is typical of the growth pattern of inorganic and organic products, linked with one another through common technological attributes affecting the expanded demand in the country for dyes, pigments, rubber chemicals, plastics and resins, etc. Raw materials for all these industries being near relatives there is an inter dependence through common aspects of production and sale. For example, rubber chemicals manufacture has yielded fungicides like Thiocarbamates.
- 26 As in the western economies, the expansion and growth of basic chemical industry opened up opportunity for ancillary products through establishment of secondary or tertiary make, some of them in the small

and medium scale sectors. Development of workable batch processes through reasonable labour costs provided the incentive. The billion dollar textile industry and its demand of dyestuffs threw up a host of new needs in the way of emulsifiers, wetting and dispersing agents from indigenous manufacture; all these provided a spin off for the pesticides and other industries. Wherever a small proportion of import need exists, appropriate foreign exchange is made available for the purpose as a policy support from State and Central Governments to help small scale manufacture in the interest of employment growth.

27 For historical reasons manufacture of organic chemicals is expanding faster than other chemical products, and this in turn makes a heavy demand on sophisticated engineering supports. Over the years a network of design and fabrication has been built up in India, with local consultancy organisations already attracting large contracts locally and turn key projects from overseas (this is an important strategy in India's plans from export earnings). A 24,000 tonne DMT Plant with an annual output worth \$ 20 million has just been inaugurated, and more than 70% of the equipment was designed indigenously.

28 Annex II shows some of the materials being manufactured and serviced locally by engineering suppliers, most of whom are situated in Calcutta and Bombay. In many products there is more than one manufacturer which makes for competition in the interest of economic pricing.

29 Air conditioning and chilling plants, boilers, compressors, evaporators, grinding mills, driers, heat exchangers, distillation units, bag-making machinery, filtration equipment, tailor-made castings, motors, switch-gear, transformers, cooling towers, are some of the items regularly contracted by the chemical industry in India to local engineering houses.

30 Both in the chemical and sophisticated engineering field, purchase of technology and know-how from overseas was a feature of the 1950's and 1960's; local experience plus R&D effort has expanded the indigenous know-how and its ramifications. A significant mark on the industrial landscape is a contribution made by a broad spectrum of entrepreneurs; large ones with local or international affiliations, and medium scale operators relying on self-help, have added to the total performance. Technologically the chemical industry is outward looking and pragmatically modern. The employment of Indian scientists and technical personnel outside India is a token of their intellectual adequacy.

31 Having built the above structure India does look ahead to taking a share in international commerce through offer of services to other countries. Already India's chemical exports exceed \$ 50 million and engineering products \$ 175 million annually.

- c. A Resume of the Indian Pesticide Industry

32 Synthetic pesticides were first introduced in India soon after the last war for control of locust. Chlorinated hydrocarbons primarily used for this purpose were projected into agriculture. The first basic manufacturer started with a 500 ton per annum BHC technical plant in 1952. Since then industry has made rapid progress in all aspects, i.e. basic manufacture, formulation technology, application techniques, etc. By 1972, fortytwo basic products were being manufactured through 13 production units. Operating manufacturing capacity totals 45,000 tonnes, and another 22,000 tonnes is planned for production. The formulation of the technical grade pesticides, whether indigenously manufactured or imported, is carried out through 147 units which, potentially, could tackle an annual output of 136,000 tonnes.

Annexe III shows :

- 1 Progressive increase in local make of technical products
- 2 Products now in regular manufacture
- 3 Licensed concotions and their utilisation (production)
- 4 Present position of Pesticides Industry

33 (Prior to the introduction of the "new strategy" on food crops through the cultivation of High Yielding Hybrid Varieties of crops, Indian agriculture was traditional in nature providing a mere subsistence for the farmer. The advent of High Yielding strains has changed the economic scene with increasing cash flow with the farmer. The use of chemical inputs has, therefore, gained momentum. To illustrate, against a fertiliser use of 10 kg per hectare in the Third Five Year Plan, the average rate for 1973/74 is put at 22 kg.

34 It is known that some 250 pests and diseases of economic significance affect the Indian agriculture; a loss of about 20% of yield is caused by insect pests alone. An equal loss is attributable to weeds, while damage in storage is put at 6/8%. Considering the dimensions of the country and its agricultural profile, pockets of endemic pestilence as well as frequent epidemics are a common feature.)

35 Another facet of the industry which is of significance is the serious imbalance in the output of the various categories of pesticides as follows :

Insecticides	61%
Fungicides	35%
Herbicides	1%
Rodenticides	1%
Others	1%



36 While the interest of the entrepreneurship in the more potential area of insecticides and fungicides was hitherto justifiable, there is a growing realisation that a much larger untapped potential lies in the fields of weed and nematode control. Several manufacturing proposals are, therefore, under consideration and it is fair to assume that in the coming decade this group of chemicals would constitute the primary centre of growth. Thus, the pattern of pesticides production/usage has almost followed on the same lines as in most of the developed countries.

37 According to the Ministry of Agriculture, New Delhi, the coverage for plant protection at the end of the Fifth Plan 1978/79 will have the following rank-up :-

Seed Treatment	21.0 m hectares
Rat Control	12.0 m hectares
Weed Control	4.5 m hectares
Intensive Treatment on surface and soil pests	<u>62.5 m hectares</u>
	<u>100.0 m hectares</u>

A task force commissioned by the Government has related the above target in terms of potential for pesticides as follow :

<u>Class of Pesticides</u>	<u>1978/79</u>	
	<u>Quantity</u> (mt)	<u>Value</u> (Rs ml).
Insecticides	54,750	568.96
Fungicides	14,920	111.40
Weedicides (including growth regulants)	5,650	156.42
Rodenticides	300	2.11
Fumigents	<u>1,000</u>	<u>73.60</u>
	<u>77,420</u>	<u>912.49</u> \$ 121 m.

38 When dealing with vast agricultural potentials through chemicals, snags can arise because of the many variables encountered in a developing economy. Two possibilities might be mentioned. Unlike industrial raw materials intended for a few points of consumption, lines of product development and marketing on pesticides run long and deep into the countryside where ancillary supports, both technical and commercial, are important. Also, pesticides result from products and co-products of modern chemical processes and there can be competitions in respect of supply and demand for raw materials including for usage other than pesticides. The need for an integrated plan is thus obvious, which should look to long term trends and not mere short term consumption patterns. This context seems to have weighed with the Government of India when viewing the policy of practical self-reliance even at the risk of tolerating surplus capacities. India's critical dependence on agriculture has influenced this approach.

#### 39 Equipment for pesticidal application

With the availability of about seven million tonnes of steel annually, and with domestic sources for non-ferrous metals like aluminium, copper and zinc (and their alloys) the Indian engineering industry has abundant capability to meet the requirements for agriculture. Sprayers and dusters are in regular production both in the large scale and medium/small scale sectors.

40 It is estimated that the total production for sprayers and dusters in the organised units all over India is worth \$ 5 to 6 million annually, about 40% of this is exported. Quality standards conform to specifications laid down by the Indian Standards Institution.

41 The Heartland of the engineering industry is in Eastern India (Calcutta), and the industry also makes use of plastics. India produces about 100,000 tonnes annually of thermo-setting and thermo-plastic resins. With about 2000 plastic processing units all over India adequate design and fabrication facilities are offered for any equipment simple or complex, needed by agriculture. However, a fleet of helicopters for aerial spraying of selected crops will be required for import in connection with the Fifth Plan targets.

42 It would be pertinent to mention here that India enjoys supremacy in package development because of the indigenous availability not only of engineering services but also packaging materials comprising card-board, plastics, tin-plate, aluminium, etc. Suitable package development services exists on the lines of product development through collaboration of specialist companies. There is also an Institute of Packaging.

#### 43 Exports

Foreign Exchange, free, as well as from bilateral arrangements with different countries, is being released regularly to meet the import requirements of pesticide manufacture. As in other areas of priority development, it is expected from the industry that it would earn back maximum foreign exchange by export of intermediate or finished goods. This has been accepted as a legitimate long term objective, even though the total earnings presently are a fraction of what is claimed in terms of import needs.

Annexo IV shows export performance since 1966/67, product groups involved and lists of buying countries.

44 Although exports have been made to 37 countries, the performance is patchy; the absence of a coherent pattern is attributed to stiff global competition because of lower international prices for technical grade pesticides. This is in line with Indian experience in other branches of the chemical industry. High prices from India are also attributed to high freight charges. The Conference rated freight structures are inimical to the developing countries as last year's discussion at UNCTAD III showed. Irregularity of traffic and small size of shipments to individual destinations, resulting from the very nature of the variegated business offered, militated against India. Despite all these factors it is noted that Indonesia, Burma, Thailand, Malaysia, Sri Lanka, as well as some countries in Europe were successfully cultivated by the industry. As most of the countries in South East Asia do not yet manufacture basic pesticide chemicals, their dependence on outside sources must continue. It is hoped that if India's plans fully mature in the coming few years, the R&D effort already put in would also make available newer pesticides of likely interest to India's neighbours.

45 A word about the present supports from the Government of India to exporters; cash assistance of 15% on the f.o.b. value and import replenishment facilities ranging up to 60% of the f.o.b. value go some way to bridge the price gap vis-a-vis global competition. Additionally, the Government of India have just announced (Apr 73) that supply of raw materials by indigenous producers to exporters at international prices will be treated as exports for purposes of grant of incentives. This innovation should further improve quotations from India.

46 Standards: Rigorous standards are enforced via conformity to strict specifications developed by the Indian Standards Institution which is affiliated to international bodies. By and large these Standards are based on British and American practice. Standard specifications exist for formulations as well as technical products, and new ones are added from time to time.

47 Insecticide Bill: Recognising the likely hazards from indiscriminate and careless usage of products toxic to humans and animals, Government of India introduced the Insecticides Bill, in Parliament as early as 1964. After thorough discussion its provisions were made statutory through Insecticides Act. The rules set out the role of Central and State Governments for regulating import, sale and inspection of Pesticides. Aspects of prohibition, licensing and appeal against Government decisions are provided for. Before adopting the various provisions active consultation was sought with the Pesticide Industry, making use of experience elsewhere in the world, to avoid adverse effects on the overall campaign for correct treatment and promotional work for plant protection.

48 Ecology: No separate organisation exists at present for regular assessment and control of ecological hazards from pesticides. Reliable data is not yet available on all aspects even from international experience. Preliminary steps have, however, been taken by the Government through exercises recently launched with a Specialist Committee under the Planning Commission. It is hoped that this nucleus for study will develop into a broad-based review of the Chemical Industry including Pesticides. Meantime, the agricultural institutes in the country are alerted to the problem and possible future implications. It is conceded that reliance on other countries' experience would be a guiding factor.

### CHAPTER III

#### INTRA-REGIONAL COOPERATION IN S.E. ASIA.

##### - a. Need for a Common Plan

49 With the exception, perhaps, of plantation crop areas there appear some common problems for agriculture in India and South East Asia. In all the countries agriculture is primarily rain-fed and subject to fluctuation in output between the good and bad years of monsoon. Fragmented holdings and low productivity are frequently encountered; the agricultural infrastructure for storage and transport is far from adequately developed. Also, the pace of development of capital intensive and technologically oriented agro-chemical industries (fertilisers and pesticides) is slow. Pest control programmes are thus limited in scope, with emphasis on curative and 'fire brigade' measures rather than on advanced planning through prophylaxis. There is also a gap in post-harvest technology which leads to substantial losses of crops. The relative play of different factors would vary from country to country, but taking the overall regional picture, there appears lack of adequate development on effective crop husbandry. This must retard economic progress.

50 In view of the shared context there is room for a common plan for South East Asia where Indian technology, raw material resources, and experience of about 20 years in the sphere of production, education, extension services, distribution channels, etc might be harnessed to develop a suitable programme for mutual help. However, areas of action will have to be identified first through appropriate investigations.

##### - b. Scope of a Techno-Economic survey

51 The following key factors will be relevant in the seventies in relation to any development programmes covering local manufacture and consumption :-

- 1 Although promotional effort by governments and civil agencies, supported by quick communication media, has led to the establishment of pesticides in South East Asia, the pace of progress has varied from country to

- to country in the context of the supports for indigenous manufacture, deployment of foreign exchange resources and the availability of the requisite infrastructure.
- 2 Use of pesticides is now akin to medicine with comparable roles in diagnosis, prevention, treatment and control. Competing products selective-vs-broad spectrum - toxicity and residual effects are common features.
  - 3 The diagnosis of diseases and treatment of crops are not ends by themselves, and workable answers, depend on availability of crop technical service and formulation as near the points of consumption as possible. Long distance servicing handicaps application of new technology.
  - 4 The chemical industry, especially in relation to petrochemical technology, is unrelenting in its growth, and new products from continuous research will be available, and some of these must have potential for replacing today's known pesticides, thus adding to the complexity.
  - 5 Fear of product obsolescence and the uncertainty on adequate returns from this capital intensive industry, through application of new technology in a small consumption area, has often inhibited new entrepreneurship.
  - 6 Apart from the resources of technology and know-how, trained manpower 'cultivated' in more than one discipline would be an essential requirement to promote the use of pesticides.

52 As a first step towards cooperation in S.E. Asia, a techno-economic survey seems necessary to chart out the present status and future prospects for pesticide industries in the region.

53 The thrust of the survey will be on products - insecticides, fungicides, weedicides, fumigants and rodenticides - with emphasis on depth examination of the situation against the background of the last 10 year's experience, with a view to assessing the potential for a definitive role each country in S.E. Asia can perform through its own knowledge and expertise covering manufacture, marketing (including product development) and post sales service, etc. The primary objective will be to :

- 1 build detailed country profiles
- 2 suggest a frame for multinational effort
- 3 determine the roles of any centralised services and international agencies like U.N.bodies etc.

54 Assuming this approach is accepted, some suggestions are made under the 3 heads. concerning the type of information that would be needed to prepare a regional inventory of data.

- c. Country Profiles

- 1 Government policy concerning promotion of agriculture - the role of incentives/benefits offered for individual areas of agricultural and industrial production.
- 2 Price trends.
- 3 Patterns of current consumption: Product/Areas/Crops/Pests: past trends and future projections allowing for product displacement and substitution.
- 4 Pattern of imports/exports; quality of import channels and their value for sales promotion, market research and commercial R&D. Duties/tariffs.



5 Local manufacture and future plans :

Technical grade pesticides  
Formulations

Indigenous sources of chemical  
raw materials, equipment and  
know-how.

Ancillaries - Fillers, spraying/  
dusting apparatus.

6 Nature and quality of services offered by local manufacturers  
- product development, post sales, global usage information,  
marketing network.

7 Availability of institutional supports - agricultural  
research centres, universities, data collection, extension  
work.

8 Personnel availability - product/crop managerial experience,  
training and development programmes.

9 Miscellaneous :

Standardisation

Geographical location of inputs

Transportation and freight costs

Adequacy of finance/credit

Environmental/ecological developments  
and their impact.

Experience on toxicity and harmful residues.

- d. Multi-national effort

(a) identify areas for priority action in relation to viewed  
potentials on an intra-regional basis.

(b) link of one country's strong points with the technological/  
commercial gaps in the others. To adjudge feasibility of  
product demarcation in each country taking into account  
individual strong points, i.e. availability of local  
inputs, equipment, manpower etc.

- (c) the nature and quality of inter-country collaboration feasible for manufacturing and/or trading ; sharing of technology, joint ventures with shared investments.
- (d) influence of economy of scale and resulting lower costs with a large marketing network.

- e. Centralised Services

- (a) organisation of a central data bank to act as a clearing house for feedback of information to countries - determine its remit, location and organisational layout.
  - (b) exchange of information - product research and development
  - (c) exchange programmes for training and development.
  - (d) outline steps to bridge the technology gaps via a specialist cell (which would investigate sources of new technology, and also embrace other relevant functions, e.g. process and patent evaluation, market research including product substitution, cost benefit analyses, test marketing etc).
- (e) Role of U.N.Organisation, i.e. UNIDO, UNDP, etc for (a) to (d) above.

55 The lists could no doubt be supplemented on a number of points. The outline throws up for discussion a few important aspects of a desired study. The governing consideration will be intra-regional cooperation in S.E.Asia in the pesticides area of agricultural inputs, to establish the possibility of joint interests through planned pooling of technological and commercial resources on manufacture, marketing, research, technical training and related services, to the overall advantage of the agricultural economy of the region.

## CHAPTER IV

### CONCLUSION:

56 In the World today regionalism is becoming fashionable, making most of the opportunities on a supranational basis is now as popular with the international community as was the operation of a multinational business corporation although the latter was sometimes maligned. Developing nations are now expected to take a lead themselves on their economic planning and setting their own goals and priorities. Also World Bank's policy in this respect is clear and farsighted. An important objective now accepted unreservedly is the optimisation of scarce resources including deployment of technology-intensive measures which have particular relevance in agriculture and its infrastructural supports.

57 Countries in the S.E.Asian region have common problems relating to agricultural productivity although the relative impact of lack of different inputs - fertilisers, pesticides, trained manpower, varies from country to country. Nevertheless high dependence on agriculture for a large percentage of population in S.E.Asia is a shared feature, with a common rationality of better expectation.

58 Pesticides are one of the many links in the agricultural chain, where a number of factors act upon each other. Fertilizers, pesticides, irrigation, optimal use of new strains of grains credit, price stability, transportation, preservation of food, balancing of good against bad harvesting seasons, are all components of the system. Experience has shown that the maximum potential is realised if the entire scheme works as an integrated machine. This makes the task of a planner difficult indeed.

59 Most countries in S.E.Asia are largely dependent on imports of technical pesticides and indigenisation calls for outside technology which has its own problems of costs and obsolescence.

In these circumstances it seems logical to project some phase of courtship and collaboration within the region to help one another with available technology/know-how to create skills and jobs and at the same time to provide back up for promotion of new industry. It appears that any developing nation cultivating an illusion of "going it alone" is looking for disappointment, as the Japanese saw ahead in their wisdom. If an insular approach is rejected as not suited to today's reality, a regional approach offers a workable alternative. To stress regionalism is not to underestimate the value of global technology (and know-how including its commercial attributes) developed at considerable cost.

60 Transfer of technology is a ticklish affair and the relevance of each technology-low, intermediate or high, is constantly shifting. Pesticide technology is a good example of this where safer and surer products are demanded continuously. It is therefore good house-keeping to economise on development budgets wherever feasible and look to one's neighbours for help, if available. This could be done through business-like methods such as bilateral arrangements in the framework of some agreed international norms. This however can only follow a deliberative planning through construction and analysis of possible future contingencies. All this will require new homework with an eye on the regional context.

61 A new detailed techno-economic study, therefore, seems desirable, preferably under the aegis of some international agency such as UNIDO to avoid any psychological overtones of paternalism or profit. An intra-regional development programme through integration of individual countries' technological and cultural "capital" will be well in line with the objectives of United Nations.

62 An attempt has been made in this paper to provide a profile of the Indian situation in important aspects of pesticide usage, local manufacture and development. The present capability and future growth is indicated against the background of developments in the

chemical industry generally. All this seems promising potential for India to help S.E.Asia. To the discerning, gaps will be visible. It will be for competent workers to investigate these and relate them to the measures for tomorrow - measures that will give the countries in the region greater economic thrust and drive through better agriculture.

ANNEXE I

PESTICIDES - INDIAN BASES OF CHEMICAL RAW MATERIALS

<u>PRODUCT</u>	<u>MAIN RAW MATERIALS.</u>
1 BHC	1 Benzene 2 Chlorine
2 DDT	1 Chloral 2 Chlorobenzene
3 Phosphamidon	1 Dichloroacetamide
4 DDVP	1 Chloral
5 Copper Sulfate	1 Copper 2 Sulfuric Acid
6 Copper Oxchloride	1 Copper 2 Hydrochloric acid
7 Nickel Chloride	1 Nickel residues 2 Hydrochloric acid
8 2, 4-D-Acid	1 2, 4-Dichloro phenol 2 Monochloroacetic acid
9 Aluminium Phosphide	1 Aluminium 2 Phosphorous Red
10 Zinc Phosphide	1 Zinc Powder 2 Red Phosphorous
11 Thiram	1 Carbon Disulfide 2 Dimethyl Amine (forecast for manufacture) 3 Sod Hydroxide

Annexe I contd

<u>PRODUCT</u>	<u>MAIN RAW MATERIALS</u>
12 Ziram	1 Carbon Disulfide 2 Dimethyl Amine (forecast for manufacture) 3 Zinc Chloride 4 Sod Hydroxide
13 Thiocarbemato	1 Carbon disulfide 2 Ethylene diamine (forecast for manufacture) 3 Zinc Chloride 4 Sod Hydroxide
14 Toxaphene	1 Camphene 2 Chlorine
15 Phorate	1 Phosphorous Pentesulfide 2 Ethanol 3 Formaldehyde
16 Phenthoate	1 Ethanol 2 Methanol 3 Phos Pentesulfide
17 Tetradifon	1 2,4,5-Trichloro Phenyl 2 Chlorobenzene
18 Dicofol	1 DDT 2 Chlorine 3 Sulfuric acid 4 Para Toluene sulfonic acid
19 Carbamate	Naphthol Methylamine (forecast for manufacture) Phosgene or MIC

Annexe I contd.

<u>PRODUCT</u>	<u>MAIN RAW MATERIALS</u>
20 Carbofuran	MIC
21 Endosulfan	Thionyl Chloride
22 Faraquat	Sodium Cyanide (procass for manufacture) Pyridine Methyl Chloride
23 Furadan	Methyl Isocyanate Chloroform Methyl alcohol Sodium Methoxide
24 E Parathion	Phosphorus Trichloride
25 M Parathion	Phosphorus Trichloride
26 Dimethoate	Phosphorus Pentasulphide
27 Fenitrothion	Phosphorus Trichloride Phosphorus Pentasulphide
28 Malathion	Phosphorus Pentasulphide

Source: Field Survey



LOCAL ENGINEERING MATERIALS.

ANNEXE II

Airconditioning: Refrigeration: Ventilation Plants: Aluminium:  
Anticorrosion materials: Anodising: Autoclaves: Abrasives:

Boilers (Industrial) & Boiler Mountings: Bright Bars & Shaftings  
(Special Steels): Belts & Fasteners: Bearings - Ball, Roller:  
Needle: Bag Filling Machines: Feeding Machines: Bonding Materials:  
Building Materials: Batteries: Battery charges: Rectifiers:  
Balancing Machines:

Castings - Cast Iron: Compressors: Centrifuges: Cooling Towers:  
Calculating & Adding machines: Chains: (Roller, Bush etc):  
Sprockets: Containers: Castings - Non-ferrous: Castings - Aluminium:  
Counters: Chain Pulley/Cranes:

Expanded Metal: Electronic equipment: Extruders (Thermo-Plastic):  
Electric Motors: Electric Fans: Electrical Goods - Light Electrical  
Goods: Electrical Lamps: Fluorescent Tubes: Electrical Testing &  
Measuring Instruments: Electrical Accessories (Cables: Wires &  
Conductors: Cable Accessories: Carbon Brushes: Control Switches:  
Current Transformer: A.C.S.R. Conductors: D.F.B. Isolator: Push Buttons:  
Flameproof light fittings: Generating sets: Geyser: Elec. heating  
elements: Lighting Arrestors: Poles: Pigmy Lamps: Relays & Contactors:  
Rectifiers: Dust/Vapour-proof fittings: Re-winding of motors:  
Switchgear: Starters: Sirens: Transformers: Voltage stabilizer:  
Voltage Regulators: Electrical Installations)

Filters: Fibre Glass Jobs: Flanges: Fork Lift Trucks: Fire fighting  
equipment: Forgings: Furnaces-Industrial:

Grinders Pulverisers: General Fabricators: Genl. Fabricators for CL.III  
Vessels: Gear Industry: Glass:

Hoses: Hardware & General Traders:

Insulation materials (Elec & Mech): Insulation Contractor: Instruments:

Annexe II contd

Jointing & Packing:

Lifts: Lead-lined Vessels: Lead Products: Laboratory equipment:

Mechanical Handling/Lifting equipment: Multimeters: Metallizing:

Non-sparking tools:

Oil Seals: Oil Burning Equipment: Office equipment:

Pumps: Protective (safety) appliances: Pneumatic cylinders: P.V.C.

Pipes & Fittings/Plastic: P.T.F.E Products: Piling:

Refractories: Rubber lining: Roll Charts for Instruments:

Rotameters:

Spring: Structural Steel Fab & Erections: Steel doors & Windows:

Steel Castings: Slotted Angle: Steel Pipes & Fittings:

Tubular Structures:

Valves - Ammonia: Valves - Air: Valves - Butterfly: Valves - Check:

Valves - Diaphragm: Valves - glasslined: Valves - Gate: Valves -

Globe: Valves - Lead: Valves - Needle: Valves - non-return:

Valves - Reflux: Valves - Reducing: Valves - Safety: Variable Speed

Drive: Vessel & Equipment fabrication:

Wagon Triplore: Water Bath: Water Meters: Water Cooler: Weighing

Machines: Water & Steam Fittings: Water Treatment Plants:

Welding Accessories.

Source: Field Survey

1 Progressive increase in local make  
of technical products

<u>Year</u>	<u>No of Products</u>
1955	3
1958	5
1961	9
1964	13
1967	19
1970	39
1972	42

2 Products now in regular manufacture

Insecticides:

Aluminium Phosphide	Malathion
BHC	Metasytox
Citricide	Methyl bromide
DDT	Nicotine sulphate
Dimethoate	Parathion (ethyl)
EDCT Mixture	Parathion (methyl)
Ethylene dibromide	Pyrethrum Extract
Fenitrothion	Texaphene
Lime sulphur	Lindane
Phosphamidon	Thionit

Fungicides:

Aureofungin	Organo mercuriale
Barium polyculphide	Sulphur colloidal
Copper oxychloride	Sulphur wettable
Euprous oxide	Streptocycline
Ferbam	Thiram Zineb
Nickel chloride	Zineb with manganese

Rodenticides:

Coumafuryl
Warfarin
Zinc phosphide

Annexe IFI contd

Molluscicide:

Metaldahyde

Nematocide:

Metham Sodium

Herbicide:

Ammonium Sulphate, 2,4-D, 2,4,5-T

3 Licensed capacities and their utilization (production)

<u>Year</u>	<u>Capacity (tonnes)</u> <u>(tonnes)</u>	<u>Production Technical</u> <u>(tonnes)</u>
1960	9108	7442
1961	18721	8984
1962	19939	8591
1963	26080	9573
1964	26660	10863
1965	35141	12670
1966	37900	14137
1967	51128	16365
1968	53033	16078
1969	63014	18647
1970	59914	26000

4. PRESENT POSITION OF PESTICIDES INDUSTRY

AS ON 31-12-1972

<u>Sl No.</u>	<u>Name</u>	<u>1973-74 demand</u>	<u>Capacity licensed</u>	<u>Capacity installed</u>	<u>Capacity under consideration</u>	<u>Production 1971</u>
1	2	3	4	5	6	7
1	BHC	52,000	28,900	25,900	8,640	15,429
2	DDT	15,000	4,200	4,200	-	4,116
3	Aldrin/Dieldrin/ Chlordane/ Heptachlor	1,000	-	-	-	-
4	Endrin	3,500	-	-	-	-
5	Carbaryl	3,000	2,000	-	5,000	-
6	Endosulfan	750	-	-	3,600	-
7	Toxaphene	1,000	250	250	1,000	-
8	Malathion	3,500	2,300	1,700	4,000	819
9	Parathion	3,200	-	-	500	602
10	M Systox	*	1,200	1,200	-	46
11	Fenitrothion	2,000	-	-	500	43
12	Dimethoate	*	220	220	-	188
13	Phosphamidon	*	636	636	-	-
14	DDVP	300	276	276	-	-
15	Phorate/Formothion/ Disyston/Thiometon/ Quinalphos, Monocrotophos	5,000	-	-	500	-
16	Al Phosphide	400	450	250	330	178
17	MB/EDB	300	968	608	-	72
18	Marcide/Tedion	400	-	-	-	-
19	Copper oxychloride	2,300	2,284	2,284	-	865
20	Nickel chloride	400	150	150	-	46

Annexe III contd

1	2	3	4	5	6	7
21	Thiocarbamates	10,000	4,684	3,700	-	1,120
22	Dithiocarbamates	1,200	850	850	-	24
23	Dicofol	500	-	-	-	-
24	Organomercurials	80	111	86	-	12
25	Weedicides	6,000	2,485	1,860	9,940	350
26	Nematocides	500	-	-	-	-
27	Rodenticides	700	350	350	-	195

Source: Pesticides Association of India.

ANNEXE IV

EXPORTS OF PESTICIDES FROM INDIA.

(i) PERFORMANCE

<u>Year</u>	<u>Rs lacs</u>	<u>\$ 000</u>
1966/67	14.6	195
1967/68	5.0	66
1968/69	0.1	120
1969/70	47.9	637
1970/71	31.5	420
1971/72	9.5	127
1972/73 (Jan)	16.3	217

(ii) PRODUCT GROUPS

BHC	Fumigants	Rodenticides, including substituted ethyl hydroxy coumarin
Calcium Cyanide	Fungicides	
Copper Oxochloride	Herbicides	
DDT preparations	Insecticides	Sulphur preparations
	Phosphides, zinc and others.	Weedicides
		Zinob

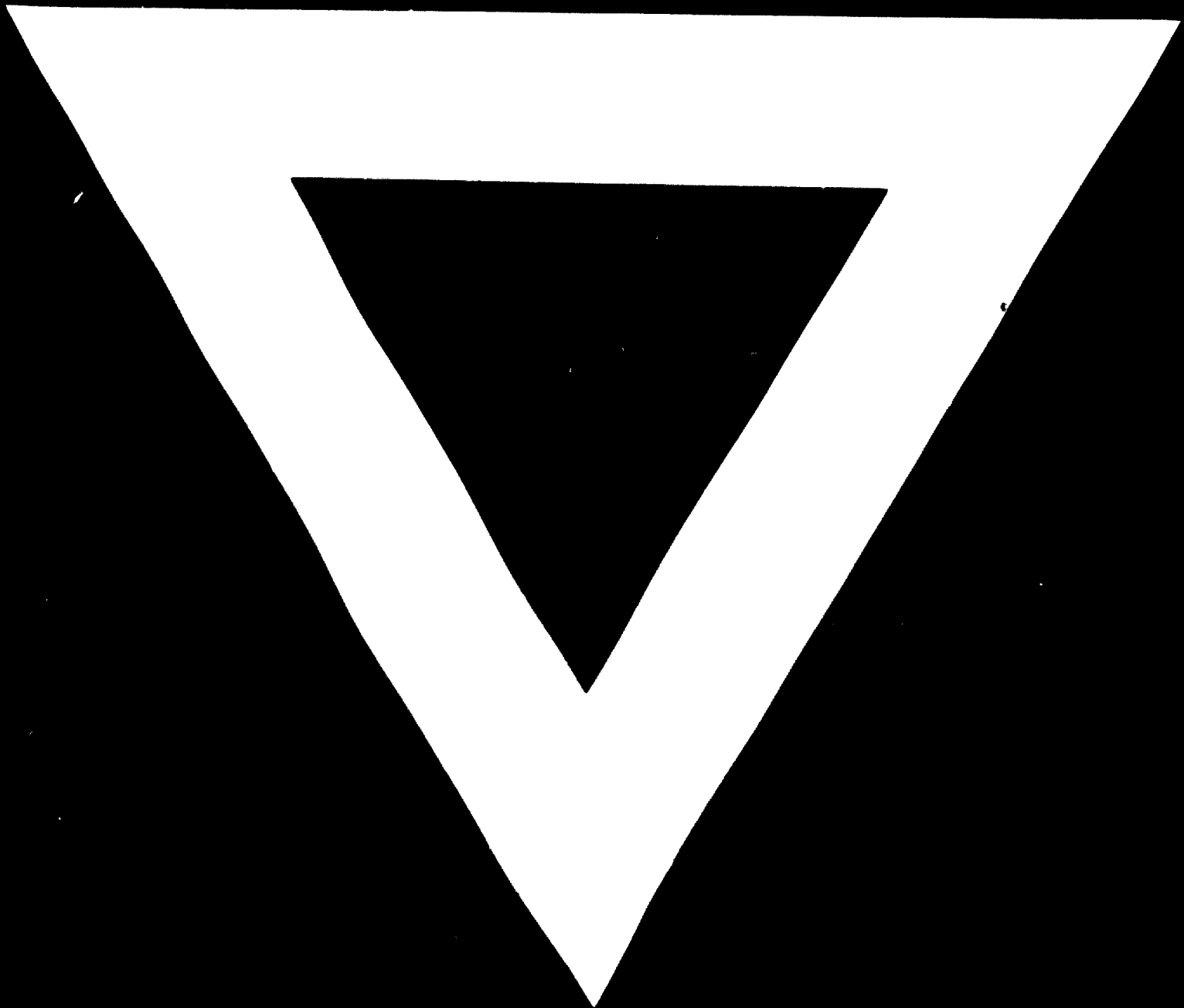
(iii) BUYING COUNTRIES

Afghanistan	Iraq	Philippines	Tanzania Rep
Bahrain Island	Italy	Qatar	Thailand
Belgium	Kenya	S Yemen P Rep	Uganda
Burma	Kuwait	Saudi Arabia	United Kingdom
Cambodia	Malawi	Seychelles	U.S.S.R.
Czechoslovakia	Malaysia	Singapore	Yugoslavia
Ethiopia	Muscat	Sri Lanka	
German F Rep	Nepal	Sudan	
Hongkong	Netherlands	Surinam	
Indonesia	Nigeria	Sweden	

Source: Basic Chemicals Export Promotion Council, Bombay.



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**17. 6. 74**