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PRODUCTION AND PROMOTION OF PESTICIDE AND
SUB-REGIONAL/REGIONAL CO-OPERATION IN THE
PESTICIDE INDUSTRIES .

Report of the Regional Symposium for Asia and the Pacific,
Bangkok, Thailand, 4-7 February 1977 .

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Explanatory notes

References to dollars (\$) are to United States dollars, unless otherwise stated.

A slash between dates (e.g., 1970/71) indicates a crop year.

A full stop (.) is used to indicate decimals.

A comma (,) is used to distinguish thousands and millions.

References to "tons" are to metric tons, unless otherwise specified.

The following abbreviations of organizations are used in this report:

ASEAN	Association of South East Asian Nations
ESCAP	Economic and Social Commission for Asia and the Pacific
UNCTAD	United Nations Conference on Trade and Development
ILO	International Labour Organisation
FAO	Food and Agriculture Organization of the United Nations
WHO	World Health Organization

The following technical abbreviations are used in this report:

c.i.f.	cost, insurance and freight
l	litre
t	metric ton
a	annum
EC	emulsifiable concentrate
WP	wettable powder
BHC	benzene hexachloride
DDT	dichlorodiphenyltrichloroethane
2,4-D	2,4-dichlorophenoxyacetic acid
MCPA	2-methyl-4-chlorophenoxyacetic acid

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CONTENTS

<u>Chapter</u>	<u>Page</u>
Introduction	4
Conclusions and recommendations	5
<u>Part one. Report of the Symposium</u>	
I. Organization of the Symposium	21
II. Summary of discussions	22
Production of pesticide technical materials	22
Production of pesticide formulations	28
Pesticide distribution and marketing	31
Regional co-operation for development of the pesticide industry .	31
Organizational needs	32
<u>Part two. Summaries of technical papers</u>	
<u>Part three. Summaries of country papers</u>	
Afghanistan	38
Bangladesh	38
Fiji	39
Hong Kong	39
India	40
Indonesia	40
Malaysia	41
Niue	41
Pakistan	41
Papua New Guinea	42
Philippines	42
Republic of Korea	43
Sri Lanka	43
Thailand	44
<u>Annexes</u>	
I. List of documents	45
II. List of country papers	46

INTRODUCTION

The Regional Symposium for Asia and the Pacific on the Production and Promotion of Pesticides and on Sub-regional/Regional Co-operation in the Pesticide Industries was held at Bangkok, Thailand, from 1 to 7 February 1977. It was organized by the United Nations Industrial Development Organization (UNIDO) in co-operation with the Economic and Social Commission for Asia and the Pacific (ESCAP).

Two of the main objectives of the Symposium were (a) to provide a forum on the recommendations of the joint UNIDO and the Food and Agriculture Organization (FAO) pesticides survey mission that visited several ESCAP countries and (b) to recommend ways and means for the developing countries of the region to stabilize, improve and economize the supply of pesticides to their agricultural and public health sectors.

The long-range objectives of the Symposium were to consider the following topics in depth:

- (a) Achievement of closer co-ordination between projects executed with bilateral and international co-operation;
- (b) Pesticide production projects suitable for regional or subregional co-operation through integrated utilization of raw-material inputs and marketing of pesticide products;
- (c) Potential investment possibilities for local and foreign investors;
- (d) Reduction of the pollution load on the environment due to pesticides;
- (e) Areas and mechanisms for subregional/regional co-operation.

Supplementary immediate objectives of the Symposium were to provide guidance to experts of developing ESCAP countries on:

- (a) Changing trends in pesticide production resulting from concern for environmental and human health protection;
- (b) Improved exploitation of locally occurring natural (botanical) pesticides;
- (c) New technical developments in pesticide production and formulation;
- (d) Improving the efficiency of pesticide distribution and marketing organizations;
- (e) The advantages that may be derived by establishing local pesticide formulation plants.

The Symposium was also expected to help resolve problems facing the pesticide industries of the ESCAP region (e.g., underutilization of capacities) and provide an initial platform for investment promotion.

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations listed below are based on discussions held both in the working-group and in the plenary sessions and were formally adopted by the Symposium. The remainder of the report was prepared in accordance with UNIDO procedures and was not presented for general discussion.

Working Group I. Production of pesticide technical materials

General

Conclusions

1. There are instances in which indecision by governmental agencies or the lack of a definite policy by them toward the establishment of basic pesticide manufacturing units has retarded the development of this industry in some ESCAP countries. Consequently, there is a great need for local authorities to make quick decisions on feasible pesticide projects using local raw materials.
2. There is a need for close co-ordination between the public health, industrial and agricultural sectors in the use of some compounds. The effectiveness of malaria vector control programmes may be reduced when the development of vector resistance is accelerated by the presence of large residual quantities of the pesticides used in agriculture.

Synthetic organic chemicals

Conclusions

1. Since the World Health Organization (WHO) has stressed that DDT is one of the most economical and effective weapons against malaria in the region and the supply situation may be uncertain, it appears desirable to establish basic production facilities for DDT to sustain current malaria control programmes in several ESCAP countries.
2. There is an urgent need to promote the use of pesticides by small holders growing subsistence crops in the ESCAP region to increase food production, and the commodity pesticides offer the most likely way to accomplish this.
3. Cash or estate crops will continue to require speciality pesticide products in addition to commodity pesticides.

4. The current chlorine surplus produced by several ESCAP countries could be utilized to produce a number of these commodity pesticides, such as DDT, BHC, 2,4-D, MCPA, and toxaphene.
5. It is possible that, initially, such plants might not be economic and there might be a need for a selective tariff barrier to protect the infant industry.
6. ESCAP, UNIDO and other sources for transfer of technology for such manufacturing units exist, and consultancy groups are available to make full feasibility studies on a regional/subregional basis, if required.
7. The economic development of several ESCAP countries has reached the state that pesticide production seems feasible.

Recommendation 1

United Nations and private organizations should assist in the initiation and implementation of pesticide production projects, particularly in the commodity group, in ESCAP countries that have indicated an active interest.

Recommendation 2

The members of Association of South-East Asian Nations (ASEAN) in the ESCAP region should co-operate in the establishment of basic manufacturing facilities for a select group of chlorine-based pesticides (DDT, BHC, 2,4-D esters, MCPA and toxaphene). Assistance should be sought from ESCAP, UNIDO and other sources for transfer of technology for these products that does not conflict with or is limited by proprietary interests. Participation of the Socialist Republic of Viet Nam and Sri Lanka in this scheme would be desirable.

Pesticides of botanical origin

Conclusion

Pyrethrum and other botanicals are grown at a number of locations in the ESCAP region and the development of this industry appears to be desirable. The substitution of these crops for opium poppy is being promoted by narcotic control agencies. Close co-operation in marketing for these products is essential if the substitution effort is to be successful.

Recommendation 3

Close co-operation in the marketing of pyrethrum products should be established in the ESCAP region to encourage fuller utilization of existing pyrethrum

production and processing facilities (Papua New Guinea) and lead to expansion of production wherever feasible (Nepal).

Recommendation 4

Regional production and processing of other botanical pesticides should be encouraged.

Inorganic chemicals

Conclusion

Sulphur resources in the ESCAP region are either limited or unexploited. Sulphur itself is a useful fungicide, while sulphuric acid is needed in large quantities to produce phosphate fertilizers. Sulphur is obtained from pyrite processing to enhance copper ores. Copper resources, too, are not being exploited for the production of fungicides, several of which are now being imported from sources outside the region.

Recommendation 5

There is scope for India and the Philippines to co-operate in the development of pyrite processing and by-product sulphuric acid production, not only to benefit the development of their phosphate fertilizer industries, but also for the ultimate development of sulphur and copper fungicide production in the Philippines.

Regional contributions to production of pesticide technical materials

Conclusions

1. Information on pesticide demand, supply and transportation cost is neither universally available nor up to date.
2. Shortages in manpower possessing the skills required to manage, operate and maintain basic pesticide manufacturing units exist in many ESCAP countries.

Recommendation 6

A regional pesticide development programme should be established that would:

- (a) Provide economic information services bearing on pesticides;
- (b) Establish and monitor quality control standards and unit operation pilot-plant production facilities;
- (c) Provide facilities to train personnel to manage, operate and maintain pesticide manufacturing facilities;

(d) Organize and exchange ESCAP regional teams to assist new units in start-up operations and provide technical assistance to evaluate proposed pesticide manufacturing projects within the region;

(e) Organize regional workshops to strengthen technical and general management structures in pesticide manufacturing units to increase efficiency and plant utilization.

Environmental implications and legislative safeguards

Conclusions

1. Effluents from pesticide manufacturing units can be handled so that the impact on the environment is minimal, even insignificant, since appropriate technology is available. Frequently, by-product recovery results in production of other salable products.
2. National pesticide regulatory boards are required; where they exist they need strengthening.

Recommendation 7

National pesticide regulatory boards should be established or strengthened to ensure that the pesticide manufacturing industry in the ESCAP region conforms to safety standards that protect its employees, its customers, the public and the environment, if necessary, by the introduction of appropriate legislation, including registration.

Recommendation 8

Undesirable harmful effects of pesticides to man and environment should be avoided. All pesticide purchases should be made in compliance with national and international standards and specifications adequately covering the safety aspects. Countries that lack facilities for checking compliance with safety standards should make use of the services and facilities made available to them by international organizations and the proposed regional development programme or should employ qualified private agencies.

Recommendation 9

The dissemination by United Nations organizations to governmental agencies in particular and the public in general of information on the environmental impact of the production and utilization of pesticides should be strengthened.

Recommendation 10

Pesticide analytical facilities at the national, subregional and regional level should be strengthened or established.

Working Group II. Production of pesticide formulations

Establishment of local pesticide formulation units
and expansion of the formulation industry

Conclusion

There are constraints on the development of the pesticide formulation industry in the different countries of the region; moreover, conditions vary greatly over the region. While many countries have made considerable technological advancement in the formulation industry and have adequate formulation capacities for the major pesticides, there are others that are dependent on imports of finished formulations. In some countries, formulation capacity is not put to optimum use. The reasons for underutilization of formulation capacity are varied and in some cases are attributable to government fiscal policies, non-availability of the technical-grade material at the right time, seasonality of pests and diseases etc.

Timely availability of pesticidal formulations based on patterns of use would be ensured if each country had some formulation capacity, at least for pesticides used in sufficiently large amounts. DDT, BHC, malathion, 2,4-D and copper oxychloride may be candidate products in some countries. Care will have to be taken that the setting up of formulation facilities do not put the farmer to any long-term disadvantage. Besides achieving savings in foreign exchange, such a measure would help in developing the technical skills of the people, thereby leading to further expansion of the industry, which in turn should bring down prices, provide employment opportunities, and develop self-reliance.

Recommendation 11

Each country should have adequate formulation capacity for the pesticides used most in that country, in keeping with the local government policy. The goal should be to provide the finished products to the end users at optimum prices. In setting up formulation capacity, due regard should be given to the projected requirements for the pesticides over the next 5 to 10 years.

Pre-investment studies

Conclusion

While there is no doubt that pesticide formulation requires a relatively lower level of technology and a smaller investment compared to the manufacture

of the active ingredients themselves and that the bulk of the components are locally available in most of the countries, there is a need for research on the suitability of these local materials. Plant equipment and technical know-how can also be obtained, if not from within the country, from within the region. Even training of skilled personnel can be arranged similarly. Such facilities are also available from the manufacturers of the active ingredients. The resources available in the region, however, need to be assessed.

Recommendation 12

In co-operation with other United Nations organizations, UNIDO should undertake studies of ESCAP countries to identify the strength and weaknesses of these countries in relation to the local resources available and their pesticide requirements. The study should cover the availability of technical know-how, plant and equipment, raw materials and carriers as well as technological skills. Such a study would go a long way in fostering regional co-operation.

Quality control

Conclusion

While the specifications necessary to maintain high quality have been laid down in some countries and the necessary regulatory measures exist, they are deficient in other countries of the region.

Recommendation 13

To serve the interests of the end user and the development of the formulation industry, a central quality control laboratory supported by the Government should be set up in each country, with regulatory measures and adequate monitoring capacity to serve the needs of the individual country. Such a laboratory would also serve the larger interest of providing effective and safe pesticides to the farmers.

Industrial health

Conclusion

It is obvious that the safety of the workers in the industry has high priority. Here again, there is need for regulatory measures that suit local conditions without in any way impeding the growth of the industry.

Recommendation 14

Each country should make suitable provisions to ensure the safety of workers in the pesticide formulation industry.

Regional contributions to the production
of pesticide formulations

Conclusion

While forecasts are available regarding the pesticides required for public health purposes, the availability of data pertaining to the agricultural sector is not adequate for the planned growth of the industry. Some countries have experienced difficulties in making demand estimates on account of the wide variety of crops and pests, pattern of pest infestation, outbreak of epidemics in certain areas etc. It is essential to have basic data on demand estimates, consumption etc. and facilities for such data up to date. In addition to the maintenance of data for each country, there is a need for collecting data on a regional basis in order to encourage a regional outlook on co-operation and development. While a regional information programme can co-ordinate the activities pertaining to the entire region, it is incumbent on individual countries to provide the feedback by establishing suitable machinery for collecting information.

Recommendation 15

In order to assist the countries in evolving a suitable methodology for making accurate demand estimates, the assistance of ESCAP, UNIDO, FAO and WHO, as necessary, should be made available.

Recommendation 16

A regional co-operation programme should be organized for maintaining data pertaining to the region on:

- Formulation technology
- Toxicological studies
- Safety measures
- Quality control measures
- Demand forecasts, including seasonality of demand

Conclusion

The pesticide formulation industry is in a position where the countries of the region could pool their resources, share knowledge and experience and

assist in the development of the industry in the region. Such assistance may be in the shape of providing technical know-how, supply of capital goods and technical-grade materials, training of personnel, supply of raw materials, such as surfactants, stabilizers and solvents, and data relating to toxicological studies etc.

Recommendation 17

Transfer of technology should be encouraged within the region using the assistance of ESCAP, UNIDO and other United Nations bodies as applicable and as may be required by the receiving country.

Conclusion

There is need at the regional level to harmonize the activities of United Nations organizations concerned with the pesticide industry.

Recommendation 18

A unit should be set up in ESCAP or UNIDO to harmonize the activities of all United Nations bodies with respect to the pesticide industry.

Conclusion

With the growth of the industry, additional trained manpower will be needed, but adequate facilities for training are lacking. The need is urgent, and the organization of a full-fledged regional training programme will take time.

Recommendation 19

ESCAP and UNIDO, in co-operation with ILO, FAO and WHO, should organize a regional training programme to provide necessary training facilities to the pesticide industry.

Government assistance

Conclusion

Where existing formulation capacity is underutilized, assistance from Governments may be necessary if the industry is to survive and grow. Imported products used by the pesticide formulation industry could be exempted from payment of customs duty, emulating the examples of Afghanistan, Bangladesh and Pakistan.

Recommendation 20

The formulation industry should be assured of regular availability of all active ingredients needed for agriculture and public health use whether they are indigenous or imported. In this context, national fiscal policy should also be evolved on a sustained basis that would permit lowering the cost of pesticides to end users.

Recommendation 21

The need of the industry to get low-cost financing should be considered favourably by Governments in order to promote and accelerate the development of the industry.

Working Group III. Pesticide distribution and marketing

Statistical information

Conclusion

Reliable statistical information is not readily available in ESCAP countries on pesticide imports, production, formulation, consumption; on pest damage in the field and in storage; and on the availability of suitable application equipment. However, this information is generally available for health programmes. This inadequacy of information can hamper proper planning for the import and manufacture of technical pesticides and formulations and this may contribute to shortages or over-stocking of products, which may in turn lead to artificial pricing, depending on the prevailing situation rather than on actual marketing opportunities or constraints.

Recommendation 22

The ESCAP countries should develop a mechanism appropriate to their own circumstances, in order to obtain data that are as reliable as possible. These data, besides meeting the national requirements, could provide the basis for a regional information programme. Assistance from the regional development programme may be required to develop methodology for the collection of these data. These data should also be freely available to anyone interested in the use and promotion of pesticides in the region. Data needed are:

Imports of technical-grade pesticides properly classified (tonnage and c.i.f. value)

Manufacture of technical-grade pesticides (tonnage and ex-factory value)

Information on imports and manufacture of formulations, properly classified (if not possible, then only by group, e.g., dust, WP, EC, granules etc.)

Information on consumption:

By major group (insecticides, fungicides, herbicides etc.)

By crop (only total quantities and value of grouped technical materials needed)

By product (if possible, crop by crop)

Information on application equipment:

Imports by category (dusters, sprayers etc. by type)

Local manufactures by category (dusters, sprayers etc. by type)

Information on pest damage, crop by crop

Data on poisoning incidents involving pesticides

Recognizing that it may be difficult to obtain such detailed information in a short time, Governments should aim to achieve this data base over the long term.

Farmer motivation

Conclusion

Although it is common for large farmers to use pesticides, many small farmers still do not use them. The majority of farmers who grow food-grain crops, other food crops and edible-oil crops, and these constitute the majority of the farming community, are not using or are using only negligible quantities of pesticides, because of the lack of information or knowledge or because of problems with financing, credit or obtaining worthwhile returns on the produce sold.

Recommendation 23

Major emphasis should be placed on the training of farmers in the safe and effective use of pesticides under programmes being developed or to be developed under country, ESCAP, UNIDO, FAO or industry sponsorship.

Recommendation 24

Demonstrations should play a major part in the training programmes. The demonstrations should be on a scale appropriate to local farm holdings, and they should be properly conducted and supervised, so that the cost and benefits of pesticides, as well as how to apply them, are shown to farmers.

Recommendation 25

In addition to and in support of demonstrations on the use of pesticides, appropriate training materials should be developed. These should be carefully developed on a regional basis and then adapted as necessary to suit local needs and conditions.

Recommendation 26

Extension services should be strengthened at the national level, but expertise for doing so might well be exchanged on a regional basis.

Recommendation 27

In the initial stages, when pesticides are being introduced in a new area or on a new crop, subsidies on the cost of pesticides and on application equipment might encourage their proper introduction into use.

Recommendation 28

Farmers should be assured by Governments of a reasonable return for produce.

Recommendation 29

Credit on reasonable terms might be provided by Governments through farmers associations or co-operatives. Crop insurance may also be necessary to protect the farmer in the event of crop failures.

Packaging, distribution and storage

Conclusion

Packaging, distribution and storage are very important factors in the promotion and safe use of pesticides in the ESCAP region, and special attention needs to be paid to them.

Recommendation 30

There should be sufficient outlets, conveniently situated, so that farmers have easy access to pesticides when they require them.

Recommendation 31

Suitable packs should be developed to meet the needs of the end user. They should be economical, sturdy enough to withstand the rough transport and storage conditions often found in the ESCAP region, and safe to handle.

Recommendation 32

Pesticides should be formulated to minimize deterioration in storage.

Recommendation 33

Governments should impose more severe penalties on anyone who adulterates pesticides in distribution, and industry should similarly take a strict attitude towards distributors and transporters.

Recommendation 34

If possible and appropriate, e.g., with granules, packages should have built-in applicators.

Recommendation 35

Steps should be taken to avoid mistaken reuse of pesticide packages.

Application technology

Conclusion

In general, the availability of application equipment in ESCAP countries is adequate. However, in villages, repair facilities and availability of spare parts tend to be inadequate. Also, training of farmers in equipment maintenance, further improvements in application equipment, and the development of formulations that are easier to apply are desirable.

Recommendation 36

Improvements in application equipment should be made to provide simplicity, robustness, better quality and economy.

Recommendation 37

Suitable formulations should be developed that lend themselves to application with simpler equipment.

Recommendation 38

Attention should be paid to achieving a more ready availability of spare parts.

Pricing

Conclusion

Any reduction in the prices of pesticides without reducing their efficacy or safety would encourage their wider use. Working Groups I and II considered the problem of reducing prices by reducing manufacturing costs. Prices can also be reduced in other ways, such as by reducing tariffs, levies or distribution costs.

Recommendation 39

ESCAP and UNIDO should recommend to the Governments of ESCAP countries that fiscal policies should be reviewed in order to reduce prices of pesticides.

Recommendation 40

An attempt should be made to reduce distribution costs, e.g., by reducing the number of links in the distribution chain.

Recommendation 41

Transport charges within a large country could be a major cost factor. The possibility of locating formulation plants in major areas of consumption to reduce transport costs should be investigated.

Recommendation 42

Since international freight charges are becoming very high, UNCTAD should be requested to examine the possibility of preferential shipping terms for agricultural inputs, including pesticides.

Registration requirements

Conclusion

It is important to remove barriers that inhibit the flow of pesticides to farmers. On the other hand, standards of registration are also essential to ensure the safe and effective use of available products. The harmonization of registration requirements is already engaging international attention under the auspices of FAO, which is organizing an intergovernmental consultation in October 1977. However, within the ESCAP region, there is also scope for harmonization of registration requirements.

Recommendation 43

The Governments of the ESCAP countries should follow the resolutions of the FAO pesticides consultation in April 1975 and those which may emanate from the FAO consultation on harmonization of registration requirements to be held in October 1977.

Recommendation 44

For the information and protection of the farmer, labels should prominently carry generic names in addition to brand names.

Environmental implications

Conclusions

1. Safe and effective use of pesticides is not only important in itself but also of great importance in protecting the environment. The aspects of safety considered to have the greatest effect on the environment are the aspects of registration and training in the field.
2. Since environmental influences frequently extend across country boundaries, regional co-operation is necessary to solve many environmental protection problems.

Recommendation 45

Environmental monitoring and protection should be co-ordinated through a regional programme.

Regional contributions to pesticide
distribution and marketing

The foregoing topics are those which seemed to Working Group III to be the most relevant to improvements in distribution and marketing in the ESCAP region. Once a pesticide has been formulated and packed for the consumer, its safe use and its economical and efficient marketing become a national affair. However, within this context, there are certain aspects that lend themselves to regional and subregional influences, and attention has been drawn to them in certain of the recommendations above, such as in recommendations on the development of methodology and the dissemination of data; training of farmers, including development of training materials; assistance in reviewing fiscal policies to reduce pesticide prices; liaison between ESCAP countries to follow FAO consultation guidelines for harmonization of registration requirements; and the co-ordination of environmental monitoring and protection work.

Regional co-operation for development
of the pesticide industry

Conclusions

1. Economic information service. There is a need for developing a system for reliable information collection and dissemination from and to the member countries

of the region, consistent with resolution 5, recommendations 1, 2 and 3 of the Ad-Hoc Government Consultations on Pesticides in Agriculture and Public Health, held at Rome from 7 to 11 April 1975, and on a continuing basis, of the following data:

Present pesticide consumption by categories, products, formulations and, if possible, by crop and public health outlets

Demand projections which take account of national programmes on agricultural development and health

Present formulation and basic production capacities and their utilization

Plans for establishing new or additional capacities

2. Regional resource study. Appropriate studies are required to identify the availability of the requisite resources for production of formulations and basic pesticides within the region and would cover:

Raw materials and auxiliaries

Personnel

Plant and equipment

Technical know-how including by-product utilisation, effluent disposal etc.

Quality control on raw materials, basic pesticides and formulations

3. Training of personnel. Development of skills and appropriate training of the personnel for the following operations is essential:

Preparation of pre-feasibility studies

Operation and maintenance of production and formulation plants and application equipment

Promotion and strengthening of extension and farmer education programmes already being carried out by other United Nations bodies and industry

Monitoring of the quality of pesticides and raw materials

4. Environment protection. Increasing use of pesticides calls for suitable steps to protect the environment and the people. For this purpose the requirements inter alia are:

Establishment of national pesticide boards

Harmonisation of registration requirements

Establishment of residue-testing facilities

5. Botanical pesticides. Botanical pesticides (pyrethrum, nicotine sulphate, rotenone etc.) are useful and the prospects for their production and expansion of use in the region need study.

Organizational needs

Regional programme

Recommendation 46 (incorporating recommendations 6, 12, 15, 16, 17, 19, 22, 25, 26, 39, 43 and 45)

The establishment of a regional programme is recommended. The programme will carry out the following functions to assist member countries to promote pesticide use and develop the industry:

- (a) Collect and update techno-economic information on pesticides;
- (b) Assist in the establishment of formulation capacities where feasible and to this end carry out testing of local raw materials;
- (c) Develop formulations consistent with local needs;
- (d) Promote co-operative manufacturing programmes on the basis of raw material resources in the ESCAP countries.

The programme will also develop guidelines for training of personnel for production, formulation and marketing services.

The programme will liaise with the appropriate United Nations bodies, industry and the Governments of the ESCAP countries. Due care should be taken to see that there is no duplication of efforts in this regard among the various United Nations bodies.

National programmes

Recommendation 47

Techno-economic information and co-ordination units directed by high-level officials should be created to ensure co-ordination with concerned agencies within the country.

Recommendation 48

The following facilities should be strengthened or established:

Quality-control laboratories (recommendation 13)

Institutional facilities for training plant-protection and extension units operating at the farm level (recommendations 23, 24 and 26).

Part one. Report of the Symposium

I. ORGANIZATION OF THE SYMPOSIUM

The Symposium was attended by 75 participants and observers from 23 countries and territories. Nineteen of them represented countries and territories, 52 represented industrial companies and international organizations, and 4 were UNIDO consultants.

Messages to the Symposium from the Executive Secretary of ESCAP and the Executive Director of UNIDO were delivered by Mo Myit, officer-in-charge ESCAP/UNIDO Division of Industry, Housing and Technology, and Maliyil C. Verghese, Head of the Chemical Industries Section of UNIDO.

The officers, elected at the first session, were as follows:

Chairman	Lata Singh (India)
Deputy chairman	Mulyani Soekardi (Indonesia)
Rapporteur	V. S. Bhatia (UNIDO consultant)
Officer-in-Charge	Karoly Szabo (UNIDO secretariat)

Since the Symposium covered highly specialized and diverse subjects, it was organized into three working groups:

I	Production of Pesticide Technical Materials	Chairman:	Ram S. Hamsagar (India)
		Rapporteur:	William J. Magee (UNIDO consultant)
II	Production of Pesticide Formulations	Chairman:	M.A.L. Vasir (Pakistan)
		Rapporteur:	Naushad Ali (Bangladesh)
III	Pesticide Distribution and Marketing	Chairman:	B.W. Cox (FAO)
		Rapporteur:	C.L. Dhawan (UNIDO consultant)

The work of the Symposium was done in six plenary sessions and four sessions for each of the working groups. Thirty-six technical and background papers and 14 country papers were distributed and furnished material for discussion in the working sessions. The technical and background papers are listed in Symposium document ID/WG.223/8 (see list of Symposium documents in annex I), the country papers in annex II.

II. SUMMARY OF DISCUSSIONS

Production of pesticide technical materials

This section summarizes the discussions of Working Group I and the data contained in the 16 technical and background papers submitted to the Symposium that dealt directly with the manufacture of pesticide active ingredients or, in the case of the botanical pesticides, with their extraction, and in the nine country papers that contained data on local production of basic materials or indicated that production was being contemplated.

Synthetic organic chemicals

Current pesticide consumption in Afghanistan, Bangladesh, Fiji, Hong Kong, India, Indonesia, Malaysia, Niue, Pakistan, Papua New Guinea, the Philippines, the Republic of Korea, Sri Lanka and Thailand is in excess of 141,000 t/a of active ingredients. The installed capacity in those countries and territories is 88,709 t/a with an additional 5,025 t/a of herbicide being produced at the final, acid-neutralization step. India accounts for approximately 58 per cent of the basic manufacturing capacity of the developing countries of the ESCAP region, and indigenous demand is still greater than the industries' installed capacity of 51,374 t/a. Based on data supplied in the country papers, the growth rate of pesticide demand in the developing territories of the ESCAP region is estimated to be about 16 per cent per annum.

Background papers submitted by FAO and WHO estimated current requirements for the ESCAP region to total over 225,700 t/a. The difference between this estimate and the use rate reported above arises in part because this estimate includes data from additional parts of the region. In addition, FAO estimates for agriculture were based on a survey conducted in late 1974; since then, consumption may have declined in some areas for reasons similar to those reported by Bangladesh, where there were no serious pest or disease outbreaks during the last three years and the supply of free pesticides was stopped about the time the survey was conducted.

New plant investment was not reported as such in the country papers. However, the reports that projects are under consideration by Bangladesh and Pakistan indicate it could be considerable in the near future. Plans to invest in one manufacturing venture in the region were effectively stalled by the Government's not being able to decide on, or not having a clear policy

towards, the establishment of basic pesticide production units after protests were lodged by pollution-conscious organizations. Suitable technology is available for handling effluents from pesticide manufacturing units to produce minimal or even insignificant impact on the environment. Such technology must be incorporated in new plant construction and covered in the investment costs. As a consequence, new manufacturing units will cost more than old units that were erected with little regard for environmental safeguards. Part of this increased cost can, however, be recovered by the recovery of by-products that can be made into other salable products.

Chlorinated hydrocarbon pesticides

Approximately 43 per cent of installed capacity in the ESCAP region is devoted to the production of chlorinated hydrocarbon pesticides. According to WHO, the public health sector currently requires 28,520 t/a of pesticides, including 5,013 t/a of BHC and 16,480 t/a of DDT. Installed capacity of the latter in the developing territories of the ESCAP region is about 7,780 t/a. The ASEAN countries, which have excess chlorine, currently require 4,874 t/a DDT for anti-malarial programmes and are projected to use in excess of 4,100 t every year for the next four years. A co-operative venture by the member countries of this subregion to produce DDT for sustaining their current malaria programmes would be desirable. Although WHO has managed to obtain adequate supplies of DDT for its programmes in the past, the supply situation for future requirements looks uncertain. In contrast, two DDT-producing countries, Bangladesh and Pakistan, indicate that their production units are underutilized now that their public health requirements for DDT are less.

When the development of vector resistance is accelerated by the use of large quantities of residual pesticides in agriculture, the effectiveness of programmes to control malaria vectors may be reduced. To minimize this risk, close co-ordination between the agricultural and public health sectors in the use of some compounds is required. In this way, maximum long-term benefits will be derived from the application of these products and maximum return on investment will be realized from the facilities that manufacture them.

In the ESCAP region, cash or estate crops are usually well managed operations employing the most sophisticated agricultural management systems.

Such systems skillfully utilize modern agricultural inputs, including pesticides. As a consequence, most growers of cash or estate crops will use the product they find most profitable, whether it be a commodity or a special proprietary pesticide. Pesticides, therefore, are used efficiently and as required, with few credit restraints. However, with cash or subsistence crops grown by small holders, it is the economic weakness of the farmer that has limited the use of production inputs, including pesticides. According to FAO, 75 per cent of the agricultural population of the ESCAP region are small holders with whom there is an urgent need to promote the use of pesticides to increase food production. The commodity pesticides appear to be the most likely avenue to increase the small holder's use of this essential production input. A number of these commodity pesticides, such as BHC, DDT, 2,4-D, MCPA and toxaphene could be produced using the excess chlorine produced by several of the ESCAP countries.

The selection of compound or compounds to be produced and the manufacturing site should be determined by raw-material availability, ease of manufacture and requirements of the market. ESCAP, UNIDO and other sources for transfer of technology for such units exist, and consultancy groups are available for making full feasibility, regional and subregional studies if needed. Initially such plants may not be economic and selective trade or tariff barriers in the countries co-operating in the project may be needed to protect the products produced. The ASEAN countries, the Socialist Republic of Viet Nam and Sri Lanka are countries that could benefit from such a joint venture.

Organophosphorus pesticides

India produces a number of organophosphorus pesticides and has developed indigenous technology for 14 of them. The country papers by Bangladesh and Pakistan indicated interest in manufacturing several of these compounds, especially those which could use the excess chlorine from their underutilized DDT manufacturing operations. Bangladesh has under consideration a joint venture project with the original manufacturer for production of diazinon, dichlorvos, dicrotophos and phosphamidon.

Pesticides of botanical origin

Most of the country reports submitted to the Symposium did not indicate separately the magnitude of their requirements for botanical pesticides.

Several countries and territories, e.g., Hong Kong, produce aerosols and mosquito coils that utilize pyrethrum and export large quantities of these items to other markets. Afghanistan, which also exports aerosols containing pyrethrum, expressed an interest in local pyrethrum production to establish a captive source to conserve foreign exchange. Papua New Guinea extracts some 5 t of pyrethrins annually but does not formulate locally for its expanding domestic and warehouse market.

Since pyrethrum and other botanicals are grown at several locations in the ESCAP region and alternate crops are being sought as replacements for opium poppy, the development of this industry should be encouraged. Close regional co-operation in marketing of pyrethrum products should result in fuller utilization of the existing pyrethrum production and processing facilities in Papua New Guinea and lead to the expansion of production into other areas. Regional co-operation to develop this market is also essential if efforts to substitute pyrethrum for opium poppy are to be successful.

Inorganic chemicals

The Afghanistan and the Philippine country reports indicated an interest in obtaining down-stream products from their copper and sulphur resources. Copper resources in the ESCAP region are not being exploited at present for plant protection purposes, and it appears that several copper fungicides now imported from outside the region could be produced. By-product sulphur is obtained from pyrite processing to enhance copper ores. Sulphur is a useful fungicide, while sulphuric acid is needed in large quantities to produce phosphate fertilizers. The development of this industry linked to the new Philippine copper smelter was recommended in 1974 by a joint study by the Tennessee Valley Authority (United States of America) and the International Fertilizer Development Centre, and pyrite roasting is expected to supply part of the sulphur requirements of the Indian phosphate fertilizer industry. Co-operation between India and the Philippines in developing pyrite processing and by-product sulphuric acid technology would benefit the development of their phosphate fertilizer industries and could lead to production of sulphur and copper fungicides in the Philippines.

The economic development of several ESCAP countries has reached the point that production of basic pesticide chemicals appears feasible. Consequently the United Nations agencies and private organizations should assist those countries that have indicated an active interest in the initiation and implementation of pesticide production projects, particularly in the commodity group.

Regional contributions to pesticide industrial development

Statistical information on the availability and cost of raw materials and intermediaries, along with information on pesticide demand, supply and transportation cost, is an essential element in making intelligent management decisions on new plant construction, plant location, product selection, manufacturing capacity, production schedules etc. Such information is not universally available for much of the ESCAP region, nor is it up to date. A central clearing house should be established in the ESCAP region, to collect and monitor these data on a regular basis for distribution to any interested party. Methodology for collection of these data may have to be developed, with the clearing house assisting or guiding contributing organizations at the country level.

To be efficient and profitable, basic pesticide manufacturing requires skilled manpower to manage, operate and maintain production units. Experienced personnel is particularly important during start-up operations of new units. Shortages in manpower possessing the skills required to manage, operate and maintain basic pesticide manufacturing units now exist in many ESCAP countries.

There is a need for a regional programme to assist the developing countries of the ESCAP region that have installed or are in the process of establishing basic pesticide facilities. The programme could provide economic information and training services, establish and monitor quality control standards, and provide or channel expert assistance for these manufacturing units.

Environmental implications and legislative safeguards

The attitudes expressed in the papers and working groups on the legislative control of pesticide manufacturing and use varied widely. Fiji and Malaysia have recently enacted pesticide laws which appear to be adequate, and Hong Kong is in the final stages of preparation of a new pesticide ordinance. India attaches great importance to pollution control measures and safety

aspects in the manufacture and use of pesticides. Pesticide registration is compulsory under the Insecticide Act and granted after the Registration Committee is satisfied that the candidate chemical can be used in a manner safe to humans, animals and wildlife. State Water Pollution Control Boards that set specific effluent standards and those set up by the Indian Standards Institute for discharge of waste waters into natural systems help conserve the health of the environment. Much, however, remains to be done on collection of monitoring data. The reports of Bangladesh and Pakistan did not mention specific pesticide-control acts, but the Governments of these countries, as the sole importers of the pesticides used in them, exercise considerable control over product quality and use. An updated pesticide-control act for the Philippines still awaits ratification. Strict compliance with tolerances and other regulations set by the importing country for its export crops has helped prevent the indiscriminate marketing of pesticides in the Philippines for use on its export crops.

Considerable improvements can be made in regulatory control measures that would compel the pesticide manufacturing industry in the region to conform to safety standards that protect its employees, its customers, the public and the environment. National pesticide regulatory boards supported by appropriate legislation are required; where they exist, they should be strengthened.

The undesirable harmful effects of pesticides on man and the environment, which may reach catastrophic proportions when toxic materials are used in vast quantities in health and agricultural programmes, can and should be avoided. All pesticide purchases must be made in compliance with national and international standards and specifications that adequately cover the safety aspects. Adherence to safety specifications requires testing facilities and services at various stages of manufacturing, formulation, packaging, shipping and at the destination. The facilities may be lacking in many countries. Until they are established, countries should make use of the services and facilities offered them by international organizations, the regional development programme proposed above or qualified private agencies. Obviously, pesticide analytical facilities must be strengthened or established at the national, subregional and regional levels.

Production of pesticide formulations

Establishment of local pesticide formulation units and expansion of the pesticide formulation industry

Current pesticide requirements by the reporting countries totalled more than 346,300 t/a, and installed capacity in 1977 was reported to be over 468,600 t/a. Data provided by Bangladesh, India, Indonesia, Malaysia, the Philippines, the Republic of Korea, Sri Lanka and Thailand indicate that their formulation facilities are adequate for their present levels of consumption and most of these countries can expand by increasing the number of working shifts to meet increased future demand.^{1/} Fiji and Niue have no formulation units, and pesticide demand is not expected to justify their installation for some time. Except for aerosols and mosquito coils made locally for the urban and export market, most pesticides are imported into Hong Kong as formulated products. Afghanistan also imports its pesticides as finished products except for the feedstocks for its aerosol line.

Only a limited range of pesticides is formulated in Papua New Guinea; the remaining requirements are imported as finished products.

Data provided by the country reports indicate that the installed information capacity may not be operating at optimum output. There are a number of factors contributing to underutilization that are in some cases related to government fiscal policy, untimely delivery of technical material and the cyclic nature of disease and pest infestations. Nevertheless, each country should be able to formulate various finished products for those pesticides whose bulk requirements justify it, so that they will be immediately available to the user. Products of this category in most countries are DDT, BHC, malathion, 2,4-D and copper oxychloride. Formulation capacity for new facilities should anticipate product requirements for the next 5 to 10 years and should be at production levels that produce a profit on operations while providing the user a quality product at optimum price.

^{1/} Market trends in some of the countries seem to require the installation of formulations (e.g., granular, WP) that do not now exist.

Pre-investment studies

The decision to invest in a formulation unit is based on the availability of technology, equipment, raw materials and infrastructural support facilities at costs that, at a given level of production, will show an attractive return on investment at a price that the consumer willingly accepts.

In contrast to active ingredient manufacturing, pesticide formulation requires relatively low-level technology and investment. The bulk of the product is some form of a local inert diluent that testing has proven suitable. Plant equipment and technical know-how can be obtained from within the ESCAP region when it is not available in the country. The training of personnel to manage, operate and maintain the plant can also be done in the region. The manufacturers of active ingredients also provide these facilities. Much of the raw-material resources of the region, however, still need evaluation for suitability in pesticide formulations.

Quality control and industrial health

The pesticide formulation industry should adhere to high standards of quality for its products to guarantee the buyer value received for money spent, preserve the status of the active chemical ingredient and protect the reputation of the producer. As indicated above under the heading "Environmental implications and legislative safeguards" some countries have established product specifications and enacted the necessary regulatory measures while others either have no or antiquated pesticide laws that require modernization. The subsidiaries of the owners of proprietary pesticides in the region are provided with adequate analytical facilities to ensure that their products meet standard specifications. This is also the case with large public-sector and private-sector operators who custom-formulate proprietary compounds and produce their own lines of commodity pesticides. Small formulators producing their own lines of commodity pesticides rarely have these facilities and are often guilty of putting substandard products on the market. Central quality control laboratory legislation should be set up in each ESCAP country to assure the farmer safe and effective pesticide formulations. These regulations should also provide for in-plant worker safety without impeding the growth of the industry in any way.

Regional contributions to the pesticide formulation industry

A number of countries, including Bangladesh, India, Indonesia, Pakistan, the Philippines, the Republic of Korea and Sri Lanka, reported difficulties in projecting accurate pesticide demand estimates. Since the accuracy of such forecasts is highly relevant for production planning, the need to develop more suitable technology for making them was expressed. Accurate forecasts by WHO are available for pesticides required in anti-malaria programmes. Data for the agricultural sector, other international public health programmes and those carried out by municipalities, however, are not adequate to ensure planned growth of the industry. Since there is a wide variety of crops, and pests and infestations are cyclic and frequently unpredictable, methodology must be developed that will make demand estimates more accurate. These data will have to be collected and maintained at the national level, but a clearing house should be established at the regional level to assemble, maintain and distribute the information to interested agencies and parties.

A regional pesticide development programme should be organized. This programme would collect and distribute data from the co-operating countries on formulation technology, pesticide toxicology, safety in all its aspects, quality-control standards and seasonal and long-range demand forecasts. The pesticide formulation industry within ESCAP is in a position to assist in the further development of the industry if the countries pool their resources and share their knowledge and experience. The regional programme would provide or channel this intraregional assistance by arranging transfers of technology, suggesting sources of capital goods and technical-grade materials, organizing regional training programmes and establishing training facilities to service the industry and give advice on supply sources for raw materials such as surfactants, stabilizers and solvents.

There is no one now on the staff at ESCAP responsible for co-ordinating the activities of the various United Nations bodies concerned with the pesticide industry. Such a unit is needed to harmonize the activities of these bodies and should be set up immediately in ESCAP.

As the formulation industry grows, it will require additional trained manpower and adequate facilities that should be planned now. Such planning would be a function of the regional pesticide development programme suggested

above. Even if the programme already existed, it would take time to organize staff and equip a full-fledged training unit. In the interim, ESCAP, UNIDO, ILO, FAO and WHO should consider arranging selected training programmes at locations within the region rather than outside it.

Government assistance

Underutilization of existing formulation capacity was referred to earlier in this chapter, and government fiscal policy was listed as a probable cause. Where formulation capacity is underutilized, assistance from the Government may be required if the industry is to survive and grow. This could take the form of exempting imported components required for formulation from payment of custom duties. The Governments of Afghanistan, Bangladesh and Pakistan do this, and perhaps all countries in the region should adopt this policy. The formulation industry needs to be assured that all active ingredients required for agriculture and public health use, whether indigenous or imported, are available regularly and on time. The industry should also receive low-cost financial assistance in order to promote and accelerate its development. For these reasons, national fiscal policies should be evolved on a sustaining basis that would support the industry and permit lower pesticide costs to the end user.

Pesticide distribution and marketing

Working Group III discussed the factors and constraints that influence the sale and promotion of pesticides and their use in the ESCAP region. Both agricultural and public health programmes were considered during the deliberations. Most of the papers distributed at the Symposium contained information related to some aspects of pesticide marketing and distribution. The work of the Symposium on this topic is adequately well summarized in the corresponding section of the chapter "Conclusions and recommendations".

Regional co-operation for development of the pesticide industry

The major role that pesticides play throughout the world in increasing food production and protecting public health is universally recognized. The role is especially important in the developing countries, as is evidenced by the increase in pesticide demand and the fact that consumption in the

early 1970s apparently greatly exceeded the previous industry estimates of an annual growth rate of 10 per cent. Increase in demand and consumption undoubtedly contributed to the tight pesticide situation in 1974/75.

The importance of establishing pesticide production facilities and promoting the use of such products in the developing countries has been recognized by Governments, international organizations and industry. The field of pesticides covers various aspects, such as manufacture, formulation, transportation, storage, application, residues, tolerances, environmental protection and related pesticide legislation, all strongly interrelated. Consequently, any national pesticide production programme must be properly organized and co-ordinated as a prerequisite for its successful development. Regional or subregional co-operation on the production and promotion of pesticides could certainly provide real advantages and accelerate the industrial development process by common and co-ordinated efforts, which are necessary to ensure:

- (a) Adequate and timely availability of suitable pesticides at economic prices;
- (b) Safety in all its aspects;
- (c) Development of production capacities for formulation and basic manufacture in the region;
- (d) Adequate support for training resources for market development.

The three working groups in their separate sessions discussed these and related topics and independently arrived at the conclusion that many common deficiencies could best be corrected by regional co-operative efforts. In plenary, the Symposium reached a consensus on this topic, which will be found detailed in the corresponding section of the chapter "Conclusions and recommendations".

Organizational needs

Regional programme

Most ESCAP member countries are developing countries, and their existing pesticide industry or efforts to establish this industry are often obstructed by a number of factors, such as insufficiently reliable market information, limited domestic market for many individual pesticides, complexity of some production technologies and lack of testing facilities for evaluating local

raw materials. The establishment of a regional pesticide development programme would lighten if not eliminate these constraints. The programme would carry out periodic market surveys, test local raw materials for pesticide formulation, develop formulations consistent with local needs, advise on co-operative pesticide manufacturing programmes and the appropriate technologies to be adapted, collect and transmit up-to-date scientific and techno-economic information, participate in and develop guidelines for training personnel for production, marketing and marketing services. The programme should provide services in addition to those provided by other United Nations organizations and avoid duplication by consultation with them.

National programmes

At the national level, techno-economic information and co-ordination units should be created to provide input into the regional pesticide development programme and get feedback from it. The units would also co-ordinate the activities of concerned agencies within the country.

Most developing countries do not have adequate quality control facilities and these should be expanded to meet the needs of the national regulatory agencies. Institutional facilities for training plant protection and extension units operating at the farm level also need strengthening in most of the ESCAP countries.

Part two. Summary of technical papers

This part presents some of the more important data contained in the 36 technical and background papers distributed at the Symposium. A complete list of these papers is in "Provisional list of documents" (ID/WG.223/8).

Although sales of pesticides in the developing countries is low, a 1973 survey of 14 developing countries in the ESCAP region indicated that pesticide requirements in the region should increase about three and a half times within seven to eight years. The amount of total active material that would be required in 1978 was put at 140,000 t. Based on installed and planned formulation capacity figures collected at the time the countries were surveyed, formulation undercapacity was estimated to reach about 100,000 t/a and would affect those countries most which did not have adequate facilities when surveyed. Capital requirements to make the region self-sufficient in both basic production and pesticide formulation were estimated to be \$238.5 million.

Pesticide price levels had remained relatively stable for several years until 1973, when short supplies developed in the chemical industry and the prices of petroleum products increased following the petroleum embargo. The increase in cost for pesticides for the estimated requirements for 1974 for three ESCAP countries surveyed in 1973 was estimated to be \$17.8 million. A prior investment equal to this cost increase for pesticide inputs in local basic manufacturing facilities for subregional supply of a few commodity pesticides would have been extremely beneficial.

A plant for making the isobutyl ester of 2,4-D at the rate of 700 t/a would require a capital investment, not including cost of land, of \$604,230 and have a pay-out time of 2.17 a. A methyl parathion plant of 500-t/a capacity with a capital outlay of \$2,130,369 would have a pay-out time of 5.18 a, and a malathion plant of similar capacity with a capital outlay of \$3,160,613 would pay out in 7.63 a.

The manufacture of technical pesticides depends on the existence of chemical and mechanical industries in all their ramifications that can supply basic materials, intermediates and services. Local packaging and formulation, on the other hand, require less capital, plant equipment, foreign exchange and commitment of skilled and experienced labour than the manufacture of

technical pesticides. Generally speaking, pesticide formulation generates more job opportunities in back-up activities such as production of diluents, packaging etc. than basic manufacturing. Investment decisions should allow for competitive new products that may be introduced for biological, regulatory, environmental or other reasons to improve local agricultural practice. If these factors are ignored, significant investment in chemical manufacturing may become obsolete. This is less likely to happen with formulation units because formulation technology is well established and less subject to dramatic change and can be adopted quite easily to new products.

Local formulation can often be justified for relatively small markets because of the large contribution of local cost elements to the price of the finished product. Certain precautionary measures, such as the assurance of safety in all its aspects, maintenance of high product quality and prevention of environmental contamination, require controls of the highest standard and are common to both pesticide manufacture and formulation. Training people involved with pesticides is of paramount importance whether they are working in a production or packaging plant or in the field. The pesticide industry trains its personnel on a continuing basis through workshops, courses and special assignments followed up with manuals, slide kits, product literature, safety posters and films. The industry also contributes to training programmes conducted by the United Nations bodies through the FAO Industry Cooperative Programme.

Pesticides can effectively reduce losses when pest management is given scientific support for production, distribution and market development. Since the pesticide industry makes use of and depends on research in all its aspects, a regional or subregional approach for production and placement of pesticides may help accelerate the development of the industry and promote the safe and effective use of its products. The development of a regional pesticide programme to evaluate raw materials, develop new formulations, train production personnel and assist in the transfer of pesticide technology is advocated.

Most major pest, disease and weed problems in most parts of the ESCAP region have been identified, but in-depth studies are needed on most crops to develop more rational, integrated and economic crop-protection measures.

Approximately 30 per cent of the region's agricultural production is lost annually to pests, diseases and weed competition. There are 400 million small farmers in the region and most of them are beyond the reach of the plant protection services. Probably only 2-10 per cent of the total area needing protection is covered. Not all countries of the region have pesticide laws to control pesticides. Some have quality control and residue analytical facilities, but these services need to be strengthened and established in several other countries. There is some co-ordination between agriculture and public health at the national level but none in most countries at the field level. Such co-ordination is essential and should be encouraged at all levels.

The ESCAP countries are committed to work on a co-operative basis for mutual benefit through the Plant Protection Agreement for the Southeast Asia and Pacific Region, and intergovernmental agreement that established the Regional Plant Protection Committee for the South East Asia and Pacific Region. The Committee advises the Governments and FAO on policy and other regional plant protection matters.

The 1974 FAO pesticide survey indicates that current regional pesticide requirements are in excess of 197,000 t/a of active ingredient, substantially higher than the 1973 estimate given above. Insecticide consumption is the greatest, with fungicides in second place. The region has tremendous potential for the development of pesticides of plant origin, and one of them, pyrethrum, is being promoted as a substitute for the opium poppy.

Current pesticide requirements for anti-malaria programmes in the ESCAP region are estimated to total 28,520 t/a, which, however, is only part of the pesticide volume used for public health. Significant but smaller amounts of pesticides are used all over the world for the control of other vector-borne disease. The largest use of pesticides for public health may be for urban vector or pest programmes carried out by municipalities.

Public health programmes are expected to rely heavily on pesticides for many years to come. Apart from anti-malaria programmes, where residual insecticides are, and will remain, the principal tool for vector control, other

large-scale disease-control programmes are being developed which will require large amounts of pesticides. Limitations on the use of pesticides will be imposed by higher pesticide cost, environmental concern and vector resistance. However, every effort to reduce or eliminate these factors is bound to lead to an increased demand, and the future of pesticides lies in how successfully the manufacturing industry can respond both to the needs of the programmes and to the public's concern.

Part three. Summaries of country papers

This part presents brief summaries of the papers submitted to the Symposium by 14 countries and territories of the ESCAP region: Afghanistan, Bangladesh, Fiji, Hong Kong, India, Indonesia, Malaysia, Niue (Cook Islands), Pakistan, Papua New Guinea, the Philippines, the Republic of Korea, Sri Lanka and Thailand. The titles and authors are given in annex II.

Afghanistan

Urea fertilizer production started with one factory in 1974 and is expected to reach its target of 105,000 t/a during 1977. A second factory is under consideration in order to cover the total demand for fertilizer. Although the present consumption of pesticide is low, demand is expected to increase with the increasing use of fertilizer. A feasibility study on caustic soda, chlorine and hydrochloric acid is under way and production of these chemicals is expected to start in three to four years. Pesticide demand at that time might be sufficient to justify production of chlorine-based pesticides. The country also has copper and sulphur resources that could be exploited.

The only pesticide industry in Afghanistan is an aerosol unit producing pyrethrum aerosols for domestic use and export.

Current annual requirements for pesticide formulations include:

Sulphur (t)	1 000
BHC dusts (t)	1 500
Aldrin (t)	5
Parathion and malathion (l)	24 000
Herbicides (t)	500

Bangladesh

Pesticide consumption fell from a high of 10,500 t in 1972/73 to 2,041 t in 1974/75. Major factors causing this were a low incidence of pests and diseases during the last three years and reduction of the subsidy from 100 per cent to 50 per cent of cost. Revised pesticide consumption targets indicate an annual increase in pesticide use of approximately 10 per cent until 1979/80.

Pesticide manufacturing is confined to a single DDT plant with an installed capacity of 1,500 t/a and three formulation units with capacities of 2,000 t/a WP, 6,000 t/a granules and approximately 6,200 t/a liquids. A joint venture to produce 2,400 t/a of diazinon, dichlorvos, phosphamidon and dicrotophos is being considered.

In Bangladesh, DDT is used only in the malaria eradication programme, the requirements of which are now less than plant capacity; consequently the plant does not operate all year and suffers financial losses.

Fiji

The quantity of pesticides used is small in relation to the area under cultivation because the insect and disease problems of the two major crops, sugar-cane and coconut, which account for 80 per cent of the land under cultivation, have been brought under effective and permanent control by biological methods. Herbicide use on these crops is replacing the manual measures formerly used and is increasing.

Pesticide consumption is growing at the unusual rate of 22 per cent per annum and current pesticide consumption in Fiji is:

Insecticides	15 t/a active ingredient
Fungicides	0.4 t/a active ingredient
Herbicides	895,554 l/a liquid formulations 1.6 t/a WP formulations
Other	5 t/a formulated

All products are imported in finished form; there are no production facilities in the country.

In 1971, the Pesticide Act, which regulates use and sale of pesticides, was enacted. Enforcement of its regulations now ensures full control of pesticides entering the country, storage, transportation, labelling, dealer licensing etc.

Hong Kong

Pesticide consumption is estimated to be about 250 t/a active ingredient at a value of \$3.7 million. This market is expected to have a steady growth rate of 4-7 per cent per annum, with herbicide usage expanding the most rapidly. Insecticides account for about 76 per cent of the total active ingredient consumed, and 15 per cent of the insecticide volume is used in agriculture. The lower

volume of insecticides used in households has a much higher retail value, however: two to three times the total retail value of agricultural pesticides.

Most agricultural pesticides are imported as finished goods but some dilution and repackaging is being done. Formulation facilities for aerosols and mosquito coils for household use are well developed and a large proportion of the latter are exported.

India

Pesticide active ingredients are used at the rate of approximately 70,250 t/a in India, but the installed capacity of the industry is 51,374 t/a. Consequently, there is still a substantial gap between indigenous demand and output. Difficulties have been experienced in accurately forecasting pesticide demand; however, rough estimates indicate an annual growth rate of 18 per cent in pesticide consumption over the period 1963-1984. Forty-four technical-grade products are produced and 12 of these are based wholly on indigenous technology. India is self-reliant in formulation capability and import of formulated products is normally not allowed.

Most equipment and machinery required by the pesticide manufacturing industry is available locally, and dependence on imported equipment is diminishing rapidly. Technology and turn-key plants can be offered for 21 pesticides.

The Government attaches great importance to pollution control and safety in the manufacture and use of pesticides. Legislative control of pesticides is exercised under the Insecticides Act. State Water Pollution Control Boards set specific effluent standards and the Indian Standards Institution also establishes standards for waste water discharged into natural systems.

India has established a significant technology base and is willing to share this with other developing countries. Since the pesticide industry is assuming importance in all developing countries, requirements for trained manpower should be assessed and planned. The establishment of regional training facilities with United Nations assistance is suggested.

Indonesia

The lack of statistical data in usable form makes assessment of current pesticide consumption and projected demand difficult. Approximately 10,800 t of pesticide formulations were imported in 1973 and estimated consumption was 6,838 t by the major sectors, which include industrial and estate crops, public health

and government subsidy programmes (principally on rice). Pesticide consumption in the government subsidy programmes is expected to have an annual increase of 8-10 per cent through 1978, when the current five-year plan ends. A recent study estimated that annual pesticide demand will increase by 15 per cent for insecticides, 10 per cent for fungicides and 25-30 per cent for herbicides.

In 1977, installed pesticide formulation capacity is expected to be 47,670 t/a. Stocks of technical material have to be imported. Domestic production of active ingredient has potential and will be influenced by the developing petrochemical industry.

Malaysia

In 1974, the agricultural sector consumed an estimated \$31,760,000 worth of pesticide at the consumer level. Pesticide imports for that year were valued at \$6,730,000 c.i.f. (5,967 t and 945,077 l, believed to be mainly active ingredients for formulation). Average annual growth in pesticide demand through 1985 is estimated at 15 per cent. Herbicides command 75 per cent of the total pesticide market, and there are four producers of technical material at the final acid-neutralization step.

There are eight major formulators in the country and their annual production capacity is 40 million litres of liquid formulations and 35,500 t of dry formulations. At present they are working at about 26 per cent capacity. They and numerous minor formulators can easily meet the projected local demand for the next 10 years.

Modern pesticides legislation was established with the Pesticides Act of 1974.

Niue

Pesticides usage is very limited and all products are imported as finished formulations. The c.i.f. value for these products in 1975/76 was \$18,505.25.

Pakistan

Present consumption of pesticides is over 8,000 t/a of active ingredient and the annual increase in demand is 7-12 per cent. Revised estimates for 1979/80 and 1980/81 indicate that consumption may stabilize at 8,000-9,000 t/a.

There are about 15 formulators of pesticides approved by the Government, but not all are operational. With the possible exception of those producing products for household use, none of the operating formulation units are operating at capacity. In government-owned projects formulation capacity is 8,000 t/a of dry formulation and 3 million litres of liquid products.

Technical DDT and BHC are being produced. Total capacity for DDT is 1,920 t/a and for BHC, 1,600 t/a. A proposal to produce 2,000 t/a technical malathion has been approved, and an omnibus plant that would produce other organophosphorus pesticides with minimum conversion effort is planned. Production of 500 t/a each of trichlorfon and dichlorvos has been suggested to use excess chloral from the DDT facility. The Government is also considering proposals to produce dicofol, ethylene dichloride and the microbial product Bacillus thurengiensis berliner.

Papua New Guinea

Since 1971/72, annual consumption has fluctuated between 500 t and 900 t of formulated products; in 1975 about one half the total consumption was DDT for malaria vector control programmes. The high cost of pesticides and depressed prices for agricultural exports caused a sharp drop in pesticide consumption in 1975/76 and projected demands could not be made. Commodity prices are now satisfactory and very high for cocoa and coffee. While they remain high, pesticide demand could exceed previous levels. Increased usage is also expected as a result of new agricultural developments in grain crop and expansion of oil-palm cultivation.

There is one formulation plant operating in Papua New Guinea producing a line of water-miscible oils of insecticides and herbicides, insecticide dusting powders and a livestock dressing containing insecticide. About 5 t/a of pyrethrum is extracted by a factory near production areas in the highlands. None of it is formulated locally.

Philippines

Intensified food production programmes have stimulated the pesticide industry. Annual consumption is over 11,000 t of pesticide active ingredient valued at \$15,960,000 c.i.f. and is growing at the rate of about 20 per cent per annum. Actual production figures are not available, but estimates of annual

formulation capacity on a one-shift basis are 75,000 t/a granules, 7,000 t/a powders and 5,000 kl/a liquids. Although the formulation industry has been able to cover, to a certain degree, the internal demands of the country, the increased demand expected in the future will require increased plant investment. Only technical 2,4-D is being produced at the final acid-neutralization step, by a single plant with an average annual capacity of 300 t.

Modern pesticide legislation is needed; the current pesticide control law, which covers only mislabelling and adulteration, is 52 years old and quite out of date. New regulations have been prepared and await final approval by the President. However, indiscriminate marketing of pesticides for export crops has been prevented by strict adherence to the tolerances and other regulations fixed by the importing countries. There are only three agencies monitoring pesticides, and the Government has plans to establish a formulation control laboratory.

Assistance from UNIDO to establish a pesticide formulation research and development laboratory to exploit local resources to the maximum and develop formulations adaptable to local conditions would be advantageous. UNIDO could also be involved in an intensive training programme that covers all phases of pesticide technology, such as formulation, quality control, residue analysis, pesticide management and instrumentation.

Republic of Korea

The pesticide manufacturing industry, which has been established only recently, has been rapidly developing. There are eight manufacturers of technical material; they produced 2,470 t of the 8,454 t of pesticide active ingredient consumed in 1975. The Republic of Korea is expected to meet national demands for technical material in the future because expansion of synthetic facilities associated with the five chemical and petrochemical industries is being emphasized.

There are 14 companies formulating pesticides; they produced 87,810 t of finished product in 1975, of which 87,761 t was consumed. Pesticide demand is estimated to show an annual rate of growth of 13 per cent through 1985.

Sri Lanka

Pesticide consumption for 1977 is estimated to be 907,828 l of liquid formulations and 1,085 t of dry materials, with a c.i.f. value of about \$10 million. The installed capacity for local formulation meets nearly all the

country's requirements at this time, but that could change if rapid technological changes make existing facilities obsolete. New plants would require greater sophistication now that more attention is being paid to personal safety, environmental pollution, and waste and effluent disposal. This is an area in which international organizations can offer assistance in the form of training of personnel and dissemination of technologies, best achieved through regional or subregional co-operation. Farmer education in the correct use of pesticides needs much more attention than it is now receiving.

Installation of production units for pesticide technical material is not warranted by the state of industrial development in the country and the consumption pattern of pesticides. All primary chemicals and intermediates for pesticide manufacture would have to be imported, except chlorine.

Thailand

Total pesticide consumption has declined in the last three years and in 1975 was 2,000 t of active ingredient valued at \$11 million c.i.f. The dollar value of insecticide and fungicide imports was down in 1975, but the dollar value of herbicides increased about 50 per cent. Thailand has a well developed formulation industry with perhaps seven major formulators and numerous smaller operations. Local production of technical DDT to utilize excess chlorine was planned but the manufacturing permit was not granted after an organized student protest against pollution. The situation and policy has changed, and it is now hoped that local basic manufacturing of chlorine-based pesticides might still be accomplished.

Annex I

LIST OF SYMPOSIUM DOCUMENTS

- ID/WG.223/1/Rev.1
and Corr.1 The current situation and prospects on pesticide supply and demand and investments required for adequate pesticide production in developing countries
by the UNIDO secretariat
- ID/WG.223/2 and
Corr.1 A 1975 reappraisal of the costs for pesticide inputs in three Far East countries, Indonesia, the Philippines and Thailand, as compared to data presented in the UNIDO/FAO pesticide survey (IS/RAS/71/84) prepared in 1973
by W. J. Magee, UNIDO consultant
- ID/WG.223/3 Dynamics of pesticide usage and growth in agriculture in developing countries of ESCAP region
by V. S. Bhatia, UNIDO consultant
- ID/WG.223/4 Methyl parathion - An industry profile
by C. L. Dhawan, UNIDO consultant
- ID/WG.223/5 Malathion - An industry profile
by C. L. Dhawan, UNIDO consultant
- ID/WG.223/6 Provisional list of participants
- ID/WG.223/7 Provisional agenda
- ID/WG.223/8 Provisional list of documents
- ID/WG.223/9 Report of the Symposium
- ID/WG.223/10 2,4,D Industry profile
by Incro, S. A., Spain
- ID/WG.223/11 Agrochemicals manufacture - investment considerations
by FAO/ICP/FWG
- ID/WG.223/12 Future regional agricultural pesticide requirements and trends in agricultural pesticide usage
by FAO
- ID/WG.223/13 The place of pesticides in public health programmes
by WHO

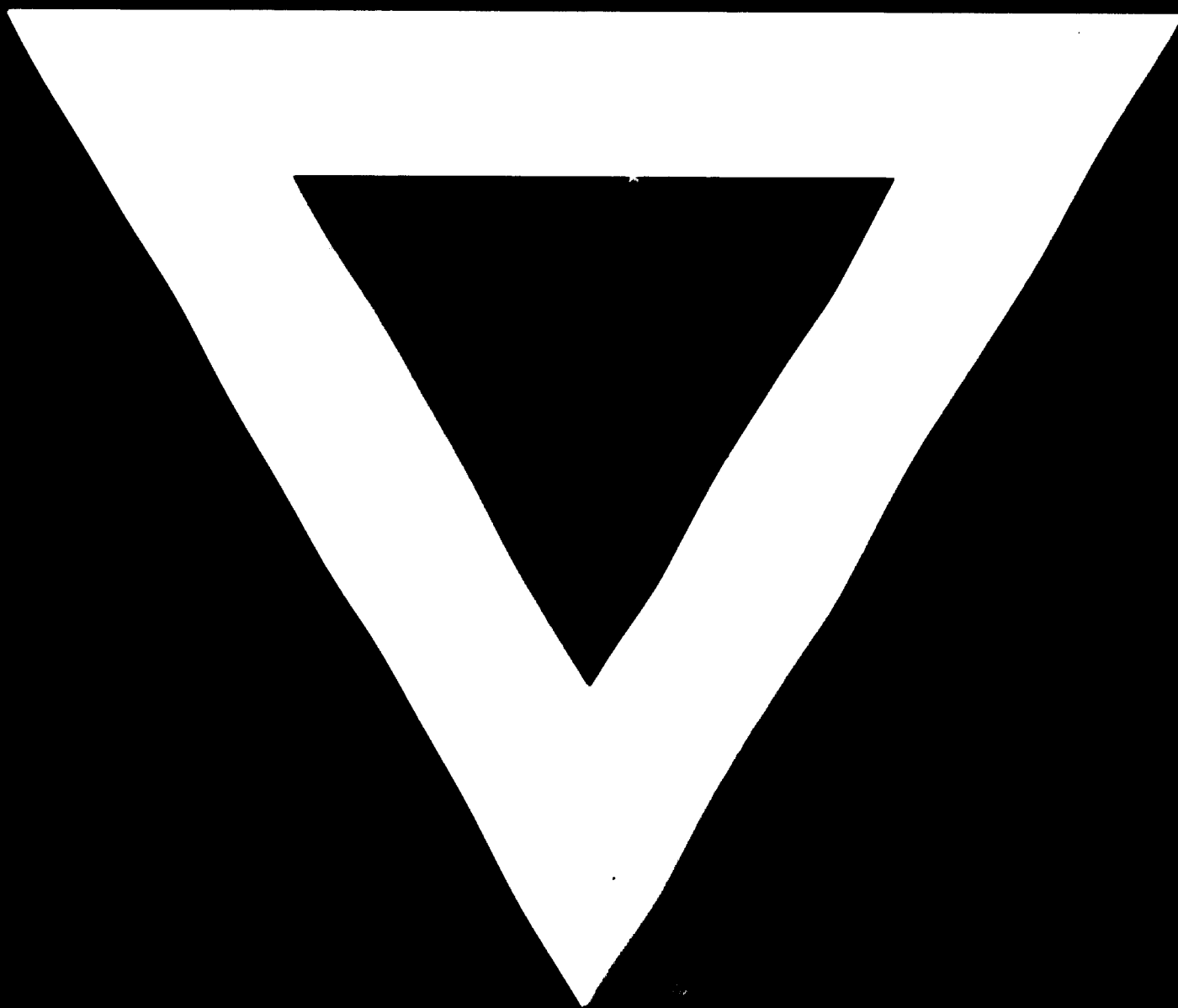
Annex II

LIST OF COUNTRY PAPERS PRESENTED TO THE SYMPOSIUM

Afghanistan	A note on pesticides by Ahmad Ali Abawi
Bangladesh	Present status of the pesticide industry, its development plan and utilization of pesticides in Bangladesh by Naushad Ali
Fiji	Brief account of some aspects of crop protection in Fiji by Satya Ram Singh
Hong Kong	The pesticide industry in Hong Kong by Richard Winney
India	Pesticides industry in India by Lata Singh and Ram S. Hamsagar
Indonesia	Development of the pesticides industry in Indonesia by Kusmono and Mulyani Soekardi
Malaysia	The present status of the pesticide industry in Malaysia by Haji Osman Bin Mohd. Noor and Ooi Soon Chye
Niue	(No title) by Morris H. Tafatu
Pakistan	Production and promotion of pesticides in Pakistan by Muhammad Latif Vasir
Papua New Guinea	Country report - Papua New Guinea by Ted L. Fenner
Philippines	The present status of the pesticide industry in the Philippines by Serapion J. Bayubay and Thelma Barredo Alvarez
Republic of Korea	Present status of pesticide industry in the Republic of Korea by Ki-Hak Han
Sri Lanka	(No title) by Rangith Kurukulasuriya
Thailand	The present status of the pesticide industry in Thailand by Kawanchai Sombatsiri



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