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# THE FORMULATION OF PESTICIDES IN DEVELOPING COUNTRIES[1/]

by

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## 1 INTRODUCTION AND HISTORICAL REVIEW

In the early fifties, when the synthetic pesticide industry was expanding rapidly in areas with highly developed systems of agriculture, formulation plants were established in many countries. These were usually simple blending units for the production of liquid concentrates - facilities for the local production of dusts and wettable powders were established in relatively few areas. Insecticides were the first products to be handled - later and on a much smaller scale, local formulation of fungicides and herbicides was established. These developments closely followed the local market demand for pesticides as modern practices of cultivation were gradually introduced, and the convenience and benefits of modern methods of pest control were recognised. At the present time a large proportion of the pesticides used in developing countries is locally formulated.

## 2 FORMULATION: A MARKETING ORIENTED OPERATION

Formulation is considered primarily a marketing oriented operation and therefore formulation plants including filling and packaging facilities tend to be located in or near the major markets. It is clearly preferable to transport relatively small tonnages of technical pesticides to the formulation plant for incorporation into less concentrated formulation suitable for field use, rather than to move substantially larger tonnages of finished formulations over considerable distances. Where a market of sufficient volume and potential exists the need for shortening of distribution lines, and for a prompt response to market demand, together with the local availability of ingredients (fillers and solvents), may provide sound economic justification for establishing formulation plants close to the market. A few words of caution are however necessary. The volume of sales and consequently the plant loading in many cases does not allow an economically sound operation. Because of the strongly seasonal demand pattern and the uncertainties in forecasting market requirements, it is common experience that many of these plants are only operated for a short period of the year prior to the actual selling season. Consequently a significant part of the available production

capacity remains unutilised. As will be discussed later this adversely affects the manpower arrangements and the economic operation of a formulation plant particularly in developing countries with a restricted market volume and potential.

It may also be noted that formulation technology is becoming increasingly complex. With many of the newer pesticides the type of simple blending unit which has been entirely adequate for the preparation of simple emulsifiable concentrates and dusts must be considerably modified, to cope with more sophisticated formulations such as soluble concentrates, wettable powders and granules, and plant operators must be trained more carefully in the safe and efficient operation of the plant. Nevertheless for many of the well established pesticides local production of formulations can provide real savings, not least in terms of reduced requirements for foreign exchange to finance imports.

## 3 CRITERIA OF FEASIBILITY FOR ESTABLISHING A LOCAL FORMULATION PLANT

The following basic criteria will determine whether a local formulation plant can be operated successfully. These apply equally to developed and developing areas.

### a Market Volume and Potential

The market demand and future potential for specific individual product formulations must be firmly established for appropriate market research. Cross-checking of data from different sources is likely to be of considerable benefit in this context - e.g. data from import statistics on both pesticides and spray equipment, total crop area and crop area subject to attack by specific pests.

Many factors may distort the figures for market demand, e.g. climatic conditions in a given year may favour a high incidence of some particular pest or vice-versa; carry over of stocks from one season to another may suggest that demand

for a product (if measured by imports) is falling off; demand for a particular pesticide may be high simply because this is currently the cheapest product imported although performance and the spectrum of control is limited. Well designed and conducted market research will identify this type of distortion. Realistic cost/performance analysis will then provide a sound basis for selecting the most suitable pesticides and types of formulation for production in a given area.

It is important that data on market demand should indicate in which months of the year the product is required, and the main areas for distribution. In some developing countries transport by road may be restricted in the wet season, and product may therefore be required for distribution several weeks or even months before it is actually applied.

Local preparation of formulated products will only result in an economically viable operation if market demand and potential for any one product or product mix exceeds a minimum quantity. Depending on local circumstances these quantities may vary considerably. However, the following figures may serve as a guideline for a minimum plant loading:

More than 500 T of liquid formulation
More than 1000 T wettable powder
More than 1000 T granules
More than 2000 T dusts

b Local Availability of Formulation Ingredients

The ready availability of cheap formulation ingredients of consistent quality, solvents and fillers in particular, is of primary importance for economic operation of a local formulation plant. Import of these materials may seriously reduce the economic attractiveness of the local formulation project, as freight costs, insurance and import duties might double or triple the price of these normally rather cheap materials. Moreover, long shipping lines will create logistic problems, and are impracticable for a seasonal production. A

quick manufacturing response to unpredictable market demands would hardly be possible and hence a major advantage of a local manufacturing operation would be lost. For similar reasons the local availability of small pack containers and packaging material is highly desirable. It should perhaps be noted that the characteristics of the locally available ingredients may be such that it is difficult if not impossible to match exactly the concentration, properties and specification of an imported formulation. In all cases it is essential to ascertain through laboratory tests that the physical and chemical properties of local ingredients are suitable for the proposed use. The performance of formulations developed from these ingredients must be tested in the field before decisions are taken to establish local formulation facilities.

c Local Technological Resources

Because of foreign currency constraints the level of technological development of local supporting industry ('Industrial Substructure') should preferably be such that major equipment, utilities, civil engineering and plant construction can be provided locally. Equally important is the quality and extent of technical service which can be provided by local contractors, to enable a smooth and reliable operation of the plant. The limited size of most local blending operations does normally not justify the establishment of an extensive technical service and maintenance department on the plant site, and hence these services will have to be contracted out.

d Availability of Qualified Staff and Labour

A basic reservoir of staff with managerial, technical and scientific qualifications and technically trained labour should be available locally to facilitate the staffing arrangements. Temporary assistance and training by expatriates may be required. Adequate staffing arrangements have to be made for the following areas of activities:

i Plant management.

ii Administration.

iii Plant operation: production supervisors/foremen, crew of operators for each formulation and packaging line, crew to operate waste disposal (incineration) and effluent treatment units.

iv Technical service and maintenance crew.

v Quality control and technical support for marketing.

vi Medical services.

## 4 ECONOMICS OF LOCAL FORMULATION

The different cost elements which govern the economics of pesticide formulation in developing countries will be discussed and illustrated by a few typical examples -

A general outline will be given of the capital investment required for liquid and solid formulation, filling and packaging facilities including storage, tankage, utilities, general service and anti pollution facilities. It may also be necessary to consider the costs of testing local ingredients and provision of formulation recipes/know-how. Operating costs will be discussed particularly as a function of plant loading, the local availability and cost of ingredients and labour requirements. The investment required for continuing plant changes and adaptations in view of the introduction of new or improved formulation procedures and manufacturing technology will be discussed.

## 5 FUTURE TRENDS IN PESTICIDE FORMULATION

The relatively fast obsolescence of commercial pesticides and the continuing improvement of products and manufacturing processes are inherent to the pesticide business.

At present there are various trends in pesticide research and development which will have a profound influence also on future formulation activities in developing countries.

a New products with a selective performance against specific pests will be developed. As a result the familiar large volume commodity products with a broad application range will tend to be replaced by new selective products, but with a more limited market potential.

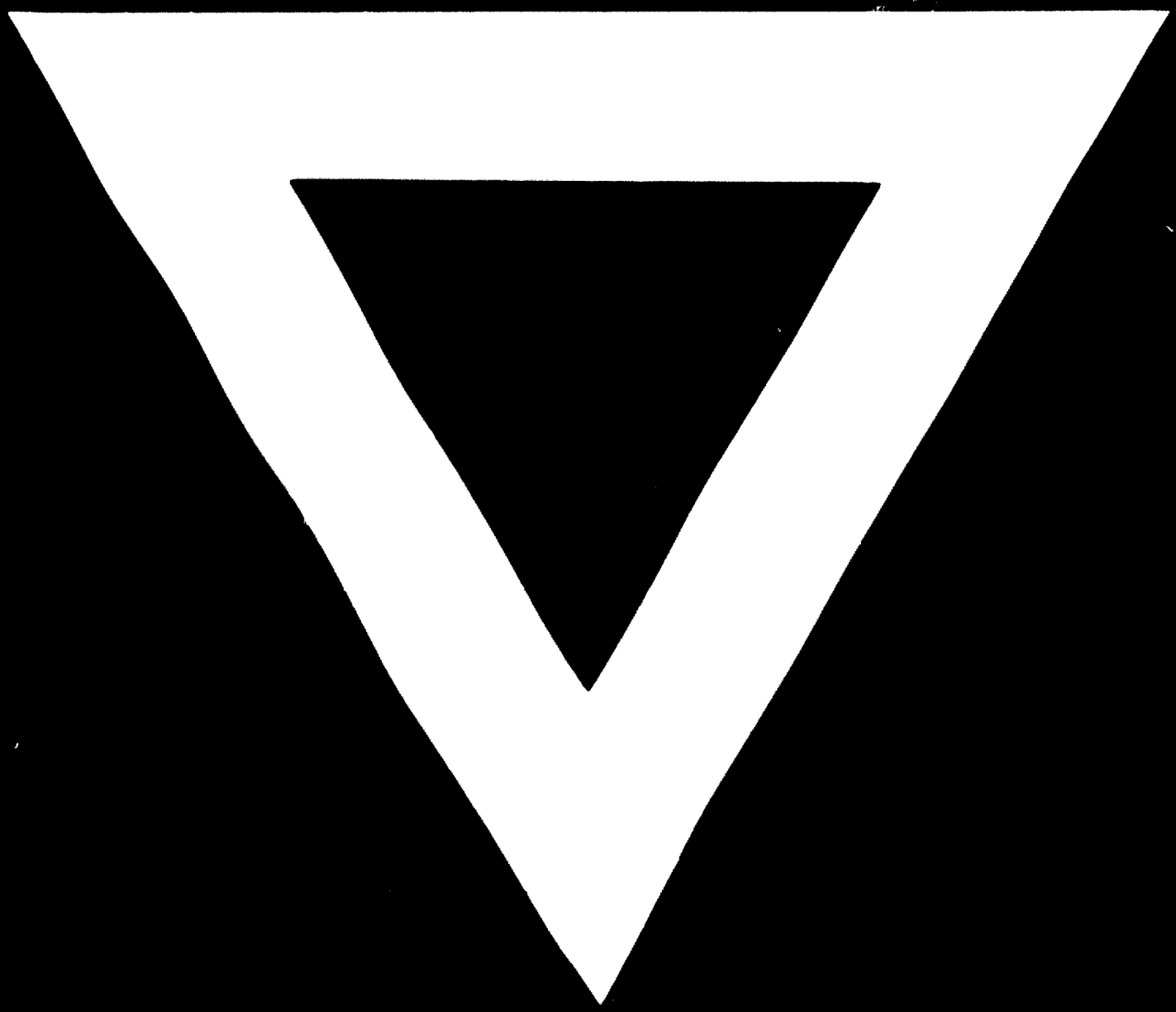
b New types of formulation are being developed. These are designed to improve the performance of the pesticide for certain applications or to eliminate undesirable side effects. Conventional pesticide formulation facilities may not be suitable for manufacturing some of these products.

c The rapid advancement of modern cultivation methods in developing countries will call for new techniques for pesticide application in crop protection. For instance ULV (ultra low volume) application technique has significant advantages in many areas. Widening interest in ULV techniques may have a profound effect upon the viability of units designed primarily to handle large quantities of low concentrate formulations.

d The increasing consciousness of problems related to environmental conservation will greatly influence pesticide development. In the manufacture of technical pesticides and formulations more attention will be paid to personal protection measures, to pollution conscious design, engineering and construction, to pollution abatement, waste disposal and effluent treatment facilities. For small formulation plants the cost of these anti pollution facilities is likely to be far greater than the capital investment required for the actual production units. It is obvious that this aspect should be fully considered when evaluating new investment opportunities with capital recovered only after, say, ten years of operation.

There is no doubt that the general trends in pesticide development, as mentioned above, will call for a high degree of sophistication, diversification and flexibility in production methods, particularly in the manufacture of formulations. A local manufacturing operation is only likely to be successful if backed up by a continuing support from a major research and development

effort. Both in the early evaluation of opportunities for economically viable local formulation facilities, and in maintaining this viability in the future, co-operation is clearly a key factor.



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