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SEMINAR ON THE DEVELOPMENT OF THE CHEMICAL INDUSTRIES IN LATIN AMERICA *

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PESTICIDES IN LATIN AMERICA

presented by

Shell International of London

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Introduction

Agriculture is a disturbance of the natural order, and the more intensive the agriculture the greater is the risk of infestation by insects, disease and weeds. Thus the use of pesticides is greater in the intensive agricultural systems of North America, Europe and Japan but Latin America uses a very significant part of the world's production of pesticides and will undoubtedly become an increasingly important market.

Before discussing the Latin American position in detail it is appropiate to summarize the more important data on the world-wide aspects of pest control in agriculture and other fields.

1. 20 per cent of all foodstuffs are lost between sowing and harvest because of insects, fungi and weeds.

2. 10 per cent of all foodstuffs are lost in storage because of insects and fungi.

3. Between 7,000 and 9,000 people die of malnutrition every day.

4. Half the world's population is short of food and world population is increasing by 140,000 a day.

5. Half of all human deaths in the last decade have been attributable to insect-borne disease.

So far, only limited success has been achieved in reducing the losses enumerated above. One significant breakthrough has been achieved in reducing deaths from malaria from 6 million in 1939 to 1.5 million in 1962. In 18 countries the disease has been eradicated. Another has been to bring under control the periodic swarms of locusts which have plagued agriculture for thousands of years in vast areas of Africa and Asia.

The position in Latin America

In Latin America insecticides probably account for more than 70 per cent of pesticides usage with fungicides and herbicides taking roughly equal shares of the balance. Within the insecticides market, the major offtake, probably exceeding two-thirds, is for pest control on crops. Domestic insect pest control is also relatively important but other end-uses such as public health and veterinary uses account for very small shares. In the fungicide market, the older inorganic products still account

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for about half the offtake but the use of the synthetic organic fungicides has increased spectacularly in recent years. In the herbicide market, the position is still dominated by the established hormone type products but the new triazines are making rapid inroads into the market.

It will be helpful to put the Latin American pesticides market into perspective in the following table:

	Annual Value at Retail Level
The World excluding Sino/Soviet Bloc	£ 420 million
USA and Canada	£ 170 million
All other areas	£ 250 million
Latin America	£ 30 million

Thus Latin America accounts for some 12 per cent of the market outside North America, where the USA dominates the scene. In terms of anticipated expansion, the area shows an annual growth rate of 10.5 per cent - which is somewhat higher than that of other major regions of the world such as Europe, Africa and Middle East, Asia and Australasia.

A word of caution must be introduced in looking at these figures since accurate pesticides statistics are just not available in many countries and have to be estimated by the major operators in the market in relation to their own position.

Some specific uses of pesticides

(a) Insecticides

The leaf-cutting ant is probably the greatest threat to agriculture in Brazil but the widespread use of aldrin dust formulations has proved invaluable to the farmers of Brazil, allowing them to plant their crops on areas where previously they would have lost a large part of their crop.

Similarly, the Coffee Berry Borer, which deposits its eggs in the coffeeberries from January to end May, is controlled by BHC or dieldrin.

In the Argentinian Pampa, there is a struggle each year between the Argentine farmer and the Tucura grasshopper. Dieldrin has been found to be the most effective insecticide to control this pest. Without this treatment, much of the grazing land carrying beef intended for export would be rendered useless.

The use of insecticides on cotton has been as successful, if possible less spectacular, as any other instance of pest control. As a crop it consumes the biggest quantity of insecticides in Latin America. This is not only because the area under cultivation is large but also because cotton comes under attack from a very wide variety of insect pests throughout the whole area and season. There is little doubt that without the use of

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insecticides, the yield of cotton would be minimal and the economics of several countries would be seriously jeopardised.

(b) Fungicides

Bananas are all important in this area. In 1935, plantations in Honduras suffered a serious attack of Sigatoka disease or banana leaf-spot, and production which has reached 27 million tons in 1930 was halved in 1935 and, by 1940, was down by 80 per cent. In Mexico, where it first appeared in 1937, production was halved between 1937 and 1941. In short, wherever Sigatoka disease has appeared, enormous economic loss has occurred and, within a comparatively short time, a flourishing banana industry destroyed.

This disease was controlled by a series of massive measures - first in field trials and then by control system. Bordeaux mixture was used for many years, followed by the less expensive oil spraying, and now a mixture of oil spraying plus a dithiocarbamate fungicide is giving satisfactory control. This has probably been one of the most significant achievements in the history of phytopathology.

(c) Herbicides

Weedkiller usage is an equally interesting story. Although in some areas, it is still cheaper to remove weeds by hand rather than by chemical means, there have been important developments in this field which have had economic benefit to the Latin American farmer.

Firstly, there is the application of the hormone-type weedkillers such as 2,4-D to sugarcane which, being a crop of major economic importance in the area, has benefited greatly from this means of weed control.

Secondly, the discovery and availability of the more persistent herbicides of the phenyl urea types, such as monuron and diuron, and the triazine herbicides such as Simazine and Atrazine. These types of herbicides are somewhat insoluble and remain in the topsoil after spraying. They are slowly broken down in the soil and it has been found that a low dosage rate can prevent weed growth for up to six months.

Thirdly, the more recent impact of DPA (Propanil) for the control of graminaceous weed in rice. The effectiveness of this type of weed-killer has now been established in many countries and, as a result, the yields of rice have shown improvement whilst labour requirements are lower - in other words, the growers' profits are improved.

The above are some of the more interesting and spectacular examples of pest problems in the area and the products used to control them. It is not appropriate here to dwell in any detail on the chemical or biological aspects of products currently used, and I would now like to say something about the principal problems facing the pesticides industry today.

/Toxicity

Toxicity

In recent years there has been a change of emphasis from concern shown about the immediate dangers from the use of pesticides - a problem which has been faced responsibly by all manufacturers in providing safe-use instructions with their products - to the extent to which residues from pesticides may create a long term hazard for the community.

The pesticide industry and independent laboratories have for many years been carrying out research and accumulating data on the side effects of using pesticides. A vast amount of information is therefore available although dispersed in laboratories and journals throughout the world. One of the reasons for the current enquiries in the USA is indeed to try to bring all this information and data together so that the effects of using pesticides may be judged scientifically.

The UK has already reviewed the use of some pesticides though this cannot be regarded in any way as extensive as the USA study - which is still in progress.

The FAO and the WHO are also reviewing various aspects of pesticide usage such as the standardisation of labelling, approval procedures, etc.

It is to be expected that as a result of these studies (and those being carried out by other Governments) some legislation and restrictions on usage will emerge. The form which this legislation will take will be a compromise between three factors:

1. The facts - the actual (or potential or alleged) hazards to applicators and consumers or the absence thereof. This is the concern of toxicologists.

2. Economic pressure - the economic possibility to avoid or necessity to accept those risks.

3. Political pressure - the political considerations whether to refuse to accept those risks.

Clearly the relative importance of the last two factors will vary from one country to another. We believe that the important role played by pesticides in the agricultural and therefore overall economies of the countries of Latin America will be the main consideration of Governments in making any future legislation affecting their use.

National legislation should ideally arise from the overall needs of groups of nations with similar interests. The EEC countries are in principle working along these lines.

This international approach is ideal in Europe with its geographic cohesiveness and its high degree of economic and political integration.

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The wide ecological differences in Latin America, which are caused by the vast natural barriers like the Andes and the Amazon Valley, make it less likely that an international approach will be used in this continent. But individual Latin American countries are turning their attention to this matter and here, in Venezuela, a sound commonsense approach to this problem has been taken. A Commission to examine and report on the facts concerning pesticide use has been set up. This Commission, which has been established in a spirit of co-operation by all parties, consists of representatives from each of the following:

1. The Ministry of Agriculture
2. The medical profession
3. The Ministry of Public Health
4. The College of Agricultural Engineers
5. The pesticides industry.

Certainly this sort of approach gives every promise that emotional and uninformed demands may be tempered by the overall economic need and more emphasis can be placed upon the toxicological facts.

Research and development costs

Next in importance to the international problem of toxicity is that of the cost of synthesising, screening and developing new compounds. Success in this field is still largely dependent on an empirical approach since although the likely biological activity of groups of chemical compounds can be estimated, the field performance of any products synthesised as a result of laboratory work will result in a large number being rejected at an early stage due to unsuitability with regard to phytotoxicity, unacceptable residues or high cost of synthesis on a commercial scale. The rejection rate of compounds at all stages of development is high, and the chances of finding a successful one and being able to develop it commercially may be as small as 1 in 5,000.

Although the costs for individual companies in the pesticides business will vary according to the type of product which they are investigating, all are agreed on the extremely high cost and element of chance involved in finding a successful pesticide today. This is well illustrated in an article published in "Farm Chemicals" May 1964 by the Vice-President of Union Carbide - Chemicals Division. Here the cost of developing an agricultural chemical is given as around $ 3 million and the chance of success in obtaining a commercial product 1 in 3,600. We in Shell would broadly agree with these figures and it must be added that the development cost does not include the investment in production facilities after the development phase. With the tendency towards a demand for products of greater specificity, higher biological activity, lower toxicity and, of course, lower cost to the ultimate consumer, one can only suppose that development costs will continue to increase.

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Manufacture and formulation

A paper given to this conference is, of course, not complete without reference to the manufacture of pesticides. With the exception of the long established insecticides such as DDT and BHC, manufacture of any pesticide has tended to be limited to one or two countries having an advanced level of industrial development. The reasons for this are several; availability of raw materials which are in many cases sophisticated chemicals produced on a small scale industrially, or may be themselves calling for new techniques of production; the high capital cost of most pesticide plants in relation to the tonnages produced; the fact that market potential in any country is generally insufficient to give economic justification for production for that country alone and the plant must therefore rely upon exports for optimum offtake in relation to design capacity.

Of course, manufacture of a number of pesticides is carried out in predominantly agrarian countries, but it is often those areas with the largest potential markets for pesticides which have the least developed industry and are thus unable to supply the raw materials for pesticide manufacture from their own resources. From this it follows that manufacture of a sophisticated chemical pesticide in a predominantly agricultural economy will invariably be more expensive to the country concerned than to import the product from a primary source of production where it can be carried out in deciding countries to seek the manufacture of a product within their territory, but from experience I can say that savings in foreign currency are unlikely to be achieved when the raw materials for synthesis have to be imported.

These are problems which face all pesticide manufacturers, but recognising the economic needs of the country and their own commercial aims, it has become the pattern to make local investments in formulation equipment for pesticides which in general has the benefit of better and quicker service to the farmer with the possibility, depending upon local availability of solvents, carriers, drums, etc., of lower prices in the field. Shell has always been in the forefront of developments to install formulation equipment and has these facilities in operation in many countries of South and Central America as well as many other countries of the world.

The future

In the climate of increasing population and the need for more food, a future of continued expansion of pest control measures is predicted, and within an overall pattern of vigorous growth two trends are discernible. Firstly, pesticides are becoming more specific - this trend is very noticeable with herbicides and recent years have seen the introduction of products which are selective to individual crops such as maize, sugar beet and rice. In the field of insect control there is a demand for products which will be specific to pest species but leave beneficial insects unharmed.

/The other

The other major development which is becoming apparent is the use of completely new techniques for pest control - involving the use of chemo-sterilants, sex attractants, anti-feeding compounds and insect pathogens (including bacteria and viruses).

It is interesting to consider what impact these developments is having upon the pesticide industry. The trend towards conventional pesticides of greater specificity is creating two types of problem. Firstly more highly sensitive and comprehensive screening techniques are necessary to identify specific activity and this increases the expense and time involved in developing a new compound. The other problem is commercial - the potential market for a specific compound is generally smaller than for a general purpose pesticide and the likelihood of rapid obsolescence greater. A combination of higher research costs, lower volume and dubious longevity tends to increase costs to the user and reduce the margins to the producer.

The move towards unconventional methods of pest control is also one which can be expected to present the pesticide industry with new problems. Generally the magnitude of the research effort necessary to produce a biochemical or biological method of controlling a pest is so great that it extends beyond the resources of individual commercial laboratories. To date this type of research has been carried out mainly by universities and government sponsored agencies, who pass any resultant compounds/processes of practical value to industry for production on a non-exclusive basis. In general the chemicals and biological preparations which have been developed on this basis are so highly active that only very small quantities would suffice to satisfy potential markets.

However, it would be misleading to suggest that the days of conventional general purpose pesticides are numbered. Undoubtedly they will remain the backbone of pest control measures for many years to come, and their replacement by more sophisticated and specialised materials will be a slow process.