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EDUCATION AND SAFE HANDLING IN PESTICIDE APPLICATION

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Edited by

E.A.H. van Heemstra-Lequin

W.F. Tordoir

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OPENING ADDRESS

L. ROSIVAL, chairman

Ladies and Gentlemen,

On behalf of the Scientific Committee on Pesticides of the International Association on Occupational Health I have the honour to welcome you in Buenos Aires at our VIth International Workshop entitled: "Education and safe handling in pesticide application".

I would like to thank very cordially our Argentine hosts who made it possible for us to have this meeting in Argentina, especially the "Associacion Medica Argentina", represented here by Dr. A. Maccagno, secretary of this association. It is a great honour for us to have the opportunity to hold our sessions in the rooms of this elegant seat of the medical profession in Argentina.

It is a great honour to me to welcome here:

Dr. L. Lennon, Rector of the University of Buenos Aires

Dr. H.R. Castells, President of the Argentine Academy of Medicine

Dr. J.G. Montanez, Dean of the School of Medicine of the University del Salvador

Dr. A. Maccagno, Secretary of the Argentine Medical Association.

It gives me great pleasure that in the 10th year of the existence of the Scientific Committee (a year of a mini-jubilee) this Workshop will take place in Argentina, being it the first time that a Workshop will be held outside Europe. This is the result of the enthusiasm, interest and excellent organisational work carried out by the members of the Workshop directorate, chaired by Prof. E. Astolfi, in particular by Prof. J. Higa de Landoni and Mrs. Leny de Smit, head of the Workshop secretariat.

I am very glad that Dr. J.F. Copplestone, Chief of Pesticide Development and Safe Use Unit of the Vector Biology and Control Division in WHO, accepted the invitation for this Workshop, which shows the great interest of WHO in the work of this Scientific Committee.

I am very pleased to welcome Dr. R. Murray, Secretary of the Permanent Commission of the International Association on Occupational Health, who supports with great enthusiasm the activities of our Scientific Committee.

It is also a honour for me to welcome the representatives of the Pan American Center for Human Ecology and Health, which is a regional technical Center of the Pan American Health Organization and the World Health Organization. The main objective of the Center is to cooperate with member countries of the Pan American Health Organization to improve the health status of human populations and to prevent or minimize adverse effects on human health which may result from the environmental changes and the possible contamination that accompany the economic development and industrialization. In this respect it is our mutual intention to try to attain by the year 2000 the objective of health for everybody.

Since 1971 the Scientific Committee on Pesticides has been involved in many activities, especially in organizing five international Workshops. Reports of these activities have been published in International Journals. The recommendations from the Workshops were accepted in the relevant scientific circles all over the world. The Proceedings of our Vth Workshop in The Hague in 1979 have been succesfully edited by Dr. W.F. Tordoir and Mrs. E.A.H. van Heemstra-Lequin and were published by Elsevier Scientific Publishing Company in 1980. This book is of interest to those who like to broaden their knowledge in the field of pesticides.

In future we would like to proceed with publishing such Proceedings and other important results of our activities.

I am convinced that the present Workshop will provide valuable data and opinions on the problems of the protection of individuals who work with pesticides: manufacturers, formulators, packers, distributors, storage personnel, mixers, loaders and applicators.

For the first time in the Workshop's history the aspects of education are included in the program. The field of health education is no longer simply a discipline among many but an attitude of mind, a new orientation of thoughts and action. The three main objectives are: to inform, to motivate and to set into action.

According to the tradition of the activities of the Scientific Committee we have prepared sessions on pesticides for the International Congresses on Occupational Health held in Brighton and Dubrovnik. I hope that we will be able to prepare also a session on pesticides for the XXth International Congress on Occupational Health, which will be held in Cairo this year and which will be the follow-up of our Workshop.

In closing my opening address I would like to express the wish that our Works will be a success and that you will have a pleasant stay in the wonderful city of Buenos Aires and in the city with the poetic name of San Carlos de Bariloche a little dot on the globe, a place so far from Europe and other continents but so near for our communication and mutual understanding.

HEALTH EDUCATION IN PESTICIDES
PSYCHOSOCIAL ASPECTS

JORGE F.A. KISS
Departamento de Psiquiatria, Universidad de Buenos Aires, Argentina

INTRODUCTION

It is the purpose of this paper to describe some psychosocial aspects related to health education in the safe handling of pesticides.

PREVENTION AND EDUCATION

Prevention of diseases is a broad concept; there are, following the public health model, three levels of prevention:

a) primary prevention: lowering the incidence of new cases of a particular nature (e.g. poisonings in a pertinent place and time) by measures that block exposure to noxious agents;
b) secondary prevention: reducing the duration of disease and preventing complications through measures of early diagnosis and adequate treatment;
c) tertiary prevention: diminishing the sequelae caused by disease, providing community scale facilities for rehabilitation.

At the community level the three forms of prevention are interdisciplinary and interdependent.

Health education is an essential part of all those. Every educational program involves the following factors: a) educators b) message c) media d) trainees e) objectives f) method g) background.

It is fascinating to analyze how an educational message interacts with the social context in which it is delivered. In fact, both things can not be separated.

Modern sciences, especially psychosocial sciences, have been influenced by a movement from the classic mechanicistic model of linear causality to a more complicated model, the general systems theory, in which natural events or pathological findings are multifactorial and each factor is a complex of other interacting factors.

As pesticides are chemical compounds used in an environment it is essential in occupational health to give a place to all the factors acting in the environment, which give a meaningful place to the psychosocial panorama in which man lives, a fact that may be useful in agromedicine.

Let's summarize some of the aspects relevant in health education in the safe use of pesticides.

Pediatric psychiatry

In child clinics one could learn that accidental domestic infantile poisonings with pesticides are more frequent in the presence of preexisting child psychopathology, as well as coincident with some special stress in the family dynamics of the involved child. Repeated accidental poisonings in the same child are almost certainly an indicator of more serious underlying psychiatric findings. Cases of severely disturbed relations in the parents of a child with accidental poisonings have been repeatedly observed by us and widely reported elsewhere. Cases of suicidal and homicidal ingestion of poisons in children have been also observed at this age.

Individual psychopathology

Mental health has always conditioned man's life, welfare and work ability. Its relevance to occupational medicine is obvious. Neuroses and psychoses are true disorders of our time, and obviously influence the adaptability of a man to a task, his decision-making process and his ability to follow safety rules and to use and discern available sources of information. Given adequate information and health education in the safe use of pesticides, most applicators will respond with adequate ability. Some will respond with overprotective measures, but some few will fall in a category well known by the trainers and by the agromedical experts: the worker who denies the risk and does not take the protective measures (e.g. fumigators of pesticides who refuse to use the mask). Many of these cases could be screened out in advance if good psychiatric testing for auto destructive potential is part of the routine preemployment examination.

It is advisable for the trainers to be able to activate the concept of risk in the trainee; group discussions in educational seminars will be of value in that task.

Alcoholism and other addictions: In many rural areas, alcoholism is a real public health disorder, with obvious occupational repercussions. The preexistence of these conditions (which are the result of a complex biopsychosocial pathologic interaction, aggravated by drug consumption) weakens the workers health, his ability to judge the value of information or to take decisions. These conditions are important as risk factors in workers using dangerous substances like pesticides, as well as in cases of workers accidents in general. Many other psychiatric disorders not related to alcohol or drugs could jeopardize man's ability to learn and work, as well as to cause or sustain severe accidents.

Primitive personalities. This pattern prevails in uncivilized groups. It is characterized by archaic thought and primitive behaviour. It has a strong link with myths, irrational cults and beliefs, superstitions and witchcraft. The underlying thought mechanism is archaic, magic, prelogical or illogical. This kind of personality is more frequent in isolated native communities and is important as a cultural factor to be remembered by a health worker in agromedicine. As may be deduced, more subtle forms of this personality can be found in marginal areas, forming a challenge to educationists and health officers, still to be resolved. It has been suggested recently in marginal areas of Latin America that a proteo-vitamin-mineral deficit in the first year of life (caused by dietary deficiencies) could affect C.N.S. development and cause low I.Q. with affective and cognitive impairment. These factors added to cultural deprivation, make it more difficult for certain groups to be guided toward progress in the short term. Moreoever, many persons and groups for different reasons, reject the idea of change, experiencing it as a danger. It is important to take into consideration the direct link between the safe use of pesticides and development, food and progress.

Transcultural psychiatry

It is interesting to learn how life becomes influenced by the norms, values, traditions and habits of the groups in which we develop our lives. In fact, man belongs to different groups at the same time. Considerations of what is normal and what is an abnormal life differ in different cultures, and since the knowledge of man refers to inter human communications, the knowledge of language and culture is the understanding of a simple complex.

Health education in a trans-national approach (or sometimes in a national scope) is a true trans-cultural experience. The process of assimilation of the educational message is directly influenced by the cultural values of the group of reference. This is illustrated, for example, by the difference in reactions to vaccinations reported from different countries. Groups are dissimilar in their approach to power, pleasure, work, transcendence, etc.

The idea of progress is affected by a similar process of group dynamics. Illiterate or primitive or marginal groups are classically difficult to incorporate into progress processes. For many reasons, groups as a whole could perceive progress or its messages in a particular way. Norms and values of another group are often perceived as invasive and threatening to one's own identity, and so the recipient group, experiencing some kind of cultural shock, might react by initially rejecting the message from those trying to preach different concepts of health, etc.

In agromedicine, it is a common experience that it is difficult to enroll the co-operation of certain communities in the fight against vectors of diseases (such as Chagas disease). It could take more than a generation of continuous effort to change this situation. From studies of geographic toxicology in Argentina there is widespread evidence that groups of Jews, Japanese and Portuguese farm workers, who immigrated into the Province of Buenos Aires with a good level of literacy, (some with their own newspaper) tend to assimilate education in safe handling of pesticides better than do illiterate native groups.

Social psychiatry

We are living at a time in which social change is continuous and the acceleration of this change is impressive. It has been stated that it is necessary to adept to change in a healthy, creative and humanistic way according to similar mechanisms to those which society recreates culture. Social aspects are essential for the understanding of health and disease. Marginal subsistence, stress, bio-psycho-social deprivations and underdevelopment acting alone or in combination upon a family group or upon individuals might interfere with behaviour and feelings, thus causing socio-genetic diseases. Entering migrant populations have a higher index of stress, family suffering, disruptive behaviour and psychoses than do well established ones. Such situations constitute another factor determining health in respect to agromedical agents.

Educational psychology

Psychology has an important role to play in planning training programs for all levels of the community including pesticide handlers. Traditional methods of education should be complemented by seminars with group - discussion. Mass media are efficacious in disseminating information and they are of assistence in specially programmed courses.

Institutional psychiatry

The treatment of psychiatric patients (i.e. acute mental disturbances - if any - caused by pesticides) is not the only place for psychiatry. Since education in hygiene is multi-disciplinary the psychiatrist has a broad variety of techniques to help individuals, groups and institutions in preventative and educational programmes. In this area of preventive psychiatry, the psychiatrist provides consultation of the following types:

1 client - centered
2 program - centered, referring to administrative procedures
3 consultant - centered, based on referred cases
4 consultant - centered, based on administrative procedures.

In Argentina the preventive working psychiatrist is a member of the multi-disciplinary team, working in education on pesticides.

EDUCATION IN THE APPLICATION OF PESTICIDES

AIDA SOTO
Miami, USA

"Perhaps if we would do more we would realize that Pedagogy has something to say in the education for the safe use of pesticides"

INTRODUCTION

The statement from the epigraph of the 'Letter to a school teacher', written by a group of students from an Italian rural school and reprinted in part in 'El Correo' (UNESCO), June 1972, represents a sharp critic to the traditional patterns of a pseudoscience and implies, in its rough and simple expression, the aspirations to develop a program for a real science of education capable of defining its specific targets with theoretical and practical models. These objectives also apply to the training and education for the safe use of pesticides.

The pedagogical 'knowledge' in its predominant form usually does not go further than statements and expressions of good will but with plenty of misunderstandings and mistakes resulting in useless controversies and arguments.

The complex phenomena of education analyzed from its different points of view (psychological, historical, social, cultural etc.) and from different approaches such as by governmental, private and religious institutions, needs a critical study to clarify where it is going, to whom it will be applied and more emphatically the methods that will be the real 'tools' for its implementation. Here again appears the importance of the educationist.

We will analyze three different aspects of this problem.

ANALYTICAL LEVELS OF THE EDUCATIONAL PRACTICE

Factual level

Education has existed long before it was institutionalized as it represents the human gregarious instinct. It has accompanied man through all his life and without discriminations.

Target level

Based on the premises of its intrinsic nature the first institutionalization of teaching and learning appeared according to specific purposes and needs such as religious, trade and artistic groups. At that time the educational messages were usually uni-directional.

Reflexive level

The previously mentioned levels have led nowadays to a most complex system with a lot of different implications, not only because of the transformation from an uni-directional to a bi-directional message but also through the ubiquity of the educational performance in the realistic world where the trainee will apply and extend the knowledge he has previously acquired. Now we can see how the complexity of the educational science requires experts in this specific field irrespective and independent of researchers, technicians or other groups of the community which are able to carry out the teaching message.

The evaluation of the results of former pesticide teaching programs leads to realistic conclusions. One of the most important is the discrepancy between the efforts put in and the poor results obtained in the field. That means that there is a gap to be filled with the help of multidisciplinary workshops like this one.

RAW MATERIALS AND RESULTS

Education can be characterized as a process of integration or transformation of certain subjects (raw materials) into the structures of a society to help preserve its basic foundations (product). 'Integration' represents the transformation from an undifferentiated into a well-differentiated state - economically, socially and politically. It comes down to the process of communication from the trainer to the trainee.

TRAINERS AND TRAINEES RELATIONSHIP

The educational level of the trainees is the critical point. Obviously most of the printed hazard information on the labels of pesticide containers is of no use to illiterate workers. LD50 values do not represent anything to the poorly educated workers which are usually handling the pesticides. Chemical names, symptoms of poisoning, antidotes, methods of disposal of used containers etc., are usually of very little value to common pesticide field workers.

The psychological and socio-economical frame of reference of both the trainer and the trainees are of great importance. The trainers must be able to identify themselves with their students and to understand what is of value and can be learned by the trainees. The investigator which inspects agricultural associations such as cooperatives or offical institutions frequently sees how the trainers like to show off their knowledge. However, we cannot generalize as it is known how agronomists, who are the closest to the field workers and to the occurrence of accidents in the fields, are very concerned with the workers problems.

The socio-economic background and the transcultural problems of the rural workers are sometimes the reason of their natural rejection of our training efforts. In this context let me point out the importance of the task performed by Dr. Copplestone from the WHO in Geneva. As another example, in Latin America educational programs for the use of pesticides have their own characteristic problems which will be discussed in this workshop by Dr. Jorge Kiss.

It is very important to know the place of residence (geographical toxicology) and the kind of hand-work (technical development, ancestral habits etc.) of the trainee because the trainer usually comes from a completely different environment (university). Only after understanding the idiosyncrasies and the convivialities of the trainers and the trainees it will be possible to know the reasons for the resistance to change and to try to overcome them.

Sometimes the resistance to change is raised also by the trainers and this shows the need for a good and timely socio-dynamic preparation of the trainer. Usually he is under stress, doing many different kinds of work simultaneously, and generally his salary is low.
Fortunately, the trainers are usually young and idealistic people willing to sacrifice to help the underpriviliged.

AN APPROACH FOR CLOSING THE EDUCATIONAL GAP

The necessity of multidisciplinary groups is well established at international as well as at local levels in order to cover all the aspects of the education in the safe use of pesticides. These groups usually include extensionists (agronomists), educators, toxicologists, biochemical researchers, governmental agents, analytical chemists and industries personnel etc. Nevertheless our experience as a participant in several Conferences on Occupational Medicine and Pesticides allows us to suggest the importance of including an educationist among the experts of a multidisciplinary educational group. The addition of psychiatrists to such a group has been introduced last year in Argentina and it appears to be greatly successful. We believe that an educationist will also be of great value in this very complicated educational task of teaching the safe use of pesticides.

EDUCATION AND TRAINING IN PESTICIDE MANAGEMENT IN INDIA

S.K. KASHYAP
National Institute of Occupational Health, Ahmedabad, India

ABSTRACT

In developing countries, in order to provide food and fibre and to control infectious diseases the use of pesticides is a must. The correct approach for minimising health risks is through a judicious use of these chemicals. The pesticide management should be a scientific enterprise manned by technically competent people. It must be under continuous surveillance. Education and training of various functionaries only can ensure safety. International bodies can play an effective role in educational programmes by the dissemination of technical information to decision making authorities and organizing meetings at regional levels to exchange experiences amongst one another. One thing is for sure, the developing countries can benefit a lot from the experiences of the developed ones. However, they must work out their own plans as in toto transformation is not possible due to the vast difference in existing conditions.

INTRODUCTION

Nowadays, pesticides draw the attention of people from all walks of life i.e., scientists, administrators, the press and the public. The reasons are quite obvious. On the one side the important role played by chemical pesticides in agriculture and public health, giving enormous socio-economic benefits and on the other side the potential risks for the environment. The present state is that the public has become quite apprehensive, on the other hand the authorities usually try to label it as merely emotional. Thus, there is an imperative need and demand on the scientific community to critically examine the risks - benefits of pesticides. It is a big challenge and we cannot be irrational in our approach, because we know that the use of pesticides is a must and that the economic benefits of these chemicals are due to their toxic nature. It is expected from us to ensure that the pesticide management programme proceeds with the maximum possible care and the widest margin of safety while accepting only reasonable risks. Thus, in all sincerity one can only talk about minimising the risks and for this purpose, education and training in pesticide management are of utmost importance. This is all the more important in the developing countries where there are constraints due to limited finances, social and cultural backgrounds and illiteracy, etc. Therefore, at international forums like this workshop the broad frame-work of an educational and training programme can be outlined with sufficient flexibility to enable adjustment to the needs of individual nations.

GROWTH, PRESENT STATUS AND FUTURE TRENDS OF PESTICIDES IN INDIA

In order to formulate an education and training programme in pesticide management for a particular country, it is necessary that one examines closely the extent and magnitude of the existing problem. India is a large country with a population of over 650 millions, the total area being 37.76 lacs sq.km. and over 80% of the people live in rural areas. Although, it is labelled as a developing country, it is reasonably well industrialised being amongst the top ten countries. Inspite of the fact that literacy is quite low, good scientific and technical advances have been made.

Pesticide industry in India

In the last three decades, there has been a tremendous growth of the pesticide industry in the country. At present, over 125 chemicals are registered for use. About 45 pesticides are being indigenously manufactured. There are over 50 manufacturing units and about 1000 formulating units. This gives an idea about the current status of pesticides industry in the country.

The production and consumption of pesticides continue to increase in our country in response to the demand. The production has increased from about 8000 tonnes in 1960 to over 40,000 tonnes, almost a five fold increase (Table 1). Simultaneously, the actual consumption of pesticides is also continuously increasing from merely 432 tonnes in 1954 to over 58,980 in 1977-78, whereas the estimations were even higher (Table 2). There is an overall coverage of about 60% of crop-area under plant protection i.e. 80 million hectares out of 156 million hectares. The average consumption of pesticides in this country is only 570 gms per hectare which is quite low as compared to about 11,800 gms in Japan and 1500 to 3,000 gms in U.S.A. and European countries. Thus, one can foresee that there is quite a good scope for an increase in the consumption of pesticides in the country.

Pesticides legislation and regulations in India

Before 1968 there was practically no control on these chemicals. However, based on experiences from other countries and on internal reports of pesticide hazards the government realised the need to regulate these chemicals. The government enacted through parliament an act known as Insecticides Act (1968) with the objective to regulate the import, manufacture, sale, transport,

TABLE 1

Production of pesticides in India

year	number of tech. products	licensed capacity (tonnes)	production (tonnes)
1954	1	500	432
1955	2	2,700	2,303
1958	4	7,684	5,460
1960	10	9,108	7,442
1961	12	18,721	8,984
1963	15	26,060	9,573
1964	17	26,660	10,863
1965	20	34,141	12,670
1966	23	37,900	14,137
1975	42	56,832	35,200
1976-77	42	75,149	34,650

(Source: Pesticide Association of India)

TABLE 2

Consumption of pesticides in India

year	quantity (tonnes) technical grade
1954	432
1970-71	24,320
1972-73	35,160
1973-74	45,000
1974-75	49,864
1975-76	58,814
1976-77 (estimate)	65,650

(Source: Pesticides Annual, Vol. V (1976) 7)

distribution and use of these chemicals for the sake of the prevention of risks to human-beings or animals.

To assist in the implementation of this act, there are two high powered bodies i.e. the "Central Insecticides Board" and the "Pesticides Registration Committee", which are the advisory as well as decision taking bodies in respect of all matters related to pesticides.

Under the Act, there is a compulsory registration of all pesticides. The manufacture, import and use of chemical pesticides can be initiated only after duly registration, after a close scrutiny of the bio-efficacy, toxicity etc. by the Registration Committee. Apart from recommending the registration for individual chemicals the Committee also lays down the details of packaging, labelling, approved uses, restrictions and precautions.

MAGNITUDE OF THE PESTICIDE PROBLEM IN INDIA

In order to formulate an effective education and training programme in pesticide management in the country, it is necessary to ascertain the present status of knowledge about these chemicals amongst workers employed in pesticide related occupations and in the public.

Pesticides users in urban areas

A pilot survey of 500 urban families in Ahmedabed, a big metropolitan centre in the country with a population of over 2 million people was undertaken. These families were visited and the specific information was collected in respect of their occupation, education and economic status, their knowledge about pesticides and their attitude towards this problem. The results are given in Tables 3, 4 and 5.

It is clear from these observations that 90% of the families surveyed were not engaged in pesticides related occupations. Over 75% had a higher secondary education or an university level education and an additional 15% had a basic education with the ability to read and write at least in regional languages. More than 50% belonged to the middle income group. It is interesting to note that pest infestation is present in varying degree in almost all the households.

The survey also revealed that over 90% of the families have heard about the use of chemicals for control of household pests and also know that these chemicals are hazardous in nature. The most striking finding, however, is that over 90% of these families do not employ pest control agencies and try to work out their problems themselves. Furthermore, only about 50% have read the labels of the chemicals in spite of knowing that these chemicals are toxic. Very few, only 16%, used protective devices. In about 40% cases the chemicals were obtained from unauthorised sources. This shows the casual approach to the problem, in other words the lack of proper education of the public.

Pesticide users in pest control agencies

The survey was undertaken in 20 pest control agencies. All the 72 workers and 20 organizers employed in these agencies were interviewed. These agencies were engaged in various types of pest control services, like spraying, fumigation, bait preparation, kitchen disinfestation, rodent control services, etc., using mildly to moderately toxic insecticides. Detailed information about these operators is given in Table 6. It shows that, except 10% of the organizers, not even a single operator had specialised training in pesticides. Most of the operators were either illiterate or educated up to the primary level. This shows that in a country like India the operators or workers need to be treated on a different line because of their low level of education.

The written instructions as given on the labels are not very effective. Any communication to or training of them can have success only if it is based on demonstrations. The enforcement of proper supervision is even more important. Since organizers are reasonably well educated, short term training courses for safe handling can be arranged for them.

TABLE 3

Distribution of the surveyed 500 urban families on the basis of socio-economic status, education and occupations.

	families	
	no.	%
socio-economic status (income groups)		
low	197	39.4
middle	271	54.2
high	32	6.4
educational status		
illiterate	18	3.6
primary	91	18.2
secondary	160	32.0
university	231	46.2
occupational status		
pesticides related occupations	42	8.4
office-goers	136	27.2
teachers	24	4.8
technicians	60	12.0
shopkeepers	79	15.8
doctors, engineers etc.	42	8.4
labourers	117	23.4

TABLE 4

Urbanites' knowledge about pesticides

		families	
		no.	%
heard about pesticides or chemicals to control household pests	....yes	487	97.4
	....no	13	2.6
know about the hazardous/poisonous nature of pesticides	....yes	479	95.8
	....no	21	4.2

TABLE 5

Attitude of pesticide users in urban households

	families no.	%
use-category		
non-users	47	9.4
seldom/sometimes users	392	78.4
often users	61	12.2
source of getting pesticides		
authorised		
- medical stores	266	53.2
- pest control agencies	33	6.6
unauthorised		
- provision stores	119	23.8
- street vendors	63	12.6
- miscellaneous: borrowing etc.	19	3.8

TABLE 6

Educational background of the personnel in pest control agencies

education	organizers		operators	
	no.	%	no.	%
university	10	50	5	7
higher secondary	5	25	14	19.5
primary	1	5	29	40.2
illiterate	2	10	24	33.3
specialised training in pesticides	2	10	-	-

TABLE 7

Use of protective devices by warehouse workers

protective devices	workers wearing the device	
	number	%
none	43	71.7
cloth masks	5	8.3
respirator	5	8.3
goggles	1	1.7
respirator + gloves	1	1.7
respirator + gloves + goggles	5	8.3

Monitoring of workers handling pesticides in warehouses

Especially fumigants are used to control pests in stored grains in warehouses. A study of 60 operators engaged in this work revealed the following interesting observations (Table 7).

Although they were supposed to use the protective devices over 70% of them did not and only 30% took protective measures. This also suggests that a continuous supervision is absolutely essential to enforce the use of protective devices. There is a need to convince the workers through various audio-visual means. Moreover, the devices should be designed to suit the local conditions.

Pesticides applicators

Medical surveillance of two categories of spraymen engaged in pest control operations was undertaken: (1) spraymen (civil) working in the National Malaria Eradication Programme, (2) spraymen working in Defence Services or Army Units.

The most important difference in these two categories of spraymen is that civil spraymen do not use protective clothing whereas army spraymen are obliged to use protective clothing. The results of DDT residues in blood of these spraymen as compared to those of control subjects are given in Table 8. It is clear that the mean DDT residues in civil spraymen (1.27 ppm) are almost three times higher than in army spraymen (0.44 ppm).

TABLE 8

DDT residues in blood of civil and army spraymen and control subjects

subjects	DDT - residues (mean)
control	0.17 ppm
spraymen (civil)	1.27 ppm
spraymen (army)	0.44 ppm

EDUCATION AND TRAINING PROGRAMME

An education and training programme on the safe use of pesticides can never be considered in isolation for a particular group i.e. applicators or management or public etc.. To ensure safety it should reach all groups and called a pesticide management programme. Education as well as training is required at all levels i.e. authorities, specialists, workers, applicators, public, etc. (Table 9). First and foremost, there is a need to educate decision making or registration authorities of all the countries who are responsible for the selection of these chemicals for use in their countries. A wrong choice of pesticide will make all the difference between safety and hazard. These authorities should be kept informed on recent developments and advances about both the old and newly developed chemicals. The job can effectively be done through international bodies, who can communicate or arrange exchange of experience of one country to another. This interchange of information at regional levels can play a very effective role.

TABLE 9

Education and training for safe use of pesticides

functionaries	education/training	agencies
A. registration authorities	1 recent developments 2 legislations	international bodies as WHO, FAO, ILO national research institutes
B. producer (industry) manufacturing and formulation management workers	1 proper housekeeping 2 environmental control 3 medical control	government agencies national institutions
C. users departments supervisors applicators	proper demonstrations personal hygiene	extension workers of government/industry by audio-visual aids
D. public	awareness avoid apprehension develop confidence	publicity media avoid sensation!

Management and workers in industry also need to be trained by government agencies, for safe handling of pesticides. There the prime attention is focussed on proper house keeping, enforcement of environmental control and medical control, i.e. strict supervision of the use of personal protective devices.

In training applicators and other users one has to pay special attention to: the educational status, the work location (being quite far away from the nearest medical services) and supervision. One should arrange proper demonstrations and impact information through audio-visual means.

Education of the public is the last but not the least important item. Severe damage to pesticide programmes has been caused by irresponsible publicity, sensational news hinders programmes or misleads the public resulting in apprehension and mishaps which can be avoided by proper handling of publicity. When it is necessary to make the public aware of these chemicals, how should one handle? What to do and what not to do? (Appendix). This simple looking task is the most arduous one in developing countries like India.

APPENDIX

GUIDELINES FOR SAFE APPLICATION OF PESTICIDES

General principles

The general principles on which safety measures are based are as follows:

1 Responsibility for safety

The authorities must ensure that application is carried out under appropriate supervision. The local medical practitioners should be fully aware of the problem. Provisions should be made for antidotes and diagnostic aids.

2 Training for safety

This should be done at two levels:

a) for specialists i.e. medical personnel, engineers and sanitarians etc. in their respective specialities on diagnostic aids and the reporting of poisoning cases.

b) for the field operators on the proper way of handling the equipments, use of protective dressings and also hygiene and first aid measures.

3 Supplies and equipment

This must include provision for safe transport and storage of pesticide concentrates. The containers must be suitably designed. There must be regular systematic inspections of all equipments and if necessary changes should be made in the design to suit the local conditions.

4 Recruitment and selection

There must be a precise definition of duties for each member of the squad or team. Their training with the help of slides and posters etc. should be given proper attention. It should be noted whether a recruit is physically fit and is able to understand rapidly altered or new methods of application.

5 Medical surveillance

Arrangements should be made to ensure reporting of any symptoms in the exposed persons. The immediate clinical surveillance of those exposed to pesticides is a must for the medical officer-in-charge of the operation.

6 Long term surveillance

This comprises of epidemiological studies of a defined population which has been subjected to a prolonged exposure to a pesticide, i.e. workers of a manufacturing plant, formulators and spraymen employed in agriculture.

7 Education of public

Inform the public through the publicity media about the possible hazards from misuse of pesticides and the precautions to be taken to avoid hazard.

8 Research

A coordinated research programme should be developed on "Safer pesticides and economically feasible pest control methodology".

Selection of pesticides

1 Use only those pesticides which are duly registered under the Central Insecticides Act.

2 Select only those pesticides which are recommended for a specific use by competent authorities i.e. Registration Committee, Plant Protection

Organization, State Agriculture Departments & Agriculture Universities, etc.

3 The choice of the formulation which is effective against the pest should be restricted to those pesticides for which suitable equipment is available for application.

4 Choice of formulations to be used:

a) Application of a spray should be preferred to dust thereby reducing drift hazards.

b) Where granules are effective they should be used by preference as there is no problem of drift.

c) In choosing wettable powders and emulsifiable concentrates note that an oil soluble formulation is usually more hazardous than a water soluble one due to its rapid absorption through the intact skin. Thus the latter should be preferred.

General precautions

1 The first and the foremost rule of safety in using pesticides is to read the label and follow the instructions and precautions written therein.

2 Store the pesticides in original, labelled, containers preferably in a safe, locked place.

3 Ensure effective disposal of pesticides leftover after use and empty containers.

4 Apply the pesticide strictly as per the recommended dosage.

5 In handling any pesticide, particularly those in high concentration and of known toxicity, avoid direct contact with the skin or any other parts of the body.

6 Smoking, eating and drinking should be strictly forbidden while handling pesticides. As a routine after work one should take a bath and change clothes.

7 In case of accidents due to defects in equipment or due to negligence, follow the first aid measures and consult the physician.

8 Ensure the availability of water for washing purposes in case of emergency.

9 Organize supervision of workers to ensure that safety precautions are being observed.

Household precautions

Besides the general precautions house-keepers are advised to observe the following precautions and safety measures to ensure a safe use of pesticides.

1 Use only the least toxic pesticides for the proper purpose and in the proper form suitable for that purpose, in consultation with technical personnel.

2 Keep inmates specially children and pets away when applying pesticides.

3 Do not spray extensively in a single operation i.e. covering the whole of floor, walls and ceiling etc.

4 Before spraying, remove food and kitchen utensils to avoid even the chance of contamination by fall-out of spray particles.

5 It is always advisable to extinguish flames and fire etc. while spraying pesticides.

6 Whenever extensive pesticide application for the treatment of a whole house is necessary to get rid of rodents, termites etc. it must be done only by professionals or other authorised agencies.

Precautions for kitchen garden

1 Apply a pesticide only on those plants for which it is recommended, strictly following the recommended schedule.

2 Neither exceed the recommended dosage nor apply more frequently than adviced by the Plant Protection authorities.

3 Do not spray on a windy day. When there is a breeze, apply the pesticide from the windward side of the area.

4 When treating lawns etc. sprinkle with water to wash the pesticide into the soil.

5 Do not apply pesticides near a water storage tank etc.

6 Never use house-hold containers for mixing etc. of pesticides.

7 It is essential to observe a waiting period between the last application of the pesticides and the time edible parts i.e. fruits, vegetables are to be picked.

Protection of the workers

The main points are mentioned below:

1 All operators handling pesticides should be informed of the risks involved in their use and receive instructions for handling them safely.

2 There should be adequate technical and medical supervision of operators, together with the provision of facilities for the treatment of any casualities. Supplies of atropine injections and atropine tablets should be available in all first aid kits when anticholinesterase insecticides are being applied.

3 Arrangements must be made to ensure that any exposed person can easily report any symptom to a supervisor who will bring the complaint to the attention of a Medical Officer.

4 Operators should wear some form of impervious head covering, which should be regularly cleaned. Masks of gauze or similar material should be worn to reduce respiratory exposure. These must be kept clean and the gauze should be renewed regularly, so that the face is not contaminated. An overall of light durable cotton fabric should be worn by the workers to avoid contamination of their clothes, and should be washed regularly. Rubber gloves should be used in handling concentrates. Shoes should also be used during work.

5 Operators having scratches on the skin or skin irritation at places likely to be exposed to the insecticide should not be permitted to work, since such damage is known to facilitate the penetration of the pesticides into the body.

6 Washing facilities including soap should be provided. Compulsory washing after the daily work should be a supervised routine in all spraying operators.

7 Separate working clothes should be used, which should be changed and washed as frequently as possible. Ordinary washing soda is a better decontaminant for the organophosphorous insecticides than any of the modern detergents in use.

8 Workers should not smoke during their work or eat without first washing their hands, and they should take other simple precautions in places where pesticides are handled.

HEALTH HAZARDS AWARENESS OF PESTICIDE APPLICATORS ABOUT PESTICIDES

J. JEYARATNAM
Department of Community Medicine, Faculty of Medicine, University of Colombo, Sri Lanka

INTRODUCTION

There are no harmless substances.
There are only harmless ways of using substances.

In Sri Lanka, as in other developing countries, pesticides are extensively used both in agriculture and in public health programmes, e.g. in control of malaria and filariasis. Both of these activities are of importance to countries like Sri Lanka for the following reasons:

1 agricultural workers constitute approximately 67% of the work-force in developing countries (ref. 1) and there is an increasing use of pesticides in agriculture;
2 a large percentage of the total export earnings of these countries are derived from agricultural products; e.g. in Sri Lanka, tea, rubber and coconut account for 70% of its total export earnings, an indication of the economic importance of agriculture;
3 diseases which can be controlled by the use of pesticides constitute a major problem. It is estimated that some 150 million clinical cases of malaria occur annually in the developing countries. Filariasis resulting in ill health occurs in over 250 million persons and schistosomiasis results in disease in some 250 million people (ref. 2).

The use of pesticides forms the backbone of the control programme for these diseases. There is no doubt that the extensive use of pesticides is necessary for both the economy and public health in many developing countries. It is therefore necessary to examine some of the problems arising from the widespread use of pesticides.

THE EXTENT AND NATURE OF THE PROBLEM

The health hazards from pesticides are twofold, acute poisoning and chronic poisoning. Chronic poisoning due to prolonged exposure to low dose levels may be of greater importance in the developed countries because of the relative infrequent occurrence of acute poisoning (refs. 3, 4). In contrast, acute pesticide poisoning is a major health problem in the developing countries as typified by Sri Lanka.

In Sri Lanka there exists a formidable problem with regard to acute pesticide poisoning. Approximately 15,000 patients were admitted to government hospitals in Sri Lanka for acute pesticide poisoning during the years 1977, 1978 resulting in a morbidity rate of approximately 100 cases per 100,000 population, a rate far higher than that recorded in other countries (ref. 5). An analysis of the cases of poisoning admitted to the government hospitals of Sri Lanka (Table I) showed that almost 79% of all cases of poisoning are due to pesticides. Further, the proportionate fatality rate for pesticide poisoning is higher than that for other types of poisoning; this is particularly so in the case of poisoning due to organophosphates and carbamates. The magnitude of the problem of acute pesticide poisoning can be viewed in the correct perspective when it is considered in relation to the important national health problems. For instance, when over 1000 deaths occurred due to pesticide poisoning in Sri Lanka during 1978, there were only 572 deaths due to poliomyelitis, diphteria, tetanus & whooping cough while malaria did not directly result in any deaths.

TABLE I

Analysis of cases of poisoning admitted to Government Hospitals in Sri Lanka-1978

type of poisoning	number of cases	number of deaths	percentage of fatal cases	cases as percentage of total number of poisoning cases
pesticides				
organochlorine	4158	231	5.5	21.1
organophosphate and carbamates	2635	217	8.2	13.4
other pesticides	7906	534	6.7	40.2
herbicides	805	47	5.8	4.1
total pesticides	15504	1029	6.6	78.8
other poisoning	4178	171	4.1	21.2
total	19682	1200	6.1	100.0

It is indeed likely that not all incidents of acute pesticide poisoning are due to occupational exposure. In Sri Lanka it has been recorded (ref. 6) that almost 82% of all cases of poisoning admitted to hospitals are suicide attempts and a similar pattern has been recorded in Malaysia (ref. 7). Nevertheless, it has been observed by the author that in the paddy growing regions of Sri Lanka a large number of patients are admitted to hospitals as a result of occupational over-exposure to pesticides. At one of these hospitals, of 72 patients admitted for acute pesticide poisoning during 1980, 32 were farmers who were poisoned while spraying their paddy fields. Again, at another hospital all 22 patients admitted for acute pesticide poisoning were farmers occupationally exposed to pesticides. Analysis of the occupational exposure history of these patients illustrates some important aspects relating to the safe use of pesticides (Table 2).

TABLE 2

Details of dilutions and spraying practices

case	dilution used (oz/gal)	dilution recommended (oz/gal)	leak in sprayer	with wind (W) against wind (A)
1	1/3	1/5	+	W
2	0.5/3	1/8-10	+	W
3	0.5/2	1/5	+	W
4	0.5/2	1/5	+	W
5	1/4	1/8-10	+	A
6	2/3	1/4	+	W
7	1/2.5	1/4	+	W
8	1.5/3.5	1/4	+	A
9	2.5/2	1/4	+	W
10	1/4.5	?	+	W
11	2/4	1/5	+	A
12	2/3	1/4	+	A
13	1.5/3.5	1/8-10	+	W
14	2/4	1/5	+	A
15	1/3	1/3-5	+	A
16	1.5/2.5	1/5	+	W
17	1.5/3	1/4	+	A
18	1/2.5	1/4	-	A
19	0.5/2	1/8-10	-	A
20	-	-	-	A
21	-	-	N.A.	N.A.
22	1/3	1/5	N.A.	N.A.

N.A. - Information Not Available

It has been known in Sri Lanka for some time that farmers, particularly those spraying their own lands, tend to use a much higher concentration of pesticides than that recommended by the manufacturers. Though this has been the impression among agricultural officers there have been no objective studies demonstrating this wasteful and dangerous habit among farmers. An analysis of the history of poisoning among these 22 patients (Table 2) clearly indicates that most of them had used a concentration far in excess of that recommended. This may be identified as one of the contributory, but preventable factors, which led to that particular episode of poisoning.

Another important fact that emerges from the analysis of these 22 patients is the lack of simple precautionary measures against pesticide poisoning. Table 2 shows that virtually all of the farmers had leaking knapsack spray-tanks and also that many of them had been spraying against the wind. It is of particularly significance to notice that in all cases the patients had failed to observe one or both of these simple precautions of safe work-practice and personal hygiene. Particularly, the use of a faulty sprayer was an extremely common finding. In view of the important problem of acute pesticide poisoning in Sri Lanka, it is appropriate to examine the existing regulations and the state of knowledge among users about practices pertaining to the safe use of pesticides. In order to minimise future occupational and other accidents these basic factors should be taken into account.

EXISTING REGULATIONS ON PESTICIDES

Since the recent (1977) liberalisation of trade in Sri Lanka, the limitations on the import of pesticides have been relaxed. Pesticides which can be imported without restriction are listed in the pesticide formulary issued by the Ministry of Agriculture. In addition, a schedule published by the Ministry of Agriculture identifies those pesticides which may be imported in restricted quantities. Apart from this, the only other control measure relates to pesticides used by the Ministry of Health in the Malaria and Filariasis control programmes (malathion and fenthion), the importing of which is prohibited. In fact, these are the only existing functional controls on pesticides in Sri Lanka. In addition, in 1980 the national legislature passed the Control of Pesticides Act, but unfortunately, at present there is no mechanism for implementation of this Act. This is a situation common to many developing countries, where legislation governing importation, registration and handling of pesticides often does not exist and even if these countries do have such legislation in many the technical and administrative capacity to implement it is lacking (ref. 8). Clearly, in these countries the technology of pesticides has outstripped the social and administrative development necessary to ensure their proper usage.

THE NEED FOR HEALTH-EDUCATION

In the context of the serious lack of regulation and the magnitude of the problem of acute pesticide poisoning, the alternative of education in the safe use of pesticides assumes an immensely important role.

It has been established that there exists in Sri Lanka a problem of acute pesticide poisoning. Though only a small percentage is due to occupational exposure, it must be appreciated that the total numbers involved are large. Further, it must be appreciated that although the number of hospital admissions has been used as a measure of the problem, in reality the true incidence of acute pesticide poisoning in Sri Lanka must be far in excess of this number.

The main efforts to reduce the number of acute pesticide poisonings, specifically those due to occupational or accidental over-exposure, must centre around educating the population at risk. This is particularly so in Sri Lanka and other developing countries which have limited effective control by legislation and enforcement.

Before embarking on an educational programme it is necessary to know the level of knowledge among the pesticide workers at risk. To this end a study was undertaken among selected pesticide workers at a formulating and packing plant as well as among agricultural workers spraying pesticides. The study established, by means of an interviewer-administered questionnaire, the extent of knowledge relating to health and safety practices of pesticide usage.

A total of 71 workers in industry and agriculture were interviewed in this study. Analysis of the data resulted in the following conclusions.

1 Knowledge of safety practices

The results of the study suggested that the knowledge of safety-practices in the use of pesticides was adequate among agricultural workers and even better among workers in industry. The knowledge of safety practices related mainly to spraying practices and maintenance of spraying apparatus among agricultural workers, whereas among workers in industry, this knowledge related to the wearing of boots, overalls, gloves and masks. The workers identified these things as the front line safety practices with regard to pesticides. The need for personal hygiene as a safety practice, though recognised, did not seem to be important in the minds of the workers. In this connection most workers were aware that pesticides could be absorbed through the skin, the possibility of absorption by inhalation was thought to be unimportant and absorption by ingestion unlikely.

2 Sources of information

The majority of the workers, particularly of those in agriculture, obtained most of their information on safety practices from their colleagues at work. But, significantly, the workers in the industrial plant in addition identified supervising officers as being responsible for providing safety information. On the other hand information from sources such as mass media, health officers, and agricultural officers, had either relatively little impact or was not available.

3 Knowledge of symptoms from different types of pesticides

The workers, both agricultural and industrial, did not know that poisoning by different classes of pesticides results in different types of symptoms. They were aware of the trade names but had absolutely no knowledge as to which class a particular pesticide belonged. Furthermore the industrial workers had no knowledge of the relative toxicity of the different pesticides they were handling, whereas the agricultural workers had some idea of the relative toxicity of the different pesticides they were using but this was not a consideration in modifying or determining their safety practices.

4 Knowledge of first-aid

The knowledge of appropriate intervention in the presence of readily identifiable early warning symptoms of poisoning was inadequate. Most of the worker, both industrial and agricultural, considered going to the doctor or informing the supervising officer the only action that needed to be taken by them. Whereas the necessity to change their clothes and wash, etc. was not considered to be urgent or even necessary at all.

Finally, on enquiring as to whether they considered it necessary to be educated on the hazards of pesticides, all workers thought this to be essential. Also, the workers were unanimous in identifying a health professional as being the most appropriate person to educate them on these matters, although none of them ever had experienced this source of information.

THE TYPE OF HEALTH EDUCATION NECESSARY

From the above mentioned study it will be clear that workers using pesticides have some knowledge of the hazards from pesticides and the relevant safety practices necessary to prevent poisoning. However, this knowledge is certainly not put in practice and to this end a change in attitude among these workers is required. Hence, the main thrust in the development of future health educational programmes should aim at effectuating a change in attitude rather than at extension of knowledge per se. Therefore, although the following two essential elements of health education are both required, the emphasis should be on the second part.

1 To inform and educate about the health hazards from pesticides and to provide reassurance about the safety of pesticides, if properly used.

2 To persuade those at risk, to work in such a manner that poisoning is prevented.

The first of these two aims is relatively easy to achieve. To some extent this may already have been achieved as is indicated by the present study. The second aim relating to a change in behaviour is more difficult. Although much has been written on the subject (refs. 9, 10) no programme has yet been instituted to achieve this end, at least not in Sri Lanka.

Without doubt there is a great need to develop our skills in the conveyance of available knowledge to those who need it. This is particularly important for the countries of the developing world, where the emphasis should be on this effort rather than on endeavours to advance the frontiers of basic bio-medical science. A concept succintly identified by Rahnema (ref. 11) who states "Rather than focussing on the achievements of the bio-medical sciences, we should be thinking of how the knowledge that has been gained can be placed at the service of the people". This is particularly relevant to pesticide toxicology, where the present state of knowledge is more than adequate to prevent poisoning, but it continues to occur and our primary concern should be to apply existing knowledge to prevent these from occurring.

REFERENCES

1 International Labour Office, 1950 - 2000. Estimates 1950 - 1970. Projections 1975 - 2000, World Summary, 2nd Edn. Vol. 5 ILO, Geneva, 1977.
2 World Health Organization, Safe use of pesticides, Geneva, 1979.

3 State of California, Department of Health, Occupational diseases in California attributed to pesticides and other agricultural chemicals, 1971 - 1973, Occupational Health Section and Centre for Health Statistics, Berkely, 1974.
4 Ministry of Agriculture, Fisheries and Food, Report on safety, health, welfare and wages in agriculture, Her Majesty's Stationery Office, London, 1976.
5 World Health Organization, Accidental poisoning by pesticides, Weekly epidemiological records, 50 (1975) 421.
6 B. Senewiratne and Thambipillai's, Pattern of poisoning in a developing agricultural country, Brit. J. Prev. Soc. Med., 28 (1974) 32 - 36.
7 R.D. Amarasingham and Ti Thiow Hee, A review of poisoning cases examined by the department of chemistry, Malaysia from 1968 to 1972, Med. J. of Malaysia, 30 (1976) 185 - 193.
8 World Health Organization, Science and technology for health promotion in developing countries, WHO Chronicle, 33 (1979) 399 - 406.
9 S. Graham, Studies of behaviour change to enhance public health, Amer. J. Publ. Hlth., 63 (1973) 327 - 334.
10 J. Wakefield, Cancer and public education, Pitman Medical Publishing Co. Ltd., London, 1963.
11 H.E.M. Rahnema, The role of frontline health workers, WHO Chronicle, 29 (1975) 6 - 9.

EDUCATION FOR PREVENTION OF TOXIC HAZARDS

P.A. CROCE
Centro de Toxicologla, Hospital 'ELIZALDE', Buenos Aires, Argentina

ABSTRACT

The toxic accident is a relatively common cause of disease, occasionally serious and generally avoidable.

The human factor has a very important aetiopathogenic role in this connection. Any prevention campaign in toxicology must be based on investigation, protection and education.

INVESTIGATION. To determine and identify the prevalent poisoning pathology, the population exposed, the environmental factors and the personal conditions of the patient which influence the accidental poisoning and to indicate the way to modify the incidence through education and protection.

PROTECTION. Through legislation which reduces the risk of exposure and also by providing adequate and well-equiped facilities for treatment of patients with acute poisoning.

EDUCATION. To bring about in the population exposed and in those responsible for their health a permanent change of behaviour with respect to toxic hazards.

An outline of an educational campaign is presented, which is adapted to the age, previous knowledge and activities of the pupils.

INTRODUCTION

With regard to Public Health, the human community should give special attention to prevention. It is well known that all efforts in this direction give the best results in medicine.

This fact is notable in diseases like accidental poisoning, in which the human factor has a very important aetiopathogenic role.

A proper prevention campaign in toxicology must be based on three fundamental activities: investigation, protection and education.

1 INVESTIGATION

1.1 Detection of the prevalent toxic diseases and of the population exposed to each causative toxic material. Determination of the physical, biological, cultural and socio-economic environmental factors and the personal conditions of the patient affected which influenced the occurrence of accidental poisoning.

In order to prepare statistics on the morbidity and seriousness of accidental poisoning, the population exposed and the circumstances of epidemiological interest, an analysis must be made of the data from the case histories of hospitals and other medical centres, death certificates, registers of causes of invalidity in the granting of pensions, limitation of entry to schools and jobs, incorporation in the armed forces, civil-responsibility suits and house-by-house polls.

1.2 Evaluation of the resources available for the prevention of toxic accidents.

1.3 Measurement of the impact of education on current habits in the handling of toxic substances and on the incidence of related harmful effects.

1.4 Evaluation of the preventive measures and of modifications to make them more effective.

1.5 Investigation of the reasons for the acceptance or rejection of education and protection campaigns.

2 PROTECTION

2.1 Legislation to promote and establish acceptable conditions for the production, storage, packaging, labeling, transportation and handling of products which are technically useful but chemically harmful to man, other living beings, or things of human interest.

This legislation should endeavour to diminish the risk to the population occupationally involved in all these processes, as well as to those in permanent or occasional contact with such people. In this manner, a 'passive immunization' as it were against the undesirable toxic action is produced.

2.2 To create a system of incentives, facilities or economic compensations for the introduction of toxic products with the best 'benefit/risk' equation.

2.3 To provide equipment for first-aid centres, systems of communication, transfer and transportation of patients, treatment centres of increasing sophistication and centres specialized in clinical toxicology.

This should be done in such a way that these institutes have sufficient personnel, equipment and know-how to handle patients with cases of acute poisoning with the speed and efficiency necessary to reduce mortality, duration of the hospitalization and the illness, and the severity of the sequela.

3 EDUCATION

3.1 To promote a permanent change of behavior in the exposed population and in those responsible for their health. This should result in a reduction in the number of toxic hazards and in improvement in their treatment and recovery.

This teaching should be adapted to the age and educational status of the pupil, and should especially be directed towards the more dangerous toxic substances and to those with which there is more frequent contact.

An outline of an educational campaign is the following:

OUTLINE OF EDUCATIONAL CAMPAIGN

AGE	MOTIVATION	COMMUNICATION SYSTEM	EVALUATION
PRE-SCHOOL AGE	Stories dramatized in a direct way or with the help of resources (illustrations, slides, records, films), referring to problems of daily life.	Kindergarten, family and massive communication media (i.e. TV, cartoons, slides, 'jingles', marionettes, etc.)	Presentation in kindergartens of test situations by the teacher, to test behaviour of children. Approval or disapproval by the children, according to whether conduct is correct or dangerous.
PRIMARY SCHOOL AGE	All the techniques of pre-school level may be used, especially in the lower grades. In the middle and higher levels of primary school there may be added themes related to health education and biological sciences programs.	School, family and massive communication media, specially TV-series, 'jingles', cartoons, childrens-magazines, didactic material, school books etc. Theatricals and dramatizations by school-children. Comic drawings of incorrect procedures.	Same as for pre-school age, plus school curriculum evaluation. Presentation of work in school museums and science clubs. Prizes or 'forfeits' if errors are noticed or not. Prizes for those completing the tests first.

AGE	MOTIVATION	COMMUNICATION SYSTEM	EVALUATION
HIGH SCHOOL AGE	Presentation of problems taken from real life, medical experience and health organizations. Incorporation of poisoning-prevention themes in the curriculum of the study of different sciences. Reading of newspapers. Commentaries in news media. Environmental pollution. Extraction of material from newspapers and magazines of general interest.	School, with curricular and extracurricular activities. Communication media, specially TV-series, cartoons, teen-ager magazines etc. Conferences by specialists. Books and graphic material in general.	Regular evaluation of curricular activity. Problematic situations presented by teacher. Presentation of work in school museums and science clubs. Indication of risks and advantages. Discussions of causes and effects of correct and incorrect attitudes.
UNIVERSITY OR TECHNICAL SCHOOL AGE	Future occupational toxic hazards.	University curriculum; special attention to the legal responsibilities required by the future occupation.	Regular evaluation.
ADULT AGE	Motivations adapted to: 1 Daily life situations (i.e. use of medicines, household pesticides, cleaners etc.) 2 Situations derived from regular employment activity on which adequate information has not been received. 3 Situations derived from other activities (i.e. hobbies), in conditions similar to 2. 4 Continuous post-graduate education. 5 Situations referring to environments where there are children under 3 years of age, for mothers and baby-sitters.	Permanent educational campaigns through communication media (practical, concrete, direct), books and written material in general (i.e. pamphlets on safe use of pesticides).	Statistical evaluation of accidents in different years. Registration of accidents attended to in hospitals and other medical centres. Information as complete as possible on the number of cases of poisoning. Pre-occupational tests. Multiple-choice tests for selection of candidates for hazardous occupations.

NON CONVENTIONAL EDUCATIONAL METHODS (EDUCATION BY MAIL)

E. ASTOLFI and J. HIGA de LANDONI
Facultad de Medicina, Cátedra de Toxicología, Universidad de Buenos Aires, Buenos Aires, República Argentina.

INTRODUCTION

Latin America is a fascinating region: vital, wealthy, moving resolutely towards the solution of her social and economic problems. A striking variety of flora, fauna, landscapes, races, climates and traditions can be found.

There exists the ruins of long-ago abandoned cities lying halfhidden between steep mountains and ultra modern cities which reflect the latest artistic, literary, economic and industrial trends.

There is a shocking duality: on the one hand vast deserts, fertile 'pampas' that stretch endlessly towards the horizon, natural millenary paths along which herds of 'llamas' amble before the watchful eyes of emotionless Indians and on the other hand ultramodern jets that cross the skies linking the Latin American capital cities with the rest of the world.

Latin America has a total area of about 20,000,000 km^2 and its high rate of population growth is very similar to that of the African Continent, thus allowing for a gross estimate that by the year 2000 the population in Latin America will have reached the 579,000,000 inhabitants. While in 1950 the population in Latin America was practically identical to the population in Anglo-Saxon America (164 vs. 166 million inhabitants), the demographic growth of the latter is calculated on the basis of the 1% index, just as in Europe and Russia; this implies that by the 1980's, 1990's and 2000's, its population will amount to 250,000,000 inhabitants. Latin America, instead, has reached the 360,000,000 inhabitants by 1980, will reach the 456,000,000 inhabitants by 1990 and will have reached the 579,000,000 inhabitants by the year 2000. This is simply due to the fact that the growth rate represents 2.7% which is considered to be a high index.

Latin America is formed by countries with the most varied geographic characteristics, and it covers all the area that lies between the Bravo River and Tierra del Fuego and even more: the Antarctic Pole.

Latin America is responsible for almost 50% of the world production of sugar cane, 85% of coffee, 93% of bananas, 100% of 'quebracho' extract, cereals, meat and fruit of all types, and all this makes her a promising source of food for the future, thus enabling her to cope with an evergrowing world population.

Within the vast expanse, only one country, Uruguay, is situated outside the tropical and subtropical area. But the mountainous regions all over Latin America have allowed man to face the hardships characteristics of the climate of a tropical zone.

On the other hand, the majestic mountainous ranges have been and still constitute a hindrance for many projects, amongst them educational ones, as they isolate the main population centres and they hinder the introduction of new technological and cultural methods as well as sanitary measures which could raise the standards of living of its inhabitants.

Not only the steep mountains, but also the vast expanse of its plains and the scarce communication facilities amongst the cultural centres (generally inserted in the great metropolis) obstruct the implementation of educational plans at all levels, specially so when these plans are preventively aimed at safeguarding the risks posed by the use of certain useful, but at the same time dangerous, agrochemicals such as pesticides.

AGROMEDICINE

According to information issued by international organizations such as FAO, it will be necessary in the coming years to resort to the aid offered by agrochemicals devised for the protection of the harvests. Studies are being carried out to realize other types of treatments such as those with specific biocides that are less toxic or treatments that involve natural ennemies, presently called 'integrated control'.

The striking development of technology in all fields (mathematics, analytics, genetics, biology, agronomy and so on) also offers an unusual anticipation to the ideas, conceptions, pragmatic philosophies and radical changes in prejudices, planning, labour methodology and structures of organization.

The greatest contribution to achieve the knowledge of events still is the personal experience, experience which becomes a 'cult of observation' as Augusto Comte wittily suggested.

Claudio Bernard pointed out that 'to reach those truths, it is necessary to descend to the objective reality of things, where these truths are hidden under their phenomenic appearance'.

Man learns for man, though sometimes the final outcome is illness and ultimately death. The old principle suggested by Saint Augustin that history is 'like the life of a man' is opposed by the cruel reality of the biological principles: 'whoever does not adapt himself, dies'. This is as applicable to human beings as it is to amoebae, without hypocrisy or cynicism, like a natural mechanism of the gregarious instinct which, unfulfilled, leads to alienation.

Learning to live with pesticides constitutes part of this chapter that also forces people to admit and accept contraceptives, colour television, noise contamination, generation gap, misery and hunger, developed and 'not allowed to develop' countries.

The causes of social stress are many and diverse, and pesticides possess various qualities among which we must include their innate quality of being toxic and poisonous.

The acknowledgement of this microworld is the essential preceding step to adapt to it, measure the risks, find the solution and obtain the benefit that it offers. Because undoubtedly, when one speaks of 'change' one speaks of 'development' as there exists the hope of a bettering in all aspects of life.

Paul Bert, D'Arsonval and Marej agreed that the sciences develop as a result of new ideas and as a result of the original and creative power of thought.

On asking His Holiness Pope Paul VI "if we had the right to use pesticides in our own and immediate benefit without prior knowledge of their present and future consequences", his answer was short, concise and straightforward: "Do it because the man of science is near God". Science and faith work jointly to suggest solutions to the problems originated in man himself.

Madame de Sengué said: "La vraie nature du merite du coeur c'est la capacité d'aimer" (The true nature of the merit of the heart is its capacity to love).

Loving is a synonym of creating, building, furthering positivism and generating energy. But as Juan Dalma said, man is also born with destructive powers: death, depression, collapse, which are negative and sad. Love and destruction embodied in one person and in all persons searching an equilibrium that shall never be reached.

Pesticides, which amount to destruction by origin and definition, become constructive as a result of the agronomical prescription that turns them into an invaluable contribution towards the aims sought. Innocently but eloquently, the Argentine farmer calls them 'medicines'.

It is a true paralogism that is correct in appearance, but it is only based on good faith, and this is precisely what differentiates it from a fallacy.

A lot can be done within a constructive group in order to achieve 'the correct use of pesticides' which constitutes the only and conclusive solution to the dangers of its toxicity.

One should foresee, teach, legislate with the pragmatic view of the person who acts and not preaches. One should resort to the new information theory to develop the products which have a minimal toxicity for man and animals, do not affect ecology, and which, in the case of abnormal over-use, can be counteracted.

One should pay more attention to agromedicine which is a new field where many members of society play an active role without official medical qualifications, though not practising quackery or white magic.

In recent publications, Sanitary Medicine and the WHO make a plea for the formation of the so-called 'health agents', who in addition to their common qualities, will have specific characteristics related to the region where they work. Because they will have been trained properly, they will be able to cope with certain trying situations whenever the doctor is not available or lives too far away.

Due to their social sensitivity, their permanent contact with pesticides and their high degree of creativity, the agricultural engineers are the first in priority to be summoned to practise this agricultural medicine for the purpose of which they should be informed about the toxicology of pesticides that they either do not know in detail or have had no time to study deeply.

These professionals have responded most satisfactorily and have saved many lives; a proper privilege for those that possess an enlightened heart and spirit. This is a spiritual reward that can seldom be expressed in other terms.

Those who always chose to defame, will point out the bureaucratic cons and shall criticize the irreverent boldness of those who lacking the Hipocratic oath, invade fields forbidden for them up to now. They will feed the destructive machinery of society destined to demolish all the good intentions.

Technically 'developed' countries, such as USA, tend to promote Agromedicine at a government level by means of the active participation of agronomists, nurses, supervisors and the persons concerned, that is to say, heads of cooperative societies, workers and the like.

It is a must to leave aside obsolete concepts in order to go with times. Let the passage of time not lead to anachronic routine but in yielding achievements.

The forerunners of the Agromedical approach for the handling of pesticides are, amongst others, J.E. Davies, M.C., M.P.H. of the Department of Epidemiology, School of Medicine, Miami University; Virgil H. Freed, Ph. D. Department of Agricultural Chemistry, Oregon State University, Corvallis, Oregon, USA and Ray F. Smith of the Department of Entomological Sciences, University of California, Berkeley and Head of the UC/AID (University of California/Agency for International Development), project of plague control.

History and appraisal of the problem

The combined effects of an increase in the population growth together with the simultaneous need for a sufficient food production to satisfy the world's requirements, is one of the most urgent and challenging problems facing the present world governments. The problem is a source of worry likewise for developed and undeveloped countries; in fact, it is a worldwide problem.

In spite of the fact that in many parts of the world attempts are being made to find a solution for the problems of the increase in population, there seems to be no feasible solution momentarily. Even more so, the demographists foresee the doubling of the world population towards the end of this century, and consequently this requires that the attempts to avoid inanition and hunger should proceed with extreme rigour.

Many countries are evaluating the situation, trying to find out if the efforts and present programmes are sufficient to meet the demand. For example, the project of the University of California, UC/AID, represents an ample approach to the world control of plagues, making use of the multidisciplinary services of several universities in the USA and aided by the US AID programme promoted by the State Department.

This project has already successfully concluded seven multidisciplinary studies on the control of plagues in different parts of the world.

Apart from plague control, the use of pesticides has received a special push and, with the purpose of fulfilling this aim, seminars on the handling of pesticides, taking into consideration both disciplines (health and agriculture), have been held in El Salvador, Indonesia and the Philippines.

The conclusion arrived at in these seminars held in different parts of the world, was that neither the health discipline nor the agricultural discipline doubt the important and continuous role to be played by pesticides in the future demands of the world to increase food production and to practise a continuous control of human illnesses transmitted by insects.

The use of pesticides is an essential component of the control of plagues and vectors. Our opinion is that the basic objectives of the production of better food and of the restriction of illnesses caused by insects shall be fulfilled only if plagues are controlled, a standpoint strongly defended by Doctor Ray Smith. The correct and satisfactory use of pesticides is obviously an essential part of this process, and most probably a prerequisite for the integrated control of pests.

The troubles that were the source of worry for both the agriculture and health disciplines concerning the handling of pesticides, led to the coining of the expression 'Agromedical' problems of the use of pesticides, and both its risks and solutions are of common interest for agriculture and health.

These 'Agromedical' problems include:

1 cases of human poisoning;

2 contamination of food by residues of pesticides, accumulation in man and persistance of some pesticides in the environment;

3 the constant increase in resistence of plagues and vectors to pesticides.

Taking into consideration 1 and 2, the possible effects of the exposure of human beings to pesticides can be divided into three categories:

a) acute exposure that provokes acute poisoning, a risk run by pesticide workers or by persons that can accidentally become poisoned at home;

b) high chronic exposure related to the long-term effects of pesticides (occupational diseases);

c) low chronic exposure or incidental exposure from residues of pesticides and the risk of cancer and other diseases (the population in general; those that are exposed to small quantities of pesticides in the water, in the food, in the air and in clothes) (Table 1).

The majority of the countries seldom report the occurrence of diseases and cases of poisoning related to pesticides and careful investigations take place only occasionally.

TABLE 1

Toxicology of pesticides

Ratio between dose, length of exposure and effects

dose	length	number of persons involved	effects/ features	preventive measures
high	short-acute overexposure	one or a few	acute poisoning; contact injuries - (skin - eyes).	safehandling instructions; labelling; early diagnosis.
moderate	chronic (occupational)	workers	occupational diseases	industrial hygiene; occupational health; sanitary education; safety measures.
(very) low	chronic (incidental)	everybody	accumulation in man; persistence in environment.	monitoring; legislation.

There is little information available concerning the type and nature of the exposure, clinical findings, results of the investigations leading to determine the origin of the poisoning, and the chemical and toxicological data that back those findings. Even so, the statistics available are shocking. The WHO deems that there are 500,000 intoxications through pesticides annually and that the rate of mortality amounts probably to 1%.

The persistence of pesticide residues brings about many economic, environmental and sanitary problems.

At a certain time in the past, the meat exports were forbidden because the residues of chlorinated hydrocarbons exceeded the permissible levels in the importing countries.

These incidental contaminations caused economic losses in the exporting countries and also poised the problem of how to get rid of the contaminated products. The chronic ingestion of residues is like wise a source of worry in the field of public health. Although up to now the negative effects of the ingestion of pesticide residues have not been proven, it becomes vital to have regular programmes to detect the presence of chemical residues in man including pesticides and other environmental polluting agents that can be measured in fat, urine, hair or other appropriate tissues of the human body. The need for epidemiological studies on the distribution of these environmental pollutors in the population has been duly stressed. To cover in a representative way the geographic and demographic variables special emphasis should be given in these studies to the size and the required stratification of the sample.

The problem of resistence

The present stage of insect resistence in different regions of the world is of extreme importance for experts on agricultural protection and public health.

In Central America, the effective programme of control of malaria vectors has fulfilled its objectives through the use of DDT inside the houses, a place which does not significantly contribute to the pollution of the atmosphere as a result of the use of this pesticide.

However, some authorities have argued that the agriculturally used pesticides have given the malaria vector a chance of acquiring greater resistence. This seems to have happened in Central America where the malaria control programmes largely depended on DDT first, on dieldrin later and finally on propoxur. At present, in El Salvador and Guatemala the Anopheles albimanus, local vector of malaria, is resistent to the three insecticides abovementioned. Georghion suggested that the agricultural use of parathion in cotton has enabled this mosquito to develop resistence to propoxur. The epidemiological data back this suggestion because the resistence of the vector to propoxur coincides geographically with areas where cases of parathion poisoning are more frequent.

All these problems clearly trouble the experts in the field of agriculture and health, and it is this particular worry that supports the 'Agromedical' approach.

Concepts and Achievements

Some fundamental concepts are the basis of the agromedical approach to the use of pesticides. Some of them may seem to be somehow idealistic because they make an appeal to human beings so that they may rise above their own individual interests and work jointly towards the fulfilment of a common purpose.

Our belief is that to face this challenge we need not sacrifice ourselves; on the contrary, we all profit from this both physically and economically.

The first concept consists of the knowledge that there is an interrelationship between the physical (health) and economical well-being of the rural area. Without food and money, even the most beautiful place can appear desolate. Similarly, wealth cannot compensate the loss of health. In this way, the concept of Agromedicine comprises a total view of the well-being of the community including food production, health protection and conservation of the local environment.

The premise that the achievement of the objectives implied requires an integrated interdisciplinarian approach is derived from this concept. At the beginning, certain primary disciplines take the lead. At least one basic agromedical group should be formed with agriculture experts, health professionals and chemists.

In many countries, the primary, and sometimes most effective contact of the official extension agent or the industrial representative with rural areas is that with the farmer.

According to the agromedical approach, we believe that this person must be seen and considered as responsible for the primary care of the communities in food production areas in what pertains all sanitary preventive actions. He will not substitute the doctor or the agricultural expert, but will help him in the handling of their problems.

This 'worker in the community' must be trained in the use of pesticides, agriculture and the practical application of sanitary measures, and it is precisely at this point where the concept of the 'Agromedical' group starts playing an important role. These groups offer short-term training to satisfy the needs of the rural areas, the relevant practice and the support services that are necessary, such as analytic chemistry, field investigations and distribution of health care.

The next element is that of the local or regional medical groups and their extension on a national level. At each level, the depth of the skill, and the capacity to fulfil the duties and carry out investigations are increased.

Together with the different levels, there exist the various governmental institutions for investigations and control, the universities and the extension agents that, like partners, complement the complex of industries that are related to one another through a coordinating board. This can be achieved by means of the formation of a supervisory body of representatives of each group with resources to furnish suggestions for regulation, investigation, training and technical assistance.

Our personal experience

The Pesticide Poison Control Centre was founded in the Argentinian Republic following a programme elaborated in 1969 which aimed at fulfilling some of the aforementioned objectives, specifically those related with products, with the purpose of establishing, or if necessary complementing, the diverse structures existing in the country and with the purpose of contibuting primarily to the treatment of acute poisonings caused by pesticides.

This programme originated as a result of an increase in the frequency of toxic accidents. The level of agro-economic development, when compared with data coming from abroad, allowed to foresee a relatively high number of toxic accidents. On the other hand, the diagnosis and therapy of those cases of poisoning proved to be rather difficult, since the products that caused them were practically unknown and unsatisfactorily identified. The doctors were ignorant of their existence, the pathology they induced and the way to fight it.

Methodology

The Poison Control Centre based itself on the following principles:

- the greater or smaller risk of a toxic accident depends on a series of circumstances and situations that, to a certain degree, can be altered;
- if the proper way of behaving is known, and the means necessary for that action are also known, it will be possible to avoid poisoning and its consequences.

In that way, the objectives to fulfil and the means necessary for the concrete interventions to be practised, were defined.

Priority number one was to prevent mortality and morbidity as a consequence of the use of pesticides. For that reason it was not necessary to stimulate the creation of an emergency centre as these cases could very satisfactorily be dealt with in hospitals and emergency services. The essential task was to guide the victim towards the most effective service and to offer technical and scientific aid to the doctors who required it. For this purpose we created a specialized information centre, non existent in the country up to that moment.

In those cases in which time was not pressing, the patients directed themselves to the Centre and, in some cases, even received advice by mail, according to the particular case.

The typical activities of our Centre are grouped in two kinds:

1 one of them that gathers the documentation and

2 another that dissiminates the information.

Figure 1 synthesizes the action programme of our Centre.

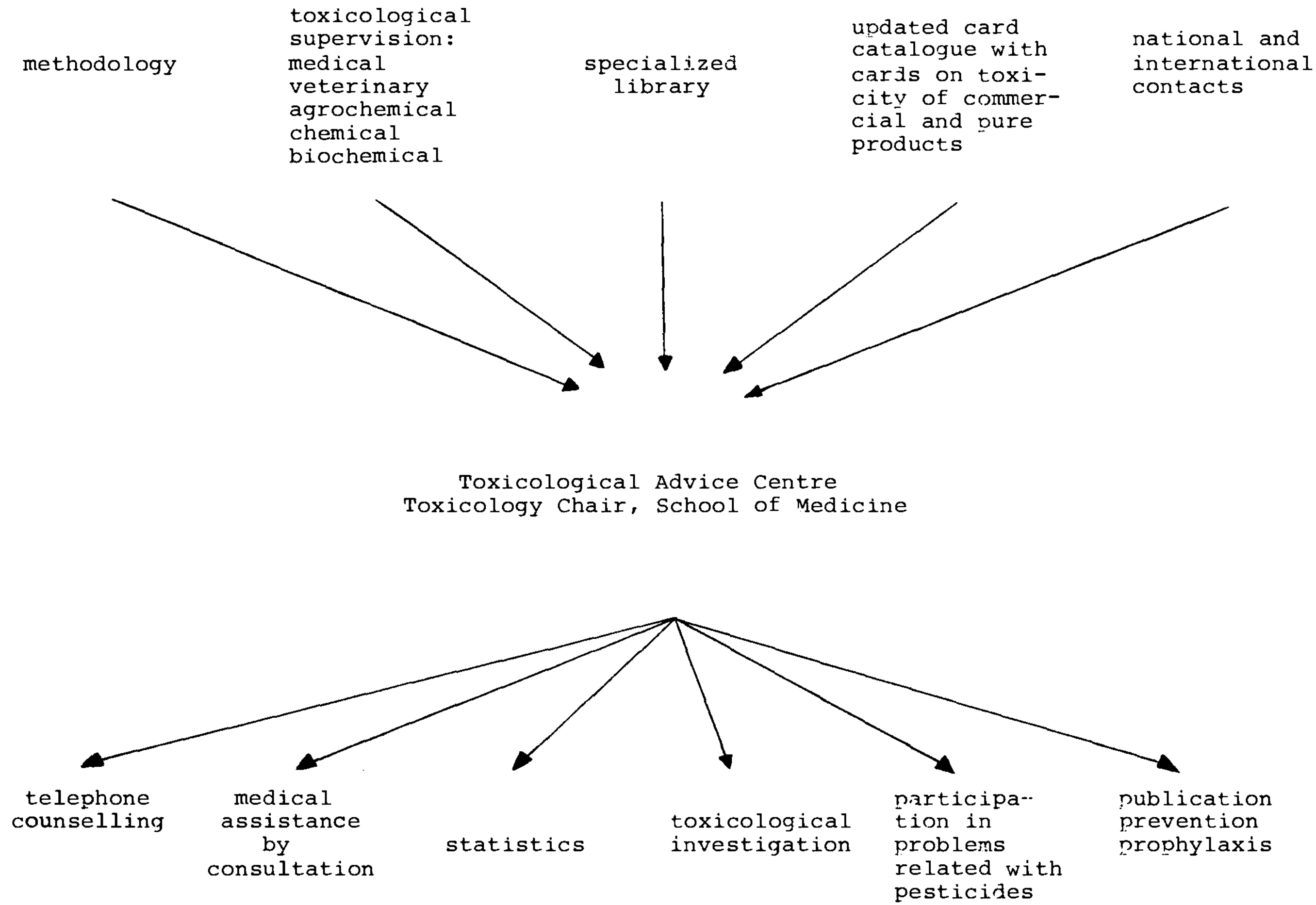

Fig. 1. Organization of a toxicological advice centre for pesticides.

How the Centre functions

In cases of poisoning the Centre

1 offers the requirements necessary for the diagnosis if the etiology is uncertain;

2 informs the victim, or whoever it may concern, about the risks involved in the accident suffered, how to practise first aid and the measures to be taken until the arrival of the doctor;

3 offers the doctor or the qualified person all the data about the product;

4 furnishes the specific antidotes that are difficult to obtain (BAL, Contrathion, etc.).

Preventive measures

The Centre

1 organizes programmes at school level and rural level providing popular, supervisory or professional knowledge;

2 carries out the planning of epidemiological studies;

3 issues reports about new things or aspects of importance in connection with pesticides.

The basic documentation of the Centre consists of a card catalogue of agrochemical products.

In theory, all the products that are available in the country are filed there, with their composition and toxicity data.

The sources that furnished the composition of the products were:

- Ministry of Agriculture
- Secretariat of Health
- the producers and their commercial agents
- original publications, in particular in the case of foreign products
- bibliographies on the subject obtained from specialized techno-scientific and industrial magazines.

All information on the toxicity and clinical effects of the active ingredients was obtained from foreign documents and cards as well as from clinical experience gathered in our Centre.

Card Catalogue

The cards (over 1,500) were classified according to two systems:

a) cards with the trade name or registered name of the product alphabetically ordered, in which the chemical composition, its main component, the manufacturer and the presentation or formulation were included.

b) cards with the active ingredients also ordered alphabetically with the concise description of the clinical symptomatology of the poisoning, the toxicity of the compound, its treatments and the bibliographic references for additional information if necessary.

The need for a continuous updating and renewal of the information about the phytosanitary products lead to the formation of a specialized library, with numerous publications, specialized magazines which are difficult to obtain, and all the classical textbooks on general toxicology.

But the most cumbersome effort made by the Centre was the organization of campaigns for the prevention of accidents caused by the misuse of agrochemicals.

The campaigns, organized on a national level and primarily directed towards the rural areas where the ignorance about the toxic properties caused damage to the local community, were organized using the press and the radio and television broadcasting stations which contributed to the positive spreading of the message by persons trained for that purpose specially taking into consideration the level of the audience.

To this end, the guidance of school children was included, bearing in mind a two-fold purpose: transmitting the message on the use and dangers of agrochemicals to them and, consequently, to their parents.

Other essential activities undertaken by this Centre were the assistance and counselling rendered by telephone, by mail and even in person.

Benefits

The statistical survey carried out during one year of activities proved the benefits of the existence of this specialized Centre. This is evidenced through the sanitary problems brought about by the release of numerous agrochemical products capable of giving rise to acute or chronic symptomatology, or even to ecotoxicological effects. Evidence was also obtained from the diverse mechanisms that caused them, such as labour accidents or accidents of any other nature, homicides, suicides, social, endemic, nutritional causes, and so forth.

On the other hand, it should be noted that there is an urgent need for adequate data collection on the diagnosis, treatment and prophylaxis by means of a programme of preventive medicine and sanitary education, with the purpose of checking the problems originating in the use of pesticides. This has been conveniently proven with the creation of the Pesticide Toxicological Centre in our country. Its findings and discoveries may prove useful for other Latin American countries.

AGROMEDICAL EDUCATION

In order to fulfil the objectives set in the work of our concern, the training of the agromedical agent became an essential element in the execution of a programme which would offer greater sanitary benefits in rural Latin America. The report of the first meetings called 'Sanitary Platforms' for Rural Latin America, clearly determines the items and makes recommendations necessary for an immediate action.

The introduction to the report says:

"In two years and a half since the First National Conference of Rural Latin America, the sanitary problems of the rural population have become worse instead of improving. Isolation, poverty and the improper distribution of the sanitary centres combine themselves to hinder the adequate health care in rural areas.

The Government measures and the priorities in force are inadequate to face the continuous sanitary crisis in rural Latin America. In general, neither the rural population has been consulted nor its particular concerns in rural sanitation have been taken into consideration for the elaboration of better sanitary projects and more satisfactory financing of programmes.

In detriment of the seriousness of the health problems and the negligence of the special needs of rural health, up to the moment there exist no organizations that advocate for specific measures in the realm of rural health".

That means that the problem posed by rural health conditions is not new at all. The use of dangerous products further darkens that gloomy horizon and one of the solutions suggested is that of education.

The need to teach and train has been discussed several times during several seminars and round tables. The education of the public at large, both urban and rural, on the advantages and disadvantages of the use of pesticides, is of extreme importance. It is necessary for the public to apprehend the objectives and methods of a country's programme on the use of pesticides. The specialized local institutions are responsible for the formulation of the details of this programme of public education (e.g. Poison Control Centre, Pesticide Department).

The degree of technical proficiency in all levels should be constantly enhanced. One of the means available to materialize this training, is to attend courses abroad. The persons working for the numerous institutions dealing with similar technical matters (e.g. chromatography of gases and diagnosis of poisoning through pesticides), should receive adequate training on working methods and periodical sessions of discussions.

The instruction of the agromedical group concerns both agriculture and health; it is essential to combine these two areas since none of them can cope with the problem on its own.

Health institutions concentrate mainly on the health and well-being of man, but they, nevertheless, acknowledge the need to use pesticides for the purpose of controlling plagues of medical relevance and the vectors of illnesses.

The agriculture departments make use of pesticides to increase the food supplies, but they, nevertheless acknowledge the importance of the health condition of man in the preservation of an effective work potential. Man does not live on food alone. The cereal supplies do not suffice. The welfare of the rural community cannot be separated from its health conditions and agriculture and, at the same time, both health conditions and agriculture determine, to a large degree, the 'welfare' (in all the senses of the word) of the rural community. Agriculture, health and the relevant members of the group must work jointly towards the fulfillment of this 'welfare'.

This will be achieved only if complemented by a better training of the agromedical agent, in this particular case the Agricultural Engineer, who is in close contact with the rural communities and who may transmit the necessary knowledge on the safe use of pesticides and the dangers involved as well as applying first aid.

To organize ongoing education at a university level (first stage: agricultural engineers - rural doctors) is a difficult task due to the vast extension of Latin American countries, aggravated by the deficient and costly communication network. We use the phrase 'ongoing education' because it refers to a subject currently in vogue in the field of pedagogy - ongoing education with all its characteristics.

It has a double dimension: horizontal and vertical. From the horizontal point of view, it implies the expansion of education through all the modern communication resources (the mass media that break into the life of the student with a great educational and formative impulse). From the vertical point of view, it implies the extension, throughout one's lifetime, of periodical systems of education with every time more formalized procedures. It expresses itself in several ways: postgraduate courses, revaluation of professional or academic degrees, and so forth. This also includes an important innovation: the fact that the idea of the finished product has been overcome (a doctor and an agricultural engineer had their fields completely defined). During a long period of time the university sustained the principle, in some way subconsciously present, that the graduate is a finished product to whom occasionally, a service can be rendered just as it happens with a person who has an industrial product and rarely looks after.

This concept disappears with the idea of ongoing education. We tend to think of products as half finished and hence capable of being used for different purposes.

The university product (doctor, chemist, agronomist, nurse, veterinary surgeon) can be, according to the modern criteria, updated, conditioned, polished and the like, in order to satisfy the changing needs of the present way of living (Agromedicine).

This premises the existence of still another novelty: the relativization of the formal degrees awarded by the University. In future years, what we at present call the maximum degrees, will have little significance. This denomination is one of the symptoms of those concepts with which the University has governed itself. Beyond the maximum degrees there exists nothing else. Summing up, the idea of ongoing education means more and more that one is, to a certain degree, all his lifetime in some kind of school or other, and that society itself is a school. Man should not feel absorbed by the idea of an activity, the school activity, to which he shall devote himself for a number of years. During the rest of his life, he shall have to form part of institutions that, in one way or another, are also schools. According to this programme of ongoing education, the teaching of toxicology of pesticides to agrodoctors implied a research on the educational principles according to which the teaching process would have to be perfected.

This proved to be impossible with the very traditional medieval teaching methods where the process of learning was a mere transmission of knowledge accomplished through the passing of that knowledge from the mind of the teacher to the mind of the student, and this was carried out in the classroom (from the latin chair, seat). The student grasped the information through the word of the teacher or what he dictated. Both had to be comfortably seated, and this to a large degree explains the very traditional furniture that, more or less changed, is still being used. The evaluation of the students was a means to test the degree of absorbed knowledge, and they resorted to repetition to secure the process of memorization.

Which is, then the fastest and most suitable method for the acquisition of new information? In order to solve this problem several possible answers have been suggested throughout the history of education. But in reality, all these answers have headed in the same direction, that is to say, they have pointed to the breaking up of the subject to be taught in as many components as were possible. In that way, following a very traditional methodology, they attempted to divide the subject to be taught in its constituting elements thus obliging the student to learn successively all the separate stages determined before passing to the following stage. What modern investigation has done is to purify and refine this technique as old as humanity, and gradually transform it into a powerful teaching device.

This is, at present, the procedure used by what is known as 'Programmed Instruction', this being a method that we shall make use of, with certain alterations, for the teaching at a distance of the toxicology of pesticides.

Programmed instruction mainly consist of the gradual distribution of the contents of a previously set and purified programme. It offers the student the possibility of checking his performance by means of a specially devised technique and it also makes it possible for the student to move gradually from what he already knows to that which is still unknown to him.

The effectiveness attributed to Programmed Instruction largely depends on the experience obtained after many centuries of teaching and also on a series of didactic principles which are the result of studies carried out in laboratories of psychopedagogy during the last years.

The mentioned principles are the following:

1 the student must learn to follow his own pace;
2 he must always start from what he already knows and then move on to learn new things;
3 he must learn by answering actively to each and every one of the points included in the programme and not by means of the answer given by the teacher which would make this process of learning utterly passive;
4 he must learn in a sensible and organized way; in order to achieve this, the subjects should be arranged logically;
5 the students must know the results of their practical work immediately so that they can check, without delay, whether their answer is correct or not. In this way, the students need not wait for the teacher to grade their work.

6 the stages of the programme should be brief and carefully organized in hierarchical order, so that the student does not start with a new subject without knowing the answer to the previous one. This will allow him to practise on the basis of correct answers instead of repeating, and therefore consolidating, mistakes.

7 the student should revise periodically so as to make it easier for him to remember and preserve what he has already learnt.

As can clearly be seen, none of these principles is in itself new in the realm of didactics. What is new, is the way in which the subject is programmed and the methods and instruments used for its proper enforcement.

In this respect, the Programme Director should bear in mind essentially three didactic principles.

1 the extremely precise and concrete identification of the objectives of the process of learning on the part of the student. Programmed instruction should indefectibly focus on what is essential in each subject. It is not sufficient to have as an aim the 'thorough learning of the toxicity of pesticides'; the Programme Director should clearly define 'what it is that the student should necessarily know about the toxicity of pesticides'.

2 the formulation of a didactic strategy to be followed in the fulfilment of the programme. The Programme Director must know exactly at least three things:

a) where to begin;

b) what the student should learn before being able to assimilate something new;

c) in what order the questions should be set.

3 the formulation of the stages of the programme and its subsequent checking, in order to confirm the strategy followed. This can be achieved in the following way: the Programme Director determines the steps of a subject and presents them to a student. He studies the difficulties encountered by the student in answering the questions and the type of answers offered. He makes the necessary corrections and presents the subject to another student to deal with it. Following the same methodology used in the case of the first experiment, he repeats the process with at least ten other students.

It is really a difficult task, but once concluded, it can offer most satisfactory results.

In all cases, the Programme Director must bear in mind that what is essential in the elaboration of the subject is the principle that it is the student who, with his reactions and answers and with the certainty and speed with which he solves and learns the questions, determines whether the programme presented to him is satisfactory or not.

It is possible to put this method into practice with students of different ages and intellectual level.

The expense involved varies. Simple mimeographed pages can be used or very expensive 'teaching machines' can be used. The devices can be different, but what is really important for this methodology is not the way in which it is presented to the student but the satisfactory gradation of the contents to be learnt.

Taking these fundamental principles of programmed instruction as our starting point, we have planned and put into motion a course by mail on the toxicity of pesticides.

These experimental or try-out courses are still under a process of revision and in process of development. It may happen that in some cases the experimental projects are much more advanced than the information acquired from research. There should ideally be reciprocity between the current research and the experimental plan.

There exists a considerable 'dark area' between research and actual putting into practice; these experimental try-outs offer a positive mechanism for the necessary interchange.

OUR PERSONAL EXPERIENCE 1978-1981

Courses by mail

A practical way of overcoming the innumerable geographical obstacles, unsatisfactory communications and lack of economic resources involved in the transfer of university graduates from one place to another, was to programme the 'Swallow Project' which consisted of the following essential items:

1 the elaboration and writing out in chapters of a course on the toxicology and ecotoxicology of pesticides;
2 the selection, through competent bodies, of the newly inducted members selecting them from university agronomists and students following the last year of the same specialization;
3 weekly remittance of fascicles with self evaluation system in the form of multiple choice questions and novelized stories to stir and attract the reader's attention;
4 free enrollment and admission, being financed by a non-profit institution making no commercial advertising whatsoever;
5 groups formed by 400 students per course;

6 possibility for the students to go to a nearby university, once the course has been completed, in order to participate with one or more of its authors in a 'Colloquy' on the subject, lasting one day or more;

7 the regionalization of the problems and adjustment to the local needs;

8 basic knowledge of agromedicine, first aid, social and legal matters and registration of products;

9 related subjects giving rise to controversy at national levels.

Aims

A) to train all those persons who, being technically qualified in pesticides, cannot attend meetings, conferences, symposia or other cultural and scientific activities to improve and update the knowledge of the subject for reasons related to distance, lack of economic resources and the work itself;

B) to create a feed-back for the teaching staff in order to get to know the specific needs of each given region as well as the student's answer according to the level of the course, the wording chosen and other significant parameters;

C) to make people aware of the importance of ecotoxicology, Poison Control Centres, the adequate infrastructure of analytical laboratories, the checking of data and all other elements that lead to a correct diagnosis and to the proper education and prevention of secondary levels: cooperative societies, supervisors and so on until the user and his family are reached;

D) to win the local media so as to implement sanitary campaigns;

E) to promote the correct use of pesticides through an integral knowledge of toxicology.

Methodology

The pedagogical approach to the lessons is such that the student does not need to use technical dictionaries or attached glossaries.

The weekly reception of the lessons gives time enough to fix the previous information which is strengthened by the tests with which it is accompanied. The results thereof are checked at the beginning of the subsequent lesson, providing a sequence that leads to unity and coherence in the work.

The suggested bibliography enables the student to enlarge any special subject or to complement any kind of information that has not been given in detail or is not clear.

From time to time, loose pages are attached including information related to scientific gatherings, conferences or activities in which the agricultural engineer is able to take part if so desired. In this way, the course becomes a link between the place where the student lives and the big cities where the information is generated.

In the case of special subjects or of points which have not been included in the syllabus, the text is arranged in such a way that it is still up-to-date.

Results

In the three courses that have already been completed, the voluntary attendance exceeded 80%. A different number of people asked the officials in charge of the meetings (generally speaking, these took place in universities in the provinces which have a School of Agriculture) to be admitted and were added to the lists. The interest shown by this group was such that it was agreed to send them the next course by mail.

The profiles and characteristics of each course conditioned the preference for certain books, magazines and other sources of information. Information was up-to-date. The opinion on the course given by the students was absolutely positive and most of them arranged the fascicles in a book for further reference and consultation.

Old chapters were updated though some of them were fully replaced due to the need of dealing with certain matters which had arisen in the meantime.

The mail made a good performance: less than 1% of the deliveries were lost. When non-delivery was claimed, the lessons were mailed again.

More than 45% of the students stated their wish to continue receiving information of this or any other kind. This fact evidences that the course arose their interest in updating their scientific knowledge.

DEMONSTRATION OF SLIDE KIT ON HAND-HELD ULV SPRAYING. AN EXAMPLE OF AN EDUCATIONAL PROGRAMME

R.G. MARLOW
Shell International Chemical Company Ltd., London, U.K.

INTRODUCTION

With increasing use of the hand-held ULV technique for application of insecticides to cotton in many parts of Africa, farmers new to the procedure must be properly trained.

The technique itself is very popular with farmers who cultivate relatively small areas of cotton and it has a number of advantages over the more conventional 'knapsack sprayer' application of water-diluted emulsions. For example, using hand-held ULV, one man can treat a hectare of cotton in 40 minutes compared with 2-3 days required with a knapsack type sprayer for the same area. Also, with the knapsack sprayer, about 500 kg of water will be required per hectare compared with only 2-3 kg of the special ULV formulation employed with hand-held equipment. This is particularly valuable in situations where water is scarce or difficult to transport to the application site.

Against these advantages must be set the fact that hand-ULV requires a higher degree of skill and expertise on the part of the operator since the technique relies upon small spray droplets being drifted by the wind onto the target. Thus it is necessary for the operator to make judgements concerning wind speed and direction in order that his crop is properly treated and his exposure to the spray is reduced to a minimum.

SLIDE KIT ON HAND-HELD ULV SPRAYING

Recognising the importance of farmers being properly aware of the necessary safety precautions for hand-held ULV, the slide kit entitled 'Spray Safe with ULV' was developed as an educational programme for African farmers as the target audience. The kit consists of 65 slides (35 mm film) of photographs taken on location in Africa, together with a written commentary which can be read by the presenter as the slides are shown. Alternatively a recorded commentary is available which can be synchronised with the slide projector using the necessary electronic equipment. The kit has been made in both French and English language versions.

Educational programme

The educational programme focuses on '10 key safety rules' to be followed by all users of ULV formulations and hand-held ULV equipment. These rules are as follows.

1 Check that the product is right for the job and read the label.

2 Always store formulations in their original containers, away from food and out of reach of children.

3 Carefully check that the ULV equipment is operating correctly.

4 Take special care when filling ULV bottles.

5 Think before you spray! Check wind speed and direction.

6 Do not smoke, eat or drink while spraying.

7 Do not let the spray drift onto your clothes or skin.

8 Avoid leaks and spills.

9 Dispose of empty containers safely.

10 Wash all exposed skin after work.

The slide kit has been used extensively in both East and West African countries and has been instrumental in promoting a better safety awareness on the part of those involved in hand-held ULV application of cotton insecticides.

PROBLEMS IN EDUCATION ON THE SAFE HANDLING OF PESTICIDES

J.F. COPPLESTONE
Chief, Pesticide Development and Safe Use, Division of Vector Biology and Control, WHO, Geneva, Switzerland

INTRODUCTION

It is a truism to say that the surest way of preventing accidental poisoning by pesticides is by educating those who handle the compounds at all stages from manufacture to final use. While legislation is effective in achieving part of this goal if it is efficiently enforced, education is essential in even the most well regulated countries. However, the fact that, after more than 30 years of widespread use of pesticides, the subject of mode of education is still being discussed, shows that not as much has been achieved in this respect of prevention as might have been expected.

It is of course always easier to define problems than to find solutions, but sometimes failure to reach a goal is due to inadequate definition of problems or restraints so that adaptations of methodology to overcome these are neglected. It is easy to give counsels of perfection, but man is rarely perfect and therefore rarely achieves the level of the counsel. Indeed, his failure to do so may cause him to jettison advice that he should really follow in his own best interests. Therefore the accent must always be on practicability even if this falls theoretically short of perfection.

DEFINITION OF A PESTICIDE

One of the difficulties common to all educational approaches in this field is the definition by chemical class and relative hazard. Fig. 1 shows the distribution of technical products listed in the Guidelines to the WHO Recommended Classification of Pesticides by Hazard (refs. 1,2) according to their classes. The distribution shown is chiefly relevant to manufacture and to a lesser extent to the transportation and formulation of pesticides. For other handling including application, the distribution will be shifted to the right due to dilution factors.

It can be seen that using the word pesticide without qualification is equivalent to using the word transportation which can mean anything from a bicycle or a donkey to a jumbo jet or the ship Queen Elizabeth II. Obviously, education has to be aimed at the safe use of those pesticides in Classes Ia, Ib, and II (defined in Fig. 1) but these constitute only 42 per cent of all the compounds classified. This proportion varies according to the type of pesticide. For example, 86% of

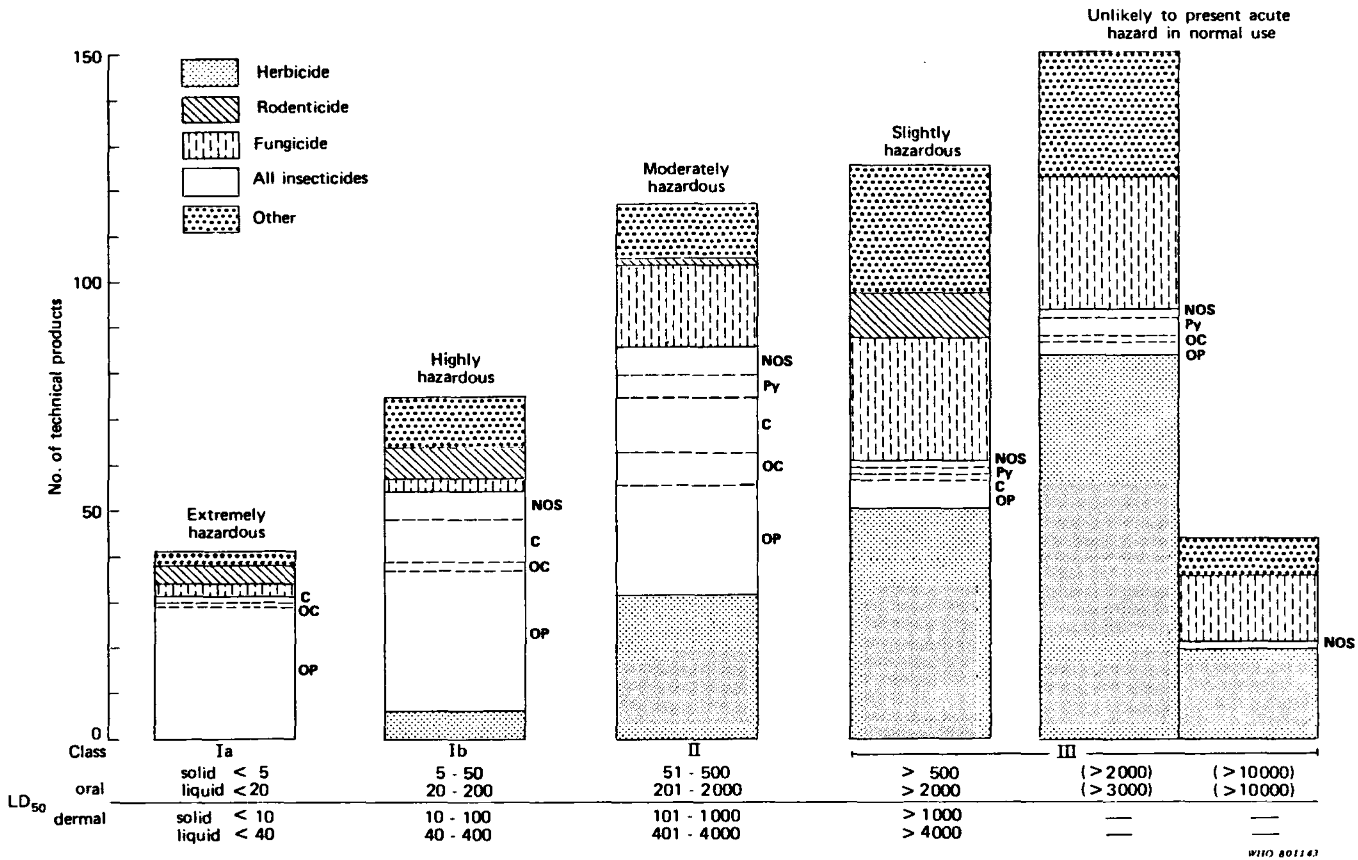

Figure 1 - WHO Recommended Classification of Pesticides by Hazard: Distribution of technical products among hazard classes

For insecticides: OP = organophosphorus
OC = organochlorine
C = carbamate
Py = pyrethroid
NOS = not otherwise specified

insecticides fall into these three higher hazard classes while only 20% of herbicides fall into the same classes. If all pesticides are treated the same way educationally, there seems to be real danger that precautions which are necessary for the higher hazard classes will be neglected with impunity when compounds in the lower hazard classes are used. Precautions may then not be taken when later needed for the application of a more hazardous compound. This is a picture seen in public health operations when men used to applying DDT switch to applying an organophosphorus compound and has given rise to cases of poisoning.

LABELLING

One might say that this eventuality can be prevented by labelling designs, symbols and colours, and this is true to the extent that these designs, etc. are understood by the applicator, even if he is illiterate. Experience has shown that this is not always so.

We are a long way from adoption of an international system of labelling but we must recognise that such a measure would be a valuable educational tool, especially if it was limited only to those compounds whose formulations fall into Classes Ia and Ib. In any case, for the sake of credibility, educators must try to be more specific when talking about pesticides. Perhaps this means that they themselves have to know more about individual compounds in order to know to which hazard class they belong. Continued qualification of the word might have a valuable side effect in educating the public who have been lead to believe that all pesticides present high hazard, even in minute quantities.

MODE OF USE AND EXPOSURE

If the subject matter to be taught is to be practicable, the mode of use has also to be taken into account as this has a profound influence on hazard. It is in this area that we are still very short of a data base on relative exposure hazards on which to base sound educational principles. The subject of pesticide exposure was discussed in detail at the last International Workshop and has been the subject of an excellent book (ref. 3) presenting the conclusions. Therefore, I don't wish to go over this ground again. In the last two years, we have accumulated a small amount of additional exposure data but the sum total is not nearly enough to draw practicable conclusions. However it does seem that there has arisen a much greater interest in this subject which may be productive in the next few years. Particular attention is needed on exposure in tropical areas in order to try to relate minimum acceptable precautions to hazard class.

ATTITUDE AND COMMUNICATION

There are two further problems which merit discussion and may indeed provide the key to successful education. The first of these is attitude and the second is communication. The problems of attitude fall into two parts, the attitude of the trainer and that of the trainee. Frequently, one finds that trainers in this field seem to prefer to show off their own knowledge rather than to ask themselves what is relevant and learnable by the trainee. For example, many courses on the safe use of pesticides include a section on the mode of action of the different chemical classes of insecticides without any real consideration as to whether the educational background of the trainees in any way equips them to understand this. To really understand cholinesterase-inhibition, a background in the structure and function of the autonomic nervous system is necessary - a subject which requires at least high school biology as a basis. However, this understanding is irrelevant so long as the man knows the readily recognizable symptoms and the emergency treatment. In many walks of life we learn important things by rote such as how to drive a car. Before we try and educate people in detail, we have to be sure that they can understand the detail and then ask ourselves how far the detail is necessary in order to achieve the desired end, which is to motivate the trainee to take reasonable and practicable precautions. We are all sometimes guilty of trying to blind our audiences with science and it is a fault we must take care to correct.

In the matter of attitudes, one cannot put all the blame on the trainer. The trainee also has an attitude, more deep seated in most cases, which has to be overcome if he is to be motivated. This can be summed up as 'it won't happen to me'. Here, we are in a quandary, because we cannot achieve much by making people fearful; in any case, it is doubtful if we are acting in anyone's best interests by trying to subdue this almost instinctive feeling which has led men to feats of valour and achievement that are almost unthinkable in the clear light of logic. Motivation may come more effectively from example and from peer acceptance, which illustrates that education is really an everyday practical matter rather than a course of lectures. However, it has to start somewhere and talks are a good starting point so long as the speaker has the respect of his or her audience. In the rather neutral type of atmosphere in which courses on safe use are usually given, this respect can usually only be gained by an obvious involvement on the part of the trainer and by his demonstration that he is fully aware of the practical implications of his counsel and is willing to discuss and justify these.

Finally, it all comes down to communication and we have already discussed some aspects of this with regard to the avoidance of detail which cannot be absorbed. However, difficulties in communication go much deeper because the trainee must be able to identify himself in the situations described if he is to be motivated to act. An obvious essential is that he must be able to understand what is being communicated which may not be all that easy where the language of communication is not his native tongue.

Visual aids of various types are an essential part of communication, growing in importance as the level of literacy or word vocabulary declines. Here too, relevance is necessary to achieve identification: background, racial type, and the actual equipment or technique illustrated have all to be within the knowledge of the person being trained if he is to react to these. It is on these principles that the WHO multilevel course on the Safe Use of Pesticides (ref. 4) has been founded. This modular course only provides a skeleton of instruction which has to be translated and transposed into national terms before it can be used.

An example from this course will suffice to explain the cultural differences that may arise. One module deals with the need for the general public to be excluded for a period from fields sprayed with compounds of moderate or higher toxicity. After consultation with national counterparts, one Arabic version for use in Egypt shows a picture of a notice with words in Arabic and a death's head symbol. In my view, this is of doubtful effectiveness in communities with a low literacy level but no alternatives could be proposed. For the Sudan, a flag suffices, of no definite colour. Apparently this works because the use of such flags as markers for aerial application has lead to an association between the presence of a flag in a field and chemical treatment. Farther west, in Nigeria it is sufficient to hang a palm frond on a string or place it across a path. Apparently this is a mystical sign that an area is out of bounds and is well understood throughout West Africa. Thus a single concept can be pictured in these quite different ways, but these will not become obvious unless nationals are closely involved in the process of formulation of courses. It is also important that they should be allowed to suggest the pictorial treatment; they will sometimes be diffident to do this if the treatment should seem unusual in western terms.

Therefore, to summarize briefly what has been touched on above, in order to overcome some of the difficulties in education in the safe use of pesticides it is necessary to be more precise in approach and in emphasis on where precautions are really needed, to try whenever possible to base training points on fact rather than conjecture, and to relate the whole training to the language, experience and culture of the group being trained.

If these points are logically followed, the result tends to be a rather simplistic form of training which may not take into account all the variants of exposure which may arise; however it is often the attempt to take these into account which gives rise to confusion and to rejection of the advice. An example is the advice frequently given on the need for wearing respirators because with any spray, there may (or will) be some particles of respirable size, even though the hazard may be virtually negligible and the wearing of respirators a practicable and economic impossibility in many tropical countries.

We are all aware of the point of view which regards the quest for absolute safety in pesticide testing as being illogical and frequently counterproductive in terms of human health. We must beware that we are not guilty of the same lack of balance in educational activities. We are more likely to be effective in preventing accidental poisoning by pesticides if we concentrate our activities in relevant terms on those areas where hazard is really high than by trying to give blanket and comprehensive coverage to all pesticide users.

REFERENCES

1 Recommended Classification of Pesticides by Hazard, WHO Chronicle, 29(1975)397-401.
2 Guidelines to the Use of the WHO Recommended Classification of Pesticides by Hazard, WHO unpublished document VBC/78.1 (Rev. 2, 1981)[1].
3 W.F. Tordoir and E.A.H. van Heemstra (Eds.), Proc. Vth International Workshop of the International Association on Occupational Health, The Hague, October 9-11, 1979, Field worker exposure during pesticide application, Elsevier, Amsterdam, 1980.
4 WHO Multilevel Course on the Safe Use of Pesticides: Course Manual, unpublished document VBC/78.7; Establishment Manual, unpublished document VBC/80.1[2].

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[1]Obtainable on request without charge from Pesticide Development and Safe Use Unit, Division of Vector Biology and Control, WHO, CH 1211, Geneva 27, Switzerland.

[2]Copies of these documents are available only to those actively interested in adapting them to national courses: applications should be made to the above address.

PREVENTION OF ACCIDENTS FROM PESTICIDE APPLICATION IN PARAGUAY

STELLA M. BARRIOS GUANES
National Institute of Technology and Standards, Asunción, Paraguay

INTRODUCTION

The geographical situation of Paraguay, situated in a subtropical zone with high temperatures and intense rains most of the year, results in an environment that is favourable for the growth of all kinds of pests which are harmful to agriculture as well as to human health. This necessitates the permanent use of chemicals to control these pests. Moreover, the high rate of agricultural development at commercial level demands the use of greater and greater amounts of such chemicals, with the subsequent ecological and sanitary impacts.

In fact, the use of pesticide in Paraguay has as main targets the promotion of agriculture and human health. The commercial products are organo-chlorinated and -phosphorous compounds, carbamates, phenoxyacetic acid-derivatives, pyrethroids and copper- and mercury-compounds. Officially these products must be registered in a Register at the Ministry of Agriculture and Livestock, and each agency must present a list of products and the total amount imported every year. At the marketplace, however, no control is exercised and the sale is completely free of restriction.

These agencies supply with their products brochures explaining the use of the pesticides; their technical staff usually organize demonstrative applications and, from time to time, training courses for interested people from all levels.

APPLICATION IN AGRICULTURE

There is neither a single law that embodies the whole pesticide use in agriculture, nor a single department responsible for this specific subject, but many national programs exist for the main commodities of the country, as for instance, tobacco, cotton, corn, wheat and soybeans, having each their own laws and regulations in an individual way.

Some checks are carried out on exportation lots, but they are not systematically done and do not extend to the domestic consumption products.

Since the application, in general, is carried out by the farmers the Ministry of Agriculture has created an Agricultural Extension Service (SEAG), distributed all over the country. This Service works directly with the farmers, assisting them in their needs and providing training in the effective and efficient use of pesticides.

Besides the Ministry distributes free of charge an Instruction Manual illustrating the use of pesticides and a First Aid Appendix for cases of poisoning. This Ministry also has a Research Department that looks for the best conditions within each Program, adapting to each particular case the instructions given by the agencies. This Department organizes training courses and provides the recommendations to the staff of each program involved in the pesticide treatment. But it doesn't deal with further checks, leaving the responsibility to the farmer.

APPLICATION IN PUBLIC HEALTH

In the field of public health a single legal system does not exist. The Ministry of Public Health does not have a specific Department on this subject, but there are many Divisions which are closely involved in the application of pesticides and these establish the respective regulations.

National Service of Malaria Eradication (SENEPA)

In order to prevent endemical diseases, such as malaria and Chagas disease, this Service carries out intensive treatments in a systematic way all over the country with DDT, malathion and Sumithion, especially on the most dangerous zones, such as exist near some borders. The actual use of DDT is approximately 100,000 kg a year.

The staff members of these operations, at all levels, get sufficient education to achieve high qualifications, as well in technical matters as in responsible behaviour. After the annual vacations they receive again an additional training to ensure their efficiency.

Personnel of high and middle level attend international courses and the technicians attend courses in the country every year; for this purpose the country is divided in four big zones. The aim of these courses is to update their knowledge and understanding of methodology and spray techniques in a continuous way.

The control of the operations is carried out through the program's structure itself, in which beforehand the levels, time and frequency of the controls and supervision in the field are determined. There are nine different levels of technical, administrative and operational personnel at the lowest stage. The spray team is composed of 90 operators. In addition, there is an Instruction Manual which contains all the details on exposition time of the operator, on equipment maintenance and on the obligations and rights of the personnel involved.

In case of accidents, the necessary materials and antidotes are available. Each supervisor, at all levels, is able to render First Aid.

In order to prevent chronic poisoning the cholinesterase level in blood is periodically checked in sprayers and handlers. When a dangerously low cholinesterase level is detected the affected operator is suspended from his job. This check is carried out by a simple colorimetric test, with a portable photometer provided by the central office. As is shown, this Service really promotes the health protection of the workers.

National Service of Environmental Sanitation (SENASA)

In practice this Service of the Ministry of Public Health is the Division that defines the necessary rules to prevent accidents from the use of pesticides, especially in the area of cities. Its function is not specific for pesticides only, but for the environmental protection in general.

Courses are periodically held to train urban fumigators, teaching them all the details how to operate and also discussing all their individual problems. These fumigators spray houses and stores within the city and they must be registered in a Register at the Ministry of Public Health.

In the country-side pesticide usages are not controlled systematically, but if a potential problem is reported, the inspectors make a visit. If it is confirmed that a dangerous situation really exists, people are notified of that risk and the necessary steps are taken to avoid poisoning of humans as well as of animals.

Actually a Bill exists that embodies the use, handling and marketing of pesticides, stating the obligatory supervision by skilled professionals.

NATIONAL INSTITUTE OF TECHNOLOGY AND STANDARDS (INTN)

In the industrial sector, the Ministry of Industry and Trade has entrusted to the INTN the set up of a specialized laboratory, as well in equipment as in personnel, to cover the analytical aspects of the use of pesticides offering its service to the public and private sectors.

This laboratory established a specific program to support analyses in the following cases:

1 Formulated commercial pesticide products. Analyses are requested by:

a) official institutions before the distribution to the farmers for the different development programs at national level;

b) the farmers in cases of technical problems, for instance by pest resistance.

2 Residues in food. The INTN has a national program for the control of chlorinated pesticide residues in export meat. This program is carried out according to a standard procedure, which is drawn up and applied by the INTN. It implies an annual activity, and the results are sent to the Ministry of Agriculture and Livestock for the offical proceedings. The INTN laboratory is approved by other Governments, for instance the USA.

Other programs exist in the Ministry of Agriculture, such as for export tobacco in which the INTN is participating.

In the private sector, there are enterprises that use the INTN services.

This laboratory also serves in accidental poisoning cases, by determining or confirming the presence of a specific pesticide in food or in biological material.

3 Research. The INTN also carries out a program to determine the contamination of water in the main agricultural regions of the country, especially by chlorinated pesticides, in order to keep control of contamination.

ACKNOWLEDGEMENT: I appreciate very much the collaboration of officers from the Ministries of Agriculture and Public Health, especially from SENEPA and SENASA, for providing me with the necessary information.

SAFE USE OF PESTICIDES IN URUGUAY

J. PRONCZUK de GARBINO
C.I.A.T. (Centro de Información y Asesoramiento Toxicológico), Hospital de Clínicas, Montevideo, Uruguay

ABSTRACT

Uruguay is an agricultural country and the use of pesticides is extensive resulting in high risks of poisoning. This has promoted the creation of a Poison Control Center (C.I.A.T.); its abilities allowing an important action in the field of agrochemical products.

25% of the total consultations received originate from organo-phosphate and organo-chlorinated insecticides, carbamates, thallium salts, arsenicals and other less common pesticides.

In spite of its short existence and difficulties encountered the C.I.A.T. is able to:

- collect statistical data;
- centralize the available information on pesticides;
- provide information for the appropriate treatment of poisonings;
- maintain a bank of antidotes;
- classify pesticides according to their toxicity with the possibility of denying registration;
- promote the multidisciplinary study of pesticides;
- participate in the education of safe use of pesticides.

It is the aim of the center to maintain and increase all these activities, and especially to promote proper instruction on pesticides at different levels as this will help the preservation of human life and environment.

INTRODUCTION

Safe use of pesticides is in principle the occupation of official and private agencies, but the Center of Toxicological Information and Advice (C.I.A.T.) feels a great responsibility for this subject.

The beginning and development of Clinical Toxicology in Uruguay has been closely related to poisoning by pesticides. The physician from the Emergency Room used to know how to manage a poisoning by drugs thanks to his clinical experience and knowledge of pharmacology, but faced with a case of pesticide poisoning he would feel frightened by his ignorance of the product, its toxicity and the adequate treatment. In our country, being essentially agricultural (the rural population is 17%) a high incidence of poisoning by agrochemical products is possible. However, statistically reliable data do not exist.

In 1975 the Poison Control Center was created by the Dean of the Medical School. Its first purpose was to collect, organize and study all the available information on pesticides. This was accomplished by a group of physicians that started the study of toxicology and became the guide for colleagues and members of the public faced with poisonings. The C.I.A.T. functions in the university hospital (Hospital de Clínicas) and is not only an information center but has also an educational role and it even participates in the control of pesticides.

POISONING BY PESTICIDES

The number of telephone calls or personal consultations has been around 8.500 in five years, and pesticides were the first cause during the first two years. Thereafter, psychoactive drugs took the first place by a minimal difference; agrochemical products still induce around 25% of all consultations. Few are real poisonings, but on the other hand we know that many cases do not reach our center, especially those that occur in the remote countryside, where risks are ignored and medical assistance is not sought.

The pesticides most frequently involved are (ref. 1):

1 organo-phosphates (40%)

2 chlorinated hydrocarbons (30%)

3 carbamates (12%)

4 thallium sulphate (10%)

5 arsenic compounds (2%).

Organo-phosphate pesticides were first introduced around 1943 and from then on their utilization has increased. 40% of all consultations due to pesticides are caused by these products. Poisonings are usually accidental, secondly intentional, and in a small percentage they are occupational. Some cases of homicide were due to mevinphos (Phosdrin), after which the manufacturer himself stopped its commercialization. Clinical cases might be severe, especially in suicide attempts which are usually fatal. C.I.A.T. recommends the classical treatment with atrophine sulphate and enzymatic reactivators that are provided by the center. The only specific laboratory determination is the determination of cholinesterase activity by colorimetric methods. We encourage preventive determinations in exposed workers but few places have the facilities to do it regularly, particularly in the countryside. Pilots and other aircrew in charge of aerial spraying will be examined by the Poison Control Center during this year.

Chlorinated hydrocarbon pesticides follow in frequency (30%). Poisonings are usually accidental. Many deaths, especially among children, have been due to contaminated food by mistaking the products for flour or baking powder. Suicide attempts are not rare. Occupational accidents have a low frequency. Patients are treated symptomatically and in some cases organochlorine levels in blood have been determined.

In 1979 a comparative study of occupationally exposed and unexposed populations was done. It showed in both groups higher organochlorine blood levels than those reported in other countries. This discovery prompted us to investigate the cause. It appeared to be, logically, the wrong and unsafe use of the compounds. Unknown quantities of pesticides are illegally imported resulting in uncontrolled applications of excessive amounts because the small cultivators are afraid of loosing their crops. We even know that sometimes treated seed intended for culture has been consumed. In the new legislation on pesticides, special consideration has been given to these aspects.

Carbamate insecticides represent 12% of all consultations on pesticides. Accidents are the most frequent cause, followed by intentional ingestion and occupational exposure. Clinical cases are not severe. The recommended treatment is atropine sulphate. Laboratory determinations are not available. According to our statistics, poisoning by carbamates does not represent a real menace.

Thallium sulphate is nowadays the fourth cause for consulting the C.I.A.T. on pesticides, but it used to be the first one. For example, in 1976 it accounted for 10% of all consultations and 34.5% of those on pesticides. In 1980 the last percentage fell to 10% thanks to a decree that banned its use. This rodenticide became very popular for suicide attempts among young women. Accidental poisonings were more frequent than intentional poisonings, but the clinical picture is mild or even asymptomatic. Only attempted suicides or homicides produce the typical digestive symptoms, alopecia and polyneuritis, whilst carditis and encephalitis are less common. Only the qualitative colorimetric method for thallium detection in urine is available so far. Quantitative determinations will be possible in a few months. In most cases the treatment has been symptomatic. Dithizone has been abandoned and Prussian Blue is not available yet. In 1979 the Ministry of Public Health has banned thallium sulphate but poisonings still occur with the remaining rodenticide.

Arsenic poisonings are not very frequent but always severe. Lethality is around 60%, and in case of survival neurological sequelae are the rule. Although these products are strictly controlled under the new legislation, great quantities of arsenic tri-oxide are still to be found on farms and ranches. Sodium arsenite is being used as fungicide and other arsenicals are used in the leather industry, but occupational poisonings are rare. According to the statistics from C.I.A.T. 90% of arsenic poisonings were due to suicide attempts. The treatment consists of supportive measures and BAL. Detection of arsenic is done in the laboratory of the Center but quantitative determinations are only obtained through the forensic laboratories of the Police.

Other pesticides are being used in the country, but their incidence or importance of poisonings is much lower. Paraquat should be mentioned due to its enormous danger when ingested. The total amount of product imported in 1980 was around 11.000 liters but only one case of poisoning is known: a suicide attempt followed by death after 6 days.

This short review gives a general idea on the characteristics of poisonings by pesticides in Uruguay. More detailed studies are being done in order to evaluate the national situation in this aspect.

ROLE OF THE POISON CONTROL CENTER

We consider that our "history" of the toxicology of pesticides goes back only five years: it starts with the inauguration of C.I.A.T. Before 1975 no reliable data were available on the subject. The only information on compounds and treatments were some old posters hanging in the Emergency Room or the advice of the Dean of the Medical School, a professor with a strong toxicological vocation. Our experience has been short in time but our activity has been productive in spite of the difficulties encountered. Fortunately, the Poison Control Center has good possibilities in performing an effective educational and regulatory task. This is due to the fact that it is unique and national. Besides, it belongs to a small country, where inter-relationships between governmental authorities and agencies are facilitated. For example, in the case of thallium rodenticides C.I.A.T. succeeded in having the product banned after a request to the Ministry of Public Health.

Another example was the prohibition to publish suicides by poisons in the newspapers, because it was observed that they were followed by small "epidemics" of intentional poisonings (as happened with parathion). But on other occasions it is not so easy. Pesticides used at home (as well as household products) are under a very old and vague legislation where responsibilities are not well defined. This confronts the Poison Control Center with cases where the pesticide is a completely unknown substance. For example: many insecticides sold in small groceries, especially in the outskirts of the city, have a "mysterious" composition and manufacturers are never found. Only the pesticides registered at the Ministry of Agriculture are correctly labelled with a specification of the components, first-aid measures and the telephone number of C.I.A.T. Other products for which registration is applied in other official agencies escape this norm, as is the case with veterinary products. Lack of human and of material resources are the cause of insufficient supervision, as for example in fumigation enterprises.

The Poison Control Center is conscious of the consequences of the vague regulations and the scanty supervision. Solutions are being considered, such as a new regulation concerning registration and control of household and veterinary pesticides.

With regard to agriculture the situation is fortunately different. On March 1977 a legal decree was approved for the registration, control and sale of agricultural pesticides (ref. 2). It consists of 61 articles that establish among other requirements the obligatory registration of all these products, proper labelling and packaging, correct use of the products, appropriate information and warnings for workers.

C.I.A.T. has been included in the decree with a specific role. Each manufacturer or importer provides the Center with scientific information on their products. The information is studied and the products are classified according to the toxicity scale of C.P.N.T. (*) in collaboration with agronomists. The Center is even allowed to deny registration of extremely toxic pesticides.

A new measure introduced with this regulation is the controlled sale of extremely hazardous pesticides (Class 1). In effect, they can only be purchased under presentation of a prescription issued by an agronomist. In this way, the most dangerous compounds will be only accessible to workers or employers with an educational level enabling the understanding of labels, of instructions for safe use and of first-aid measures. Out of 460 registered agrochemical pesticides 52 are sold under control and they include: aluminiumphosphide, cyanides, mercurial salts, arsenicals, methyl bromide and certain organophosphate and organochlorinated insecticides.

Manufacturers and importers are also obliged to distribute brochures and illustrated posters on correct handling of Class 1 pesticides for workers and supervisors. Technical material has to be supplied for the agronomists as well as toxicological information for physicians. The Poison Control Center supervises all printed material.

The new decree has only been in force one year but it has already proved to be effective, although some difficulties have been encountered.

(*) Comisión Panamericana de Normas Téchnicas (1973)

In the first place, legal supervision is not sufficient. For example, unscrupulous or ignorant grocers sell all kinds of pesticides in small quantities, in totally inappropriate containers and without labelling.

In the second place, the controlled sale of very dangerous agrochemical products (Class 1) does not work in some aspects, because too many prescriptions are being issued with no real supervision.

In the third place, the accepted toxicity scale is sometimes controversial. Some formulations require very detailed studies for classification. In practice, final agreement is reached in a multidisciplinary group discussion. The need for more specification in the toxicity scales has been recognized.

Finally, the new decree does not include regulations on the transportation of pesticides, nor on the disposal of surplus products.

So, in some aspects the regulation might seem incomplete, but it has to be considered as a first step towards an organized and adequate control of pesticides. As clinical toxicologists we are proud of the recognition that our Poison Control Center has received.

C.I.A.T. has also assumed an educational role. Besides the information given on request of any inquirer, educational courses on the risks of pesticides have been organized at different levels.

Training of professionals

Physicians in practice can assist in continuing education programs where clinical and therapeutical aspects of poisonings by pesticides are considered. Agronomists are usually invited in order to give a more complete idea on the use of pesticides and circumstances of exposure.

The post-graduate specialization in Rural Medicine and Occupational Medicine includes a complete study of poisoning by pesticides and its prevention.

During curricular studies, medical students have some courses on toxicology with special emphasis on agrochemical products.

As we see, opportunities are being offered to the medical profession for estimating the danger of pesticides for obtaining a therapeutically oriented training and for learning the safe use of pesticides as preventive medicine.

Meetings on the safe use of pesticides are organized almost every year under the sponsorship of the university, FAO and WHO. Veterinarians, chemists, physicians, agronomists and representatives from governmental agencies, private industry and C.I.A.T. participate. These meetings provide a good opportunity for the exchange of ideas and the increase of knowledge.

Training of workers

The Poison Control Center participates in courses held by the Ministry of

Agriculture for the education and information of those involved in handling of pesticides. Instructions on storage, mixing, application, clean-up and disposal of empty containers are given by agronomists. Physicians explain the risks of poisoning, the recognition of clinical symptoms and the first-aid measures. This is done with audiovisual devices and a language adapted to the educational background of trainees.

These courses have been welcomed by workers, but in practice after a certain time they sometimes neglect the use of protective equipment, the rigorous personal hygiene or the safe handling. The only solution is to hold the courses regularly and as frequently as possible. We feel that the best way to teach is not only to explain but to repeat.

Training on the safe use of pesticides has been accessible to workers from governmental agencies as well as farmers, to independent rural workers and to people not directly involved in pest control operations.

It is the aim of our Center to continue in participating in these courses and to promote their extension.

Training of the public

In training of the public, little has been done so far, but C.I.A.T. understands that its importance justifies a vigorous effort. The chemical era has come too fast encountering an unprepared population. This has a special significance in underdeveloped countries, where education is insufficient and risks of heavily used pesticides are underestimated or ignored.

Uruguay has a particularly good educational level - illiteracy is around 8% - so recognition and understanding of toxicology can be achieved with relative ease.

Upon request of the Ministry of Public Health, C.I.A.T. has prepared short communications on prevention of poisoning by pesticides and on safe use of domestic pesticides. They were broadcasted through radio and TV with good acceptance by the citizens. Mass media are the best and most suitable way for the dissemination of safety messages and they should be exploited for the training of the public.

One of this year's objectives is the distribution of printed information on dangerous substances in the household. It will be sent to every home from where a case of poisoning has been reported to our Center. Since a great number of victims are children, the brochures will explain to the mothers how to "poison-proof" the home, how to use and store poisonous products and what should and should not be done in case of an accident. The language will be simple and illustrations attractive in order to call attention and arouse interest.

Broader objectives are being considered for the future. Educational campaigns should be promoted. Reasonable coverage of toxicology could be a part of the science textbooks of elementary and high schools. Teachers could be trained in how to train children in recognition and avoidance of poisons.

Accidents will not be stopped, but the misuse of pesticides and other poisonous products will be reduced.

Safe use of pesticides is necessary for the protection of human life, but the environment should also be protected. This is usually known but neglected in countries where the whole economy depends on the land and logically on pesticides. It has even been said that environmental protection is a luxury afforded by economically rich potencies...

In practice, the enforcement of correct management of pesticides protects the natural environment, but ecological risks should be explained to workers and the public.

In Uruguay no important ecological problems have been encountered so far, but the danger might exist. There is an official commission (*) for the study of environmental risks, and a few months ago the Society of Toxicology and Ecotoxicology was established. Both organizations have a close relationship with the Poison Control Center and they are aware of what the uncontrolled use of pesticides might cause in the environment.

On the other hand, the new regulation on pesticides covers ecological protection in some way. Manufacturers and importers are obliged to provide complete information on ecological risks when applying for registration. Labels specify the correct amounts of product to use, the appropriate applications and instructions for the disposal of containers. But this is not sufficient, as more information should be given to those involved in pest-control operations.

From what has been said, it is evident that the Poison Control Center has good possibilities of promoting the safe use of pesticides. A proper attitude towards safety will result from a multidisciplinary and cooperative approach to the problems. Support and close collaboration of ministerial authorities, national organizations and commercial enterprises are of great importance for a better fulfilment of our objectives.

REFERENCES

1 C.I.A.T., Estadísticas anuales 1975-1980, Montevideo
2 Ministerio de Agricultura y Pesca, Dirección de Sanidad Vegetal, Decreto 149/66 del 15/3/77, Reglamentación para el registro, contralor y venta de plaguicidas de uso agrícola, Montevideo

(*) Comisión Nacional de Control y Preservación del Medio Ambiente

EDUCATION OF PESTICIDE APPLICATORS IN THE STATE OF RIO GRANDE DO SUL, BRAZIL

A. FURTADO RAHDE
Brazilian Drug and Poison Information System, Porto Alegre, Brazil

ABSTRACT

Education of pesticide applicators in the South of Brazil is very limited. The applicator is usually a poor and illiterate rural worker, means of communications are inefficient and the State is a large territory.

There are many educational institutions with similar goals but they develop tneir programs separately and do not coordenate as it should be. Consequently, scattered and poor results are obtained.

CHARACTERISTICS OF THE STATE OF RIO GRANDE DO SUL, BRAZIL

General information

The State of Rio Grande do Sul is the region with the most agricultural tradition of Brazil. Located in the southern region of the country it has a climate suitable for almost every type of crop, the principal ones being wheat, soyabeans, rice, grapes, corn, tobacco and beans.

The total area of the state is 26,752,800 ha. Its population is near 8 million inhabitants. The majority of the rural property owners have small farms. However, these are mostly truck farms which provide the fruits and vegetables for the local market.

There are 459,371 rural properties with a total area of 21,730,679 ha. Of this total there are 450,700 individual property owners with an area of 18,364,184 ha. The remainder of the properties are in joint or corporate ownership.

There are 166,306 small rural properties of less than 10 ha in size, occupying 837,932 ha. However, this number would be around 200 thousand if one considers the large proportion of rural properties that are not officially registered. The number of property owners from 10 to 50 ha is 284,643 comprising a total area of almost 6 million ha.

At present the medium size of these small farms is 4.6 ha and the medium size of the 10 to 50 ha farms does not reach 20.6 ha.

Principal crops

The principal crops and related data are presented in Table 1.

TABLE 1

Principal crops, number of properties, planted area and annual harvest data

type of crop	number of properties	area planted ha	annual harvest, metric tons
wheat	158,127	1,919,992,9	1,610,689
soybeans	193,017	2,040,311,9	1,706,372
rice	34,085	356,074,5	979,704
corn	333,144	1,793,307,4	1,825,477
grapes	22,580	34,685,4	284,779
tobacco	26,001	55,493,9	56,658
beans	66,692	143,015,1	101,472
others	-	163,417,7	-

RURAL FARM ASSISTANCE ORGANISATIONS

Rural farm assistance is offered depending on the type of agricultural activity, on matters of health, economy, environment and the agricultural sciences (agronomists and technicians).

The people who apply the pesticides are directly involved in agriculture. They can be self-employed which counts for the great majority or it can be someone who works for the agricultural cooperatives or other related companies (Fig. 1).

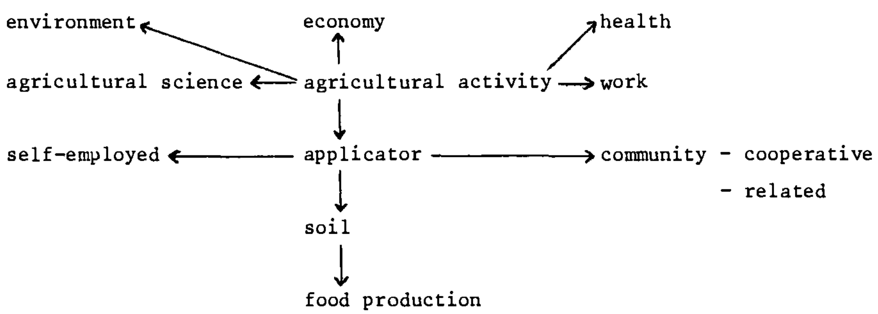

Fig. 1. Aspects of rural farm assistance.

Association of Enterprises for the Technical Assistance and Rural Development of Rio Grande do Sul (EMATER)

EMATER is a department of the Ministry of Agriculture and connected to the State Secretary of Agriculture.

EMATER is initiating an action plan for the agricultural year 1980/1981, in which courses will be offered to agricultural engineers and technicans to prepare them for instructing others in the use pesticides. Also courses will be offered to the farmers. All courses will have a basic theme except those for agricultural engineers and technicians which will be specialized ones. The courses for the farmers will be less technical and will be based on a day-to-day activity.

The teaching aids will include slides, films, brochures, manuals, spray equipments, protection masks, etc. Besides, practical demonstrations of safety equipment will be given and actual cases of pesticide poisoning will be described. The important role of the person who applies the pesticides will also be explained to the farmers. Furthermore, information will be given about legal requirements, types of pesticides, classes of pesticides, formulas, toxicity, routes of absorption, classification of pesticides according to toxicity, residues, tolerance, etc. Other subjects will be the principles of insect control, use of the proper spray equipment and first aid. Also, the proper storage of pesticides and cleaning of the spray equipment will be taught.

Since the farmers normally have poor personal hygiene habits, EMATER is concerned with teaching them basic rules such as taking a shower and changing clothes after applying pesticides, and also the rules of proper application are emphasized. Examples: farmers will be asked not to spray pesticides on windy days, not to smoke, drink or eat during the application. EMATER recognizes that one of the biggest problems is to convince the farmer to get used to the safety equipment (overalls, masks, gloves, etc...).

EMATER is in the process of publishing an application manual which will include methods of protection, spray equipment maintenance, rules of application and other subjects. At present the farmers are being stimulated to keep a notebook of pesticide usage. Consequently, before applying the pesticide, the farmer has to read the product directions and to take note of the name, the antidote, the dose, the insect to be killed and so forth. Then if an accident occurs, the person who aids the victim will know what to tell the doctor.

It is important to consider the type of work being developed by EMATER; it is reflected by the profile of the pesticide applicator. Usually he is an agricultural worker, but there are also people who use pesticides who are small farmers and others with large farms. The latter use modern farming equipment, including combines and airplanes. Normally the large property owners are the most interested in the latest techniques and use of pesticides.

In general an agricultural worker, is chosed by the farm owner for his higher degree of education and knowledge of operating farm machinery. When a high rate of insect infestation occurs the farm workers have to work around the clock applying pesticides because they don't know the adequate techniques for prevention.

Key objectives by EMATER for the year 1980/1981 include:

- courses coinciding with the occurrence of pests
- continuing assistance for the principal crops (wheat - soybeans)
- complete orientation of the farmers on pesticide application
- training courses for skilled workers
- increase the number of qualified operators
- one or more courses in each city EMATER has a field office

- credit facilities for insecticides chosed by EMATER
- lectures by local doctors regarding pesticide poisoning.

According to EMATER, the present situation of the use of pesticides is critical because:

- the farmers do not know how to use the machinery
- lack of assistance to the farmer who does not know how to choose the best product
- the use of large volumes of pesticide
- production of highly toxic products and unscrupulous businessmen.

National Foundation for Safety, Health and Occupational Medicine (FUNDACENTRO)

This Foundation is a department in the Department of Labor, with its headquarters in Porto Alegre, capital of the State of Rio Grande do Sul. It offers courses wherever solicited including courses regarding prevention of accidents in the farms. The majority of training is intended for agricultural engineers and technicians, because these people will instruct others. Although specific courses for the use of pesticides are not offered for lack of infrastructure, preventive rules on pesticides application are given.

A specific manual for the application of pesticides will be distributed among departments (cooperatives, education branches, rural schools, etc...) according to the programs to be developed.

The cooperatives have a greater capability of distribution of teaching manuals because they work directly with agronomists and farmers.

During these courses one of the most difficult things is to convince the farmer of the necessity of wearing protective equipment because of lack of assistance to the farmers and his low level of education. For example, when he sees an insect, he sprays all the crop indiscriminately without knowing if this insect is really harmful, whether he is using the right product or whether the insect is attacking the whole crop and so forth. Thus, the technicians of FUNDACENTRO believe in the urgent need for agricultural manual instructions for the use and control of the product, the quantity to be used and the selection of the right people as applicators.

FUNDACENTRO is promoting a national campaign of security and occupational rural health in order to prevent and avoid work accidents in the whole area of Brazil. This campaign is being carried out in all areas of the country and has shown promising results.

The population reached in this campaign is the following:

- number of instructors, auxillary instructors and trained staff: 16,474
- number of participants of rural schools: 1,439,881
- number of rural teachers: 64,223
- number of people who participated in the symposiums, seminars and meetings: 2,089

- trained people from the rural communities (producers, property owners, workers and rural administrators): 2,104,497
- total of participants: 3,627,164

The number of participating units of the Federation is 25 with 2,936 municipal units and 47,519 rural schools.

The number of training aids distributed to date is approximately 1,594,000.

Brazilian Cooperatives Federation for Wheat and Soybeans (FECOTRIGO)

FECOTRIGO is a private organization. It has a committee for research and technical assistance. The research section is experimenting with pesticides to determine which are the less toxic, leaving smaller residues, are more efficient and more economical. FECOTRIGO has training courses once or twice a year for technical people. This training is based on their bulletin "Wheat and Soybeans".

Training or courses for farmers are given from time to time. Additionally, FECOTRIGO provides manuals for use of pesticides, information bulletins, demonstrations in use of airplanes for applying pesticides, audio-visuals, etc. They also publish a magazine "Agriculture and Cooperatives" which has a subscription list of approximately 15,000 people and is written in a manner readily understood by the farmer. FECOTRIGO only advocates the use of pesticides as a last resource and this is one of the ideas transmitted to the farmer.

In respect to this idea, FECOTRIGO has published a small booklet - "Producer keep an eye on the soybeans - you can control the insects". The method outlined in the booklet is to determine the population of the insects and the amount of damage done, the periods when the insects appear and the ability of the soybeans to recover; the idea being to aid the farmer in his decision whether to use insecticides or not. Also the booklet advises the farmer to seek the assistance of an agronomist to help him in the correct usage of pesticides. Where farmers are using this method, the number of applications has decreased from 5 or more times per season to one or two.

In 1978, a manual "Adequate use of pesticides" was circulated as the center section of agricultural magazines, as part of a training series. In 1979, some cooperatives offered courses for technicians and farmers on the use of pesticides. Moreover the 68 cooperatives connected to FECOTRIGO have the disposal of all sets of audiovisuals. Some of the cooperatives have periodicals that teach how to prevent accidents. In 1978 FECOTRIGO offered intensive training courses for the technicians who work in the State of Rio Grande do Sul. They showed the producer that a gradual decrease in the quantity of pesticides used is not only necessary but also possible.

For this purpose the institution developed a program of dealing with soybean caterpillar, with the following observations:

- the soybean itself copes exceptionally well with the damage caused by the insects to its foliage;

- a small number of leaf insects is not harmful to soybean production;
- tne natural enemies generally present in the crops help greatly to control the insect growth under the level of economic damage;
- the average number of pesticide applications in the soybean can be drastically reduced, thus contributing to less environmental pollution, to cost reduction and to reduction of toxic hazards.

Workers' Agricultural Federation of the State of Rio Grande do Sul (FETAG)

This is a department connected to the Ministry of Labor. There are 227 syndicates of rural workers grouped in 19 regional locations. FETAG looks after all the 650 thousand syndicate members. One of FETAG goals is to prevent the indiscriminate use of pesticides since one of their biggest concern is the farmers' health.

FETAG has 40 agricultural technicians. They work in cooperation with the State Agricultural Department and try to make the farmers aware of the proper use of pesticides and its adequate application.

Syndicate leaders take training courses on the same subject and they instruct others using teaching aids such as: blackboards, illustrated lectures, posters and so forth. When FETAG works in association with other institutions it uses the material available in these institutions. It also develops a program based on the day-to-day life of people. For instance, during the lectures the technicians ask the audience if they know any case of pesticide poisoning in their own family or tne neighbor's family. Based on their answers, the technicians choose the subjects to be discussed in the meeting. They always emphasize the non - use of pesticides and also the need for the farmer to use protective equipment, to spray the pesticides directly on the focus, not to go back into the crops after the application, etc...

In spite of all instructions and preventive campaigns, when an insect infestation occurs the farmer generally uses pesticides indiscriminately. This happens because pesticides are available in any store on the road and are also freely sold.

However, there are places that could be considered as developed in this respect because local people are very concerned with the proper use of pesticides. When there is something wrong, these people take their problems to the syndicate leaders and, if necessary, they go to higher authorities in search of solutions. In some regions, some farmers prefer not to use pesticides at all to avoid poisoning.

Lately the farmers have used less of the credit facilities because the UBC (Basic Value of Cost) is increasing. So , they are planting less but in return are using less pesticides. Also they are running less risks of having accidents, for, as it was stated previously, the purchase of pesticides is included in the loan.

National Association of Pesticide Producers (ANDEF)

This Association was established in 1975, in São Paulo; with the following policy:

a) to promote the improvement of techniques, the industrialization and also the synthesis of raw materials, the commercialization and distribution of pesticides in Brazil;

b) to assist its members in their common interests;

c) to make their know-how available to the Federal Union States and counties. Also to autonomous institutions, mixed economy societies, group associations, cooperatives and general private enterprises;

d) to keep good relationship and to establish fruitful agreements with both private and public institutions that have a common interest in Agriculture, primarily those connected to industrialization and commercialization of pesticides in Brazil;

e) to make the population in general conscious of the proper use of pesticides;

f) to cooperate with official departments aiming at the same purpose.

The relationship between industry and farmers has developed as follows:

- providing the producer with all possible technical assistance whether in the first use of a new product or in new application techniques;
- total cooperation with the farmer, that is, making use of the farmer's own property for trying out new products, new formulations or new methods;
- utilising the farmer's property to demonstrate the experiences with and the results of these new products, formulations or know-how;
- promoting technical meetings for the producers in order to stimulate their productivity and profits;
- keeping constant and up-to-date communication by delivering the farmers technical publications and promotional brochures about subjects of their own interest.

ANDEF has already promoted three campaigns about the proper use of pesticides in the State of São Paulo, Paraná, Rio Grande do Sul, Minas Gerais and Pernambuco. In these activities hundreds of technicians were involved, official and private ones, and in the first phase more than 100,000 pesticide users were reached.

The educational campaigns were carried out by agricultural technicians from official departments of the rural development. These people were specially trained to instruct people on the most adequate use of pesticides. The community was also benefited by these campaigns. There were lectures about the subject, slide demonstrations at the local schools, non-profit organizations and other institutions.

In addition to these campaigns programs about the same subject were broadcasted on TV and radio; brochures, magazines and posters were distributed among the local people.

Together with ANDEF's normal schedule a big national campaign is being planned for the year 1981, involving courses for professionals (physicians and agronomists) in the proper use of safety pesticide equipment and environmental protection.*

CRITICAL EVALUATION OF RESULTS

EMATER

At present EMATER is promoting a campaign on the proper use of pesticides. This activity aims for long term results since its line of action is neither intensive nor continuous and it will not reach the whole population. It is a department that deals with other activities besides pesticides. It has a large influence on the population for it gives assistance to 198 counties of the State of Rio Grande do Sul. It emphasizes teaching by the agronomists because EMATER considers them as means of constant communication between rural workers and institution. Results so far have been satisfactory. One example of this is the distribution of teaching materials to the farmers.

FUNDACENTRO

It directs its work mainly at the prevention of work accidents. It gives the farmers directions of how to protect themselves when using pesticides. Also, it teaches them how to use the products, their proper storage and first aid when poisoning occurs. It is a department that depends on the action of others and as such it establishes programs with cooperatives, syndicates, schools and both private and public institutions.

FECOTRIGO

It is a federation of cooperatives and its line of action reaches the farmer directly. At present it is developing a satisfactory program on the rational and

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*Use of airplanes for applying pesticides

This work is done cooperatively by the Agricultural and Air Force Departments of Brazil. There is no need for the pilot pesticide applicator to be connected with the Department of Agriculture. In the State of Rio Grande do Sul 28 enterprises offer this sort of service; 50% of this total is registered in the Department of Agriculture. The remaining 50% is only filed as pesticide applicator. There are 100 airplanes for applying pesticides in the State of Rio Grande do Sul. Eight cooperatives offer plane service to their members. In addition, there are other enterprises from other states that render this kind of service from time to time to Rio Grande do Sul.

The State Agricultural Department has an Aerial Patrol that also offers the same kind of work.

It should be pointed out that pesticide spraying is sometimes carried out by private airplane owners. To own a private airplane the farmer must have a property of at least 3 thousand ha. and he is only permitted to operate over his own land. Since the registration of such planes is not compulsory, it is difficult to keep track of it; official checking is almost impossible. To be an agricultural airplane pilot, the candidate must be licensed as commercial pilot first with 300 hours of flight experience.

A specialized course for agricultural pilots is offered in São Paulo. The person in charge is Waldemar Ferreira de Almeida M.D., specialist in toxicology.

economic use of pesticides. Because of the state's big size, FECOTRIGO's program is still considered as limited and not reaching the population as it should be by normal standards.

FETAG

It is a department concerned with the worker himself, his food, his clothing, his medical assistance, his problems at work, his salary and so forth. FETAG uses agricultural technicians to instruct the workers in the adequate use of pesticides. It is the strongest department of all the above. It is also the most dependable one an the most respected by the farmers as well. It reaches every county of the State and the farmers are used to rely on it for any problem they may have. Unfortunately not everybody in the rural region is a member of the syndicates.

PARAMETERS FOR EVALUATION

There are few parameters for evaluation related to the instruction of pesticide applicators. Statistical data are considered incomplete. The registration of accidents with pesticides is minimal.

Rural Funds - Assistence Department for Social Security of Rural Workers (FUNRURAL)

Table 2 presents the cases of poisoning registered by FUNRURAL in February and March 1980.

TABLE 2

Cases of poisoning registered by FUNRURAL

	February 1980	March 1980
alcohol, solvent, petroleum derivatives poisoning	16	21
gas poisoning	1	1
chlorinated pesticides poisoning	27	10
organophosphate and carbamate poisoning	25	15
herbicide and fungicide poisoning	16	35
rodenticide poisoning	2	3
venoms and plants poisoning	35	43
poisoning caused by other substances	43	56

Poison Information Centre - Department of Health and Environment of Rio Grande do Sul (CIT).

This is a centre specialized in toxicology registering cases of poisoning by chemical products. It also gives information about these to hospitals and doctors.

The reports are voluntarily submitted and do not depict the total number of poisonings occurring in the State. The value of the data on requests for information is that they are considered to represent cases of poisoning (Table 3).

TABLE 3

Requests for information on pesticides from November 1978 to October 1980.

	1978	1979	1980
January		13	44
February		14	28
March		19	37
April		13	33
May		14	26
June		12	22
July		16	22
August		8	28
September		18	22
October		31	26
November	9	18	--
December	9	39	--
total	18	215	288

Environmental contamination

At present routine collection of data has been initiated by the Department of Health and Environment. Up to the present time (October, 1980) laboratories have been installed in order to monitor the effluents.

Food and residues

There is no registration of any information about the effects of the campaign on adequate use of pesticides on the contamination of food and fluvial waters. These data will be collected only through monitoring pesticide residues. This procedure was carried out in wheat and soybeans by CIENTEC (Science and Technology Foundation) and even the highest residue levels obtained were not considered harmful to health by the staff of the department in charge.

The control departments of Health and Environment of the State Secretary of Rio Grande do Sul and the Ministry of Agriculture keep a rigid control on food quality. Food is examined periodically in the laboratories and must meet the governmental and the WHO standards.

CONCLUSIONS

The departments in charge of instructing farmers how to use pesticides adequately try to assist them in every possible way. However, the assistance is given from time to time only and not as intensively as it should be. This is caused mainly by the state's big size and the rural workers' low level of education. In addition, the lack of enough funds to carry out these sorts of programs should be pointed out. Thus, continuous assistance is only given when critical situations occur in a certain region (poisoning for instance).

Specific courses or campaigns intended to instruct pesticide applicators are not offered. Though farmers are offered general courses about health and adequate use of pesticides, there is not any specific one aimed exclusively at the pesticide applicator. The agricultural engineers and technicians are specially trained to assist farmers with their problems such as helping them in buying the proper pesticide, how to use it and how to protect themselves from accidents. In reality, however, only a few regions of the State can count on this privileged assistance.

It is also essential to point out that the low level of education of the rural population, the poor medical assistance and inefficient means of communication makes it difficult for the farmers to understand their real situation. Another obstacle is the different methods applied and too sophisticated vocabulary used by distinct institutions. These people use a higher level of language than the farmers which makes understanding difficult and results in contradictory situations.

As a final conclusion and based on data collected at the various farmers assistance institutions some more relevant problems were identified such as:

- generally people regard the work of the pesticide applicator as unskilled labour and of little importance; as such, he is put on the same level as the small farmer, who in most cases has very little education or is completely illiterate;
- technical assistance is irregular and only provided from time to time;
- there is a lack of funds for intensive campaigns;
- means of communication are inefficient in the large territories;
- there are many institutions with similar goals but developing their programs separately and not coordinately as it should be. Consequently, scattered and poor results are obtained.

Acknowledgement

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EDUCATION AND LICENSING PROCEDURES FOR PESTICIDE APPLICATORS AND VENDORS IN CANADA

C.A. FRANKLIN and N.I. MUIR
Environmental Health Directorate, Department of National Health and Welfare, Ottawa, Canada

ABSTRACT

Education in agricultural sciences is available at the degree level in seven out of the ten provinces. The licensing of people who sell and use pesticides is done in the majority of the provinces and the classes of licenses as well as the licensing requirements are discussed for both applicator and vendor licenses. A brief description is given of the role of the federal government in the registration of pesticides, and the relationship between it and the provinces with respect to pesticides is discussed. Abbreviations: Ontario (Ont), Quebec (Que), Manitoba (Man), Saskatchewan (Sask), Alberta (Alta), British Columbia (B.C.), New Brunswick (N.B.), Nova Scotia (N.S.), Newfoundland (Nfld), Prince Edward Island (P.E.I.).

AGRICULTURAL EDUCATION

Education in Canada is a provincial responsibility resulting in differences in curricula and duration of programs which are up to 13 years for the primary and secondary phases. Generally, postsecondary education is given in universities, colleges or community colleges, with degree programs in agricultural sciences requiring four years to complete, and diploma programs requiring two years.

British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec and Nova Scotia all have agricultural colleges associated with universities giving undergraduate and postgraduate courses in agricultural science.

The University of British Columbia offers a four year degree program in Agriculture. Several colleges in British Columbia offer educational courses in pesticides and in cooperation with the Ministry of the Environment, courses pertaining to applicator certification.

There are three regional colleges in Alberta which offer courses focusing on agricultural activities, many of which have been designed to enable students to enter credit programs at various times and locations. These colleges are also involved in the programs which are given as part of the licensing requirements for applicators. A joint green certificate program involving farmers, the Alberta government and four colleges offers on-the-job and classroom training for farm hands and farm managers. Not only have the colleges been responsive to the needs of the industrial and rural sectors, they have also participated in international exchange and world youth programs.

In Saskatchewan, the College of Agriculture is part of the University and is a degree granting institution. There is also a School of Agriculture which gives a two year diploma course intended for people wishing to return to farms or farming industries. A two year course in farm machinery mechanics is offered at one of the community colleges.

In Manitoba, the University offers a four year degree program in agriculture and a two year diploma course. The faculty of Agriculture also offers many programs for graduate studies in agricultural sciences.

In Ontario, the Ministry of Agriculture and Food offers five diploma-course programs at the Ontario Agricultural College, University of Guelph and at four colleges of agricultural technology. Sir Sandford Fleming College offers a two year program leading to applicator certification.

In Quebec, two universities offer degrees in agricultural sciences, two community colleges offer diplomas and the Department of Agriculture operates two institutes of agricultural technology. Vocational training in agriculture is also provided at the secondary school level by 15 boards.

In Nova Scotia, the Nova Scotia Agricultural College offers a four year degree program in agricultural science and in agricultural engineering. Several technical programs and vocational courses are also offered to update farmers and industry personnel.

Ontario, Quebec and Saskatchewan all offer degree programs in Veterinary Medicine.

PESTICIDE REGULATION

In Canada, both the federal and provincial governments have regulatory authority over pesticides. Although each level of government has distinct areas of responsibility, coordination of activities is necessary to ensure proper control.

Federal role

The primary federal legislation governing the sale and use of pesticides is the Pest Control Products Act and Regulations (P.C.P. Act) which is administered by the Department of Agriculture. The intent and philosophy of the P.C.P. Act is that "no person shall manufacture, store, display, distribute or use any control product (pesticide) under unsafe conditions". (Section 3(1) P.C.P. Act).

All pesticides which are sold in Canada must be registered by the federal government under this Act, and conditions under which the product may be sold and the purposes for which it may be used are specified. The registrant must provide sufficient scientific data to enable evaluation of the safety and merit of the product before registration is granted. Various other federal departments including National Health and Welfare, Environment, and Fisheries and Oceans are involved in the review process and act in an advisory capacity to Agriculture.

Under the P.C.P. Act, the classification of a pesticide as Domestic, Commercial or Restricted is dependent upon its toxicological characteristics and/or its intended use. Products registered for forestry or aquatic uses are classified as Restricted regardless of toxicity. Other types of restrictions may be on use, whereby only qualified persons are allowed to use the product, or on storage and display to ensure food or feed are not contaminated.

Labelling of pesticidal products is also regulated under the Act. Precautionary statements concerning potential exposure routes, recommendations for personal protective equipment and toxicological information and antidotes in the case of poisoning are included. This information is derived from the accompanying toxicological studies.

Provincial role

Contingent upon federal registration, the province has the final authority over the sale and application of a product within the province. Provincial control over pesticides is exercised through licensing requirements for professional users and sales outlets (Table 1). It must be emphasized that only people who seek remuneration for applying pesticides are affected by the applicator licensing requirements. Eight provinces have specific legislation under which various aspects of licensing are controlled (Table 1). The remaining two provinces do not have specific legislation but do exert some control under other acts. However, specific legislation pertaining to pesticides, is in draft form in both of these provinces. The Acts are administered by Departments of Agriculture or Environment throughout Canada, and in 5 provinces, a Pesticide Advisory Board comprised of members from many provincial departments actually advises the Minister responsible for the Act (Table 1).

APPLICATOR LICENSES

There are numerous classes of licenses which are granted in various provinces (Table 2), and to some extent this reflects the extent and variety of agricultural pursuits within the province.

TABLE 1

Provincial licensing requirements for pest control operators and vendors

Province	Department Issuing License	Act	Applicator License Required	Applicator Number (1980)	Vendor Person License Required	Vendor Premise License Required	Number of Farms*	Population (1976) (millions)
B.C.	Environment	Pesticide Control Act	yes	3,279	yes	yes	13,033	2.5
Alta.	Environment	Agricultural Chemicals Act	yes	593	yes	yes	57,310	1.8
Sask.	Agriculture	Pest Control Products Act(Sask)	yes	633	no	no	69,578	0.9
Man.	Agriculture (Pesticides Advisory Committee)	Pesticides and Fertilizer Control Act	yes	165	yes	yes	29,963	1.0
Ont.	Environment (Pesticides Advisory Committee)	Pesticides Act	yes	7,435	no	yes	76,983	8.2
Québec	-	-	no	-	no	yes	43,097	6.2
N.B.	Environment (Pesticides Advisory Board)	Pesticides Control Act	yes	37**	no	yes	3,244	0.7
N.S.	-	-	no	-	no	no	3,441	0.8
P.E.I.	Agriculture and Forestry (Agricultural Chemicals Advisory Board)	Agricultural Chemicals Act	yes	23	yes	no	3,054	0.1
Nfld.	Environment (Pesticides Advisory Board)	Pesticides Control Act	yes	60	no	yes	398	0.6

* defined as 0.4 hectares or more with annual sales of $1,200 or more (Canada Year Book 1978-1979)
** license issued to pesticide applicator companies

The number of licensed applicators varies considerably from province to province (Table 1). The apparent higher numbers in some provinces reflects the number of licenses issued rather than the number of people licensed. An applicator may hold more than one license but would be obliged to meet the requirements for each class of license held. In every province, except New Brunswick, the license is issued to the individual. In New Brunswick, the license is issued to a company and the license allows anyone in that company to apply pesticides under the conditions described on the license.

The conditions which must be met to obtain a commercial pesticide applicator's license are quite variable and are summarized in Table 3. In some provinces licenses may be referred to as certificates or permits.

TABLE 2

Major classes of applicator licenses throughout the provinces

Major Classes*	BC	Alta	Sask	Man	Ont	Qué	NB	NS	PEI	Nfld
1 General Pesticide Applicator (application conditions specified on license)							x			x
2 Agricultural Crops	x	x^a	x^a	x^a	x^a				x	
3. Greenhouse Pests	x	x								
4 Aquatic Application (weed or other)	x	x	x^b		x^c					
5 Wildlife Control	x				x^b					
6 Forestry (Silviculture)	x		x^a		x^a					
7 Fumigation	x	x	x^c		x^b				x	
8 Landscape and Garden	x	x	x	x^b	x^a				x^b	
9 Biting Fly	x	x			x^a					
10 Structural	x^a	x	x^c	x^b	x^b				x^a	
11 Industrial Vegetation	x	x	x^b		x				x^b	
12 Noxious Weeds	x	x	x^b	x^a	x^a				x^a	
13 Aerial		x		x^a	x^a					
14 Livestock		x^a								
15 Public or Gov't Employees		x								
16 Seed Treatment	x^a	x		x^a	x^b				x	
17 Miscellaneous		x	x						x	

* some provinces have subgroups within these major classes

x indicates that licenses are issued in that major class

x^a, x^b, x^c } indicate that all major classes with the same letter constitute a single major class in that province

Course requirements

The conditions for obtaining an applicator license are outlined in Table 3. Five provinces (Alberta, Saskatchewan, Manitoba, Ontario and P.E.I.) have mandatory courses and examinations before a license is granted; B.C. offers an optional educational course but an examination is mandatory before a license is granted; N.B. and Newfoundland issue licenses but provide no courses; and Quebec and N.S. do not license commercial applicators and have no course. In Alberta and Saskatchewan, a one year interim license may be granted without a course or examination. At the end of this time, the examination must be written to obtain the 3 year license. N.S. does however provide a course which can be taken on a voluntary basis and is unrelated to licensing.

The type of courses given vary not only from one province to another, but also within provinces depending on the class of license. In some instances, the applicant does all the preparation on his own at home and prepares answers to questions which are then marked by provincial authorities. In others, the applicant must attend specific courses. In either case, the candidate must pass a written examination and comply with any other requirements of the Act before a license is issued (Table 3).

Table 4 outlines the general topics which are given to commercial applicators to enable them to understand the nature of the hazards which might result from exposure to pesticides and to handle these products safely.

It is apparent that much more could be done by many of the provinces to improve the awareness and understanding of potential health related problems. In the area of the use of personal protective equipment (P.P.E.), which is the first and only line of defense in using the more hazardous chemicals, B.C., Alberta, Manitoba, P.E.I. and Ontario appear to cover the topic to some extent. One of the reasons for the seeming weakness in the area of health and safety may be that these programs are run by Environment and Agriculture Departments who may not have ready access to the expertise necessary to address these topics.

An awareness by the applicator of the importance of the information on the label is critical. The precautionary statements on the label appear to be one of the primary means of alerting the user to the inherent hazards of the product. To fully appreciate this the user must:

1 read the label fully
2 understand the implications of the warning symbols and statements
3 use the recommended protective equipment
4 understand what to do in the case of accidental contamination or poisoning
5 adhere to personal hygiene recommendations.

TABLE 3

Conditions for obtaining a commercial pesticide applicator's license according to provincial legislation

	B.C.	Alta.	Sask.	Man.	Ont.	Qué.	N.B.	N.S.	P.E.I.	Nfld.
Major classes of license	16	12	5	4	4	0	1	0	6	1
Course required	optional home or course	home or course	home or course	course	home	no	no	no	home	no
Length of course		*	*	2 day						
Examination	O.B.	W	O.B.	O.B.	W O-struct.				W	
License duration (years)	1 or 5	1 yr interim then 3	1 yr interim then 3	1	1				1	1
Medical	no**	annual	no	no	yes				no	no
Insurance required	no**	yes	no	yes	yes				class B only	no
Minimum age	16	18	18	none	16		none		none	none
Conditions for renewal	file review & exam.	refresher course & exam.	file review	occasion. refresher	file review				file review	file review
Medical for renewal	no	yes	no	no	no				no	no

* varies with class of license
** can be requested under Act
W - written; O - oral; O.B. - open book; O-struct - oral for structural class

TABLE 4

Preparation for safe handling of pesticides

Topic covered	B.C.	Alta	Sask	Man	Ont	Qué	N.B.	N.S.[a]	P.E.I.	Nfld.
Federal Classification of Pesticides	T	T	M	A	T	-	-	*	T	-
Label Interpretation	T	T	T	A	T	-	-	X	A	-
Safety and Health	T	A	T	A	T	-	-	X	T	-
Personal Protective equipment (use & maintenance)	A	A	X	A	A	-	-	X	T	-
First Aid/Poisoning	T	T	T	A	T	-	-	X	T	-
Handling of Pesticides	T	T	T	A	T	-	-	X	T	-

a voluntary course available to applicators
M minimal emphasis
A adequate emphasis
T thorough emphasis
* topic covered in course outline but unable to assess quality
(M, A, T, *: either covered in course or resource material provided)
X topic not addressed specifically in course
- no course

Renewal of license

Licenses must be renewed every 1 to 5 years depending on the class of license and the province (Table 3). At this time, Alberta is the only province that has mandatory refresher courses which involve attendance at a designated centre and re-examination. B.C. requires applicators to rewrite the examination for license renewal. Other provinces review the applicant's file before renewal of his license. British Columbia, Saskatchewan, Alberta, and Ontario offer voluntary update courses to applicators to ensure they are aware of any new developments in their field.

Medical examination

Alberta and Ontario require that all applicants have a complete medical examination before obtaining a license (Table 3). Alberta requires a medical annually thereafter. In both of these provinces, renewal of the license is dependent upon passing a medical. Saskatchewan and B.C. recommend applicants have a medical when applying for a license and upon renewal.

Minimum age

In the provinces that have minimum age requirements, Ontario and B.C. have the youngest at 16 years. Saskatchewan and Alberta have a minimum age of 18 years.

VENDOR LICENSES

The premises from which the pesticides are sold may require licensing and in some provinces the person who is selling the pesticides must also be licensed.

Premises

Six of the provinces require the pesticide vending premises or business to be licences, and the specifications for obtaining the license (or permit) are extremely variable (Table 5). Usually vendor premise licensing encompasses a number of housekeeping requirements to ensure the safe storage and handling of pesticides. B.C., Alberta and Manitoba require that a provincially trained and licensed person be at the licensed premise at all times to advise on the proper use and hazards of the products being sold. Newfoundland and Ontario require that a knowledgeable, but not necessarily licensed, person be in attendance on the licensed premises. The renewal period for vendor premise licenses ranges from one to four years, and no province except B.C. has specified conditions for renewal. In B.C. sales records of schedule III products must be submitted before a license is renewed.

Ontario is the only province which requires vendor permits for premises selling Domestic Class as well as for Commercial and Restricted Class products.

Sales records must be maintained in B.C., Alberta, Manitoba, N.B., Newfoundland and Ontario for certain types (schedules) of pesticides which may be particularly harmful to humans or the environment (Table 5).

Salesperson

Any person who wishes to sell pesticides in B.C., P.E.I. or Manitoba must first obtain a vendor's license (Table 6). This includes the sale of domestic class products in B.C., but not in Manitoba. Alberta requires persons selling pesticides on a retail basis, but not wholesale, to be licensed. Educational courses ranging from one to three days or home study courses are offered. B.C. does not require a course to be taken before the examination is written. All provinces except P.E.I. require successful completion of a written examination to obtain a license.

SCHEDULES

Superimposed upon the classification system which is operative under the P.C.P. Act, several provinces categorize pesticides into groups or schedules. The same basic principles apply to both systems. The more toxic or environmentally hazardous products are grouped together, and more stringent restrictions on sales and purchase are imposed. In addition, some provinces issue use permits for certain products which are potentially harmful to human health or the environment. The schedules and restrictions are outlined in Tables 7, 8 and 9.

TABLE 5

Conditions for obtaining a vendors license (premise or business)

	B.C.	Alta	Sask	Man	Ont	Qué	N.B.	N.S.	PEI	Nfld
License required	yes	yes	no	yes	yes	yes	yes	no	no	yes
Licence issued to trained person	X	X								
License duration (years)	1	3		1	1	1	1			1
Conditions for renewal	sales records	none	none	none	none	none	none			none
Licensed staff on premise	X	X*		X						
Responsible or knowledgeable staff					X					X
<u>General Requirements</u>										
Stored to prevent harm or contact	X	X	X		X		X			X
Clean & orderly	X	X					X			
Locked access to storage room	X	X	X		X		X			
Signs with contents of storage room		X	X		X		X		X	
Exclusive pesticide storage	X	X	X				X		X	
Drains etc. separate from other water		X	X		X		X		X	
Exhaust fans or ventilation	X	X	X		X		X		X	
Personal protective equipment in area		X	X		X		X		X	
Fire specifications	X	X	X		X					
Maintenance of sales records	sched. III	retail sched. A-C wholesale sched. A-D	none	com. res.	sched. 1,2,5	none	all except dom.	none	none	all except dom.

*for retail sales only

sched. - refers to the classification system within the province

res. - restricted class

dom. - domestic class

com. - commercial

TABLE 6

Conditions for obtaining a vendor's license (person) according to provincial legislation

	B.C.	Alta	Sask	Man	Ont	Qué	N.B.	N.S.	P.E.I.	Nfld
License required	yes	yes*	no	yes	no	no	no	no	yes	no
Classes of license	2	5		1					1	
Course required	optional home or course	home		course					no	
Length of course	2 day			1 day						
Examination	O.B.	W		O.B.						
License duration (years)	1 or 5	3		1					1	
Conditions for renewal	rewrite exam	none		none					none	

W - written
O.B. - open book
* retail sales only

A comparison of the classification by the federal government, Manitoba which utilizes this system, and the three provinces with schedules of parathion, paraquat, picloram and temephos is given in Table 10.

Application permits

Federal legislation requires that use permits be obtained for research applications - i.e. application of an unregistered compound or the application of a registered product for a use other than those stated on the label.

Beyond this, the province may require permits for additional uses or groups of pesticides. Newfoundland and Manitoba have no provincially administered permit requirements beyond those required by the federal government. Provinces such as New Brunswick and Nova Scotia use the permit system as the major means of controlling use of pesticides in the province by reviewing each application on an individual basis. Although control of pesticides in the Northwest Territories has not been discussed, it should be noted that the approval of the N.W.T. Environmental Service is required for any pesticide application. Upon approval, information is provided to the applicant on the safe and efficacious use of the pesticide. The uses requiring provincial permits are outlined in Table 11.

Sale of restricted class pesticides to untrained users

A farmer who wishes to apply pesticides to his own property does not have to be licensed to do so in any province. The class or schedule of pesticide that he can purchase varies from province to province and in several provinces

TABLE 7
British Columbia Schedule

Schedule	
I	restricted use pesticide purchase and use permit needed to buy and use, sold to licensed applicator or service only
II	sold only to licensed pest control services or certified pesticide applicators
III	signed for by purchaser
IV	must be 16 to buy and must consult with pesticide dispensor
V	sold to anyone

TABLE 8
Alberta Schedule

Schedule	
A	sold to licensed applicator who has use permit, records kept
B	sold to class F, J or K applicator or agriculturalist with permit,records kept
C	sold to licensed applicator or agriculturalist spraying on own land, records kept
D	anyone over 16
E	anyone over 16
F	anyone over 16

TABLE 9
Ontario Schedule

Schedule	
1 & 5	restricted pesticides to be used under the authority of a specific use permit schedule 5 for use on agricultural land only and is use permit exempted; records must be kept of sales
2	restricted to use by agriculturalists, licensed exterminators and registered custom sprayers; records must be kept of sales
3	for domestic use no sales records
4	most PCP domestic products (package size limitations)
6	most PCP domestic and commercial products

TABLE 10 Comparison of classification between federal government and the provinces

Product	Classification	Restrictions
Parathion	Ontario - all schedule 5	- use only under use permit, agriculturalists exempt from permit requirements
federal registrations:		
12R - 9.6 lb/gal, 15% W.P.	Manitoba - federal system	- restricted; is signed for by purchaser
	Alberta - all schedule A	- sold only to licensed applicator with use permit
	British Columbia - all schedule III	- signable product
Paraquat		
federal registrations:	Ontario - > 3% schedule 2	- restricted to agriculturalists and licensed exterminators
9D - sol. 2.5%		
3C - 2 lb/gal	< 3% schedule 3	- for use by anyone
1R - 2 lb/gal (aquatic use)	Manitoba - federal system	- restricted must be signed for
	Alberta - 2.5% schedule E	- anyone over 16
	2.5-9% schedule D	- anyone over 16
	9% schedule C	- signed for by agriculturalists and licensed applicators
	British Columbia - all schedule III	- signed for by purchaser (even aquatic)
Picloram		
federal registrations:	Ontario - all schedule 2	- restricted to agriculturalists and licensed exterminators by permit only
4C (PIC)		
2C (PID)	Manitoba - federal system	- available with provincial authorization
	Alberta - < 2% schedule D	- anyone over 16
	> 2% schedule C	- signed for by agriculturalists or licensed applicators
	British Columbia - all schedule III	- signable product
Temephos	Ontario - all schedule 3	- sold to licensed applicator or agriculturalist
federal registrations:	Manitoba - federal system	- must be signed for
1D	Alberta - all schedule C	- signed for by licensed appl. or agriculturalist
3R	British Columbia - all schedule IV	- must be 16 to buy from the pesticide dispensor
1C		

R - restricted; C - commercial; D - domestic farmers are specifically exempt from purchaser restrictions. This situation is very disconcerting since it is possible for a farmer (or any other person) who is not required to have any formal training in the safe handling of pesticides to purchase any restricted class pesticide in Newfoundland, Manitoba, Saskatchewan, N.B., N.S., Quebec and P.E.I. The only exemption to this occurs when the label specifies that the product should only be sold to a licensed pesticide applicator. In general, these provinces have no mechanism to control restricted class sales. In Ontario, farmers are exempt from obtaining a use permit for the more toxic schedule 5 pesticides. They can still access the most toxic class 1 pesticides by obtaining a use permit. In Alberta, only a few pesticides in schedule A are not available to farmers. Farmers can buy schedule B pesticides provided they have a permit; while pesticides in schedule C must be signed for at time of purchase. In B.C. schedule I and II pesticides are unavailable to farmers unless they are licensed.

TABLE 11

Applications requiring provincial use permits

Uses	federal	B.C.	Alta	Sask	Man	Ont	Qué	N.S.	N.B.	P.E.I.	Nfld
Same as federal					X						X
Aquatic		X	X	X		X	X	X	X	X	
Aerial						X	X	X	X	X	
Green zones - pasture, public land, parks, right of way, etc)		X	X						X		
Research uses	X	X	X			X			X		
Forestry		X	X			X		X	X		
Any commercial application								X			
Schedule		I	A&B			1,5					
Fumigation					X	X					
Rodent Control					X						

This overview points out the serious inadequacy of control on pesticide use in the provinces to ensure that the more toxic products are used by adequately trained personnel. As well, signing for products or obtaining use permits are ineffective in assuring safe use, as most of the review involves assessing environmental and operational aspects of the operation. No consideration is given to whether or not the applicators have adequate equipment and knowledge to ensure personal safety during the operation.

FUTURE DIRECTIONS

The two provinces, Quebec and N.S. which are without specific pesticide legislation, have drafts of proposed legislation under review at this time. Several provinces have just enacted pesticide legislation in the last few years, and it is obvious that the full spectrum of the licensing regulations have not been developed. Problems which are apparent in several provinces are:

1 too few applicators in any given class of license to warrant development of an extensive educational course;

2 limited expertise to draw on from within the provincial government to develop courses, as well as to present and administer these courses;

3 licensing is low priority due to limited demand for licensed applicators.

Every province, no matter how advanced in the licensing process, has recognized the importance of licensing applicators and indicated the intent to initiate or improve on present licensing courses and procedures.

RECOMMENDATIONS

General

1 Improve the professional status of commercial pesticide applicators and likewise upgrade the courses to reflect this.

Licensing courses

2 Provide "lecture courses" in those provinces which have the resources to do so and where all material can be covered within a reasonable time frame.

3 Develop "home study" courses for those provinces where experts cannot be accessed or the numbers of candidates are low. This format can be used indefinitely and needs only to be updated occasionally.

4 The written examinations following "lecture courses" should be scheduled at a time which enable the participants to review the material.

5 Introduce mandatory refresher courses as a requirement of license renewal. This could combine an update with an intensive review of one aspect of application.

Course development

6 Cooperation between provinces in program development should be promoted through a body such as CAPCO (Canadian Association of Pesticide Control Officials).

7 Courses must improve all areas pertaining to the safe use of pesticides.

8 An educational program should be developed for farmers and only those who have taken the program should be eligible to purchase and use the more toxic pesticides.

THE USE OF UNIQUE SPECIALIZED PUBLICATIONS, SUCH AS RAPID PUBLICATION OF TOXICOLOGY JOURNALS TO EDUCATE PROFESSIONALS AND PREVENT INTOXICATIONS FROM THE USE OF PESTICIDES: EXPERIENCES WITH VETERINARY AND HUMAN TOXICOLOGY

FREDERICK W. OEHME
Comparative Toxicology Laboratories, Kansas State University, Manhattan, Kansas (USA)

ABSTRACT

The development of rapid communications within the scientific field has been spurred due to the development of new electronic and printing techniques. Journals are especially valuable in scientific communications by the stability of their product and the ability that readers have of utilizing the information contained repeatedly and at varying times. The necessity for rapid written communications is especially important due to the rapid growth and development of advances in toxicology. Utilizing a rapid publication format that enables material to be published within days after its receipt by the Publication Office, Veterinary and Human Toxicology has evolved into a premiere reference and news publication. The service rendered by this journal is evidenced by its rapid growth and its acceptance by national and international abstracting and indexing services. Efforts to improve this publication are continuing and suggestions from the profession are valued.

INTRODUCTION

Of all the means of communications important to scientists, the written word has the advantage of permanence and flexibility. It is able to be utilized at specific times and locations convenient to the reader and may be recalled for review as necessary. The desire to maintain credibility in scientific writings has lead to the development of "peer-reviewed" publications and to the concept of subjecting scientific manuscripts to critical review by experts before the material is published. However, there are also many other items of scientific value that are newsworthy and are current events. Organizational activities and announcements, meetings, new publications, and statements of events that have scientific import are all of variable interest to the scientific profession. Coupled with the desire for publishing accurate and valid research data, as well as information of news interest to scientists, is the promptness with which such material is available to the profession. The rapid growth and the phenomenal developments in chemically-induced problems and techniques has produced a time-lag phenomena for toxicologists. Often the news media makes scientific information available to the lay person that the professional will only months later read about in detail.

Fortunately, efficiency in editorial activities and the availability of new printing and distribution techniques allow the maintenance of good scientific control and the rapid availability of this information to toxicologists. This paper describes the philosophy and activities that over the past ten years have resulted in Veterinary and Human Toxicology (VHT) becoming a major source of new and relevant information to clinical and research toxicologists.

RAPID GROWTH AND DEVELOPMENTS IN TOXICOLOGY

Scientific communications, especially those that are written and allow the reader to carefully and selectively review the material, have always been the most important means of transmitting toxicological information. The flexibility and reliability of writings is variable by the increasing number of scientific journals. Nowhere is the growth of a science as well documented as in the expansion of journals dealing with toxicology.

With the development of concerns for chemical hazards and the increasingly sophisticated production of information about how chemicals effect the environment and man, and the necessity for documenting new diagnostic and therapeutic procedures in cases of chemically-induced disease, the past several years have seen a virtual explosion of journals dealing with chemicals, the environment, and frank toxicology. This is especially true in the area of pesticides, where the chemical industry is generating new compounds at a phenomenal rate. Toxicologists in the field are often dealing with poisonings caused by chemicals prior to knowing very much about the inherent toxicity of the commercial compounds.

The lag between the generation of new pesticide information and its appearing in a scientific journal for toxicologists to read embraces the time required for the preparation of the manuscript, the editorial and peer-review process initiated by submission of the manuscript to a journal, and the lag in publication due to traditional printing and distribution techniques, as well as the backlog of prior-submitted manuscripts. In order to be a truly useful publication, the scientific toxicology journal must incorporate valid information in a format that can be made available to the toxicologists as promptly as possible in a fashion for immediate use in dealing with daily problems.

REQUIREMENTS OF THE IDEAL TOXICOLOGY JOURNAL

Of paramount importance is that the scientific toxicology journal provides its readers with relevant information applicable to their needs as promptly as possible following submission to the publication offices. This information must be accurate and scientifically valid. For this purpose all journals maintain an editorial board of selected known experts in the specific fields covered by that publication. These individuals are responsible for reviewing submitted manuscripts and material and for assuring that the information asked to be published is valid in its generation, accurate in its reporting, and reliable in the interpretation and conclusions drawn from the results. While no editorial board is perfect, the ultimate credibility of any publication lies in its review process.

Depending upon the objectives of the journal, the subjects covered by it may cover limited or extensive areas of toxicology. Most readers prefer to have publications that cover a relatively wide scope of toxicology. Hence the ideal toxicology journal should offer its readers a range of subjects dealing with chemically-induced problems. Because of the extensive utilization of pesticides and the importance that pesticides play in toxicology, most toxicology journals do include pesticide chemistry and toxicology within their scope.

The valid information covering the specific areas of toxicology must then be presented in a readable fashion to toxicologists. It should be relatively free of printing errors, have high contrast in both type form and in figures and illustrations, and should allow rapid scanning and identification of specific articles and materials by the reader. A professional appearance for this publication may be reached by utilizing colors and specific type styles reflecting the prestige and reliability of the journal's contents. Although slick-covers add visual impact, the utilization of slick-paper for the interior of the journal is only needed if quality of photograph duplication is a concern. New printing techniques allow nonslick papers to provide excellent photograph reproduction, and the cost of using slick-cover material has permitted the acceptable use of heavy weight dull texture papers for journal covers. The 8½ x 11 inch size is efficient and allows maximum information content for each journal page.

Of increasing and now very special importance in toxicology publications is the necessity for rapid publication and dissemination of the printed manuscripts and journal. New printing techniques utilizing photographic processes allow journals to go from layout to cut-and-bound form within 3-5 days. The addition of computer-set copy together with automated labelling and efficient postal distribution techniques permit delivery of the journal to go from typed or computer-set final copy to the readers desk within a 3-week time period. The area of pesticide toxicology is one that is especially aided by this rapid publication-distribution technique development since acute toxicity and massive environmental exposure with pesticides require that clinicians and toxicologists be fully armed with the latest information and techniques in evaluating and dealing with field problems.

The ideal toxicology journal should also provide news of peripheral relevance to its readers. Governmental actions, organizational response to regulations and procedures, reports of recently held meetings, editorials on new happenings, information for members and other persons interested in various toxicology organizations, reviews of new books and other documents, employment opportunities for toxicologists, details of programs for upcoming toxicology meetings, and other news and up-dates provide the reader with information that might not be available by any other means. The inclusion of light-hearted comments and occasional philosophical notes may provide a welcomed relief from the scientific format. Current information that is relevant to events directly effecting toxicologists in the near future must have a high priority. The providing of up-to-date material which adds to previously available information is important.

To accomplish all this, the publication process should have the opportunity for "11th-hour" insertions and last-minute changes in content to accommodate these late-breaking events that will effect the readers a few weeks later when they receive the publication on their desks.

Finally, economics must play a role in the ideal toxicology publication. The cost of journals has been increasing as inflation has pushed subscription rates ever higher. Certain efficiencies due to automation, electronics, and general publication efficiency are possible, but there is little available to combat the increasing costs of labor, paper and materials, and postage expense. The 8½ x 11 inch format with narrow margins assists in maintaining paper expenses at a minimum. The use of light-weight paper for pages and the omission of slick-paper for interior pages and covers further holds down expenses. Some savings may be realized by photographic reduction of the final type-set material so that more information is publishable on each page. However, the publisher must also consider readibility and the necessity for limiting reduction to the point before the fine print becomes annoying for the enthusiastic and expectant reader.

The ultimate standard of value for the successful toxicology journal is the degree of education it provides for its readers. Education, via distribution of the printed word, is a primary responsibility for the credible toxicology publication. If the journal is able to educate its readers, it has accomplished its purpose, filled a need, and offered a necessary service. To be effective, however, this educational process covers many details, including all the requirements for the ideal scientific toxicology journal. Because of the need for such a service in clinical and environmental toxicology, the idea of VHT evolved several years ago.

"VETERINARY AND HUMAN TOXICOLOGY" AS AN EXAMPLE

In the mid-late 1960's the demands and advances being made in toxicology generated a concern for a better means of communicating toxicological information among practicing toxicologists. Scientific meetings provided direct but limited communication opportunities, and there were only a few heavily research-oriented journals providing toxicology data for its readers. Clinical and environmental toxicologists were seen as needing a communication media that would provide a permanent record of developments, would offer the flexibility of providing new information retrievable at the toxicologist's convenience, and would make this material available as rapidly as possible after its generation. The limited availability of individuals with specific expertise to produce such a publication, and the ever-present cost consciousness, resulted in a scientific yet inexpensive, rapidly-publishable yet flexible theme. From this concept, VHT was born (ref. 1).

"Veterinary and Human Toxicology" is a non-profit scientific journal that embraces the total scope of toxicology. It is published at Kansas State University using a small publication staff and an international editorial board. Its primary purpose is to make scientific developments and news available to toxicologists throughout the world as rapidly as possible. Scientific manuscripts and other materials requiring referee evaluation and editing undergo a review process of some 4-6 weeks, with publication usually occurring within 3 months after a paper is received. Items of news interest (announcements, scientific happenings of importance, or timely events) are published promptly in the issue under development at the time the news is received. Contributions are invited from all areas of toxicology, including news items and announcements, manuscripts of original research, scientific reviews, and field observations in man and domestic or wild animals. Papers presented at meetings and those of general educational value to toxicologists and related scientists are also welcomed. The journal is published six times yearly in February, April, June, August, October and December.

Original research, critical reviews, well-documented field investigations and similar refereed manuscripts are considered for publication as "Scientific Reports" and appear in the first section of the journal. Papers of continuing education value, such as those presented at workshops, that review accepted toxicologic methods or concepts, or that reflect the personal views of the authors, are usually published in the "Continuing Education" section. The refereed or review manuscripts for these two major sections of VHT usually comprise more than half the total pages of each issue.

The remainder of each issue is devoted to news items and current information of interest to toxicologists and to members of several organizations that utilize VHT as their communications medium. The section "Actions and Interactions" provides news items of regulatory, industrial, or environmental concern, often containing philosophical comments, documentation of regulatory actions, or recently-made available results of research observations. Several sections are then devoted to specific items or news of interest to the members of several toxicological organizations. "AACTion" provides news from the American Academy of Clinical Toxicology. The American Board of Medical Toxicology has a section with membership information and self-assessment examinations and criteria. "The Poison Penletter" is a section for members of the American Association of Poison Control Centers. Sections offer news from the American College of Veterinary Toxicologists, and announcements and information from the American Board of Veterinary Toxicologists follow. Announcements from the Council for Agricultural Science and Technology are published in the section "Comments from CAST" A book review section ("Reviews of New Publications"), a listing of job opportunities for toxicologists, and an updated listing of "Forthcoming Meetings of Interest" give additional interesting readings. If specific reports are available from meetings of interest to toxicologists, these may be published in a section entitled "Reports from Recently Held Meetings", such as is true of the report planned for the April 1981 issue from a National Institute of Environmental Health Sciences sponsored "Symposium and Workshop on Toxicology Education and Training". Short subjects of humorous interest or general announcements of value to the general reader are interspersed throughout the publication and are listed in a table of contents section entitled "This-and-That". Each issue is 80 pages of the 8½ x 11 inch format. With reduction to 80% of original type size each issue contains considerable information.

Supplements to VHT are published on a variable basis, but usually at least one supplement is published each year. Supplements are frequently the proceedings from a toxicological meeting and provide the manuscripts of that meeting for review by participants and other readers of the journal. Several of the organizations utilizing VHT as a communications medium for their membership have committed themselves to publishing the proceedings of their annual meetings as a supplement to this journal. The proceedings are usually published within two months following the meeting, although some extension of that time is necessary if late-submitted manuscripts are to be included.

Supplements may also include documents of value to toxicologists on a broader or even more specific topic. For example, a 44-page supplement to VHT published in 1980 dealt with "Breast Feeding and Drugs in Human Milk" and had a printing of 10,000 copies.

All issues and supplements of VHT are indexed or abstracted by all the major services, including Archives of Environmental Health, BIOSIS, Chemical Abstracts, Current Contents, Index Medicus, Excerpta Medica, Science Citation Index, and the computer indexes of the United States National Library of Medicine. Such indexing provides authors publishing in VHT with international exposure, as is verified by the number and international span of reprint requests received by authors following their manuscripts' publication.

AN EVALUATION OF "VETERINARY AND HUMAN TOXICOLOGY"

What started out as an effort to fill a perceived need several years ago has developed into a truly international and uniformly indexed-referenced journal. The perceived need was indeed there and the response of the profession to the publication has resulted in this journal growing approximately 10% per year. It is distributed internationally and publishes a scope of toxicology manuscripts and news not equalled in any other single toxicology publication. An analysis of VHT was recently made (ref. 2). The history was traced and the needs filled by VHT documented. The analysis concluded that the journal's content and rapid publication characteristics appeal uniquely to the toxicology audience, and that its continuing growth indicates satisfaction by and success with its intended audience.

Although such an evaluation is rewarding, the most profound measure of a journal's success is its acceptance and growth by its intended users. In this, VHT's publication and editorial staff has been most gratified by the reader response. Every effort will be made to maintain the quality and improve the value of this journal to its intended audience.

HOW TO MAKE TOXICOLOGY PUBLICATIONS BETTER

As the proverbial "We are what we eat", so a journal is what its contents are! To improve toxicology journals, the contributions that go into it must be of increasing high quality. While the editorial board is charged with maintaining the standards of quality, the submission of relevant, well-performed and documented, and specifically referenced manuscripts permit their favorable review and rapid publication and dissemination for use by the profession. Similarly with news items and reports, the degree to which toxicologists submit these materials for publication determines the use that fellow toxicologists may make of this information.

With the availability of such quality manuscripts and materials, the editorial board and publication staff can then use the techniques available to them to provide a quality format, excellently readable print and useable illustrations, and rapid and efficient publication and distribution. As the quality of content increases, the appearance of a journal and its management will also improve. As readership increases, costs become less of a concern and higher quality paper and artwork may be utilized. All the criteria for the ideal toxicology journal may then be more rapidly met; but all depends upon the publication availability of valid and accurate toxicological manuscripts and news items.

Toxicologists can also improve the quality of journals by using them and applying their contents to their daily activities. To apply data published in a journal reflects favorably upon that journal and results in the stature of that publication increasing with time. Credibility is an important scientific criteria and is never more valid than in the publication field. Quoting data published in a specific recent issue of a journal helps immensely in the prestige of that publication. It also assists in making other toxicologists and related scientists aware of the journal's quality and importance. Distribution is thereby increased and with it the dissemination and utilization of material that all of us find so important in our daily patient-care and environmental problems.

Improvements can also occur in a journal if the horizons of the publication staff are broadened. Comments from readers on content and format assist greatly in making the editorial and publication staff aware of areas that need attention. Greater concern for pesticide information, publication of more articles for lay reading, a higher emphasis on educational materials and updating practicing toxicologists, and requests for specific meeting or news information all help to improve subsequent journal issues. Toxicologists should be generous in their suggestions and should recognize the service their ideas and comments performed to the editorial and publication staff. The publication staff is often busy with the details of getting the journal into appropriate style by the publication deadlines. The staff's noses are often buried in details. The "forest is often not seen because of the trees"! Readers of VHT are urged to provide ideas and suggestions to make that particular journal of greater value to its readers.

CONCLUSIONS

Toxicology journals fill a needed void in the scientific literature by giving toxicologists the opportunity to publish their specific data information and to direct it to a unique audience. The use of highly specialized toxicology publications, especially those that have a rapid-publication ability, provides immense educational potential for professionals and lay persons alike. The experiences of VHT illustrate the importance of the published word in toxicology. The use of this specialized publication to disseminate information over the broad field of toxicology, to educate a wide audience in new developments in toxicology, and to use this information to diagnose, treat and prevent intoxications from a wide range of chemicals, including pesticides, illustrates that the opportunity to contribute to progress in toxicology is there. As toxicologists, we must take advantage of it and utilize this and similar services to do a better job in meeting our professional demands.

REFERENCES

1 Veterinary and Human Toxicology, Publication Office, Comparative Toxicology Laboratories, Kansas State University, Manhattan, Kansas 66506 (USA). Copyright 1981.
2 S. L. Oehme, An Analysis of the Veterinary and Human Toxicology Journal, Vet. Hum. Toxicol., 22(1980)429-430.

EDUCATION OF WORKERS EXPOSED TO PESTICIDES AT A MULTIDISCIPLINARY LEVEL

I. VASSILIEFF
Department of Pharmacology of Instituto Basico de Biologia Médica e Agrícola, "Campus de Botucatu", Rubião Junior, Sao Paulo, Brasil

Pesticides are indispensable in our society, contributing to human welfare, industrial and agricultural development, and world-wide economy. The use of these products is directed towards increasing food production (agriculture and cattle raising), pest control, and control of disease transmission by insects and other parasites (public health), resulting in dramatic increases in population (explosion of demographic index) and environmental pollution.

"Pesticides" is a general classification based on chemical groups that include a.o.: insecticides, rodenticides, fungicides, herbicides, and fumigants. These compounds, manufactured for the sole purpose of destroying some form of life, are classified as pesticides because they are directed against organisms that society deems undesirable. Although a selective toxicity of pesticides is extremely desirable, all can produce at least some toxic effects in man and domestic animals and also an effect on the environment. The assessment of the toxic hazard of a pesticide involves the acute toxicity (single dose) and the chronic toxicity (repeated smaller doses over a period of time). Mortality attributed to accidental poisoning by pesticides in developed countries seems to have declined over the last decade, perhaps due to increased awareness by poison control centers, legislation and regulations in relation to crop protection, human welfare, and the education of workers in the use of these pesticides.

Actually the use of pesticides in the world has grown tremendously since world war II, accompanied by a greater risk of occupational exposure to these chemicals, in production and in use, mainly in developing countries because of lack of knowledge with regard to the extent of the damage. However, exposure to pesticides is not limited to occupational incidents; residues often remain on products, so that man is constantly subjected to low levels of these chemicals. Numerous incidents of acute pesticide poisoning have resulted from eating food that was grossly contaminated during storage or shipping.

Pesticides have strong links with land utilization both through their effect on the production of food and other commodities and through their application in public health providing certain areas for profitable and enjoyable human activities.

Of course, natural waters and lands may be contaminated with pesticides by: accident or hazard; direct application for insect control; percolation and runoff from agricultural land; drift from aerial and land applications; discharge of industrial waste water; or from clean-up of industrial equipment, used in the production of pesticides. When such contaminated water is used for consumption, the presence of pesticides is a potential hazard to health. Furthermore, with the present trend towards increased usage of these toxic compounds, the quantities reaching water courses may become large enough to cause serious damage to existing water resources. The pH of natural water generally lies between 5 and 8 and, therefore, is expected to influence the chemical stability of these pesticides. In slightly acidic waters these compounds could be stable and persist for long periods of time, with increasing possibility of absorption into various trophic levels of food chains.

The Food and Agricultural Organization (FAO) has estimated that food supplies must expand 4 per cent per year in order to keep pace with population growth and to compensate eventually for existing deficiencies. However, while the modernization of agriculture by the introduction of improved crop varieties, the extension of irrigation and the wider application of fertilizers and pesticides offer hope for significant increases in productivity, a doubling of world food production would require a more than three-fold increment in the annual use of fertilizers, and a much more extensive use of pesticides (WHO). The augmented use of pesticides by indiscriminate application will result in contamination of the environment, incidents of severe poisoning, and modification of man's welfare.

The prevention of overexposure is undoubtable the best insurance against poisoning, and remembering that all chemical pesticides have some degree of toxicity to man, everyone who works in pest control should be aware of the potential hazards which accompany their use. This should be asserted constantly because pest control chemicals must be looked upon as two-edged swords: they are not selectively toxic to the target pest, but present varying degrees of hazard to humans as well as non-target plants and animal life.

Many governments have their own legislation and regulations for the application of pesticides conformable to the recommendations by WHO and FAO. The rules for chemical safety for workmen are good, but in practice they are less effective because people do not have sufficient knowledge to realize the seriousness of the problems and the possible damage to employment.

Brazil's Medical Schools do not have officially a discipline of Toxicology; the graduate students receive some orientation in the employment of pesticides through the Department of Public Health.

Since 1972, it was decided to organize a Service of Toxicology in the School of Medical and Biological Sciences of Botucatu, remaining annexed to the discipline of Pharmacology in the Department of Physiological Sciences. On this occasion the responsability to organize and develop this service was given to me, since I had already manifested my interest in this field in Pharmacology and I was encouraged by my colleagues in Pharmacology.

As the clinical hospital and the veterinary hospital of Campus de Botucatu are located in an essentially "agro-pecuaria" area where the ratio of acute and chronic poisonings by pesticides is high, I decided to specialize in this field within toxicology.

The first step was to set up a laboratory of toxicological analysis for quantitative analysis of chemicals and identification of the substances in biological tissues, as well as a laboratory for research in the field of toxicology.

The second step, in 1973, was to organize and administer a course in general toxicology and analytical toxicology (80 class-hours) for the students in the degree programme of Biological Sciences, as well as a course in general toxicology (30 class-hours) for the students of the Medical School.

At the same time the discipline of toxicology and toxic plants as minimum requirements was introduced in the Faculty of Veterinary Medicine, and as a result I worked in close cooperation with my veterinary colleagues organizing and administering the course for graduate students of Veterinary Science.
I also became the technical adviser in toxicology in clinical cases that appeared in different wards in the Clinical Hospital of Botucatu, including surveillance of chronically-ill patients poisoned by pesticides, and assisting the Secretary of Public Security in cases involving poisoning.

In 1976, I organized and taught the course of toxicology (40 class-hours) with a specific programme for specializing in occupational medicine enabling the physician to obtain - after an examination - permission to work in the area of Public Health.

In 1978, I started to administer a specialized course in clinical toxicology, theoretical and practical (160 class-hours) for residents in medicine and veterinary medicine (post-graduate students). Moreover, I have given courses, conferences, consultations, seminars, symposia, etc. for various professionals interested from the medical and biological point of view in the field of pesticides.

After some years of working in the field of pesticides I have managed to awaken the interest of various professionals for a joint programme at a multidisciplinary level in the "Campus de Botucatu".

My objective is to develop the interest of other professionals with sufficient knowledge about pesticides and develop a good programme for a course in preventive medicine to train the people directly involved in the application of these compounds. I have observed that it is very difficult to implement this programme because most physicians have not had previous training in the field of toxicology of pesticides and therefore were unable to participate in interchanges with other professionals such as agronomists, veterinarians, biochemists, biologists, etc.

In the Botucatu Campus of Saint-Paul State University the exchange of multidisciplinary knowledge between professionals is possible, and the results of this interdepartmental cooperation can be observed in practice at the university's two enormous experimental farms involving both students and workers. If the objectives i.e. detailed study of agricultural land and correct application of pesticides according to recognized techniques will be completely reached, the consequences would be further protection of the health of the worker, greater economy by avoiding indiscriminate use of these chemicals and therefore decreasing danger to the environment, and increasing the likelihood of producing food in excellent condition for consumption. In conclusion, the education of both workers and professionals as to the proper use of pesticides would create short-term benefits for the general population, and could indirectly influence the establishment of the discipline of toxicology in the Brazilian Medical School.

PREVENTION AND EDUCATION IN THE USE OF PESTICIDES IN THE AREAS OF THE UNIVERSITY

F. PUENTES
Universidad Industrial de Santander, Comité Agromédico de Santander y Sur der Cesar, Bucaramanga, Colombia.

INTRODUCTION

At present the majority of developing nations are confronted with serious problems in the control of pests affecting agricultural production. There has been much discussion about the possibility of totally replacing chemical pesticides with biological methods of control but, for the present numerous chemical substances are required in order to guarantee an adequate economical return.

Unfortunately, the low educational level of the rural workers who handle these pesticides, such as in the case of Colombia where many have had only 2 or 3 years of schooling or even no schooling, makes the written warnings on the pesticide labels either unreadable or incomprehensible. In addition, the risks of handling these chemical substances are increased.

On the other hand, the enforcement of official decrees concerning pesticides is hampered by lack of sufficiently trained officers capable of enforcing the legal norms. We in Colombia observe, for example, that, in spite of the legal prohibition to utilize persons instead of signals to guide the spraying aircraft, there are still people employed for this dangerous work and people continue to expose themselves, ignoring the risks involved, because they are paid a higher salary. Furthermore, the ban on spraying in suburban areas etc. is likewise not respected. All this results in the frequent occurrence of cases of acute, subacute and chronic poisonings from pesticides. However, in addition to this, in the various university fields related to production, commercialization and application of pesticides, the courses in pesticide toxicology are insufficient to adequately educate these professionals. Likewise there are, with very few exceptions, no courses on pesticide toxicology for health professionals in our country. At the same time there is a great need to train school teachers to teach their students in those rural areas, where intensive spraying is practiced, some elementary precautions related to the problems of handling, application and safety as well as the risks and problems of contamination. This means that the teacher training institutions as well as the schools should organize adequate training courses for future teachers concerning pesticide toxicology.

I shall now explain the utilization of a method for designing university courses according to responsibilities and functions in professional performance which in my view, is easily applicable to any country.

DESIGN OF UNIVERSITY COURSES BASED ON RESPONSIBILITIES AND FUNCTIONS IN PROFESSIONAL PERFORMANCE

In the traditional planning of university courses the educator's view on what the future professional should be, has always been used, along with his experience and knowledge, to program the courses which will, in his opinion, result in properly prepared graduates. A different possibility is to use the inverse process of directly asking the practicing professional what the real priority needs are so that the respective courses can be designed, revised and updated appropriately. This can be done by utilizing at least a 15 minute interview which practicing professionals in each university field of study with the help of a for this purpose specially designed form. Thus the functions and responsibilities of the practicing professionals can be established. For the purpose of revising and updating the existing programs in each area, an exercise can be done, comparing the image of the professional as seen by the university educator with that of the professional in actual practice, utilizing this interview.

In this study it is necessary to consider some special features in order to make it more complete. These include the principal fields of work of the professional, the place or institutions of work, the environment in which he must perform his duties, the type of persons or population to which the professional is attending, the position most commonly occupied and specific features of the work environment, such as rural or urban, type and characteristics of colaborators and the supplies and equipment for the work.

Based on data from a sufficient number of interviews for each university field of study and for each subject a final list of functions and responsibilities of the professional in each field of study can be prepared.

Once this part has been completed, it becomes necessary to consider the subject of student proficiency in order to design each course.

DESCRIPTION OF STUDENT PROFICIENCY

Once the information regarding the real professional has been obtained the final list of responsibilities must be considered separately. In each course, the beginning level of knowledge or pre-requisites must be established to assure effectiveness and uniformity of education. The next step is to determine the material which each student must learn in order to perform the corresponding responsibility. At the same time the final level of knowledge must be decided; that is to say, the actions which the professional in practice must be able to perform in order to fulfill each responsibility. Since not all the universities have the same educational possibilities, the following points must be analyzed in detail: time, teaching staff, educational aids, classrooms and facilities for practical training. Once this phase has been completed, programming of the teaching-learning process should follow.

PROGRAMMING OF TEACHING - LEARNING PROCESS

Once the contents have been established and teaching resources of each university have been analyzed, the preparation of didactic units follows. Specific final objectives or responsibilities must be established for each unit. It should be kept in mind that an educational objective is understood to be the specification of the behaviour which the student must demonstrate once he or she has completed successfully the learning experience. Since we are talking here of final behaviour it should be understood that this is any quantifiable and observable activity by the student when the instruction is finished. After defining the objectives of each didactic unit, the contents should be selected and organized according to criteria of sequence, extension, integration etc. Afterwards, the number and kinds of activities to be performed by the student must be determined as well as the resources necessary to develop the didactic unit. As the final part of this phase, forms for the evaluation of the learning achieved during the teaching process are established.

APPLICATION OF METHODS AND MEANS OF LEARNING

In accordance with the existing resources in each university, teaching methods and means for learning by the student must be determined. Undoubtably in this aspect there will be differences depending upon the different possibilities of each university environment. Finally, a record or control must be kept of the methods and means used for the learning process so that these can be effectively administered.

EVALUATION OF THE TEACHING - LEARNING PROCESS

Ideally, in all university courses a pre-test or entrance exam has to be made in order to establish the entry level of knowledge in each course; especially to observe if all students have met the minimum requirements. Systems of evaluation must be designed and applied during the training and education of the student in order to observe the progress or difficulties in the teaching-learning process. Once this course is over, an evaluation of the final level of knowledge of the student is made to establish whether or not the previously determined objectives have been met.

VERIFICATION OF PROFESSIONAL PERFORMANCE

When the process of the university education is concluded and the new graduates have begun their endeavours on a professional basis at least six months to a year should be allowed to pass before the interview formula is applied to the new professionals in their respective fields of employment. Then, once again, these new data are used to make a comparative study of the performance of the functions and the responsibilities of the professionals that the university educator had in mind and tried to achieve, and the real professional as found in practice. With this information, the respective courses can periodically be reviewed and updated, producing more effective teaching methods.

In conclusion, this process of designing university courses for each subject according to investigations of the performance of function and responsibilities in professional practice permits the educator to identify problems and needs in order to keep university education up to date.

In the case of pesticide toxicology and its implications for the health field, we will now relate briefly what has been done, up to this moment, in the School of Health Sciences of the Industrial University of Santander, Bucaramanga, Colombia.

DESCRIPTION OF THE PESTICIDES EDUCATIONAL PROGRAM FOR MEDICAL STUDENTS AT THE INDUSTRIAL UNIVERSITY OF SANTANDER, BUCARAMANGA, COLOMBIA

The educational program on pesticides for medical students is presently included as an integral part of the clinical toxicology course given during the semester in Internal Medicine in our University. During the semester dedicated to internal medicine the students are divided into groups of 6 to 8 and each group rotates through the different areas of activity one of which is the emergency room and clinical toxicology. This clinical toxicology course consists of the following activities.

Classes in theory on the most common types of poisoning in the region according to the statistics of our Toxicology Analysis Laboratory; discussion groups to analyze chosen topics related to clinical toxicology; a presentation by each student of a recent article from the scientific literature on toxicology, revision or elaboration of an indexed card on a poison at the Advisory Centre on Toxicology, clinical practice with patients admitted to the emergency service of the internal medicine and pediatrics departments for acute poisoning, collaboration in consultative advice on toxicology to the various hospital services and practice in taking and sending of specimens to the Laboratory of Analytical Toxicology as well as interpretation of the results. The students must elaborate and discuss with the teacher the clinical history of patients seen in the emergency service as well as of the patients seen by the consultant.

The schedule devoted to toxicology consists of 4 hours in the afternoons from 2 to 6 p.m. and in the emergency service from 7 to 10 p.m. The students must also be informed about cases which arrive during weekends and holidays in the emergency service during the three weeks rotation. In addition to an evaluation made of each one of the various above mentioned activities, at the end of the course a 50 question multiple-choice answer test is administered.

In respect of the role played by pesticides, it should be mentioned that in our university hospital the primary cause of acute poisoning is attempted suicide, in 60% of the cases by means of pesticides. This gives the students an excellent opportunity to become familiar with the clinical picture presented by, as well as the treatment of, these patients. In a program coordinated with the neurology department and, to a lesser extent, with the psychiatry department, patients who manifest neurological or psychiatrical disturbances are also seen on a consultation basis. In the region at present, a majority of these cases are caused by pesticides. Thus, the opportunity has presented itself for several clinical research papers. Thanks to the frequent and easy contact with the physicians serving in this rural region and to the important collaboration with the Agromedical Committee of Santander and southern Cesar, a survey of 20 physicians, graduated over the past four years, was conducted to establish the functions and responsibilities of the medical doctors graduated from our university in relation to prevention and handling of health problems due to pesticides. This survey has allowed us to integrate into the theoretical part of the program the basic precepts of agromedicine and the agromedical team, of the agro-eco-system and also of integrated pest control, of safe handling norms for pesticides with regard to protective clothing, basic hygiene and cleansing of exposed personnel and the need for periodical checks in the Laboratory of Analytical Toxicology as well as clinical toxicology.

In addition to the clinical picture the students become familiar with the method used for measuring blood cholinesterase inhibition and with the methods of thin layer chromotography for identification of pesticides and their use and significance in clinical practice.

Within the next 2 semesters we expect to apply once again our initial survey formula for the study of the professional performance of the first group of medical doctors that graduated after having participated in this new type of programming initiated in the first semester of 1978 at the Industrial University of Santander, Bucaramanga, Colombia, in order to evaluate, review and update the contents of the program.

AGROMEDICINE AND PESTICIDE MANAGEMENT

W.F. ALMEIDA
Biological Institute, São Paulo, Brazil

ABSTRACT

Agromedicine is a relatively new concept. It deals with the interdisciplinary application of agriculture, applied chemistry and medicine to the safe global production of food with maintenance of the health conditions of agricultural workers and the general population.

The concept of pesticide management calls for a coordinated multidisciplinary team approach for controlling agricultural pests. The objective is to apply the required amount of pesticide at the precise target area with a minimum of loss to the surrounding environment and without hazard to man.

Highly hazardous pesticides and formulations must be submitted to a system of restricted use. Many countries solved this problem with intensive training of pesticide applicators followed by their licensing or certification. Other countries require for the sale of hazardous pesticides a prescription issued by an agronomist.

INTRODUCTION

Agromedicine is the integrated interdisciplinary application of the skills and knowledge of agriculture, applied chemistry and medicine to the safe global production of enough food and fiber to meet the needs of man (ref. 1).

Agromedicine is a relatively new concept. It deals with all agricultural workers, including women and children employed on the farm, whether for remuneration or not, and covers items such as age of admission of children to agricultural employment and maternal protection (ref. 1).

The ultimate goal for agriculture is to produce a beneficial and nutritious supply of food. As the magnitude of malnutrition in the developing countries and the significant causal attributes of dietary factors in many of the chronic diseases in the developed world become more widely appreciated, agromedicine is concerned in assuring that the goal will be attained, with maintenance of the health of agricultural worker, bystanders and the general population.

AGRICULTURAL WORKERS

Agricultural workers constitute an appreciable high proportion of the general population throughout the world. As a group they present general problems, related to the physical environment (housing, water, sewage and waste disposal), some significant diseases and the social environment. They are also exposed to specific problems (economical situation, working conditions and occupational hazards).

Health problems of agricultural workers are numerous, complex and influenced by a multiplicity of factors. Toxicity of agricultural chemicals represents an important chapter in the group of occupational hazards of the agricultural workers.

PESTICIDES AND PUBLIC HEALTH

Public Health is defined as "the science and the art of preventing disease, prolonging life and promoting physical and mental health and efficiency through organized community efforts" (ref. 2).

Several hundred chemicals are used as pesticides (e.g. insecticides, larvicides, miticides, fungicides, herbicides, molluscicides, nematocides, and rodenticides), and processed into thousands of different formulations. A few highly toxic organic phosphorus compounds were originally developed as war gases (Schradan) and used in agriculture (OMPA, Pestox-3, and Sytam). However some of the insecticides still in current agricultural use (aldicarb, for example) are ten times more toxic than the original war gases.

Acute poisoning

Highly toxic pesticides are commercialized and used in many developing countries without any restriction (ref. 3). Illiteracy, lack of information, and insufficient steps to ensure the safe and adequate use of pesticides are the main causes of poisoning among pesticide applicators and bystanders.

Morbidity and mortality data are not available in developing countries in relation to pesticide accidents because many cases are not attended by medical doctors and remain without diagnosis. Even in hospitals, the lack of adequate equipment hampers the confirmation of the diagnosis. However, some cases have been reported (Table 1).

Long-term effects

Pesticides can also be responsible for diseases which manifest itself many months or several years after continuous absorption of small daily doses. In these cases the diagnosis is much more difficult than in acute poisoning by pesticides.

Agricultural workers may present clinical symptoms several months or years after the beginning of the work, due to the continuous absoprtion of small doses during the pesticide spraying.

On the other hand, the general population is also exposed to the long-term effects of pesticides by the ingestion of food with pesticide residues higher than the maximum permissible limits and the maximum acceptable daily intake for man.

The long-term effects depend upon the type of pesticide. Among these effects it is worthwhile to mention: 1- lesion of the central nervous system (methyl mercury fungicides); 2- delayed neurotoxicity (several organic phosphorus compounds); 3- peripheral neuritis (chloro-phenoxy acid herbicides); 4- decrease in antibody production (organo-tin fungicides); 5- testicular atrophy (tridemorph fungicide); 6- male sterility (dibromo-chloro-propane nematicide); 7- mutagenesis (alkylating agents) ; 8- teratogenesis (dioxin in 2,4,5-T; methyl mercury fungicides); 9- carcinogenesis (aramite, 4-chloro-ortho-toluidine in chlordimeform, ethylenethiourea in ethylene-bis-dithiocarbamates).

PESTICIDE MANAGEMENT

R.F. Smith (ref. 4) has defined pesticide management as "the technology concerned with the safe, efficient and economic use and handling of pesticides from time of manufacture to the final utilization and disposal. Included in this process are formulation, packaging, transfer, storage, official registration, labelling for use and sale, selection for use, application and the disposal of containers and unwanted materials. In addition, pesticide management is concerned with the problem of residues in food and in the environment, and

TABLE 1

Some acute pesticide poisonings in Brazil, 1977-1980

Year	Location	Situation of accident	Pesticide involved	Number of deaths	Number of cases
1977	MG	several cultures	O.P. + O.C.	35	700
	RS	soybean plantation	O.P. + O.C.	3	?
	SP and MS	soybean and cotton plantations (aerial application)	O.P.	11 [a]	33 [a]
1978	SP and MS	soybean and cotton plantations (aerial aplication)	O.P.	1 [a]	4 [a]
	SP	crèche	rodenticide	-	26
	SP	cotton plantation	monocrotophos	1	?
	MG	food contamination	O.P.	6	9
	PR	soybean and cotton plantation	O.P.	3	750
	RS	soybean plantation	not specified	-	30 [b]
1979	SP	contaminated rice	parathion	1	?
	SP	agricultural spraying	decamethrin	-	1 [c]
	PR	seed treatment	carbofuran	-	54
	RS	several cultures	not specified	-	30
1980 (Jan. Oct.)	SP	head lice treatment	parathion!	2	7
	RS	several cultures	O.C.	-	19 [b]
			O.P.+carbamates	-	14 [b]
			others	-	15 [b]

Notes:

MG= State of Minas Gerais; MS= State of Mato Grosso do Sul;

PR= State of Paranã; RS= State of Rio Grande do Sul;

SP= State of São Paulo.

O.P.= highly toxic organic phosphorus insecticides (usually parathion).

O.C.= highly toxic chlorinated hydrocarbon insecticides (usually endrin).

(a)= agricultural pilots.

(b)= data from the Toxicological Information Center - RS.

(c)= neurological signs from the 2nd to the 4th week after exposure.

the total impact of these on man".

Some of these aspects, directly related to agromedicine, will be discussed in this paper.

Reducing pesticide hazards by improving methods of application

The concept of pesticide management calls for a coordinated multidisciplinary team approach to the control of agricultural pests. The basic team should include experts in the areas of agriculture, health and chemistry to deal with three major areas related to pesticide application technology (ref. 5).

1) Factors affecting application efficiency. The objective of the application is to apply the required amount of pesticide at the precise target area with a minimum of loss to the surrounding environment. The selection of the proper nozzle is one of the most important factors to be considered in the operation of spray equipment. The nozzle type and operating parameters affect: application rate, spray distribution pattern, and droplet size distribution. It is very important to select nozzles that produce a minimum of fine particles and that are geared to the type of chemical, crop, pest problem and surrounding environment.

2) Hazards to health of pesticide applicators. The type of application equipment and the toxicity of the chemical dictate the type of protective equipment required during pesticide applications. If the chemical is highly toxic, the applicator should be fully protected with waterproof trousers, coat, hat, gloves, and respirator. Under tropical conditions it is necessary to use a less toxic pesticide or a less toxic formulation. Another approach is to make applications only in the morning or in the evening when protective clothing can be worn.

Application of toxic materials must be avoided during very stable weather conditions associated with strong temperature inversions.

3) Hazards of pesticide drift into the surrounding environment. The drift of even minute amounts of certain pesticides may present a hazard to people, livestock, wildlife or non-target crops. The drift of 2,4-D and related compounds has been recognized as a potential hazard for a long time. Drift of these herbicides have caused damage or symptoms on sensitive plants several kilometers downwind from the treatment area.

Inhalation of particles or vapors as well as deposition on skin or clothing may pose a health hazard to nearby farm workers or others adjacent to the application.

Drift of pesticides onto edible crops near harvest time and into water supplies may pose a health hazard as a direct contaminant of food or indirectly through contamination of meat or milk. Many countries have strict tolerances or maximum residue limits -MRLs- for pesticides in food products. If pesticide tolerances or MRLs are exceeded this could have a serious financial effect on either internal or export sales.

Safe and adequate use of pesticides

The correct use of agricultural pesticide depends upon several very important points: 1- Method of application; 2- Restricted use of highly toxic pesticides; 3- Periodical training of agricultural workers; 4- Establishment of a system for certification of pesticide applicators; 5- Epidemiological study of pesticide poisonings; 6- Monitoring studies on pesticide residues in food; 7- Good network of poison control centers in the country. Many of these important items are often missing in developing countries (ref. 3).

Restricted use of highly hazardous pesticides

Many countries have restricted or are restricting the use of extremely hazardous and highly hazardous pesticides. Licensing of applicators is the system usually adopted; however, some countries require for the sale of hazardous pesticides a prescription issued by an agronomist.

Agronomic prescription for acquisition of highly hazardous pesticides

A prescription issued by an agronomist is required in Venezuela since 1967 for the sale of highly toxic pesticides to the farmers (ref. 6).

A decree in the State of São Paulo, Brazil, established in 1967 the same procedure for the sale of highly toxic pesticides in this State (ref. 7). However this legislation was never enforced and the free sale and undue use of highly toxic and hazardous pesticides continued in the State of São Paulo and all over Brazil as well. Several years later, a successful campaign was carried out on the same line by the Association of Agronomists of Rio Grande do Sul and, consequently, Brazil Bank agreed with a procedure that requires a prescription by an agronomist for clearance of credit operations to farmers interested in the acquisition of agricultural pesticides.

Finally, a recent federal legislation established for all Brazilian territory the system of restricted use of pesticides. The sale of highly hazardous pesticide formulations -classes I and II- is permitted only to commercial applicators (refs. 8, 9) and farmers presenting a prescription or a plant protection plan issued by an agronomist (ref. 9). The toxicological classification of pesticide formulations in Brazil follows the system recommended by the World Health Organization (ref. 10) based on the hazard of a formulation rather than on the LD_{50} of the active ingredient.

On the other hand, a relatively new legislation in Brazil dictates the recording of general, agronomical and toxicological information on the label of pesticide products and also determines the color of a band on the label according to the toxicological classification (ref. 11). A similar legislation also exists in Venezuela (ref. 6).

The main benefits derived from the adoption of the system of agronomic prescription for hazardous pesticides are:

a) recommendation of a really efficient pesticide and the most adequate formulation against a particular pest;
b) application of the pesticide only when and where a pest is an actual problem;
c) use of the safest pesticide according to the level of technical skill of local agricultural workers;
d) prevention of pesticide poisoning because hazardous formulations will be prescribed only where skilled applicators and adequate equipment are available;
e) adoption of good agricultural practice, which saves pesticides and reduces the residues in food far below the tolerances or maximum residue limits; consequently, farmers have a more economic operation, the general population is protected and the international trade is facilitated.
f) promotion of commercial firms which produce more efficient pesticides and safer formulations.

Certification of pesticide applicators

Many developed countries solved the problem of safe and adequate use of hazardous pesticides with periodical training of the workers responsible for pesticide application. This system requires intensive courses with theoretical and practical classes.

Agricultural workers who pass the examination receive a certificate and become "certified pesticide applicators". The renewal of the certificate is achieved by an intensive refreshing course on toxicological and agricultural aspects of pesticides.

A few intensive courses on pesticide toxicology and pesticide application have already been carried out in several Brazilian States during the past ten years (ref. 12).

An interministerial and multidisciplinary group is now studying the bases for the establishment of a national programme on the certification of pesticide applicators. This programme will be aimed at the ground applicators because aerial applicators or agricultural pilots have already been very well trained in special courses under the co-ordination and supervision of the Ministry of Agriculture.

Certified applicator means any individual who is certified to use or supervise the use of any restricted use pesticide. There are several categories of pesticide applicators; 1) Agricultural pest control (private and commercial applicators); 2) Agricultural pilots; 3) Seed treatment; 4) Stored grain treatment; 5) Livestock pest control; 6) Ornamental and turf pest control; 7) Forest pest control; 8) Aquatic pest control; 9) Right-of-way pest control; 10) Household pest control; 11) Public health pest control.

The implementation of the certified applicator programme in Brazil is highly important to prevent the occurrence of acute pesticide poisoning among agricultural workers and to avoid high residue levels in food. On the other hand, the certified applicator programme represents a sound support for the system of restricted use pesticides through prescription of agronomists.

Benefits resulting from the certified applicator programme

First of all, the implementation of a system for certification of pesticide applicators in a country establishes a permanent training of agricultural workers. This system is actually dynamic with practical lessons and periodical refreshing courses.

On the other hand, the adequate training of agricultural workers results in:

a) efficiency, achieved by improved methods of application and use of an adequate pesticide during the most susceptible phase of a pest;

b) savings, accomplished by the application of a pesticide only when and where it is absolutely necessary;
c) protection of the health of workers, bystanders and the general public through correct spraying of less hazardous pesticides and formulations;
d) increase of foreign exchange through exportation of food with pesticides below the maximum residue limits;
e) social improvement through establishment of a new profession (certified applicator) so that unskilled workers become experts in pesticide application.

Responsibilities of the certified pesticide applicators

After the intensive training course a pesticide applicator will:

1) recognize the most important pests (insects, mites, fungi, and weeds) in the region;
2) have a general idea on the more adequate methods for controlling these pests;
3) read the labels of pesticide products and understand them, specially in relation to the use pattern of the pesticide and restrictions;
4) know where to get information on the most appropriate pesticides for the most common pests in the region;
5) know the techniques for stored grain treatment and what are the permitted pesticides;
6) carry out the necessary dilutions of a formulation, following the recommendations on the label;
7) have a clear idea of the hazards related to pesticides and their formulations;
8) correctly apply pesticides, preventing acute poisoning of the applicator and bystanders, and also keeping the residues below the maximum permissible limits;
9) know how to give first aid in case of poisoning by pesticides;
10) correctly handle different types of pesticide spraying equipments, extending their period of usefulness;
11) calibrate different types of nozzles to obtain the most adequate spray for each case;
12) take charge of the acquisition, transportation, storage and application of highly hazardous pesticides.

CONCLUSION

Agromedicine is the reciprocal input of the strategies of agriculture and medicine promoting safe food production and adequate nutrition of man. This is possible only through an interdisciplinary integration.

Good pesticide management calls for a team approach to achieve the safe and adequate use of pesticides. This team must be basically formed by an agronomist, an applied chemist, a biologist, and a medical doctor.

Restricted use of highly hazardous pesticides and formulations prevents the occurrence of pesticide poisonings and precludes high residue levels in food. The systems adopted for this aim are usually based on: a) certification or licencing of private and commercial applicators; b) pesticide sale subject to the presentation of a prescription issued by an agronomist.

REFERENCES

1 J.E. Davies, Proceedings of the Seminar/Workshop in Pesticide Management, University of California/Agence for International Development - USA and University of Alexandria, Arabian Republic of Egypt, Alexandria, 1977, pp. 50-60.

2 C.E.A. Winslow, Science, 15 (1920)23.

3 M.E.W. Almeida, D. de Mello, N. Rodríguez V. and W.F. Almeida, in H. Frehse and H. Geissbühler (Eds.), IUPAC - Pesticide Residues, a Contribution to their Interpretation, Relevance and Legislation, Pergamon Press, Frankfurt, 1979, pp. 95-97.

4 R.F. Smith, mentioned by Davies in ref. 1.

5 W.E. Yates, Proceedings of the Seminar/Workshop in Pesticide Management, University of California/Agence for International Development - USA and University of Alexandria, Arabian Republic of Egypt, Alexandria, 1977, pp. 75-86.

6 Venezuela, Reglamento Gen. Plaguicidas, Min.Sanid. y Min.Agric., 9 Julio 1968.

7 São Paulo, Decreto 47.683, Diário Of., São Paulo, 28 Jan. 1967.

8 Brazil, Portaria 429, Min.Agric., Diário Of., Brasília, 23 Oct. 1974.

9 Brazil, Portaria 347, Min.Agric., Diário Of., Brasília, 11 Nov. 1980.

10 OMS - Crônica, 29 (1975) 429-433.

11 Brazil, Portaria 220, Min.Agric., Diário Of., Brasília, 16 Mrch 1979.

12 W.F. Almeida, Saúde Ocupacional, São Paulo, 6(1978) 37-44.

ACCIDENT PREVENTION AND EDUCATION FOR SAFE USE OF PESTICIDES IN COLOMBIA

DARIO CORDOBA PALACIO
Universidad de Antioquia, Medellín, Colombia

ABSTRACT

The most common problems that occur in Colombia by misuse of pesticides are analyzed.

The accuracy of statistical records is discussed.

An analysis of Colombian legislation is made on pesticide production, distribution, transportation, and use on crops (air and land spraying) and in the home; emphasis is placed on the dangers of violation.

Several solutions to the problems revealed are proposed and suggestions are made on:

a) improvement in teaching at a professional level;
b) support to scientific associations of toxicology and to agricultural and cattle-raising companies, in order to obtain better information for the people who frequently use pesticides;
c) adequate utilization of mass communication media;
d) information on these topics at elementary and secondary school level;
e) need for strict adherence to legislation;
f) improvement of medical assistance to obtain adequate treatment for the poisoned patient;
g) improvement and broader dissemination of statistical records.

INTRODUCTION

The advent of new materials and of new techniques always brings the possibility of new risks and on occasions these risks are of such a nature that they endanger the life of humans and animals, either in an acute or chronic manner because of the ecological imbalance and environmental contamination that they cause. This is the negative side of pesticides; the positive side is their incomparable and irreplaceable benefit for agriculture and for the world economy.

This problem has already been discussed by recognised authorities and published by international health organisations while we in Colombia are still concerned with the most basic aspects of such a difficult problem.

When we were assigned this topic, and conscious of the responsibility that was involved, we accepted the invitation both as a means of acquiring new knowledge and of presenting the serious problems that exist in our country, which without doubt are similar to those found in other developing countries.

It is, then, our intention to refer to the Colombian reality and we will not be tempted to present a false image of our country. Our aim is to analyze our own problems and to seek advice and guidance in order to improve the present situation.

SURVEY OF THE PROBLEMS

Statistics of poisoning

In Colombia approximately 1 kg of pesticides per person per year is used. However, one of the principal obstacles found in the analysis of the Colombian scene is the great difficulty of finding reliable statistics about the occurrence of cases of poisoning, whether it be at work, suicide or of an accidental nature, as well as the lack of publications about the problems of environmental contamination and its consequences.

The data found in official statistics are not wholly reliable, since they do not record the total number of cases that occur. Let us look at some of the reasons why these data are incomplete.

1 In some cases the real causation is not established or the poisoning is not diagnosed because the physician has not received sufficient medical training on this topic in his professional curriculum.
2 It is difficult to obtain toxicological or forensic laboratory results, which adds to the problem mentioned above.
3 For a wide variety of reasons, such as individual, collective or economic interests, there is an attempt to hide the occurrence of individual or collective cases of poisoning, especially when worker or economic consequences can be avoided.
4 In the case of suicide attempts, social motives and legal implications can influence the statistics.

Production and sale of pesticides

In our country, several commercial enterprises, generally foreign, handle the sale of pesticides. Unfortunately, a complete study of the accidents caused by errors at an enterprise level could not be made. However, we can state that these companies work according to international regulations concerning pesticides and that, in general, serious problems are nonexistent in their factories with the exception of accidents resulting from negligence of employees in implementing the recommendations made by the safety officers of the companies. A frequent example is the carelessness of employees in the use of protective equipment. Accidents to workers have been increased by their refusal to wear masks and gloves. We have been told that this occurs because the workmen feel uncomfortable using such equipment.

Transportation of pesticides

An error made in the transportation of a small container of PARATHION (75 ml approximately) caused one of the most serious tragedies that have occurred in Colombia: the massive poisoning with a high death rate of nearly 500 persons at Chiquinquirá, on Nov. 25, 1967.

This lamentable event was perhaps the alarm signal that caused us to realize the necessity of getting information and teaching toxicology in our universities. For this reason we have called the tragedy of Chiquinquirá the starting point of toxicology in Colombia. Although some ideas about toxicants were taught before this event, what is certain is that, due to this event, the teaching was intensified, although even now it is not adequate. This is our personal judgement which we will demonstrate when we analyze present teaching.

Standards exist that regulate the transportation of pesticides. Ministry of Health Resolution 1304 of 1967 prohibits the transportation of these substances together with food products, drinks, drugs, clothing or containers that will later hold food. It specifies that the substances should be adequately packed to avoid breakage, seepage, etc., that they should have a warning label and recommends the use of the wellknown skull and crossbones symbol with the words DANGER - POISON. Standards regulate also, how these substances should be handled, the correct stowing of the freight subject to adequate protection and finally, they define the obligation to prevent any accident that might cause poisoning. They require the filling out of a special transportation form, with stipulations that need not be mentioned here. Similar to this resolution, others exist for the purpose of controlling aspects of transportation, storage, sale, etc. (0388 of 1968 and 2121 of 1974).

LIMITS OF TOLERANCE AND LEGAL REGULATIONS

General

In Colombia, the regulating of many of the aspects related to pesticides has been assigned to the "Instituto Colombiano Agropecuario (ICA)". The "ICA" establishes, then, by resolution 654 of 1974 the tolerance for the handling of seeds before planting and after harvesting and determines the methods of analysis to be used to obtain the values officially determined. This institute is in charge of the application of the legislation and the compliance to all the offical standards existing in this respect.

In reviewing this legislation, we found standards that prohibit the use of specific active principals. This is the case of resolution 447 of 1974 that prohibits the use of chlorinated pesticides in the cultivation of tobacco and establishes a strict control of their residues. Resolution 2189 of 1974 cancels the sale permit of fungicides based on mercury compounds.

In 1974, by means of resolution 108, the offical classification of pesticides into distinct categories was established. The Ministry of Health, by means of resolution 0388 of 1968 prohibits the use of highly toxic pesticides for domestic use. The same resolution prohibits the sale of pesticides of this kind in quantities less than 1,000 ml for the purpose of avoiding sale to persons who lack knowledge about the danger that they present and so orientate their use exclusively to organisations known to be responsible, such as the Ministry of Health, the malaria eradiction program, etc. This is not always achieved as we know that persons that are not sufficiently responsible do business daily with these products, paying no attention to these restrictions with resulting accidents and deaths.

With regard to the products whose active ingredients are 2,4,5-T and 2,4,5-TP, these are prohibited by resolution 749 of 1979.

Consequently, a series of regulations exist in our country that can be taken as an indication that something is being done by the health authorities in order to achieve the immediate safety of Colombians and the protection of their goods from pesticide contamination. In reviewing the legislation, we found that approximately 40 dispositions in laws, decrees, resolutions, regulations, etc. exist for the purpose of establishing standards concerning pesticides.

Aerial spraying

In relation to aerial spraying, standards also exist. The responsibility lies with a professional who due to his employment should not only know the benefits of these products from the point of agriculture, but also the dangers that inadequate spraying of these substances can cause not only to agriculture, but also, and perhaps of greater importance, to humans. The professional appointed with this high responsibility is the Agronomic Engineer.

For aerial spraying, there are regulations concerning the use of equipment, zones to be covered, height of flying, besides other technical aspects. To be officially permitted to spray from the air, it is necessary to inform the competent authority about other aspects among which we mention weight or quantity of the mixture per unit of surface, dose, etc.

The fixing of marker flags is also regulated and standards exist for emergencies, regulating the conduct of the pilot when for reasons out of his control he has to land in airports not authorized by "ICA".

Ground spraying

For this type of spraying, regulations also exist, but we feel that perhaps this legislation is the one that is most frequently violated and that causes the greater morbidity and mortality when violated. We can not deny the fact that there are companies and individuals that frequently do not abide by these laws. This is apparent when we so often see accidents occurring from not adhering to these standards, from the spraying of grade 1 toxicants in homes, whether it be applied by the owners who have been offered products with no trade mark and with no indication of active ingredients or instructions for first aid, or by fumigation companies lacking ethics. The domestic user can acquire these products with little difficulty in stores and supermarkets, regardless of the existence of restrictions as these are frequently ignored.

Frequently our peasants, desiring to control pests, but not having scientific knowledge and lacking information about the dangers involved in the misuse of pesticides, resort to the inadequate application of these, including the method of application, the absence of appropriate protective clothing, violation of hygienic procedures (change of clothing, bathing after finishing their work, washing of contaminated hands before smoking or eating, etc). All of these things and many more occur due to ignorance. This is why we would have liked to go deeper into the aspect of education, since we consider it of vital importance.

Application in homes

We have mentioned the prohibition of applying grade 1 toxicants in homes but we should, in order to give a complete picture, mention that in Colombia accidents with high mortality rates occur all too frequently due to the violation of these laws. Even if it is true that our authorities have tried to avoid this, it is also true that their efforts have not been as effective as one might expect. We can not deny the existence of the illegal sale of pesticides. It is enough to remember the large number of children who die annually from the application in homes of pesticide bait having high toxicity.

It is our duty to mention this problem that in our opinion is serious and presents itself not in agricultural areas, as one would logically expect, but in the very centre of our large cities. There we are confronted with illegal trade of pesticides, many of which are of high toxicity. These are sold by irresponsible persons without fulfilling any legal requirements concerning the listing of the active agent, first aid instructions, etc. as the law demands. But the irresponsibility of these businessmen does not stop here. In their desire for profit, they display shamelessly on their labels phrases such as: "harmless for humans, can be used in kitchens, dining rooms and bedrooms, combats dandruff". Once more we state that the doings of these unscrupulous businessmen for whom human lives have no value, eludes the continuous and watchful efforts of the authorities which are disregarded by these illegal manufacturers who, in their intense campaigns, have been able to convince the public that these products are harmless for humans and can be stored in homes without any risk and used with no precaution, even left within reach of children. This unequal struggle between the authorities and the illegal traders has caused innumerable deaths among children and persons with suicidal intentions.

This position that we are describing, may seem strange and exaggerated for persons of other professions, but we cannot say anything different than the alarming reality that we see every day. In Medellín, the second largest city of Colombia and an industrial centre, with little or no agricultural activity, 1.615 cases of poisoning were attended during 1979 in just one of the public health centres, not including those attended in private clinics and hospitals. Our investigations show that close to eighty-five percent of these cases are caused by pesticides and among these, of greatest incidence, are the acetylcholinesterase inhibitors with sixty-seven percent, followed by thallium, with six percent, and chlorinated hydrocarbons, with four percent.

It is, then, undeniable, that people actually live with these substances in their houses. They can be purchased despite the legal prohibition that exists, they are utilized easily as the means of committing suicide, and what is even more serious and what we cannot help but denounce is that in Colombia publicity campaigns for pesticides are carried on over the radio and in newspapers and magazines, without having any warning about the dangers resulting from their misuse. Among these, we must include the regrettable campaigns that we see on the official Colombian television channels. The laws and the most elementary recommendations about these matters are disregarded.

Fortunately, it seems that this serious situation is beginning to be corrected or, at least, reduced in intensity. We must recognize that the Toxicology Societies have played a big part since they have denounced these irregularities emphatically in nearly all the scientific meetings that have taken place.

SOLUTIONS TO THE PROBLEMS PRESENTED

Teaching

On analyzing the scene that we have presented, we consider that the aspect of teaching and information is of prime importance. For this reason we carried out a survey in the universities throughout the country for the purpose of evaluating the instruction received at the professional level in the areas of medicine, nursing, dentistry, veterinarian medicine and agronomy (Table 1).

TABLE I

Instructions on the correct use of pesticides at a professional level

		theoretical hours	practical (lab) hours	teaching enough	campaigns
Medicine	U. Nacional	10	0	no	no
	U. de Antioquia	20	2	no	no
	C. Estudios de la Salud	6	0	no	no
	U. de Caldas	20	2	no	no
	U. del Norte	10	4	yes	no
	U. Metropolitana	2	2	no	no
	U. Tecnologica	0	0	no	no
Density	U. Nacional	0	0	no	no
	U. de Cartagena	0	0	no	no
	U. de Antioquia	4	0	no	no
	U.P. Javeriana	0	0	no	no
Nursing	U. de Antioquia	10	0	no	no
	U. de Caldas	4	0	no	no
	U. de los Llanos	20	2	no	no
Agronomy	U. Nacional - Medellĩn	15	8	no	no
	U. Nacional - Bogotá	10	6	no	no
	U. de Caldas	10	10	no	no
	U. Pedagógica	10	10	no	no
Vete-rinary	U. de Antioquia	10	2	no	no

Table I shows us clearly that the instruction at a professional level is of slight intensity and that some institutions completely lack theorectical classes dealing with the correct use of pesticides, their immediate and later dangers and actions concerning cases of poisoning.

How, then, can a professional in the field of health be prepared?

How can he face individual or mass emergencies?

How can he prevent the phenomena of contamination and ecological damage?

How can he give instruction about the appropriate handling of pesticides and their risks if his knowledge is minimum or even nonexistent?

If proper instruction is deficient at a professional level, it is logical to conclude that the peasant must lack information and hence makes mistakes due to ignorance and that historically we can say that these errors are the cause of individual deaths and enormous tragedies, on which Colombians are so frequently informed about by radio, TV and in the press.

To our survey, nineteen deans and heads of departments in different professional faculties who were questioned gave their answers. They answered almost unanimously that the instruction was insufficient. This is evidence that our faculty directors realize the necessity of intensifying the instruction given on this matter in the different professions. To the question as to whether or not campaigns were carried out in the community, the answer was unanimously negative. Thus, we lack another mechanism for informing the public.

We insist that the teaching at a professional level is basic if this information is to reach lower levels, in order to obtain adequate and prompt treatment for emergency cases, to explain how these substances ought to be applied and how to avoid problems of contamination and an unbalanced ecological condition. Proper instruction is necessary so that the professional becomes the guardian to see that standards stated by organisations on a national, continental and worldwide basis are put into effect (Scientific Societies, FAO, WHO, ILO, etc.).

It is our opinion that toxicology ought not be taught only in a theoretical manner in classrooms, but also in a practical way in clinics under the supervision of an authority in the field of health and with experience in dealing with practical difficulties and able to give solutions for the complications that each specific case might have. As a consequence of this idea, we propose the creation of Centres of Information, Assistance and Instruction. Their functions would be precisely to inform, assist and serve as places of practical training for professionals.

Toxicology societies

At the present time there are in Colombia two such societies: "La Sociedad Colombiana de Toxicología" and "La Sociedad Colombiana de Toxicología y Farmacodependencia"; societies with little financial backing but many plans and projects. The sponsoring of these societies whose goal is to promote research, give advice in difficult cases and provide better preparation for the professionals who are members, is an undeniable necessity.

Mass media

A great responsibility lies with the mass media. They ought to carry out educational campaigns and not only commercial ones. We suggest for Colombia the following actions.

a) The official television channels should be employed for the enlightenment of the public.
b) The same holds true for the use of the national radio system, an official body that covers the whole of the nation.
c) Finally, the use of the "Escuelas Radiofonicas" is suggested since their prime aim is to educate those who have no access to formal education.

Logically we affirm that education in regard to the correct handling of pesticides, information about the risk and dangers and their prevention will avoid accidents; it is precisely the "Escuelas Radiofonicas" that can accomplish these results among the agricultural (and often illiterate) masses.

d) The beneficial job that companies related to cattle raising and agriculture can carry out should also be taken into consideration since they are in direct contact with those who use such products.

c) In addition, we feel that it is convenient to suggest that physicians and physicians' assistants have access to primary and secondary schools in order to give information to the future adult population.

Legislation

We believe that the Colombian legislation, that is in agreement with the recommendations established throughout the world, is sufficient. But we must suggest that the control of its application be stricter, that the instruction given to the officials in charge of this vigilance be intensified as on occasions the ingenuity of the lawbreakers caught them by surprise.

Control of application

We consider it urgent to reemphasize the need of being very strict in the fulfilment of these recommendations. The personnel in contact with these products ought to be subjected to medical examinations periodically and these check-ups ought to be more frequent and careful when the workman is a pilot or driver since, due to the responsibility of their jobs, they can be participants in lamentable tragedies.

Medical assistance

The improvement of medical attention in general is an undeniable need: better education for physicians and physicians' assistants, better equipment for treating patients, greater supply of antidotes, better and more accessible clinical, toxicological and forensic laboratories.

We recommend the creation of emergency clinics where they are nonexistent and the provision of direct means of communication with the appropriate area of the university centres for a better, more appropriate treatment of the patient.

Statistics

It is not only necessary to continue improving our statistics about national problems, but also to intensify their publication in order to be aware of our own problems and to promote the search for their solution.

RESUMEN

Se analizan los problemas más frecuentes ocurridos en Colombia por el mal uso de los plaguicidas.

Se discute la realidad y efectividad de los registros estadísticos.

Se analiza la legislación Colombina en los aspectos de producción, venta, transporte, aplicación aérea, terrestre y doméstica de plaguicidas y se hace énfasis en los peligros de su violación.

Se plantean distintas soluciones a los problemas analizados y se sugiere:

a) mejor docencia a nivel profesional;
b) apoyo a Sociedades Científicas de Toxicología, y a entidades de agricultura y ganadería, a fin de lograr mejor ilustración de las personas que utilizan frecuentemente plaguicidas;
c) utilización adecuada de los medios masivos de comunicación;
d) illustrar sobre estos temas a nivel de enseñanza primaria y secundaria;
e) aplicar estrictamente la legislación;
f) mejorar los medios asistenciales para obtener una attención adecuada del paciente intoxicado;
g) mejorar los registros estadísticos y darles mayor divulgación.

THE USE OF AGROCHEMICALS AND SAFETY MEASURES IN THE STATE OF PARANÁ, BRAZIL

J.F. AMARAL and J.M.A.R. DINIZ
State University of Londrina, Paraná, Brazil

ABSTRACT

The use of agrochemicals is a necessity in the cultivation of land in the present days, where intensification of crop production and plant sanitary problems, whether they are diseases, pests or weeds, are increasing side by side.

The situation in the State of Paraná is no exception to this, or it may seem to be even worse here. Forty percent of the total quantity of agrochemicals used in Brazil is reported to be consumed in Paraná.

The state being predominantly agricultural one would expect certain problems with such a high application of agrochemicals. However, the number of cases of poisoning is not high in relation to the use of these chemicals.

The State of Paraná, through the organizations of agricultural extension and research has provided a series of measures to minimize risks and to control the application of agrochemicals in the region.

In spite of the fact that the agricultural cultivation in the areas of the state that mostly use these chemicals, is fairly new, the problems seem to be well under control. However, the foundation of a toxicological information center in the region is important.

INTRODUCTION

Since the intensification of crop production is generally accompanied by the problems related to crop sanitation, whether they are diseases, pests or weeds, the use of agrochemicals becomes an essential feature. This is seen especially in the present days where there is an increase in the cultivation of arable land. The increase in the world population and the tendency of most of them to live in urban areas add to the problems of agriculture. The persons that remain in the rural areas are generally those in the lower socio-cultural level with low chances of progress while providing the man-power for the different types of work in these areas.

The State of Paranã offers no exception to the above situation and perhaps may seem to be affected even to a greater extent at present.

The agricultural land cultivated in the State of Paranã supports annual and perennial crops. Among the major crops in the State in 1978 according to the Brazilian Institute of Geography and Statistics (IBGE) are (ref. 1):

01.	Soyabean	2,348,541 hectares
02.	Corn	1,898,525 hectares
03.	Wheat	1,345,093 hectares
04.	Beans	744,003 hectares
05.	Coffee	670,400 hectares
06.	Rice	383,316 hectares
07.	Cotton	290,100 hectares
08.	Potato	63,626 hectares
09.	Manioc	52,905 hectares
10.	Sugar cane	47,570 hectares
	Sub total	7,844,079 hectares

Agrochemicals are used in all the above mentioned crops in varying quantities; the increase in the use of herbicides being substantial.

Among the agrochemicals used in Paranã, insecticides occupy the first place as shown below:

Consumption of agrochemicals - 1979/80 - Paranã (ref. 2)

Insecticides	11,700,000 kg	
	30,081,000 l	41,781,000 kg-l
Herbicides	3,108,000 kg	
	3,901,000 l	7,009,000 kg-l
Fungicides	7,652,000 kg	
	200,600 l	7,852,600 kg-l
Total		56,642,600 kg-l

This quantity is approximately 40% of the total agrochemicals in commercial form consumed in Brazil.

During 1979 (79/80 harvest) a relatively large number of equipment was used in the application of these chemicals in Paranã; of these 39,000 has been reported as tractor operated, while 170,000 were of the knapsack type (ref. 3).

RESULTS

Based on the data presented and considering the variations in the area cultivated, there is a considerable number of persons involved in the application of these agrochemicals. One can estimate a minimum of 39,000 persons (one per motorized equipment), as average of 209,000 persons (one per equipment, motorized or knapsack); a maximum is difficult to be estimated.

From these data one can deduce that there have been approximately 200,000 persons involved in the application of agrochemicals during 1979/80, each one handling a quantity of 283 kg or l.

When we consider that the ten major crops in the State of Paraná occupy 97,5% of the cultivated area (1978), which corresponds to 7,844,079 hectares, and that this entire area received agrochemicals, we would have a distribution of 7.2 kg or l of agrochemicals per hectare.

The data presented here are based on the information obtained from the Brazilian Institute of Geography and Statistics and the Secretary of Agriculture in the State of Paraná; according to them, these data are estimates. Even so, one can see the importance of this State in agricultural production as well as the involvement in the use of agrochemicals.

Considering the large consumption of agrochemicals in the State, the number of reported cases of accidents related to these products is relatively low.

According to the data available, during the period of March, 1972 to July, 1980 132 cases of poisoning have been registered at the hospital of the State University of Londrina, Paraná (ref. 4). The University Hospital is one of the three available in the region of Londrina where approximately 3% of the total consumption of agrochemicals in the State is used. According to Ann et al. (ref. 4) only 85 cases have been accidents, being a small number considering the length of the period. The 132 cases cited above were included in a list of 451 exogenous poisonings which covered a variety of toxins, including therapeutic drugs, agrochemicals, etc.

Having presented the situation of agrochemicals in Paraná, one can comment on the ways and means adopted for their rational use.

The State of Paraná is among those states which are concerned about the control of plant sanitary problems, reducing at the same time the amount of agrochemicals used, in order to control environmental pollution.

The Secretary of Agriculture in the State of Paraná and EMATER (Association of Enterprises for the Technical Assistance and Rural Extension of Paraná) stimulate through technical assistance the use of agrochemicals with the objective of increasing production.

Trying to obtain a greater cover of an adequate use of agrochemicals, a system of agricultural prescription has been introduced as a recent measure.

Courses on the use of these chemicals are available from the level of farm workers even up to post-graduate level. However, all these measures cannot completely solve the problems causes by the improper use of agrochemicals.

The major problem still continues to be the socio-educational level of the rural workers and their resistance to the introduction of new technology.

The problem is not one which can be solved by the agricultural graduate alone, it is a problem of multi-disciplinary status.

Integration of the knowledge of various professionals in the area of agrochemicals is lacking. The work in progress at the State University of Londrina involves a study trying to correlate the occurrence of accidental poisoning with personal habits such as smoking and consumption of alcohol, with psychological disturbances and with repetition of poisoning.

In conclusion we can say that in the State of Paraná the problems related to improper use of agrochemicals are fairly well under control. However, one important short term necessity is the foundation of a center for toxicological information in the State.

REFERENCES

1 IBGE (Instituto Brasileiro de Geografia e Estatística), Annuário Estatístico do Brasil (1979).

2 A. Jacob, Secretary of Agriculture of Paraná, (1980), (personal information).

3 Máquinas Agrícolas Jacto S.A., (1980), (technical information).

4 H.K. Ann, Intoxicaçao Exógena Aguda, Análise Retrospectiva de 451 casos, (1980), (unpublished results).

THE NEED FOR A PROJECT OF TRAINING OF TRAINERS ON THE SAFE USE OF PESTICIDES IN LATIN AMERICA

L. ALBERT

Panamerican Center of Human Ecology and Health, Metepec, México

ABSTRACT

Among the different activities relevant to the Pan American Center of Human Ecology and Health, one of the highest priorities must be assigned to the development and implementation of a Course for Training of Trainers on the Safe Use of Pesticides. The reasons for this high priority are given and a brief description of the essential components of the project is included.

INTRODUCTION

The Pan American Center for Human Ecology and Health (ECO) is a regional technical center of the Pan American Health Organization (PAHO) and together with the Pan American Center of Sanitary Engineering and Environmental Services (CEPIS) forms a part of the Environmental Health Division of PAHO. ECO is located at present in Metepec, State of Mexico, approximately 60 km to the west of Mexico City.

Although ECO is almost five years old, from the time it was started until the near past, it has had serious limitations to fulfil its functions and it has always had a deficit of two or more of the experts that are supposed to constitute the professional staff.

These limitations have even been more severe because of the need to answer in the shortest possible time the specific demands of governments. This tended to promote a certain alienation and the opportunity to integrate the demands of governments within the framework of a programme did not exist until very recently. However, the inauguration six months ago of the new facilities and the professional staff being at establishment coincided with the recommendation of the Special Advisory Committee resulting in the integration of a programme of activities.

THE PROGRAMME OF ECO

ECO has been assigned two main areas for its activities. The first relates to the health hazards associated with environmental chemicals specially those that have their origin in the industrialization, rapid urbanization and technological innovation that accompany the process of economic development. The other area is devoted to the assessment of the health impact of the development projects such as dams, new highways, etc.

It is to the first area, which is devoted to the prevention and control of the health hazards of environmental chemicals that the project of training of trainers belongs.

The programme of ECO for the prevention and control of the health hazards of environmental chemicals is a result of the recommendations of the special advisory committees and includes also the ideas of recognised Latin American experts. The programme does not intend to replace the very important efforts of governmental organizations and individuals in this area. Its objective is to support the efforts that require support, coordinate those that require coordination and in general, to use the valuable experience that already exists and by establishing a series of activities which are adapted to the particular needs and resources of each country.

The programme was structured having in mind the main recognized critical areas: the lack of human resources, material resources, facilities and adequate methodology; the deficiencies in teaching at the university level, in the technical and administrative structures that must enforce the law, and the deficiencies in legislation, communication and in information.

Therefore, the main objectives of the programme are:

1 to identify institutions and experts;

2 to assist in strengthening the institutions;

3 to help in the development of human resources;

4 to collaborate in the implementation of legislation;

5 to facilitate communication and dissemination of technical information;

6 to assist in developing relevant research projects.

The training of trainers on the safe use of pesticides as a priority activity

There are several reasons that support the selection of this item as one of the activities with the highest priority within ECO's programme. The first results from an analysis of the potential exposure of the general population and of specific groups of workers to different chemicals are one of those reasons. This analysis showed that pesticides are among the chemicals that are used more frequently, not only by specialized workers but by the general population as well. It also showed that pesticides might form the greatest part of the substances resulting from the introduction of new processes and technological changes.

Another reason is that because of the socio-economic characteristics of the countries of Latin America and the Caribbean area, the use of pesticides is superimposed on a background of poverty, illiteracy, malnutrition, and a high rate of illness that makes a large sector of the population highly vulnerable. In short, the process of technological changes has not been accompanied by a simultaneous change directed towards the protection and education of the community.

It is not exceptional for example to discover that the final users of pesticides are unable to read the labels. Even when they can read the labels they are unable to understand their meaning and very often when they understand it, they refuse to believe it. It is also very common that due to their extreme poverty they lack extra clothing to change after the application, facilities to wash and very often also shoes. This is a real situation and it is complicated by the fact that governments have other, more urgent priorities than to educate these people. There are not enough statistical data to assess the magnitude of the population that is exposed both directly and indirectly to pesticides because their inadequate use is not known. However, considering that most rural communities are isolated and lack medical services it can be postulated that the number of acute poisoning cases that is received in the poison centers is very low with respect to the total number of cases; it might even be compared with the top of an iceberg.

Therefore, just as it is obvious that the use of pesticides is necessary for the countries for very good reasons of public health and economy, it should also be obvious that at present the use of pesticides is far from safe or adequate and that only through education, specially the training of trainers, there can be any hope of improving the situation.

PESTICIDE MIXER, LOADER, AND APPLICATOR EXPOSURES IN CITRUS GROVES

F.A. GUNTHER
Department of Entomology, University of California, Riverside, USA

ABSTRACT

Making the spray mixer, loader, and applicator workplace safe during the pesticide treatment of citrus groves is a task that will require an educated foreman or supervisor and compulsory obeyance by the worker of his instructions and stewardship. It will not be possible to educate all field workers in all aspects of the safe handling of pesticides. Equipment changes in nurse rigs and spray rigs will be required, also, to ensure a safe working environment in the pest control of citrus.

INTRODUCTION

Around the world the education of people in any walk of life to handle safely pesticide chemicals and their formulations is a discouraging task. Even trained investigators and applicators become careless in handling these materials, with numerous fatal accidents each year in most agriculture-intensive countries. The old adage that "familiarity breeds contempt" is painfully demonstrated again and again by these statistics of pesticide-caused hospitalizations and deaths. Pesticide applicators are the most accident-prone group of people who occupationally must be exposed to these chemicals. Despite the flurry of excitement over the past five years in the United States about the so-called "reentry hazard" (ref. 1) (i.e., potentially hazardous chronic exposures of thinners, pruners, and pickers to dislodgable residues of some of the organophosphate insecticides), it is still the applicator who is subject to massive (acute) exposures to technical grade materials and to formulations, usually wettable powders or emulsive concentrates.

If one places the available pesticide chemicals on a linear LD_{50} (rat, oral) scale, the LD_{50} range is from about 4,000 mg/kg to about 4 mg/kg. By analogy, for a 60-kg man, the toxic dose for a human being would therefore range from about 240 grams to about one-fourth of a gram. It is easy, in pesticide application operations, to acquire a fourth of a gram of active substance on one's body (ref. 1 and 2). This is not very much material if the active ingredient is parathion.

Such acquisitions can occur through carelessness or through mishap. The problem of the safe handling of pesticide chemicals during pesticide application therefore is resolved to mitigating (or, hopefully, eliminating to the extent possible in each country) carelessness and by law eliminating so far as possible the likelihood of an accident during mixing, loading and application operations in agriculture as well as in non-agricultural pest-control operations such as attempted mosquito control, pest-control treatments of homes and warehouses, the protection of home gardens, etc.

Massive educational programs have been initiated around the world during the past ten years to "read the label," since in most countries labels characteristically bear abundant information on the "dos and don'ts" for the safe handling of pesticide-containing formulated products. Unfortunately, most pesticide-regulating governmental organizations have insisted upon so much information on a label that it becomes almost unreadable because of the fine print required for a label of reasonable size. Many pesticide formulations include with each container an additional warning leaflet, often many pages in length and usually ignored by the mixer, loader, and applicator because "it takes too long to read."

Labels are usually required to contain name of product, composition of product including chemical names which are intelligible only to a chemist, legally permitted uses and rates, minimum waiting intervals between application and harvest, safe reentry intervals, symptoms of poisoning, antidote (if any) for poisoning, instructions for attending physician in the event of poisoning, some pertinent toxicology, safe disposal of used formulation containers, possible decontamination procedures for spills, and instructions about safety clothing to be worn and personal sanitation and hygiene to avoid or mitigate significant personal contamination. This is all well and good, but how do you get the user to read it all and to comprehend it all? The owner of the pest-control company may read it and understand it, and so may the foreman, but how do you ensure that the actual workers understand the potential hazard to which they are exposing themselves?

These problems have been addressed internationally (ref. 3), because providing a safe work environment is of international concern as a human right to be expected by every worker everywhere.

Obviously, the built-in inadequacy of any realistic label is exacerbated in any bilingual or polylingual country.

The only practicable solution to this problem of making all workers aware of the health hazards to be associated with their workplaces is to ensure that they all are informed verbally, in their native language, of these potential hazards by some responsible, knowledgeable person associated with that day's operation. This informed person may be a foreman or other supervisor, but he must be in the field to oversee constantly the tasks of mixing, loading, and application; he must also know about emergency first-aid measures for suspected poisoning from the pesticide chemical in use at the time and he must know the location of the nearest source of qualified medical assistance. Responsibility for all actions subsequent to a field mishap must rest upon the shoulders of this one individual and - I emphasize - he must be on site at all times during the pest-control treatment.

It is simply not realistic to expect the field workers themselves to acquire, in some impracticable manner, the knowledge necessary to appreciate all possible contingencies that can emerge from a hazardous workplace. Field workers are usually very poorly educated and cannot develop an appreciation for hazardous substances because of starved vocabulary and lack of experience with the possible sequelae to be associated with handling insidiously toxic chemicals.

The discussion thus far has dealt in generalities.

MIXERS AND LOADERS

Mixers are the people who prepare the final spray mixture in a nurse rig or in the tank of the sprayer itself. They add the pesticide chemical, in proper amount, to the partially water-filled tank of the nurse rig or sprayer. If a wettable powder, they will add the chemical from a bag or can; if an emulsive concentrate, they will measure the proper amount from a drum or can into a transfer container, then add it to the tank. After this addition the tank is filled to the mark with more water.

A wettable powder (or dust) is much less hazardous to the worker than is an emulsive concentrate. A wettable powder can be inhaled and it can sift into openings in clothing, but dermal absorption from it is relatively slow. Dermal absorption from an emulsive concentrate spilled or splashed on skin or clothing can be very rapid indeed.

The best rule for mixers is, of course, do not have any spillage. Realizing this is an impossible goal, all mixers and loaders should wear appropriate (slowly penetrable) clothing, gloves, and shoes (ref. 4 and 5) as well as dust-proof respirators. In the event of spillage all clothing must be removed immediately and the worker must thoroughly shower at once with an alkaline soap.

Splashing from the spray tank can occur during loading operations, transfer hoses can burst, and valves and couplings can leak. The actions in the preceding paragraph should be scrupulously followed if a loader becomes wet with spray mixture.

There is a strong legal movement in the United States to require "closed systems" for transferring pesticide chemicals from supply vehicle into spray rigs (ref. 6). Theoretically, such systems will be accident-proof if operated and operating properly.

APPLICATORS

In citrus culture around the world there is a strong movement away from hand (manual) applications toward mechanical applications with, for example, oscillating boom spray rigs or air-blast spray unit with tower (to improve coverage on tops of trees). Thus, probably 70% of all spraying operations on citrus trees are now made with mechanical equipment (ref. 7) - manually operated spray guns are simply too hazardous.

The modern applicator is therefore the driver of the spray vehicle, and he must be protected. A cabless tractor or a simple windowed truck cab is exposed to drift, to spray-wet branches, and to vapors. It now looks as though an air-conditioned cab will become mandatory. This cab should be fitted with micropore filters and activated charcoal filters, placed in series. The windows of the cab must be kept closed during spraying operations, with filtered air under pressure in the cab (ref. 8).

CONCLUSIONS

Properly educating all agricultural field workers about the pesticide-induced hazards that may be associated with their workplaces is virtually an impossible task. Different degrees of intelligence, the significance per se of toxicity (hazard), different languages in many instances, evolving contempt for often-handled poisonous chemicals, and disregard for the health safety of others all contribute to the difficulty of this task. The only logical course to pursue seems to be the one that is currently being pursued. This course is to have knowledgeable, conservative researchers and lawmakers actively plan to make the agricultural workplace as safe as possible, balancing the ideal against the economics of risk, then to require that foremen or other supervisors actually on the job are trained to demand, enforce, and follow safe work practices and scrupulous personal hygiene for all workers. Working with dangerous pesticide chemicals is not to be regarded with apathy or with callousness - human lives are at stake. Pesticide mixers, loaders, and applicators around the world have already paid a dreadful toll in human lives.

REFERENCES

1 F.A. Gunther, Y. Iwata, G.E. Carman and C.A. Smith, The Citrus Reentry Problem: Research on its Causes and Effects, and Approaches to its Minimization, Residue Reviews 67 (1977)1-139.
2 F.A. Gunther, Insecticide Residues in California Citrus Fruits and Products, Residue Reviews 28(1969)1-127.
3 W.F. Tordoir and E.A.H. van Heemstra (Eds.), Field Worker Exposure During Pesticide Application, Proceedings of the Fifth International Workshop of the Scientific Committee on Pesticides of the International Association of Occupational Health, The Hague, 9-11 October 1979, Elsevier, Amsterdam, 1980.
4 J.E. Davies, Personnel Monitoring, Residue Reviews 75(1980)33-50.
5 V.H. Freed, J.E. Davies, L.J. Peters and F. Parveen, Repellency and Penetrability

of Treated Textiles to Pesticide Sprays, Residue Reviews 75(1980)159-168.
6 G.E. Carman, Closed Systems and Worker Safety, Residue Reviews 75(1980) 149-158.
7 G.E. Carman, Personal communication, Nov. 24, 1980.
8 G.E. Carman, Y. Iwata, J.L. Pappas and F.A. Gunther, Applicator Exposure Studies: Oscillating Boom Sprayer Units on Citrus in California, Paper 356, Nat. Meeting, Ent. Soc. Amer., Atlanta, GA, Dec. 2, 1980.

PREVENTION IN THE USE AND APPLICATION OF PESTICIDES IN SPAIN

M. REPETTO, M. MENENDEZ and C. JURADO
Instituto Nacional de Toxicología, Sevilla, Spain

ABSTRACT

The authors present a review of the Spanish legislation on the prevention of risks in the use of pesticides and of the rules with an educational aspect.

Two recent epidemiological studies are also reported.

In the first study 1429 agricultural workers were medically examined and 38 cases of acute poisoning were found. The study points to acaricide carbamates as main nephrotoxic agents and to organophosphates, in particular, as hepatoxic agents and having a lowering effect on blood pressure. It is considered that a condition of hypertension should be seen as a reason to exclude workers from handling these substances. It was found that the pesticides with the most nephrotoxic and hepatotoxic action induce only few cutaneous and digestive diseases, and vice versa.

The second study concluded on the basis of 1673 questionnaires, completed by people involved in the handling and application of pesticides, that almost a fourth part of the workers and managers do not recognize the hazards associated with these products and that more than half of the users do not wear protective devices.

It is concluded that greater educational effort is necessary.

INTRODUCTION

Spanish farmers go to great expense in their use of phytosanitary products, as is shown in Table I by the increase in yearly spending for pesticides. Due to its climatological and agricultural characteristics the province of Seville occupies the second position in the country in the use of pesticides, applying approximately 10% of the national total. It is stated (ref. 1) that in the Mediterranean area of Andalusia 50% of the pesticides used in Spain is applied.

This is the reason for the traditional interest among the institutions of our area and the East of Spain in the toxicological implications of the use of pesticide products, and in increasing the efforts to prevent poisoning, one of the ways being education of the users. Our involvement in these issues dates back for years (ref. 2).

This general revision of the actual situation in Spain is divided into three parts, considering separately the legislative aspects, the preventive and educational activities and finally, the conclusions of the most recent epidemiological studies carried out in the country.

TABLE I
Development of the expenditure on pesticides by Spanish farmers
(In millions U.S.A. dollars)

year	insecticides	fungicides	herbicides	miscellaneous	total
1963	18.60	8.35	1.37	1.27	25.59
1964	18.20	8.70	1.84	1.12	29.86
1965	20.30	8.98	2.08	1.01	32.37
1966	25.10	11.94	1.65	0.80	39.49
1967	26.70	13.00	2.08	0.77	42.55
1968	27.80	13.04	4.14	1.11	46.09
1969	30.30	13.50	4.68	1.21	49.69
1970	30.40	15.28	4.94	1.44	52.06
1971	31.20	18.48	8.15	1.51	59.34
1972	33.60	21.21	10.30	2.17	67.28
1973	40.00	25.05	12.52	2.58	80.15
1974	42.90	25.64	15.42	3.07	87.03
1975	45.40	26.42	19.71	3.57	95.10
1976	53.60	26.42	22.28	4.07	106.37
1977	54.30	27.85	26.00	4.57	112.72

Source: Ministry of Agriculture

PREVENTIVE MEASURES IN THE SPANISH LEGISLATION*

The preventive measures stated by the State Administration concern the classification of phytosanitary products and pesticides according to the toxicological characteristics of the substances. They regulate the requirements for the containers and their labels, and provide rules that commercial establishments have to observe in marketing and provide the preventive measures users and applicators of these products have to take into account.

The regulation of manufacturing and marketing of phytosanitary products started in Spain by the Pesticide Law of May 25, 1908. The Act of September 19, 1942, established the Official Register of Pesticides. The order of the Government Presidency of February 23, 1965, classified the phytosanitary products in three categories, and regulated the marketing and application according to toxicity.

This classification was completed through the Order of the Ministry of Agriculture of January 31, 1973, which extends the Bill 17/1971 relating to

*References 3, 4, 5, 6, 7 and 8 apply.

the Pest Control Service, and through the Order of the Government Presidency of September 29, 1976.

Taking into account these Orders, the actual Spanish legislation is as follows.

Phytosanitary products are classified in four categories, A, B, C and D, according to their toxicity, by stages from low to high. In the A category the products of low danger are classified. Category B is formed by the pesticides of moderate toxicity, whose handling and application can be carried out with certain precautions. Pesticides of high toxicity are found in the C category whose use shall be carried out under very strict rules and products of extreme danger belong to category D whose handling and application is reserved exclusively to specially authorized persons under the responsibility of a proper technic director.

Each product can belong to three different categories according to its toxicity for human beings, land animals and aquatic animals. Therefore, commercial containers shall be marked with three letters which indicate the toxicity for each of them in the same order as mentioned above. It is compulsory to display the word "poison" and the corresponding symbol in a rhombus with a red or black background on the labels of the containers of the products classified into the categories B, C and D. Moreover, the precautions to be observed in the handling and use of the product, and instructions for first aid and information about an antidote, if available, shall be printed on the label.

For the pesticides in the two more toxic categories it is compulsory that:

- persons who manipulate or use these products are men older than 18;
- these persons are medically examined every 6 months;
- applicators and users who show grazes or signs of irritation of the skin or mucous membranes are suspended from work;
- enterprises specially authorized for the employment of products belonging to category D, dispose of a Director with an university degree, as well as professional, technical and auxiliary staff to ensure safe and adequate application;
- workers wear special garment, consisting of: protective garment, hat, eye protection, respirators, rubber gloves and boots. For the very toxic products respirators of the type "absorbent" must be used and for the less toxic products respirators of the "filter" type are allowed. It shall be shown that climatological conditions frequently hinder the acceptance of the protective equipment by the staff;
- recommendations are given for pesticide workers to wash their faces and hands with soap and water before meals and to have a shower at the end of the work;

- the applicators' group take along with them a first-aid kit of which the composition is prescribed by the Ministry of Health;
- all phytosanitary products shall be stored in a safe place, out of the reach of children and unauthorized persons, in containers with labels which will identify them appropriately and also that the stores are properly labelled;
- the application equipment, recipients and containers of products of the C and D categories can not be utilized for other use. Empty containers shall be destroyed or returned to the manufacturers and in no case they may be used as containers for food or drink for animals or human beings.

Persons or institutions who acquire these products will be responsible for the fulfilment of all these regulations according to the Order of the Government Presidency, September 26, 1976. These persons or institutions will also be responsible for the cleaning of the used instruments and for the waste disposal avoiding contamination of the environment.

Private enterprises or organizations authorized to carry out treatments with category D products need a contract which is concluded beforehand with the farmers. This contract is indispensable for obtaining authorization for these treatments. In the text of the contract the responsibilities and consequences for not observing the established rules must be specified.

According to the Order of the Ministry of Agriculture, May 26, 1979, the user of phytosanitary products, either the farmer himself, an independent applicator or a professional spray contractor, will be responsible of observing the general requirements for the safehandling and application of the products as well as the specific requirements mentioned on the label.

EDUCATIONAL ACTIVITIES

From the educational point of view the activities developed in Spain are the following.

- Courses for physicians specializing in occupational medicine. The courses are organized yearly by the National Institute on Occupational Medicine in the main Spanish cities and they last for one year; in these courses special emphasis is given to the inherent risks of the handling of pesticides.
- Courses for obtaining a "Health Diploma", organized yearly by the Ministry of Health and Social Security for physicians, chemists and veterinary surgeons. This diploma gives access to official sanitary positions.
- Courses for a general training of high and middle level experts on hygiene and safety in work and for a special training of experts on safety in agriculture. These courses are organized by the Social Service of Hygiene and Safety in Work and persons with an university degree or those who are

graduated in science or technology can attend. Moreover, two institutions of the Ministry of Agriculture, the Farming Extension Service and the Pest Control Service, give courses on instruction and training for pesticide workers.

Until a few years ago training was pointed towards the control of pests and plant diseases in general, but, presently these courses deal only with a single crop under titles as "Crop diseases and pests of cotton plant" or about beet, olive yards, wheat, etc. These courses last two or three days and they are intended for the proprietors of small and middle sized farms of a family character of no more than 100 hectares. The courses are given by agronomists of the Farming Extension Agencies. For special cases they rely on the help of "Support teams", with more specialized staff. Two hundred courses of this type take place in Andalusia every year; in Spain the total number amounts to approximately thousand.

Moreover, the Farming Extension Services participate in the teaching at Polytechnical Schools and at Schools for Foremen, with studies lasting two years for the training of foremen or supervisors of farm workers.

On the other hand, the Pest Control Service organizes courses for foremen, with the aim of teaching them the control of pests and the correct handling of pesticides.

Besides the proper teaching of farming technology, all these courses include lectures through which the students become aware of the risks of handling pesticides versus the necessity of using these products for the protection of harvests and of the elementary rules for accident prevention and first aid.

Various publications, brochures and posters published by the Ministry of Agriculture are also dedicated to these aims.

EPIDEMIOLOGICAL AND TOXICOLOGICAL STUDIES

One of the various statistical studies carried out in Spain on the influence of pesticide handling on the health of workers is the recently published study by Rodríguez-Sánchez (ref. 1).

This study covers the evaluation of 1429 clinical histories of preventive medical examinations carried out in the Hygiene and Safety in Work Centre of Castellón, during 1977, 1978 and 1979. Based on the results from this study an attempt is made to set up a minimum programme for the medical surveillance of these workers.

The persons examined belong to 183 companies, 70% of them fully accepted the hygiene checks and the periodical examinations.

The method used was as follows:

- completion of a questionnaire on medical history, based on the questionnaire of the Cornell University of New York;
- completion of a questionnaire on the work conditions and the products used;
- systematical medical examinations including: sensory nerve function tests (audiometry and eye tests), X-ray of the thorax, blood and urine analysis. E.C.G., radioscopy, limb oscillometry etc. were carried out on an optional basis.

The following clinical parameters were selected for evaluation: decrease in cholinesterase activity, increase in transaminases, dermatitis and auditory, urinary, digestive, neurological, perpheral circulation and blood pressure abnormalities.

In relation to work conditions it appeared from the questionnaire that only 4.52% of the workers had followed a training course for pesticide handling, and that only 1% uses systematically personal protection devices. This demonstrates the lack of the right attitude towards prevention, both in the companies and the workers.

38 cases of acute poisoning were detected resulting in medical treatment and suspension from work (representing 2.65% of the number of medical examinations). 139 cases of subacute poisoning, which required medical observation, were also detected (9.72% of the examinations).

The relation between the incidence of functional hepatic irregularities and the phases of the application periods (summer months) is presented in Table 2.

TABLE 2
Relation between the incidence of functional toxic hepatic irregularities and the phase of the campaign

	toxic hepatitis	number of medical examinations	incidence, %
before campaign	8	209	3.82
during campaign	7	95	7.36
after campaign	39	227	17.18
before campaign	0	24	0.00
during campaign	-	-	-
after campaign	90	414	21.73
before campaign	-	-	-
during campaign	45	424	10.61
after campaign	0	36	0.00

From these data it can be concluded that the optimum moment for carrying out the preventive medical examination is just in the middle of the application period because the toxic alterations can be detected in the initial phase. Doing so, it is possible to monitor the return to normal values, or, if necessary, to suspend workers from their respective work places in order to avoid a greater risk.

The author concluded from the clinical data that a relation exists between the pesticides that inhibit the acetyl-cholinesterase (organophosphates and carbamates) and the observed hepatotoxic and nephrotoxic effects, that a probable correlation exists with the observed neurotoxic and ototoxic effects, but no correspondence with the irritative action on the skin and effects on the digestive tract. A correlation between toxic hepatitis and hypertension has not been established, on the contrary, a tendency towards hypotension was noted.

The most frequent sign of nephropathy is hematuria, which in 50% of the cases is moderate and in approximately 10% of the cases is accompanied by albuminuria.

Nevertheless, only 15% of the toxic nephropathies is of a chronic character, although it can not be excluded that due to repeated poisonings many cases become chronic. Acaricide carbamates are pointed up as main nephrotoxic pesticides, so that workers with previous kidney disfunction are excluded from handling these substances. This is considered as a very important preventive measure.

In general it was found that hepatotoxic products (organophosphates) also induce a decrease in blood pressure, except when nephrotoxic processes are also developing, in which case an increase in blood pressure is induced. Consequently, the author thinks that a permanent condition of hypertension is also a reason to exclude the workers from handling these products.

Rodríguez-Sánchez is of the opinion that pesticides with a major hepato- and nephrotoxic action do not induce many cases of dermatitis but that, on the contrary, pesticides which present a greater risk to the skin and the digestive tract do not induce so many organic disfunctions.

Independently, the Social Service for Hygiene and Safety in Work of Seville has carried out in 1979-80 a study of the real situation in the prevention of accidents caused by pesticides in the farming regions of Andalusia, Extremadura and Murcia, territories were 33% of the total amount of pesticides in Spain is used (ref. 9).

For this study a team or work group was constituted, made up by physicians, chemists, agronomists, specialists in prevention and standardization, and educators who carried out the following program.

1 Preparation of questionnaires to be completed by owners of warehouses for pesticides, farming contractors and applicators. 1673 questionnaires were completed, from which 825 by workers who applied pesticides during a mean of 40 days per year and who have been working for 13.8 years on average.

2 Clinical examinations of 500 workers from the rural areas and large properties were carried out by a mobile unit.

Of the inquired workers 22.5% do not know the hazards of the products, in spite of the fact that 34% of the contractors use formulations considered as dangerous choosing these according to their experience or following advice from other farmers.

Of farming contractors 22.5% do not know how to recognize the hazards of the products and 61.5% of them is unaware of the legislation on pesticides.

The most optimistic data suggest that 24% of the workers did not receive information about the products they use, that 26% of the contractors did not follow the instructions, and that 37% of these contractors has doubts about all that.

56% do not wear protective garments, in spite of the fact that the workers complain of eye and nose irritation after applications; 8.89% has suffered from poisoning, and 20% knows about poisoning cases as well in workers as in contractors. Moreover, 21 mortal poisoning cases have been established.

Of the poisoned workers 42% acted as application operators, confirming the higher risk in this job. However, light air craft and helicopter pilots were no included because there are no reliable data, in spite of the fact that they are considered as persons with a high risk of poisoning.

Nevertheless, the number of poisoned warehouse owners is less than 2%, what, in part, can be due to less risk and to a better notion of prevention.

The most frequent occurring symptoms observed in persons with pesticide poisoning were:

headache: 19%
eye irritation: 18.8%
skin irritation: 9.6%
dizziness: 9.1%
asthenia: 8.7%
nausea: 8.6%
paresthesia: 2.8%
diarrhoea: 2.3%
dyspnoea: 1.7%

CONCLUSION

As conclusion we can assert that the Spanish legislation is very complete as to the production, trade and application of pesticides; nevertheless, it needs a regulation which requires a prescription for purchase and use of these products, with the object of avoiding the capricious, undiscriminated and unnecessary use of the most dangerous products.

On the other hand, we praise the efforts carried out by various branches of the Public Administration, specially the Ministry of Agriculture, in education and in prevention of risks. However, they are not considered sufficient because they have not achieved to impress the risks inherent to the handling of pesticides on a high percentage of farming technicians, proprietors of exploitations, supplying and application contractors of pesticides, neither on farm workers. Finally, we insist on the necessity of learning how to balance these risks against the necessary use of pesticides for the protection of harvests.

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REFERENCES

1 A. Rodrígez-Sánchez, Las intoxicaciones subagudas por plaguicidas agrícolas, Salud y Trabajo, 25 (1980) 44-61.
2 M. Repetto and M. Menéndez, Incidencia toxicológica de los plaguicidas en el Sur de España, II Congreso Nacional de Medicina Social Agraria, Valencia, 1967.
3 M. Benlloch and J. Rivero, Cuidado con la toxicidad de los productos fitosanitarios. Servicio Capacitación Agraria, Madrid, 1967.
4 Instituto Nacional de Medicina y Seguridad del Trabajo, Lecciones del Curso formativo de expertos de Seguridad en Agricultura, Madrid, 1968.
5 Ministerio de Agricultura, Normas de Seguridad para el manejo de insecticidas, Servicio de Plagas Forestales, Madrid, 1965.
6 Ministerio de Agricultura, Manuel de Productor Fitosanitarios, Servicio de Defensa Contra Plagas, Madrid, 1980.
7 J. Salmerón and J. Salmerón, Intoxicaciones producidas por pesticidas, Servicio Extensión Agraria, Minesterio de Agricultura, Madrid, 1977.
8 J.J. Caballero, Los riesgos del empleo de plaguicidas en la agricultura, Sevilla, 1974.
9 M. Arias, J. Llamas, J. Hidalgo, e.a., Encuesta sobre peligrosidad y situación real de la prevención de accidentes en los tratamientos fitosanitarios, Servicio Social de Higiene y Seguridad del Trabajo, Sevilla, 1980.

EDUCATION AND SAFE HANDLING OF PESTICIDES IN HUNGARY

S. BORDÁS
Ministry of Agriculture and Food, Centre of Plant Protection and Agrochemistry, Pesticide Toxicology Laboratory, Keszthely, Hungary

INTRODUCTION

In parellel with the term "Good Agricultural Practice" our philosophy in the safe handling of pesticides for the protection of workers, society and environment is based on "Good Plant Protection Practice". To achieve good results, we have developed over the last three decades our own system which in broad outline is in line with other international systems.

Pesticide usage

In Hungary we use annually about 60,000-80,000 kg of pesticide formulations, about 6-8 kg per person per year.

About 90 percent of pesticide usage is in agriculture for plant protection. The remaining 10 percent of the usage is in the hygiene sector covering vector and nuissance animal control.

Of the 1200 or so presently known active ingredients we are using only 260 in about 430 registered formulations for use in agriculture, while in hygiene we have about 40 active ingredients in 70 registered formulations.

In accordance with the rules for large - scale farms, State Farms and Co-operatives, it is permitted to use all types of agricultural pesticide formulations. These large-scale farms use pesticides on 95 percent of the arable land in Hungary. The private garden owners can buy and use approximately two-thirds of the registered formulations, those which are classified as practically non toxic or slightly toxic.

The number of plant protection specialists, including engineers, technicians and skilled workers, at present is about 40,000. Private garden owners number slightly more than one and a half million.

Assuring pesticide applier's professional skill

Having regard to the importance of the benefit/risk relationship in chemical plant protection, we continually strive to build up the level of professional skill of our pesticide appliers. The result of this effort is that we now have a number of plant protection specialists in the large-scale farms, and a wide information service for the private garden owners. For the application of hygiene pesticides, there are State Hygienic Institutions and different certified organizations, e.g. licensed companies, co-operatives with highly- and medium-qualified specialists, physicians, chemists, fumigators, desinfectors, etc.

PESTICIDE SPECIALISTS

Legal rules

Rules for plant protection specialists. The 43rd order of the Minister of Agriculture and Food issued in 1968 declares that

- commencing from 1970 herbicides and toxic pesticides could be applied only on large-scale farms under the guidance of highly qualified persons; Up to 1975 this type of activity could be performed by specialists of medium qualification too.
- in large-scale farms toxic pesticides could only be handled by skilled or semi-skilled plant protection workers;
- Hungarian categories for toxicity of plant protection pesticide formulations are as follows: highly toxic, medium toxic, slightly toxic, and practically non toxic; The above constraints thus concern only the first three categories.
- large-scale farms lacking highly qualified plant protection specialists, even if only temporarily, are only allowed to use the pesticides for private gardners until a specialist becomes available.

Rules for hygiene pesticide specialists. In regulations in force from the early fifties the Minister of Health declared that

- hygiene pesticide formulations belonging to the highly toxic, toxic, and dangerous categories could be applied only under the guidance of highly and medium qualified persons;
- formulations without any restriction could be handled by anybody.

System of pesticide application

Plant protection system. The Hungarian plant protection system is highly centralized. The guidance and control of all the plant protection activities - including pesticide registration - are under the jurisdiction of the Minister of Agriculture and Food. The Minister effects this activity through the Department of Plant Protection and Agrochemistry. This directs the activities of the Plant Protection and Agrochemistry Centre, the Agricultural Aviation Service, and the Soil Amelioration Companies. Altogether there are 20 Plant Protection and Agrochemistry Stations in the various districts which keep direct contact with the specialists of agricultural farms.

System of hygiene pesticide application. The guidance and control of the use of hygiene pesticides - including registration of these pesticides and formulations - belongs to the sphere of authority of the Minister of Health.

The Minister effects this activity through the Department of Public Health and Epidemiology. This Department directs the activities of the Central Hygiene Institutes - namely National Institute of Occupational Medicine, National Institute of Dietetics and Nutrition Sciences, and National Institute of Public Health - and the Laboratory of Desinsection and Deratization belonging to the last Institute. There are Public Health and Epidemiological Stations in each county and in five towns, with sections in some of the country towns and in the districts of Budapest, keeping contact with the sanitary specialists.

Kinds of plant protection specialists in the farms

At the agricultural large-scale farms the following ranks of plant protection specialists are distinguished:

a) Highly qualified specialists for guidance:
- plant protection engineer;
- plant protection engineer (diploma);
- plant protection engineer (specialist).

b) Specialists of medium-level:
- plant protection technician.

c) Manual workers:
- skilled plant protection worker;
- semi-skilled plant protection worker.

Main tasks of specialists

a) Tasks of highly qualified specialists:
- organizing, managing and control of plant protection activities at large-scale farms;
- continual information gathering on new pesticide products, technical advances and research-development results;
- establishing a monitoring system for forcasting the occurrence of pests, weeds, and diseases on the farm including data recording;
- preparation of plant protection schedules;
- accurate professional recordkeeping;
- making provision to purchase, transfer and store pesticides;
- obtaining safety equipment and controlling its use;
- adhering to public health and environmental requirements;
- in case of occupational poisoning, providing first-aid and/or medical treatment;
- providing an information service for private garden owners living in his district.

b) Tasks of medium-level specialists:
- profound knowledge of regulations and pesticide standards;

- personal direction of obtaining, storage and preparation of pesticides;
- direct guidance of the work of plant protection brigades, including the protection of the health of workers, society and the environment;
- contribution to the activities connected with forecasting, data gathering and storage;
- provision of labor force and machine park for each working phase;
- soil and plant sampling;
- performing simple laboratory tests.

c) Tasks of manual workers:

- knowledge of pesticides;
- performing independently the pesticide application;
- adjustment, operation and maintenance of plant protection equipment;
- operation of pesticide stores;
- execution of personal hygiene and general environmental regulations.

General education system

To elucidate our plant protection education system it is necessary to review the Hungarian general education system.

Elementary school. The elementary school of 8 years is compulsory for everybody.

Vocational training school. It lasts for 3 years.

Technical secondary school. It lasts for 4 years.

Normal secondary school. It lasts also for 4 years.

The above three schools give a medium-level qualification.

Colleges and universities. After finishing an education period of 3 years, the degree of engineer can be obtained while after 5 years a diploma is granted.

Post-graduate education. After completing a college or university course there are possibilities for post-graduate training courses lasting for 2 years leading to a specialist degree.

EDUCATION OF PESTICIDE SPECIALISTS

A qualification of high degree for plant protection specialists could be obtained through the basic as well as post-graduate education system.

Highly qualified specialists in plant protection

a) Basic education

- plant protection engineer	duration: 3 years;
- plant protection engineer (diploma)	duration: 5 years;
- agrochemist	duration: 5 years.

b) Post-graduate education:

Faculty	Qualification in plant protection
- agronomist	- specialized engineer

- horticulturist	- specialized engineer
- forestry engineer	- specialized engineer in forestry
- chemical engineer	- pesticide engineer
- mechnical engineer	- engineer specialized as agricultural aircraft pilot.

Medium-level specialists in plant protection

- technicians	- 8 years elementary school + 4 years specialized secondary school.

Manual workers in plant protection

- skilled workers	- 8 years elementary school + 3 years vocational training school + 300 hours plant protection.
- semi-skilled workers	- 8 years elementary school + 300 hours plant protection.

Subjects in the education of plant protection specialists

The compulsory subjects of education - for a different number of hours according to the level of training - are as follows:

- plant pathology
- plant protection zoology
- weeds science
- plant protection chemistry
- plant protection mechanics
- plant protection technology
- worker safety and environmental protection
- plant protection law
- plant protection economy.

Number of plant protection specialists

As a result of our education system detailed above we have in 1980 about 3500 highly qualified specialists, more than 500 technicians and almost 40,000 skilled and semi-skilled workers. The number of large-scale farms is about 1600. So the number of highly qualified specialists and that of the skilled manual workers is more than sufficient.

The remaining highly qualified specialists find employment in the Plant Protection Stations, various Research Institutes, Pesticide Producing Factories, in our education system at the Universities, Colleges and Vocational Training Schools, etc.

The demand for specialists of medium-level (technicians) at the agricultural farms is nowadays high, consequently specialists' training in this respect will be expanded in the near future.

Post-graduate training of plant protection specialists

Continuously providing for up to date knowledge of specialists, our post-graduate training system is as follows:

Information service. Coordinated by the Plant Protection and Agrochemistry Centre there is a well organized information service easily accessible for any specialist throughout the country.

Library service. There are many books and technical papers in each Institution among others the "Plant Protection" journal issued by the Ministry of Agriculture and Food containing scientific articles and up to date technical informations on the subject.

Post-graduate training courses. These courses for highly qualified employees, technicians and skilled workers are organized by Universities, Special Secondary Schools and by Vocational Training Schools operating in the various counties. Data on these courses are as follows:

- duration of training courses is 105 hours triennially for highly qualified employees and 105 hours biennially for technicians and skilled workers;
- participation in these post-graduate training courses is compulsory. If somebody fails to do so he will lose the licence needed for plant protection activities.

Professional training of private garden owners

Besides the large-scale farms the number of private people who possess a piece of ground or residential garden and are producing agricultural products for themselves or for the market is about one and a half million. These private gardeners have access only to less dangerous plant protection chemicals. However, a certain technical knowledge is indispensable to assure the good and safe application of these materials since the simple reading of a label still does not ensure that effective control will be achieved.

Evening courses. For this reason evening courses and field demonstrations are organized regularly within the framework of the Plant Protection Stations, Trading Retail-network, the national organization "Association for Popularization of Natural Sciences", and the Gardeners' Clubs operating under the aegis of the Patriotic People's Front.

Mass-communication. The general public is continuously informed about dissemination of plant pathogen organisms, plant protection activities to be performed in the gardens, pesticides recommended and the worker safety and environmental protection requirements through regular radio and television programs, technical papers, regular columns devoted to plant protection in the daily press, and finally through posters provided by the Plant Protection Stations.

Personal information service. All plant protection specialists, the various Plant Protection Institutions, education centres, pesticide stores are always ready to give detailed information and advice to the private garden owners.

CONTROL OF SAFE HANDLING OF PESTICIDES

To guarantee the safe handling of pesticides in our large-scale farms and in private gardens, we have three types of control systems, namely state, social and workshop.

State control system

To take care of the health of workers and the public and to protect the integrity of the environment is the constitutional right and duty of the State.

The State executes this duty through the Minister of Health and the Department of Public Health and Epidemiology, the National Institutes of Occupational Medicine, Food Hygiene, and Public Health, and the sanitary officers of the Public Health and Epidemiological Stations in the counties.

Control system of the National Health Institutes. The main tasks of these Institutes are as follows:

- elaboration of the required preventive measures for the safe handling of pesticides issued as a general rule in the Preventive Measures of Chemical Plant Protection, and appearing in detail in each Registration Document of a plant protection chemical in agreement with the Trade Union and with the registering Minister of Agriculture and Food;
- performing exposure and epidemiological studies, monitoring of plant protection employees, the public, and environment in cooperation with other Institutions and Organizations;
- participating in the residue analysis program of food and feed crops and animal products for home use and for export-import purposes, in cooperation with other Agricultural Institutions.

Control system of the Public Health and Epidemiological Stations. Sanitary officers' duties of these Stations in collaboration with pharmacists with a post-graduate training in toxicology are:

- organizing the preemployment and periodical medical control of plant protection employees;
- regularly monitoring sanitary conditions and safe handling of pesticides in large-scale farms, in plant protection chemical factories and also in retail-trade.
- taking part in the above mentioned exposure, epidemiological and monitoring studies.

Control system of the Plant Protection and Agrochemistry Centre. As a user of pesticides the duty of this Centre is not only to ensure conditions of good plant protection practice but also to contribute to the safe handling of pesticides. In this regard its main activities are as follows:

- increasing the national toxicological investigation capacity by its own special laboratories, e.g. Experimental Pesticide Toxicology Laboratory, Ecotoxicological Laboratory for Wildlife and Aquatic life;
- elaborating proposals for elimination of specific hazards of pesticides for men and/or the environment in the framework of the National Plant Protection and Agrochemical Council under the aegis of the Vice-Minister of Agriculture and Food;
- minimizing the hazards of accidental and/or intentional contamination of the environment by pesticides by operating a special Agrochemical Contamination Survey Service for Environmental Protection.

Control system of Plant Protection and Agrochemistry Stations. The duties of these Stations are:

- development of close collaboration between Health Stations and Plant Protection Stations, Sanitary Officers and Plant Protection Inspectors and among the various Information Services and Training Organizations of private garden owners;
- regular determination of pesticide residues in treated crops from large-scale farms and in products for sale from small-scale farms for quality control of plant protection practice, and to improve requirements if necessary and finally to ensure the export-import of our agricultural goods.

Social control system

Trade Unions and other Social Organizations have the constitutional and traditional right and duty to secure good health of workers extended nowadays to include society and the environment as well.

Control system of Trade Unions. The tasks of the Central Council of the Hungarian Trade Unions, the Trade Union of Agricultural and Silvicultural Workers and the Trade Union County Council in respect of the safe handling of pesticides are as follows:

- improvement of mechanization and automatization of pesticide working processes by the application of research findings of the Scientific Research Institute for Workers Protection belonging to the Central Council of the Hungarian Trade Unions;
- improvement and/or development of new worker safety equipment also via the above mentioned Institute;
- investigation and statistical recording of occupational accidents and poisonings by the Workers Protection Inspectors of the Trade Union County Council on behalf of the workers, for their compensation and rehabilitation, and for reduction of recurrence of similar injuries;
- mobilizing of workers to take an active part for themselves in the good and safe handling of pesticides.

Control system of other Social Organizations. Many other Social Organizations e.g. Hungarian Red Cross, People's Central Committee of Control, Patriotic People's Front etc. contribute in their own way to the improvement of safe handling of pesticides:

- organizing accident and pesticide poisoning first-aid training courses by the Red Cross County Secretariate;
- conducting special studies for the detection of difficulties in the preventive system of plant protection activities and elaboration of general proposals for the improvement by People's Central Committee of Control.

Workshop control system

In the large-scale farms the leader responsible for the safe handling of pesticides is a highly qualified plant protection specialist. His principal duties in this regard are:

- to develop a working collaboration with the other specialists on the farm and competent Authorities of Protection of Health and Environment;
- to plan, organize, carry out, supervise and improve handling of pesticides in such a way as to minimize exposure levels to workers, society and the environment.

PRACTICAL EXAMPLES OF EDUCATION AND SAFE HANDLING IN PESTICIDE APPLICATION

AURELIO R. LOPEZ
Institute of Ecology, Natural Resources and Technology,
Resistencia, Chaco, Argentina

ABSTRACT

The author relates the birth and evolution of the multidisciplinary organization 'C.E.U.P.A.'-Educational Commission for the Use of Agricultural Pesticides- and gives practical examples of education in the safe and useful handling during pesticide application. He further analyses the causes that lead to accidents with rural workers. The province of Chaco in Argentina has large cotton plantations and farmers are very dependent on pest control. They prefer to use organophosphate insecticides under unfavorable climatic conditions, such as periods of heavy rainfall, over the possible loss of their crop.

Organo-phosphate insecticides are very poisonous, parathion in particular, and have been the cause of deaths by poisoning in the province of Chaco. Educational techniques can change the situation decreasing poisonings and deaths.

INTRODUCTION

Pests and diseases of crops and cattle have constituted from earliest times a threat to human economies. If we include the effects of insect vectors of diseases, we can begin to understand why the use (and possible abuse) of pesticides has become so widespread.

The development of agrochemicals has led to introduction into the environment of products previously unknown in nature. It is necessary to evaluate and control this contamination - in many cases unquantified - by means of effective agrochemicals used under professional advice and supervision.

Our experience over more than 15 years leads us to believe that it is imperative to develop an educational framework within the community which will lead to the prevention of accidents when using pesticides.

COTTON GROWING IN CHACO: THE REQUIRED USE OF PESTICIDES

Cotton growing in Chaco constitutes the base of its economy, covering in 1957 an area of 557,000 ha. Cotton flourishes in tropical and subtropical regions. In these areas the number of generations of harmful insect pests is not or scarcely interrupted by the effect of a cold winter period. Thus the number of generations is large. The life cycle of many of these insects is completed in 25 to 30 days leading, if weather factors are favorable, to high populations of insects capable of devastating the crop. Cotton suffers insect and mite attack in three well defined phases in the Argentine Republic.

a) Initial or early: This period extends from the time of sowing to the time of flowering, a period of 60 to 75 days characterized by the presence of thrips, aphids and bugs. These have great economic significance and average losses over the years are about 25 to 30% of production with the added effect of a delay in harvest of 15 to 30 days (best quality fibres are produced during the early part of the harvest). These are estimates of the Instituto Nacional de Tecnología Agropecuaria (I.N.T.A.).

b) Intermediate: This period comprises the months from December to February. The most conspicuous and regular insect pest is the leaf caterpillar. The bollworm and Horcia are less regular, just as are the attacks of thrips, red spider and fly which in this period are influenced by environmental conditions, varying according to years. Middle season insects affect intermediate harvest, producing losses of up to 10% of total production.

c) Late: This period begins in March and extends up to the end of the harvest. Although the leaf- and bollworm can still occur, the main pest during this period is the pink bollworm. The first generations of this pest appear to be regulated by environmental conditions during the intermediate period, but the species is favoured by good conditions during the months of March and April, a humid period that favours rapid development.

The above elucidation of the phytosanitary problems pertaining cotton gives us an idea of some of the causes that have contributed to the creation of a special situation in the province of Chaco during the cotton campaigns in 1965/66, 1966/67 and 1973/74.

ORGANO-PHOSPHATE POISONING IN THE PROVINCE OF CHACO

The organo-phosphates such as parathion, malathion and the systemic metasystox etc., were widely used, replacing organo-chlorines, during the sixties. At this time our experience begins.

Starting in 1956/57, there were reports in Chaco and Formosa of some fatal cases of poisoning with parathion. These accidents had no coverage in the media and the rural population apparently felt no alarm nor was there any reaction by local farmers to the use of these dangerous pesticides. At this point the Instituto Nacional de Tecnología Agropecuaria from the cotton region (previously the Junta Nacional del Algodón) and the Boards of Sanidad Vegetal both national and provincial, proposed intensive campaigns to achieve better and more efficient use by farmers of these pesticides. Unfortunately, the educative initiative was limited to official organisations as previously mentioned and lacked appropriate and direct contact with the farmer. Additionally, the sale of these products was in the hands of any shopkeeper at any rural store. To these facts we add the disorganized transport system and the lucrative greed of the sellers of these pesticides which made the use of these poisons much more dangerous in an area where ignorance of how to handle the pesticides increased the risks to public health.

This dramatic state of affairs was agravated by the lack of agricultural medicine and the availability of only a few well trained rural physicians that could scarcely cover the required treatment of the cases of poisoning.

During the early months of the year 1966 the cotton harvest in the province of Chaco went through an unique situation. The banks of the Paraná river were breached by strong currents, the port of Barranqueras with a population of 25,000 people, the port of Vilelas and almost 60% of the city of Resistencia, were flooded.

The farmers did not hesitate to protect their harvest and the application of organo-phosphates was indiscriminate and massive throughout the entire province. These applications led to a heavy exposure to poisons of the rural population. In that year 38 physically fit workers died while trying to save their harvest. The number of poisoned people was so large that we take at random only one of the many counties where statistics were produced in collaboration with the Ministry of Public Health, General San Martín. In that place, 180 cases of poisoning were reported to municipal authorities, of which 16 were fatal out of 38 critical cases. It is useful to point out that those reported deaths were mainly caused by lack of appropriate first aid assistance and late transfer of the patients to adequate medical centres. In fact, those victims were not treated by doctors due to late arrival.

Many of the poisonings were reported in children that ate fruits treated with pesticides. Contamination of items for human consumption was vast, including watermelons, tomatoes, vegetables, melons and the like, which are consumed directly without any previous cooking or washing. Fortunately, we can say that our educative action, although hard and fatiguing, was successful and corrected this state of affairs.

COMISION EDUCATIVA USO DE PLAGUICIDAS AGRICOLAS

Following this occurrence, the Government of the province of Chaco set up a coordinated programme with private and official participation, to prevent accidents with pesticides and to educate the population involved and affected by them, named 'Educational Commission for the use of agricultural pesticides' - 'Comisión Educativa Uso de Plaguicidas Agrícolas' - which Spanish acronym is C.E.U.P.A. This was done in compliance with Decree 1109/'66 and its regulatory statute 984/'67.

The activities of C.E.U.P.A. from 1966 culminated in 1978 with the holding of the Second Latin American Congress on Toxicology of Pesticides in Resistencia from May 22nd to May 26th. As a successful outcome to this Congress, C.E.U.P.A. has now been restructured with wider interdisciplinary participation, in compliance again with Decree 1057/'79.

From its very beginning C.E.U.P.A. counted on permanent advice and collaborative assistence from the Division of Toxicology of the School of Medicine of the National University of Buenos Aires - U.N.B.A. - and Dr. Emilio Astolfi advised us in Chaco in the noble task of education to reduce to a minimum the accidents that were produced by the misuse of pesticides, or to lack of appropriate know-how for the treatment of poisonings. He should be given credit for shaping an interdisciplinary response so deeply needed and so timely produced.

At present C.E.U.P.A. enjoys a solid structural organization and has the advice of FECIT and of the Argentine Society of Toxicology, which motto is to serve with dedication on your fellow being's behalf.

PREVENTION IN THE USE OF PESTICIDES

When a thorough examination of the causes that led to poisoning of rural workers in Chaco is made, we come to the following factors:

1 the distribution of pesticides (transportation system)
2 random sale (retailers)
3 lack of clothing and other protective equipment for operators
4 lack of technically adequate information for the farmer
5 drugstores and medical centres without available antidotes
6 lack of good and up-to-date information in rural areas
7 inadequate and poorly kept machinery for pesticide application. No previous testing with pesticides
8 lack of participation of the community in these matters
9 ignorance.

This enumeration of some of the negative factors serves as a picture of the situation. The film we are about to see depicts the most important facts that should be considered.

Ignorance played a very important role in this case, almost the largest, in causing these fatal accidents. For example, many users that apparently did not suffer any complications, considered themselves to be immune to poison, and this imprudence led them to suffer keen poisonings. There were cases reported of people opening bottles that were clogged by blowing into them to clear the way. The 'macho' attitude is to believe one is stronger than the other because the latter needed medical assistance. We are glad to point that these cases are only related to certain communities. Most labourers are certainly conscious of the effects of the pesticides through knowing of the deaths and poisonings among friends and relatives. Responsability should fall to the landlords, who due to climatic conditions have needed to have their harvest protected with parathion, using home made machinery without any protection whatsoever for the operator.

This episode was reported and denounced in the year of 1979 and C.E.U.P.A. reported the situation, later proceeding with firmest resolve against careless farmers. Today, 1981, the provincial legislation of biocides has stopped the previous anarchy in matters relating to pesticide use. There is also legislation in regard to control of insects and rodents.

ROUTES OF ENTRY AND HAZARDS DURING EXPOSURE TO PESTICIDES

W. DEDEK
Forschungsstelle Chemische Toxikologie der Akademie der Wissenschaften der DDR, Leipzig, German Democratic Republic

ABSTRACT
The 4 routes of entry of a pesticide into the body are reviewed with particular regard to skin penetration: oral, respiratory, dermal via the intact skin and entry via cuts or abrasions in the skin. Factors affecting pesticide penetration through skin and protective clothing are discussed with special regard to water solubilities lower and higher than 500 ppm of pesticides. Recommendations are offered on aspects of protection from pesticide exposure to be considered in education.

INTRODUCTION

The risks to which man is exposed by pesticide use in the environment can be subdivided into risks to workers in pesticide production and formulation plants, risks to applicators in their immediate environment and risks to consumers of foodstuffs treated by pesticides. Risks to this last group of consumers are very small, if not negligible, due to the well established system of checks and residue regulations for pesticides. The workers in the pesticide industry are, theoretically, supposed to be exposed to the highest risks, as the pesticides are present in the highest concentrations during working or handling. In practice, however, accidents in the pesticide industry are rare and comparable to those in any other chemical production, because the personnel is well-trained and informed about the risks of the products they are handling. Proper education as well as close supervision of workers will prevent accidents and greatly reduce the number of illnesses resulting from possible carelessness in handling of pesticides.

The group of people applying pesticides in the field, the sprayers, have a higher level of exposure and are often less well trained in the safe handling of toxic materials. This can sometimes cause serious accidents and one can state without exaggeration that here the most serious risks in pesticide use are found, and this applies to workers in the industry as well as to spraymen handling concentrated liquid formulations of pesticides. Undoubtedly, many different ingredients of special formulations can enhance the absorption of the pesticide as well as, more or less, increase the toxicity by synergistic actions of unknown mechanism.

There are 4 routes of entry of pesticides into the body: 1) oral, 2) respiratory, 3) dermal via the intact skin and 4) through cuts or abrasions in the skin. Protection against entry through these routes means prevention of exposure, and this is the best insurance against poisoning. It is well known to the specialists working in pesticide toxicology and occupational health, that dermal exposure is much greater than respiratory exposure, but this fact is usually not known to spraymen working in the field or to other pest control workers.

In the following paper some factors responsible for pesticide intoxications through the different routes of entry will be discussed and some related accidents will be reported. The dermal route of entry as the main source of poisoning will be discussed more extensively.

ORAL ROUTE OF ENTRY

The most serious oral exposure may occur by splashing droplets of liquid formulations into the mouth while pouring and mixing pesticides, by rubbing the face with contaminated arms or hands or by eating, drinking or smoking with contaminated hands. Careless actions such as attempting to blow out clogged spray nozzles also have been observed. The magnitude of oral exposure has rarely been investigated because of the experimental difficulties of measurement.

Sometimes oral intake of pesticides occurs not as the result of accidents, but rather through careless or erroneous actions. In a small town a number of persons became ill, and no specific reason could at first be detected. After medical and chemical examinations DNOC was found in the blood, and the origin of the poisoning appeared to be oral intake with bread. All the persons involved bought at the same bakers, and the flour contained some DNOC. The cause of this contamination was very simple: the truck delivering the flour had transported DNOC-material immediately before transportation of the flour and had not been cleansed.

An exchange by mistake of containers with magnesium oxide for the production of feed additives with polybrominated biphenyls (PBB) for the production of flame retardants was the cause of the famous 1973 accident in Michigan, USA, which led to PBB residues and delayed poisonings in numerous animals and, consequently, in man (ref. 1).

RESPIRATORY ROUTE OF ENTRY

The respiratory route of absorption is prevalent in those cases, where percutaneous absorption of particles is not the main route, i.e. when dusts, wettable powders and pesticides of a high vapor pressure are applied. Extremely small droplets and solid particles as found in mists (ULV-formulations and fogging concentrates) and dusts are more easily drawn into the respiratory system than the larger droplets procuced by conventional machines spraying solutions diluted with water (EC formulations).

It is generally considered that solid particles of a diameter greater than 10 μm do not penetrate beyond the nose and pharynx on account of inertia and impaction, and that deposition by sedimentation of particles with a diameter of 0.5 to 5 μm occurs in the tracheobronchial tree and alveoli. Particles with a diameter below 0.5 μm penetrate into the alveoli by diffusion. However, fibers of asbestos of 3 μm diameter and longer than 5 μm were discovered in distal parts of the lung parenchyma (ref. 2). The drop and particle spectra of liquid and dry formulations of pesticides and their relation to inhalation were discussed in the Vth workshop of the Scientific Committee on Pesticides of the International Association on Occupational Health (ref. 3).

Smoking of pesticide-contaminated cigarettes might also be a source of respiratory exposure, and additional hazards could be posed by oxidation products with increased toxicity formed inside of the burning cigarette, such as paraoxon from parathion with an increase of toxicity by a factor of at least 100. Pesticides entering via the respiratory route are directly absorbed into the blood circulation for 100% and the toxic response, i.e. cholinesterase inhibition, is immediate. A contributing factor is the oxidative activation of weak to strong cholinesterase inhibitors (organophosphates from organothiophosphates (ref. Table 3). It should be understood that pesticides are rapidly and completely absorbed via the oral or respiratory route, but the proportion absorbed through these two routes combined is only a small fraction of the total exposure and cannot be considered to be the main factor in cases of poisoning of workers in the field.

DERMAL ROUTE OF ENTRY VIA THE INTACT SKIN

The dermal route is the most important route of entry into the body during exposure to liquid pesticide formulations and has undoubtedly been responsible for many poisonings of workers, especially from the more toxic organophosphorus insecticides. More than 90% of the pesticides to which workers are exposed during most situations of spraying liquid formulations, is deposited on the skin. However, the absorption of compounds via the skin depends strongly on several factors related to the specific pesticide and the type of formulation. The greatest hazard arises generally not from the spraying itself, but during the handling, mixing and filling of various containers of the spray-equipment with concentrate-formulations. A considerable part of all pesticide applications involve low- to medium volume emulsifiable concentrates (EC) diluted with water. The EC formulations consist of high concentrations (40 - 50%) of the active ingredient in solvents, frequently of the aromatic hydrocarbons type such as xylene, which penetrate through the skin much more rapidly than does the dilute emulsion, on account of their ratner good solubility in lipids; thus, these solvents facilitate both the entry of the active ingredients into the skin and into the insect cuticula. Increased insecticidal effects of malathion in diluted mineral oil solutions related to increased penetration rates and subsequent oxidative transformation to malaoxon have been reported (ref. 4). The influence of solvents on the vascularity of skin in relation to systemic poisoning has to be considered also; dilatation of the skin blood vessels facilitates absorption of compounds, but no simple relation between skin penetration and vasodilatation applicable to all materials could be demonstrated (ref. 5). Due to the influence of the different solvents, the values of dermal toxicities depend not only on the species of the animals tested, but also on the solvent used in the experimental determination of dermal toxicity. Unfortunately, in tables of acute toxicities the solvents used are rarely mentioned.

The principle factor which determines skin penetration of pesticides is the solubility in water and different solvents (ref. 6). This factor also determines, to a certain extent, the toxicity caused by bioaccumulation and persistence. The biological activity and bioavailability of compounds can be described by the octanol/water partition coefficient, and for practical purposes this value can, at least to a certain extent, be substituted by the simple water solubility. This latter is rather well correlated with the octanol/water partition coefficient (ref. 7) which is tabulated in pesticide manuals and data sheets (ref. 8). Water solubilities of pesticides are useful constants, because they present starting points for many calculations and approximations such as distribution ratios in aqueous carrier sprays, estimation of systemic-type penetration in different organisms and prediction of residue removal possibilities. The water solubilities are given in the following brief considerations regarding solubility factors affecting skin penetration of pesticides, particularly insecticides.

<u>Pesticides with low water solubility</u> (≤500 ppm = 0.5 g/l)

Table 1 presents examples of pesticides with a low water solubility; there is no direct metabolic transformation yielding metabolites with a clearly increased polarity (water solubility).

TABLE 1

Organochlorine insecticides with low water solubility (≤ 500 ppm = 0.5 g/l)

DDT/DDE	0.003 / 0.04 ppm
aldrin/dieldrin	0.2-0.8 / 0.25 - 1.0 ppm
endrin	< 0.1 ppm
lindane	7 - 14 ppm
toxaphene	6 ppm

According to their preferred lipid solubility these pesticides following entry remain at first in the fat layers of the skin. If transport into the circulation occurs by binding to proteins in the blood, acute poisoning can arise only with compounds of high mammalian toxicity, and this is expressed by a low ratio of cutaneous/oral toxicity: e.g. aldrin/dieldrin, LD_{50} oral, rat 40-80 mg/kg, LD_{50} dermal, rat 90-200 mg/kg and the dermal route has been responsible for poisoning in man; similar relations are valid for endrin, LD_{50} oral, rat 5-45 mg/kg, LD_{50} dermal, rat 15 mg/kg. For lindane, DDT and toxaphene the dermal route was shown to be less important for acute poisonings, due to the preferred storage in the fat and the low concentrations in the blood and organs. For solutions in oil and hydrocarbons, increased dermal absorption rates can be expected. Toxicity to and killing of wild animals after aircraft spraying of toxaphene in mineral oil was higher than after spraying with water-diluted EC-formulations.

Table 2 presents examples of pesticides with a low water solubility, however transformation of the acids occurs in tissues of alkaline pH to the corresponding salts with a high water solubility.

TABLE 2

Chlorinated phenoxy acids and substituted phenols; transformation of acids to the corresponding salts increases water solubility. Water solubility of parent compounds in ppm.

DNOC	130-250 ppm	2,4-D	620 ppm
Ioxynil	50 ppm	2,4,5-T	278 ppm
Bromoxynil	130 ppm	MCPA	825 ppm

Most of these pesticides are herbicides of low acute toxicity and, therefore, low hazard of acute poisonings. The compound most frequently involved in hazardous poisonings is DNOC (LD_{50} oral, rat 26 mg/kg; LD_{50} dermal, guineapig 200 mg/kg with local irritation); the toxicity increases rapidly with increasing environmental temperature above $25^{o}C$. It is easily transported from the fat layer of the skin into the blood circulation by formation of the highly water soluble alkali salt at a pH 7.4 in the blood. No direct antidote is known for DNOC poisonings and the symptoms do not appear before a latency period of about 24 h after intake; thus, poisonings by DNOC are among the most notorious accidents in working with pesticides.

After working for 3 days at DNOC spraying in the field without changing protective clothing, which constituted a serious offence against known regulations, a young man suffered a severe poisoning and died during the transport to the hospital.

In table 3 examples are given of pesticides with a direct metabolic transformation by oxidation yielding metabolites with increased polarity (water solubility).

TABLE 3

Organothiophosphates and sulfides and the metabolic transformation products resp. organophosphates (oxones) and sulfoxides; water solubility in ppm.

organothiophosphates sulfides		→	organophosphates (oxones) sulfoxides	
parathion	24 ppm		paraoxon	2400 ppm
methyl parathion	60 ppm		methyl paraoxon	6000 ppm
phosmet (IMIDAN)	25 ppm		imidoxon	
bromophos	40 ppm		bromoxon	
malathion	145 ppm		malaoxon	
demeton-O-methyl (thiono isomer)	330 ppm		demeton methyl sulfoxide (water-miscible)	

By oxidative transformation hydrophobic groups are converted to hydrophilic groups (P=S ⟶ P=O, R_1-S-R_2 ⟶ R_1-SO-R_2) with an increase of the water solubility by a factor of 100 or more. This affects the bioconcentration (partition between the hydrophilic blood and the lipid material of the skin and the body) as well as the cholinesterase inhibition, because inhibition of cholinesterase occurs preferably by the hydrophilic organophosphates. The oxon-metabolites of the corresponding thiophosphates account for easier penetration of the active compound to reach the enzyme in the blood. Thus, the behaviour of these pesticides and the toxic effect following adsorption through the epidermis depend on the rate of metabolic activation at the interface between the fat layers and the blood vessels in the skin. Pesticides with low water-, but high lipid-solubility enter into the fat layer and the concentration of toxic compounds in the blood depends on the water solubility and binding to protein of the parent compound. This concentration is increased in addition by oxidative activation, yielding oxon metabolites with high cholinesterase inhibiting properties. The toxic response depends mainly on the degree of cholinesterase inhibition by the organophosphate or its oxidation product. If the pesticide has a sufficient water solubility and the oxidative metabolite is a potent inhibitor (e.g. methyl parathion, demeton methyl), the concentration of the oxidative metabolite in the blood circulation increases rapidly resulting in a serious acute poisoning. In cases, where the time necessary for these reactions is long and there is a rapid rate of breakdown and excretion of the toxic metabolites the threshold of acute poisoning is not exceeded.

An aircraft manned with 2 pilots had a motor defect and was forced to land in a field; nobody was injured, but the spray tank filled with methyl parathion in aqueous emulsion was cracked and the clothes of both men were soaked. They did not know at the moment what to do. The first man ran to the village to get medical aid and antidotes; he died within a short time, before reaching his aim. The other pulled off his clothes immediately, jumped into the nearest body of water and did not suffer serious symptoms of acute poisoning.

Pesticides of higher water solubility ($\gtrsim$500 ppm = 0.5 g/l)

In table 4 representatives of several groups of pesticides are listed with a relatively good water solubility.

TABLE 4

Organophosphonates, organophosphates, systemic organothiophosphates and carbamates; water solubility in ppm.

trichlorphon	154 000 ppm	mevinphos	miscible
butonate	3 500 ppm	monocrotophos	good soluble
dichlorvos	10 000 ppm	dicrotophos	miscible
dimethoate	29 000 ppm	crotoxyphos	1200 ppm
demeton-S-methyl	3 300 ppm	phosphamidon	miscible
cyanthoate	7 000 ppm	omethoate	good soluble
thiofanox	5 200 ppm	endothion	" "
aldicarb	6 000 ppm	vamidothion	" "
oxamyl	28 000 ppm	methomyl	" "
		metamidophos	" "

Most of these pesticides with a relatively good water-solubility have a sufficient lipid-solubility to enable entrance into the fat layer of the skin and penetration from there directly into the blood circulation. The toxic response will then be related to the ratio beween on the one hand the time involved in cholinesterase inhibition in the blood and, on the other hand, the rate of metabolic breakdown and excretion.

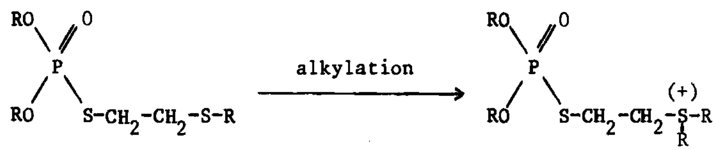
Properties of formulations important for the biological activity of the insecticides/pesticides include wetting of plant surface, penetration into plants and insects, and adsorption-desorption from different substrates. In many respects these processes are similar to mechanisms active in the percutaneous absorption in mammals. Thus, the insecticides displaying properties of easy penetration and transport, i.e. the systemic insecticides (a.o. dimethoate, demeton methyl and demeton methyl sulfoxide, metamidophos) also show the best percutaneous absorption properties, depending mainly on the partition between polar and nonpolar media. Surfactants as additives in pesticide formulations are used for increasing the wetting of plant surfaces as well as for enhancing the insecticidal activity, probably by improving the absorption properties of the active ingredient. Similar effects can be expected for percutaneous absorption in mammals, possibly intensified in addition by effects of skin irritancy. Penetration of surfactants occurs both transepidermially and via the hair follicles (ref. 9). Dimethylsulfoxide (DMSO) has not been used so much for insecticides as for herbicides and acaricides as an experimental additive to special formulations (ref. 10). DMSO was found to enhance the percutaneous absorption particularly of compounds with low water solubility (refs. 6, 11, 13).

Results of studies on local variations in percutaneous penetration in man, using radiolabelled pesticides, indicated the importance of protection of certain specific body-areas (ref. 12): in the head-neck area about 35% of the applied dose of parathion was absorbed; a greater proportion was absorbed in the armpit and the earcanal and about 100% of the applied dose was absorbed at the scrotum. Contamination of the eyes is very important in the case of exposure to organophosphorus insecticides of high cholinesterase inhibiting properties. The wearing of goggles is necessary to prevent miosis, which might impair, in pilots, the correct estimation of distance. Hydration of the stratum corneum is among the most important factors in skin penetration, increasing the permeability up to fivefold; the percutaneous LD_{50} of dinitrobutyl phenol is 140 mg/kg and 1000 mg/kg when applied under occluded and nonoccluded conditions respectively. The considerable increase of percutaneous absorption under conditions of both humidity and increased temperature were corroborated by in-vivo work and clinical studies (ref. 13). These factors become very important, if protective clothing has been penetrated by toxic compounds after having been worn too long.

ENTRY THROUGH CUTS OR ABRASIONS IN THE SKIN

This route of entry may not have been reviewed in the past. Cuts and abrasions occur most frequently on the hands and these are the area of the body most often in contact with concentrated pesticide formulations.

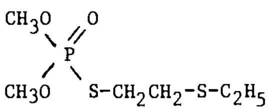
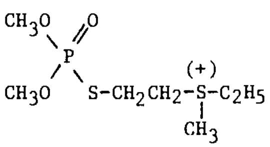
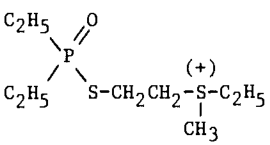
Any break in the skin permits a more direct route of entry into the blood circulation, where, at least for potent inhibitors of cholinesterase, the target for poisonings is located. Moreover, compounds or formulations without particular skin absorption properties, can enter the blood circulation via this route and cause poisonings which would not have been expected by the normal route of dermal entry. One of the best known examples is given by the reaction products of chemical alkylating reactions which take place in formulations of the insecticides of the demeton type, especially demeton methyl, and which give rise to the formation of cationic compounds depending on the time and temperature of storage of those formulations:



Related to their electrical charge these cations have no preference for membrane or skin absorption, and consequently the oral toxicity of the cationic compound and the parent insecticides is about the same, but the intraveneous toxicity is higher by a factor of about 1000 for the cationic structure (table 5), depending on the close similarity of this structure to acetylcholin and the related ligand-receptor interaction in cholinesterase inhibition. When considering the intraveneous LD_{50}, rat of about 0.06 mg/kg of the reaction products in formulations of these insecticides which have been stored for a longer time, the hazard of rapid poisonings following entry through this route becomes obvious.

TABLE 5

Oral and intraveneous toxicity of demeton, demeton-S-methyl and a related sulfonium compound

compound	LD_{50} rat, mg/kg i.v.	oral
	65	63
	0.06	9.8
	0.016	10

EDUCATION

There are several very important indirect ways of protecting pest control workers mainly by education, stressing the importance of personal hygiene and cleanliness, emphasizing the importance of not being careless, and pointing out the need for reading and following the directions on the pesticide container label. But, unfortunately, accidents do occur, even among workers who are careful.

In case of accidental contamination of the skin with a highly toxic compound every effort must be made to cleanse the contaminated area as quickly as possible; but, as a prophylactic measure it is recommended to do the same in the case of contaminations with compounds of less high acute toxicity, as most technical pesticides contain by-products or contaminants, the toxic properties of which are very often not yet known (remember the accidents with TCDD, the very toxic by-product in 2,4,5-T and its delayed toxic effects).

For cleansing of contaminated skin the recommendation at present is the use of plenty of water and soap, and washing by rubbing with the hands or with a piece of clothing; scrubbing with a brush should be avoided because the outer protective layer of the skin may be abraded to allow more rapid penetration of non-removed pesticide. A container of water, soap and towels should be carried on every pesticide application machine to be used for washing, should a spill occur; if no water is available, alternatively sand or soil can be used to absorb splashes on the skin surface. In every case, the use of solvents, such as gasoline or diesel oil, which could be available, should be avoided, because by their use percutaneous absorption would be enhanced and acute poisonings facilitated.

Similar considerations regarding increased absorption and distribution of toxic compounds in the intestines apply to foodstuffs affecting the fat/water partition such as milk, oil, butter, eggs and, last but not least, alcohol, the intake of which should be strictly prohibited in the case of probable poisonings. The importance of observing the regulations regarding intake of alcohol after having finished the work, should also be emphasized.

The efficacy of protective clothing should not be over-estimated. Protective clothing must, of course, be put on before the skin has been contaminated, because the covering of contaminated skin areas by waterproof clothing creates conditions under which percutaneous absorption is definitely increased. Penetration of pesticides through protective clothing depends, inter alia, on the solubility of the active compound in the special material of and on further additives to the formulation. EC formulations based on aromatic solvents plus anionic surfactants give rise to much more rapid penetration than the compound itself (ref. 14).

Cotton-materials may be penetrated more rapidly by water-soluble compounds and organic polymer materials by pesticides with low water-solubility (ref. 6). Leather shoes have a tendency to absorb materials after having been wetted by pesticide sprays and the active compound can easily penetrate to and through the skin. If clothing used during spraying, such as jackets, coveralls, are merely hung up to dry after work and used again repeatedly, as is often the practice, the pesticide will have contact with underclothes and skin. Consequently, boots and gloves as well as other clothing should be washed and dried thoroughly, inside and outside, as frequently as needed to remove pesticide contaminants. Definite regulations regarding the change of protective clothing after a certain working-time must be given and the importance of keeping to these regulations must be emphasized during education of pest control workers.

REFERENCES

1 H. Vogt, Umweltkatastrophe in Michigan, Naturwiss. Rundschau, 31 (1978) 292-293; cf. New Scientist, 76 (1977) 750.
2 M. Stupfel and M. Mordelet-Dambrine, Penetration of carcinogens through respiratory airways, Inserm Symp. Ser., 52 (1976) 61-72; IARC Scient. Publ., no. 13.
3 H.H. Coutts, Field worker exposure during pesticide application, in W.F. Tordoir and E.A.H. van Heemstra (Eds.), Proc. Vth International Workshop of the International Association of Occupational Health, The Hague, October 9-11, 1979, Field worker exposure during pesticide application, Elsevier, Amsterdam, 1980, pp. 39-45.
4 H. Ahmed and B.G. Gardiner, Effect of mineral oil solvent on the toxicity and speed of action of malathion, Nature, 214 (1967) 1338-1339.
5 V.K.H. Brown and V.L. Box, The influence of some solvents on the vascularity of skin in relation to effects on systemic intoxication by solvents, in: Toxicological problems of drug combinations, Excerp. Med. Int. Congr. Ser., 1971, 205-211.
6 W. Dedek, Solubility factors affecting pesticide penetration through skin and protective clothing, in W.F. Tordoir and E.A.H. van Heemstra (Eds.), Proc. Vth International Workshop of the International Association of Occupational Health, The Hague, October 9-11, 1979, Field worker exposure during pesticide application, Elsevier, Amsterdam, 1980, pp. 47-50.
7 V.H. Freed, C.T. Chiou, D. Schmedding and R. Kohnert, Some physical factors in toxicological assessment tests, Environm. hlth. Perspect., 30 (1979) 75-80.
8 W. Perkow, Wirksubstanzen der Pflanzenschutz- und Schädlingsbekämpfungsmittel, P. Parey, Berlin-Hamburg, 1971-1979.
9 D. Howes, The percutaneous absorption of some anionic surfactants, J. Soc. cosm. Chem., 26 (1975) 47-63.
10 A.G. Kanellopoulos, Additives in insecticide formulations, Chem. and Industry, 1976, 211-214.
11 K. Wenzel und W. Dedek, Zum Einfluss von Lösungsmitteln auf die Penetration unter besonderer Berücksichtigung phosphororganischer Insektizide, Wiss. Z. Univ. Halle, 28 (1979) 9-13.
12 H.I. Maibach, R.J. Feldmann, T.H. Milby and W.F. Serat, Regional variation in percutaneous penetration in man, Arch. environm. Hlth, 23 (1971) 208-211.
13 B. Idson, Percutaneous absorption (review article), J. Pharm. Sci., 64 (1975) 901-924.
14 B. Speight, Effects of formulation upon the safe use of pesticides, in W.F. Tordoir and E.A.H. van Heemstra (Eds.), Proc. Vth International Workshop of the International Association of Occupational Health, The Hague, October 9-11, 1979, Field worker exposure during pesticide application, Elsevier, Amsterdam, 1980, pp. 29-37.

EDUCATIONAL PROGRAM FOR THE SAFETY IN HANDLING AND APPLICATION OF PESTICIDES IN AN AGRICULTURAL INDUSTRY. CHECK ON EFFICIENCY OF THE PROGRAM BY BIOMEDICAL MONITORING

JUAN MANUEL MARTINEZ PRIETO*
Cargill S.A., Buenos Aires, Argentina

ABSTRACT

An educational programme is described dealing with
- the design and selection of personal protection devices
- training in the appropriate use of personal protective devices
- personal hygiene procedures.

The following tasks were studied:
- formulation of pesticides
- packing and curing of seeds
- ground application of pesticides
- aerial application of pesticides
- associated agricultural work.

A description of techniques employed for the monitoring of exposed workers and a summary of the complementary information concerning the personal habits during the time of the investigation are given.

The results of the determination of biological parameters relevant to the exposure to organophosphorus and organochlorine pesticides are presented.

The sampling techniques and the analyses of the pesticides in the environmental air of the different workplaces are described.

The results of both investigations were used to define the efficiency of the educational program on the safe handling and use of pesticides.

INTRODUCTION

The Hybrids Division of Cargill S.A. is engaged in the production of hybrid seeds from various vegetables. Hybrid seeds production implies the usage of pesticides, whether to protect the cultivation during its development until harvest, or to keep the seed, that has been produced, in good condition from harvest until marketing and later sowing.

*Collaborators in this study were: Carlos Gotelli, Néstor Pedro Gigena, Juan Antonio Muglia and Omar E. Maffei.

The area in which the Company is engaged in the activity mentioned is spread all over the country to obtain a better profit from the land and the climate. In its productive and research fields there are more than 2.000 Kms between the farthest operating centres.

The prevention of risks and to which man is subjected conforms to that reality. In the Company there is a Hygiene and Safety Department (H.S.D.) responsible for putting into practice preventive measures in connection with the relation existing between man and environment.

As regards man the H.S.D. works in cooperation with the Human Resources Sector concerning the proposal of objectives or the elaboration of training programs. The main objective is to encourage workers to have a clear idea of the importance of having the right attitude towards prevention. This priority becomes a reality by means of the Hygiene and Safety Committee working in each location, and by periodical informative and self assessment meetings to be held for the operating staff. The managerial and supervisory levels take part in the meetings of an educational and assessment character.

The H.S.D. coordinates these activities, requiring when necessary, the cooperation of external aids. All these activities are registered and communicated by means of internal circulation forms ("Committee Meetings"- "Report of theoretical and practical meetings").

As regards the working environment, the H.S.D. acts directly or with the cooperation of external aids, but always in close cooperation with the executive line. It also participates in new projects, in modification and/or enlargements, incorporating new machinery and tools, new raw materials and manufacturing processes. This participation permits to provide timely for corrective measures for probable hazards.

Once a hazard has been detected, all the techniques to eliminate it or to reduce it are used as much as possible. In this last case the compulsory use of personal protection devices is directed by means of an internal rule.

The HSD selects the protective equipment according to the hazard, checking its manufacture and testing it in order to be sure that they comply with the Company's and legal requirements that are in force in the country. Besides some of them are designed according to specifications laid down by H.S.D. because some appropriate elements may not be available on the market. In all cases and before the final acceptance, all protective devices are tested in order to verify their efficiency and acceptance (personal protective devices test).

After testing and after approval by the Hygiene and Safety Department, they are codified, graphics are made, and theoretical specifications are given and then they are integrated into the attachments of the Rule.

The assignment and compulsory usage of personal protection devices is recorded on a card made for each task.

The executive line is directly responsible for the supply, maintenance and control of all personal protection devices, and is also responsible for the training of the workers concerned. The Hygiene and Safety Department and the Internal Auditing Department periodically check the observance of the Rule.

RESEARCH PROGRAM

The Company has recommended to the external aids the development of an investigational plan to verify the results of the prevention of risks in handling of pesticides.

The program was developed according to the following items.

Investigation of pesticides presence in the work place

These studies have been developed over five years ago for all the places and tasks where pesticides are commonly handled in the company, as follows:

1 formulation of pesticides
2 packing and curing of seeds
3 ground application of pesticides
4 aerial application of pesticides
5 associated agricultural work

The pesticides commonly used and investigated by the program were dieldrin and malathion. Moreover the contents of total dust and respirable dust in all the operations and their content of respirable quartz are determined, to obtain a better information about the hazards in the work place.

Sampling was done under representative routine working conditions, and with the environmental contamination control equipment operating.

Investigation of biological indicators for exposure to organophosphorus and organochlorine pesticides

These types of studies are of recent nature and have been carried out since one year. They could not be extended to the workers related to all tasks described before.

We only present the results of biological measurements of workers involved in tasks like the following ones:

1 formulation of pesticides
2 packing and curing of seeds

The rest of the tasks involved in the handling of pesticides will be studied in future programs.

A sample was designed for this study using administrative employees of the company as a group of controls and workers directly connected to the tasks as the exposed population.

The tasks related to the preparation of pesticide solutions and the packing and curing of seeds take already much time to perform them in the annual calendary of work. That is the reason why it was possible to limit research to the blood and urine sampling immediately before the tasks involving the usage of pesticides and immediately after they were finished (formulation, packing and curing seeds).

Statistical processing of the data was also carried out.

In the case of the control group we only obtained samples before the start of the investigation.

Complementary investigation of the job routines

These studies include the compilation of the complementary data during the time in which the studied workers were exposed to pesticides on the following aspects:

1 the day by day task involving the handling of pesticides

2 protection devices used day by day

3 existing family environmental antecedents and previous medical conditions and personal hygiene habits

4 environmental and climatic conditions.

RESULTS*

The results of the concentrations of dieldrin, endrin, parathion and malathion in the environmental air show that only at some work places the current Threshold Limit Values have been exceeded. The remaining values we obtained permit to define the conditions as normal, also because the use of personal protection devices is prescribed. We are still studying the possibility of improving the production facilities and the system of local ventilation, to reduce as much as possible the spread of pesticides to the working environment.

As to the results of the complementary study, we may conclude that the studied group of workers have an adequate level of preparation in the safe use and handling of pesticides, with personal hygiene habits and sanitary condition, similar to the control group.

According to the results of the biological tests, we may conclude:

1 hepatogram

The results of the tests included in this study did not reveal abnormal liver functions neither in the exposed workers nor in the controls.

2 α - phetoprotein

The negative values found in this screening test suggest the absence of carcinogenic activity. It is a fact of special value because it is a human evidence under working conditions.

*Detailed results can be obtained on request from the author.

3 cholinesterase

This enzyme is an indicator of special interest and particular suitable to study exposure to organophosphorus pesticides. Abnormal differences were not found between the results of the exposed workers and of the control group.

4 organophosphorus pesticides in urine

No organophosphorus pesticides or metabolic products have been detected in the urine showing that the exposure to these substances did not present a health hazard.

5 organochlorine pesticides in blood

No significant differences between the control group and the exposed group have been found in the blood levels of the various pesticides studied (HCH, dieldrin, DDT), except in the case of dieldrin and pp'DDE for which the differences were, in mathematical terms, significant. Nevertheless, the confidence level of 5%, that is to say that there is 1 probability in 20 that the difference is due to fortuitous causes, is not enough to assert that these differences exist, mainly because of the small size of the samples, which could not be greater on account of operating reasons.

Consequently, in view of having all the elements available to make an appraisal, it can be said that there were no significant differences. This also confirms the positive result of the training program, of the selection and efficiency of the protective equipment and of the performance and internal auditing of the tasks that have been investigated. Nevertheless, in order to increase the value of our conclusions, it would be advisable to continue carrying out similar studies with the aim of increasing the number of studied workers and thus avoiding the probable distortion which necessarily results from a small sample in the first level of significance (probably significant).

The above conclusions may be cautiously applied to other tasks involving the usage of pesticides although their biological features have not been investigated yet for lack of time and opportunities. In case the same conditions according to which this study has been carried out take place again, it is recommended for safety reasons to go on using protective devices to meet probable variations in exposure level, whether accidently or by the fault of exposed workers.

APPENDIX

Sampling techniques and analysis of pesticides in the air of the work places

Dieldrin: The air sample was obtained by means of a sampling system, formed by a collecting drill, impingers containing trichloroethylene, precision instruments to measure the air flow, and an electrical suction pump, (portable and non-portable).

The analysis was made by means of a gaschromatograph Variant Aerograph.

Malathion: The air sample was obtained by a sampling system formed by a collecting drill, impingers containing isopropanol, precision instruments to measure the air flow and electrical suction pumps (portable and non-portable). The analysis was made by filtering the isopropanol. Hydrochloric acid and zinc powder were added followed by heating during 5 minutes. When cooled it was filtered and ammoniumsulphamate was added. Then it should stand for a while, brought up to the exact volume and measured by visible ultraviolet spectrophotometry.

Endrin: The sample was obtained by a sampling system formed by a collecting drill, impingers containing tetrachloroethylene, precision instruments to measure the air flow and electrical suction pumps (portable and non-portable). The analysis of the material withheld was made by means of gaschromatography.

Parathion: The sample was obtained by means of a sampling system formed by a collecting drill, impingers containing a solution of isopropanol, precision instruments to measure the air flow and electrical suction pumps (portable and non-portable). The analysis was carried out by filtering the solution of isopropanol. It was brought up to the exact volume adding hydrochloric acid and zinc powder. Once covered, it was heated to the boiling point during 5 min. It was cooled, filtered and sodium nitrate was added. Then ammonium sulphamate was added, and after 10 minutes the reagent 1-naphtyl-ethylene-diamine-hydrochloride. After some time it was measured by visible ultraviolet spectrophotometry.

Analysis techniques in biological indicators

Erythrosedimentation:	Weatergreen technique
Hepatogram:	
bilirubine:	Malloy-Evelyn technique
total proteins:	Biuret system
cholesterol:	Enzymatic method
total lipids:	Chabrol-Charonat method
G.O.T.:	Enzymatic kinetics in U.V.
G.P.T.:	" " " "
alkaline phosphatase:	Method of optimized conditions
α-phetoprotein	Technique of electrophoresis and immunodiffusion
cholinesterase:	Kinetics in U.V.

organochlorine pesticides in blood:	Methods developed by Dals and Collaborators (Hexano extractable chlorinated insecticides in human blood; Life Sciences 5, 1966, 47) Once the pesticides of the blood were taken out, the resolution and quantification was carried out by gaschromatography.
organophosphorus pesticides in urine:	Chromatographic technique developed by Kingstone and collaborators.

Technique for the statistical processing of data

In order to study the differences, three techniques were put into practice: 1 a group that was present at the sampling before exposure; 2 a group present at the sampling after exposure; and 3 the control group. For each group a mean ($\bar{x}$) was calculated; the standard deviation ($\sigma n-1$) and the variance ($Sn-1$) with a formula applicable to small samples.

In order to appraise the differences the Student T-test was used, calculating the differences of the median value ($|\bar{x}1 - \bar{x}2|$) the typical deviation or mistake of differences ($^{\lambda}\sigma w$) and the value of "T" as the quotient of the difference of median values and the typical mistake of the difference, appraising the probability in charta.

PESTICIDE EXPOSURE - NEW SOUTH WALES SERVICES

G.R. SIMPSON
Division of Occupational Health and Radiation Control, Health Commission of New South Wales, Lidcombe, Australia.

INTRODUCTION

The Division of Occupational Health and Radiation Control both in its own right and in conjunction with the New South Wales (NSW) Department of Industrial Relations has been interested in pesticide exposure for the last 20 years. This began with the deaths of two operators in New South Wales in 1960. Since then some monitoring system has been used both in the field and in the factory to monitor exposure of those handling pesticides with the view to reducing exposure to the minimal safe level.

MONITORING IN FACTORIES

These are conducted at regular intervals by officers of this Division, in this case using their inspectorial powers under the Shops Factories and Industries Act and reporting back directly to the Department of Industrial Relations. The following situations are monitored.

1 Local exhaust ventilation. It is essential that the local exhaust ventilation is maintained in such plants in order to reduce the atmospheric contaminants to a minimum. The standard of 0.61 metres/second capture velocity is aimed at in all circumstances.

2 Airborne contaminants. Industrial hygiene evaluation of airborne contaminants is conducted at regular intervals using either area sampling or personal sampling methods.

3 Surface contamination. Swab tests are conducted on most horizontal surfaces to ensure that these are clean because of the problem of skin absorption of most pesticides.

4 Biological monitoring. If the plant is incapable of carrying out its own biological monitoring service this is usually conducted by the Division.

A lengthy document concerning industrial hygiene evaluation and inspection of pesticide plants is available on request. This sets out most principles under which such inspections are conducted.

MONITORING IN THE FIELD

Exposure of operators in the field is monitored using methods described in various publications from this Division over the years. Determination of dermal contamination is usually arrived at by pinning filter papers on the operators for a period of time and assessing their dermal contamination by the amount of chemical lodging on the paper. Inhalational exposure is arrived at by the use of 12 Volt operated impinger or filter systems or commercial personal sampling devices.

The following principal groups have been looked at by this Division.

1 Pest control operators. This group is rather unique in that it uses organochlorine pesticides consistently and situations such as spraying underneath houses or termite control can cause considerable operator contamination.

2 Aerial spraying. Considerable control has been effected on aerial spraying operators using the present Hazardous Pesticides Regulations. All chemicals are now handled off concrete loading and mixing facilities with adequate washing and drainage points being provided.

3 Orchardists. This group uses high volume spray equipment; large concentrations of chemicals are spread over a considerable distance by the air blast unit.

4 Market gardeners. Market gardening is generally conducted by ethnic groups who have a poor command of English and get into considerable trouble in pesticide handling through lack of local knowledge and poor communication. Although pesticide poisonings from field operation have been reduced to a minimum in recent years, this group is usually responsible for most poisoning cases.

5 Graziers. The use of organophosphorus dips and jetting fluids have resulted on many occasions in lowered blood cholinesterase values of the operators. The situation has become better by the use of protective clothing and greater awareness.

BIOLOGICAL MONITORING - BLOOD ANALYSIS

<u>Organophosphorus and carbamate pesticides</u>

- Field cholinesterase evaluations

The Division conducts tests in about forty centres through the State each year to ensure that those handling chemicals are not affected, or if they are partly affected to have them removed from exposure before they become poisoned. The cholinesterase method in use is a colorimetric one modified from the method of Fleischer et al and calibrated for various temperatures and other conditions. This whole blood method has proved to be a very effective way of screening whereby several thousand field tests are conducted during each season. Results for 1979/1980 are presented in Table 1.

TABLE 1

Field cholinesterase (whole blood) results; 30.6.1979-29.6.1980

occupation	>80%	60-80%	40-60%	<40%
pesticide factory staff	3			
pest control operators	285	6	3	1
stores, shops, etc.	15			
greenkeepers	50	1		
market gardeners	169	3		
orchardists	173	4		
nurseries	87	1		
farmers, graziers, labourers,	252	8	2	
tobacco growers	27	1		
aerial operators - cotton	110	4		
government employees	170			
council employees	91	1		
miscellaneous	60			
Grain Elevators Board, factory processors, etc.	27			
total	1519	29	5	1

total number of cholinesterase analyses: 1554
2.3% of all tests fell below the normal range of 80-120%

The method has a normal range of 80-120 per cent for males and 60-100 per cent for females. If an operator,after exposure, has a cholinesterase value of 60 per cent or less for males or 50 per cent or less for females, they are removed from exposure until such time as their cholinesterase value returns to the lower limits of their normal range. Symptoms are usually evident at below 20 per cent.

Successful field evaluations have been conducted by the Ellman method using portable spectrometers such as the Spectronic 20 and 70 series.

While on these exercises urine specimens may be collected for weedicide analysis and, as well, venous blood specimens taken for laboratory assay of organochlorine pesticides.

- Laboratory cholinesterase evaluations

The modified Fleischer method is used again here as a screening test. Results are presented in Table 2. Specimens in doubt and a routine cross-section of all specimens are examined for plasma and red cell cholinesterase values separately using the Michel method. The normal range accepted is 0.42-1.22 pH/hour for red cells and 0.64-1.02 pH/hour for plasma. Results are given in Table 3. When results fall below the normal range the operators are removed from exposure until such time as their cholinesterase activity recovers to within normal limits. Exceptions are those with a hereditary factor giving a lowered plasma cholinesterase activity. This occurs in about one in every three hundred tested.

TABLE 2

Laboratory cholinesterase (whole blood) results; 30.6.1979-18.6.1980

occupation	>80%	60-79%	40-60%	≤40%
pest control operators; greenkeepers	361	20		
farmers, graziers, labourers	206	3	3	1
gardens (market)	49	1		1
nursery; mushroom farmer	12	1		
Grain Elevators Board;	68	5		
factory processors, etc.				
pesticide factory work	48	7	1	1
stores, shops, etc.	20			
government workers	71	1		
Council; agriculture				
rangers, etc.	56			
aerial/markers	11			
orchard	15	1		
sprayers	18			
maritime, etc.	5			
miscellaneous: students, children, domestic, drivers, etc.	201	13	2	1
surveys; Rice Board	24	2	1	2
total	1165	54	7	6

total number of cholinesterase analyses: 1232
suicides, accidental, etc. : 15

TABLE 3

Laboratory cholinesterase results (Michel method); 30.6.1979-18.6.1980
Number of normal and abnormal values.

cholinesterase	normal*	abnormal
plasma	69	60
red cells	94	30

*0.64-1.02 pH/hour for plasma ChE
0.42-1.22 pH/hour for red cell ChE

The Ellman method is also being used, particularly for those exposed to carbamate pesticides. This method has proved valuable where spontaneous plasma cholinesterase regeneration occurs during the incubation period as in the Michel method.

Organochlorine pesticides

Analyses are conducted by the Division of Analytical Laboratories and all results are coordinated through the Division of Occupational Health and Radiation Control. The GLC equipment used for these tests is computer controlled with a printout system and an automatic feed whereby 30 or 40 samples may be processed at night or when unattended. Results are presented in Table 4.

TABLE 4

Summary of residues of organochlorine pesticides in blood (µg/l)

pesticide	total	<1	1-20	21-50	51-100	100-150	>150
HCB	1983	17	1686	202	66	5	7
BHC	209	43	163	1	2	0	0
lindane	124	75	48	1	0	0	0
heptachlor-epoxide	443	65	343	27	6	1	1
dieldrin	769	68	582	66	27	11	15
DDE	2081	2	1877	163	27	9	3
DDD	269	62	204	1	1	0	1
DDT	647	34	574	27	9	1	2
total DDT	2097	3	1824	204	41	10	15

total number of analyses in 1979/80: 2207

The Division has placed an arbitrary ceiling limit of 50 ppb for dieldrin, aldrin, chlordane and heptachlor metabolites in blood and operators who exceed that figure are removed from exposure until their results return to below 50 ppb. In earlier years many pest control operators exceeded this level but at present it is rare for an operator to go above the range. A proposal has been put forward to reduce this figure to 20 ppb thus keeping operator exposure at an absolute minimum.

BIOLOGICAL MONITORING - URINE ANALYSIS

Pentachlorophenol

At present the Division is experiencing problems with overexposure to pentachlorophenol used as a mould deterrent in the mushroom growing industry. An arbitrary limit of 100 ppb pentachlorophenol in urine has been imposed on the operators in order to keep exposure at a minimum and to ensure that they wear proper protective clothing, etc. Results of analyses are presented in Table 5.

TABLE 5

Biological monitoring - urine analysis, 1979/1980 (μg/l)

pesticide	N.D.*	1-100	100-200	200-500	500-1000	≥1000
2,4-D	735	119	23	53	16	27
picloram	951	21	1	0	0	0
2,4,5-T	377	383	77	71	25	40
pentachloro-phenol	615	351	6	1	0	0

*N.D.: not detected
total number of samples analysed: 973

2,4-D and 2,4,5-T

Because of an adverse press the Division has received many requests in recent years to conduct exposure tests for 2,4-D and 2,4,5-T. An arbitrary ceiling limit of 100 ppb has been imposed for operator exposure which means that those handling the chemical must wear full protective clothing and it is only with difficulty that results below this figure can be achieved.

Results of exposure tests on Council and Forestry workers were published in the Medical Journal of Australia and the Division presently has case histories of over 600 operators going back 5 years. Results over 1979/1980 are given in Table 5.

Heavy metals

Mercury and arsenic tests in urine are conducted as required. With the banning of organic mercury compounds for seed dressing this has not become so necessary in recent years. However, considerable use has been found for arsenic in copper chrome arsenate and other preparations which are used for pole treatment and control of operator exposure is necessary. At present a ceiling limit of 0.2 milligrams per litre arsenic in urine has been imposed on such operators.

TRENDS IN USAGE AND SURVEYS

A recent population survey for organochlorine pesticides in blood has been conducted in the Wee Waa area of New South Wales again using a much larger section of the population. This was compared with Goulburn as a twin town. Results have not yet been correlated and will be published at a later date.

The overall trend of organochlorine pesticides in blood appears to be a general decline in recent years in hexachlorobenzene (HCB) in blood following the prohibition of the use of this material as a seed dressing several years ago. We still see occasionally individuals with raised HCB levels in blood but this is now becoming a rarity. It is expected that a similar trend may occur with DDT as its prohibition progresses. The first step in the prohibition will occur after July 1981 when it will be no longer used in cotton growing areas.

Field results for blood cholinesterase levels vastly improved in recent years. For example, in a large orchard growing area such as Orange the first surveys in the early 1960s revealed 30 per cent of the population affected by organophosphorus pesticides whereas 5 years later this figure had dropped to 1 per cent or less. Similar remarks apply to the cotton growing areas where wholesale poisonings occurred in the 1972-3 seasons and at present poisoning cases are at a minimum.

Controls

The decline in the number of pesticide poisoning cases due to field exposure in the State and a similar decline in unsatisfactory blood tests for pesticide exposure are probably due to several factors. These are as follows.

1 Monitoring services. The monitoring services offered by the Division have reduced pesticide poisoning cases by demonstrating under what conditions an operator may be affected. Similarly, removing operators from exposure before they become poisoned is a great help.

2 The Dangerous Substances Regulations. The Hazardous Pesticides Regulations made under the above and promulgated late 1978 give this Division direct control over most aspects of the use of the more dangerous pesticides. The regulations control handling, transport, mixing, storing and most other facilities. The use of these regulations and regulations from the NSW Department of Agriculture enforcing the use of the correct chemical on the right crop will go far towards reducing poisoning cases or other incidents of overexposure.

EDUCATION AND SAFEHANDLING IN PESTICIDE MANUFACTURING

C.F. OTTEVANGER
Industrial health department, Shell Nederland Raffinaderij B.V./Shell Nederland Chemie B.V., Pernis, The Netherlands

INTRODUCTION

The purpose of this paper is to describe the essential features of the education of men (and women) who are engaged in the manufacture and formulation of pesticides. It will include, of course, the education of plant management at all levels as well as that of the plant workers themselves (operators, drumfillers, laundry workers, etc.).

Quite different educational problems arise with respect to the actual users of pesticides and with the design of container labels intended to provide instructions on the safe use of pesticides and advise to doctors on the treatment of acute toxic effects/signs and symptoms. These problems will not be dealt with in this paper except to stress the need for frequent updating of company literature about the safe use of pesticides and the treatment of poisoning.

EDUCATION OF MANAGEMENT

It must be made clear to management that the utmost safety in working in a pesticide plant is not only of the highest importance for the health of the workers, but that there is also the economic value of keeping workers working.

A clear understanding of the sequelae of acute and chronic exposure of man to pesticides must be acquired, as well as the means to prevent exposure and ways of detecting exposure of the workers.

This can be done by monitoring

a) appropriate biological parameters identifying deviations from normal, and
b) the environment for the presence of toxic chemicals associated with pesticide manufacture.

In this respect attention should be given to intermediates and by-products as well as to the end-product.

If the health of pesticide workers is to be protected effectively, the management must provide adequate medical facilities including professional people such as industrial health doctors and other industrial health professionals.

The doctors concerned with the care of pesticide workers will require a knowledge of pesticide toxicology and occupational hygiene as well as the facilities of a medical laboratory with well-trained personnel using modern methods and equipment to produce reliable data. Special problems may arise if the doctors and laboratories are not company employed/company-owned and therefore only provide contractual service.

These conditions may appear to be costly but they are not in comparison with plant-operating costs, and they are essential if exposure is to be monitored and controlled effectively. It should not need to be pointed out that an ineffective monitoring system is not only a complete waste of money but also that it may provide no real protection to the workers, while giving them a false sense of security.

The management must make sure that excellent standards of personal hygiene are maintained within the plant, for which purpose many measures such as protective clothing, gloves, boots, and respiratory protective equipment are necessary to minimize exposure during work and when mishaps occur.

It is equally important that all this equipment is maintained in a good functional state with frequent inspection and replacement when necessary.

On top of this, other hygienic measures include the cleaning of working clothes - a complete and clean set of clothing must be supplied to each worker every day - and contaminated equipment. This will call for special cleansing facilities, preferably within the plant site in order to make sure that decontamination is achieved effectively and without hazard to the environment.

Washing facilities should be established near but not within the plant; these will act as a precaution against absorption by mouth and thus minimize the possibility of exposure to toxic products by this route.

As eating is not allowed in the plant a special lunch counter should be provided for pesticide workers and conveniently sited in relation to the washing and changing facilities.

The physical lay-out of the plant should be so designed to make it easy for the workers to comply with above mentioned regulation.

There should be a clear demarcation of clean and dirty areas, in relation to washing and changing facilities, which should be arranged such that the worker can remove his working clothing, shower and then put on his own clothes avoiding contamination.

The management is also responsible for the control of environmental pollution and therefore has a marked responsibility for the safe disposal of solid waste and the prevention of air and water pollution. These tasks are made easier by good housekeeping and this should include:

1. local exhausts of air from appropriate points in the manufacturing and formulating processes;
2. frequent cleaning of production and formulation plants;

3. scrubbing and/or filtering exhaust air;
4. measures to prevent polluted process water, clean-out water and scrubbing water from flowing into public waters.

The efficacy of these measures will require confirmation by regular sampling and analytical procedures.

It must be remembered that all these cleaning operations may themselves lead to exposure of the workers concerned and so these workers should also be included in the educational program and receive adequate protection.

Management also has a joint responsibility with the above mentioned industrial health doctor(s) and the personnel department in selecting for employment a group of workers who can be developed into safety-minded employees, capable of understanding these measures and procedures in the light of their own safety and health, and that of their fellow-workers. Management must also be made aware of the need to supervise the effective performance of these safety measures.

EDUCATION OF PESTICIDE MANUFACTURING AND FORMULATING WORKERS

The education of a pesticide worker may be said to commence when he is interviewed by the personnel department as well as by the plant manager, for plant safety and hygienic measures must be discussed at an early stage. The worker must show his willingness to work with the safety regulations before his employment is confirmed. He will then be examined by a doctor and when he has been declared medically fit, he can commence work.

The education of the worker continues with a course of formal instruction and then, as a never ending process during his working time at the pesticide plant. He must be informed about the safety regulations by an instructor who is responsible to management for ensuring that the worker understands and complies with these rules. These regulations should include:

A. Precautions against absorption via mouth or nose

1. Workers must not eat or drink in the plant, nor bring food into the plant.
2. Workers must wear dust filters or fresh air masks whenever there is the possibility of generation of dust.
3. Workers must wear fresh air masks or positive pressure masks when toxic vapours or gas may escape from the plant equipment, for instance, during sampling or when a spillage has taken place.
4. Workers must wash hands and face thoroughly before eating.
5. There must be no smoking on the plant.

B. Precautions against skin contamination and dermal absorption

1. Workers must wear only prescribed clean clothing and shoes.
2. Workers must take a full shower bath using soap and plenty of water before

going home and also during the working day if working conditions make it desirable.

3. Working clothes to be laundered daily.
4. Shoes must be kept in good condition with soles and uppers inspected regularly for cracks and other signs of wear.
5. The approved gloves must be worn in all places where pesticide contact is possible.
6. Workers must wash hands before (and after) using the toilet.
7. In case of contamination, clothing must be changed at once, a shower taken and the industrial medical department informed of the accident.

All workers must understand these regulations and be willing to comply with them at all times while at work. Every newcomer to the plant must be carefully trained and instructed in working in the plant by an older colleague (plant instructor), who has time to devote to this training or is specially chosen for a certain period of time to help in the education of newcomers.

A large part of the training is dedicated to safety instruction and this must include emergency procedures in cases when overexposure is suspected.

These emergency procedures require special training of groups of men from the workforce, with periodic practices.

During training and in talks with supervisors and plant instructors, all workers are encouraged to visit the medical department any time they feel the need to do so, to discuss problems arising from their work.

The maintenance of good relations between all workers and the medical department must be ensured by frequent visits to the plant and talks with the day-foreman and workers by the doctor and/or other medical personnel.

Maintenance personnel must be asked to abide with the same regulations. They also require education about the safe handling of pesticides.

Workers coming from outside contractors should also be included in the population of the plant in the sense that they must follow, in the same way as full time company workers, the special safety regulations and personal hygiene measures.

Such workers, therefore, require training and education.

In this way maintenance and contract workers are regarded as pesticide workers and are treated as such, minimizing exposure as far as possible.

CONCLUSION

Education and safehandling in pesticide application as well as in manufacture and formulation depends on three groups of individuals, the management, the occupational health staff and the workers themselves.

Each group must make its own particular contribution to education and safehandling but also, each group relies on the other two for the optimal effectiveness of its own work.

Full cooperation between the three groups is necessary if the highest standards of safety are to be achieved, and this will be facilitated if free and open channels of communication and information are established between the three groups.

CONSIDERATIONS IN CONNECTION WITH ESTABLISHING RE-ENTRY TIMES AFTER PESTICIDE APPLICATION

H.G.S. VAN RAALTE
GIFAP Toxicology Committee, The Hague, The Netherlands

INTRODUCTION

The problem of re-entry intervals is much more complicated than that of Maximum Residue Limits (M.R.L.) of pesticide residues in and on food. The word "interval" may give rise to confusion with "pre-harvest interval" and therefore the term "re-entry time" is preferably used. The concept "pre-harvest interval" covers the period that has elapsed at harvest since the last application of a pesticide.

The purpose of setting pre-harvest intervals is to ensure that under normal conditions of Good Agricultural Practice and micro-climate, the residues will not exceed the M.R.L. Checking the aim of the established pre-harvest interval is reasonably straightforward and easy: chemical analysis of the raw agricultural commodity or of the food. The objective is protection of the consumer and belongs to the province of Public Health.

The objective of the setting of re-entry times (R.E.T.) is protection of agricultural workers against poisoning by pesticides. It therefore belongs in the province of occupational health and in many countries it would involve a different Ministry or Department - i.e. the Department of Labour - than does establishing pre-harvest intervals or M.R.L.'s with which the Department of Health or Department of Agriculture is involved.

In many other aspects do R.E.T.'s differ from pre-harvest intervals (scheme 1).

Firstly Pre-harvest intervals are related to Maximum Residue Limits (M.R.L.) which involve the total residue, including the proportion of a systematic pesticide incorporated inside the plant, whereas the R.E.T's are related to the amount of residue which can readily be brushed off the surface of the plant. This is known as dislodgeable deposit.

Secondly The M.R.L. is related to the total residue in and on the edible part of the crop only, whereas the dislodgeable deposit on leaves and stems is most important and comes in addition to what can be dislodged from the harvested edible part of the crop. In short, the dislodgeable deposit on all contactable and contacted parts of the crop should be considered when setting

re-entry times.
Pesticide-laden dust from the soil, in contact with bare feet, knees or hands should also be taken into account.

Thirdly As regards to the M.R.L., a person would eat and absorb all of the residue contained in or on the food whereas as regards to R.E.T. he would be exposed and could therefore absorb only that amount of the dislodgeable deposit with that part of the skin with which he makes the contact while the clothes he is wearing constitute a considerable barrier.

Fourthly Some part of the dislodgeable deposit on the skin of the agricultural worker may be washed-off after work and will not be absorbed whereas the amount of residue in or on food, once eaten, is taken up into the body.

Fifthly Under special circumstances, depending on the compound, the formulation, the method of application and particularly in glass-houses, the possibility of inhalation of the vapour or in other cases of pesticide laden dust, should also be taken into account.

Sixthly Usually, exposure to dislodgeable deposits occurs occasionally and seasonably whereas residues in and on food may be eaten daily.

Re-entry times following fumigation in empty glass-houses, sheds for stored commodities or raw agricultural produce, ship-holds, poultry houses, stables, kessels etc. form a different problem where inhalation may constitute an important part of the total exposure. Here the situation is straightforward and occupational TLV's should be observed.

RE-ENTRY TIME	PRE-HARVEST INTERVAL
dislodgeable deposit	total residue
all contactable parts of crop	edible parts of crop only
absorbed only by contact anatomy	
partly washed off	eat it all
occasionally/seasonally	daily

Scheme 1. Differences between re-entry and pre-harvest intervals.

HAZARDS FROM RE-ENTRY

In the field, the hazards from re-entry depend on
- the toxicity of the active ingredient in the form in which it is present on the vegetation;
- the amount of the dislodgeable deposit;
- the area of the bare skin which is in contact with the vegetation;
- the duration and frequency of this contact;
- the working habits and personal hygiene of the agricultural worker.

The toxicity of the compound

This, of course, is dependent on the inherent toxicity of the active or activated substance or mixture of substances present in the dislodgeable deposit and on the formulation in which they are present. It is known, that sometimes conversion of the original compound to a more toxic conversion-product is enhanced under appropriate environmental conditions.

Examples are the conversion of parathion to paraoxon, malathion to malaoxon, some organochlorines to their ultraviolet - or photo conversion products. It is also known that certain, mostly aromatic, solvents enhance the dermal toxicity - or possibly more accurately: the percutaneous absorption - of some insecticides.

Amount of dislodgeable deposit

This depends on the product, the crop, and on environmental factors (scheme 2). Product-related factors include formulation. The amounts of dislodgeable deposit from a U.L.V. concentrate spray formula, an emulsion, an aqueous solution, a wettable powder, a dust or granules are all different and may dissipate at different rates.

The amount of dislodgeable deposit may also vary according to the application rate (grams per ha) and the method of application (aerial-, tractor-, knapsack-, handspraying application).

It is obvious that the hazards from dislodgeable deposits vary according to the type of crop, its height and its maturation, the density of foliage, the accessibility of that part of the crop which must be handled etc. Strawberries, potatoes, sweet corn, apples, tobacco, cotton, rice, all pose different problems. An additional factor may arise from pesticide-laden dust on the soil.

Environmental conditions may modify the dissipation of the deposit by variations in temperature, sunshine (photo-degradation), moistness, wind, in short by variations in the micro-climate.

	DISLODGEABLE DEPOSIT	
PRODUCT	CROP	ENVIRONMENTAL CONDITIONS
formulation	type of crop	temperature
application rate	maturity-height	sunshine
method of application	density of foliage	moistness
conversion product	accessibility of part to be handled	wind
dust on soil		

Scheme 2. Factors influencing the dislodgeable deposit

Area of skin in contact with the crop; the duration and frequency of contact

These vary with many conditions. In order to get an insight in worker - crop contact situations several studies have been carried out. Wicker and Guthrie (ref. 1) performed time and motion studies to estimate the "amount of contact" between worker and treated crops from an evaluation of carefully timed motion pictures in each of five crop situations (tobacco, cotton, peaches, sweet corn, blue-berries). They filmed at five consecutive 3½ minute intervals. The total time of contact between a specific anatomic region and the crop was recorded. Variables as breaktimes, working rates, personal habits, field conditions, etc. differed considerably. The type of work is, of course, important and varies with the work-activity (i.e. scouting, pruning, harvesting, mechanically or by hand) and the crop. Other conclusions the authors arrive at, are:

- that the area of skin exposed, not an excess amount of pesticide deposit determines the toxic effect;
- that from the results of their own work and from data in the literature it becomes clear that long sleeves and long pants do provide adequate protection in many working situations.

The main exposure of field-workers is apparently dermal with smaller oral and respiratory components. Field-workers "dislodge" pesticide-laden particulate matter from foliage, fruit and soil surfaces. These particles settle on the worker and are inhaled. The specific combination of the apportionment between dermal, oral and respiratory exposure depends on particle size. Most actual measurements by analysis of extracts of exposure pads and patches have been done with organophosphate insecticides, particularly with parathion. Later, also other insecticides (a.o. refs. 1, 2, 3, 4).

It is indeed plausible that such hazards as might exist, would mainly occur with organophosphates. However, the distribution of the pesticide over the various areas of contact is probably very similar for other pesticides.

Based on analysis of extracts of exposure pads and patches, Spear et al (ref. 5) estimated that hands and fore-arms received approximately fifty percent of the entire dermal dose of dislodgeable parathion residues on citrus; the torso received ten percent; the head and neck region ten percent, upper arms and shoulders ten to fifteen percent and the legs fifteen to twenty percent. According to Wolfe et al (1963), Jegier et al (1964) (refs. 6, 7) respiratory exposure amounts to no more than a few percent of dermal exposure.

Usually, and particularly so in dry areas, much of the dislodgeable deposit will be in the form of pesticide-laden dust and fuzz from the fruit, foliage and branches including fall-out and dust from disturbed soil.

HOW TO SET ACCEPTABLE RE-ENTRY TIMES?

Several suggestions for "Guidelines" for setting re-entry times and for required data to enable this setting have been made (a.o. refs. 8, 9, 10, 11, 12). It has even been suggested to use mathematical models. These models should take into account metabolism, kinetics, soil-type, unusual weather conditions, geographical area of applicability, epidemiology of field-workers etc. Even if this could be done, it might not be very practical.

In the meantime, in the United States of America, the Environmental Protection Agency, in the framework of FIFRA, has set re-entry periods for field-workers for fourteen organophosphorus insecticides. These national standards require that agricultural workers do not enter a treated field for 24 or 48 hours after an organophosphorus application, the time depending on the specific organophosphorus compound.

The California Department of Food and Agriculture has set, for California, more stringent regulations for twenty organophosphorus compounds. These include re-entry times of one day for malathion and 45 days for high rates of parathion (ref. 9).

In view of the innumerable variations in crops, in formulations, in rates and techniques of application, in working practices it would seem almost impossible to set re-entry times for a specific compound applicable to all crops and all areas.

It is suggested that the best method for arriving at responsible re-entry times should be based on an estimate of total exposure. This should be calculated from the amounts of pesticide extracted from pads and patches worn by workers in field trials. Field trials are carried out anyway and obtaining such data would not be too difficult. The results should be expressed in mg of active ingredient per hour worked. This can be correlated with the subacute dermal toxicity (no-adverse effect levels) in the animal experiment or with whatever human data that may be available from observation of field applicators. Additional data required for evaluation of the safety of re-entry times will usually already be available. These include information on primary skin- and eye irritation, and skin sensitisation and the results of the conventional toxicological studies as for instance described in the Council of Europe's Brochure on Pesticides (ref. 13).

REFERENCES

1 G.W. Wicker and F.E. Guthrie, Worker - crop contact analysis as a means of evaluating re-entry hazards, Bull. Environ. Contam. Toxicol., 24 (1980) 161-167.

2 H.R. Wolfe, J.F. Armstrong, D.C. Staiff, S.W. Comer and W.F. Durham, Exposure of applethinners to parathion residues, Arch. Environ. Contam. Toxicol., 3 (1975) 257-267.
3 N.A. Buck, B.J. Estesen and G.W. Ware, Dislodgeable insecticide residues on cotton foliage: fenvalerate, permethrin, sulprofos, chlorpyrifos, methylparathion, EPN, oxamyl and profenofos, Bull. Env. Contamin. Toxicol., 24 (1980) 285-288.
4 G.W. Ware, B.J. Estesen and N.A. Buck, Dislodgeable insecticide residues on cotton foliage: acephate, AC 222,705, EPN, fenvalerate, methomyl, methylparathion, permethrin and thiodicarb, Bull. Environ. Contamin. Toxicol., 25 (1980) 608-615.
5 R.C. Spear, W.J. Popendorf, J.T. Leffingwell, T.H. Milby, J.S. Davies and W.F. Spencer, Field-workers' response to weathered residues of parathion, J. Occ. Med. 19 (1977) 406-410.
6 H.R. Wolfe, J.F. Armstrong and W. Durham, Health hazards of the pesticides endrin and aldrin, Hazards in some agricultural uses in the Pacific Northwest, Arch. Environ. Hlth., 6 (1963) 20-27.
7 Z. Jegier, Health hazards in insecticide spraying of crops, Arch. Environ. Hlth., 8 (1964) 670-674.
8 Anonymus, Numerous sites/uses covered by draft re-entry guidelines, Pest. Tox. Chem. News, 20 (1980) 33.
9 H.N. Nigg, Prediction of agricultural worker safety re-entry for organophosphate insecticides, Am. Ind. Hyg. Ass. J., 41 (1980) 340-345.
10 J.B. Knaak, P. Schlocker, C.R. Ackerman and J.N. Seiber, Re-entry research: establishment of safe pesticide levels on foliage, Bull. Environ. Contamin. Toxicol., 24 (1980) 796-804.
11 W. Popendorf and R.C. Spear, Preliminary survey of factors affecting the exposure of harvesters to pesticide residues, Am. Ind. Hyg. Ass. J., 35 (1974) 374-380.
12 G. Zweig, J.D. Adams and J. Blondell, Minimizing occupational exposure to pesticides: Federal re-entry standards for farm workers (present and proposed), Res. Reviews, 75 (1980) 103-112.
13 Council of Europe, Pesticides, Advice and recommendations to be used by national and other authorities as well as manufacturers concerned with the registration of agricultural and non-agricultural pesticides, Strasbourg, 4th edition, 1977.

PESTICIDE SAFETY - AN INDUSTRY VIEW

R. C. TINCKNELL
Shell International Chemical Company Limited, London

ABSTRACT

The main factors which contribute to safety in the use of pesticides are reviewed and discussed. The lack of precise information on the relative importance of these factors is noted. When promoting safe use the importance of motivation, efficient deployment of resources and maintenance of effective co-ordination between the efforts of industry and the authority, are stressed.

INTRODUCTION

Promoting safe use is a very important aspect of pesticide technology. In my talk I would like to outline some of the aspects that I think need to be considered in planning one's approach to this goal. As you will notice I have called this talk an industry view. It is really my view and I cannot claim to speak for anyone else although I believe that many of my convictions are fairly widely held by others. Of one thing we can be certain; no-one wants pesticide accidents.

Statistics available

As you will be hearing during this symposium there are great variations in our information about pesticide intoxications. In industrialised countries useful statistics can usually be found and often the incidence of cases is relatively low. Thus, in the U.K.(ref. 1) in 1979 there were no fatalities attributable to pesticides among farming and forestry workers and of a total of just over 4000 non-fatal accidents on farms only seven were attributed to pesticides. In the U.K. we also have statistics on home gardens. It is interesting to notice that in 1978, of a total of 1156 gardening accidents pesticides were very low on the list. Pesticides were the cause of 31 accidents compared with, for example, 50 for deck chairs. Moreover the pesticide accidents could all have been avoided if users had complied with the simple advice printed on the label.

In the U.S.A. according to Barrons (ref. 2), the majority of pesticide accidents were non-occupational. Citing data from the National Centre for Health Statistics, deaths from pesticide poisoning among occupational workers (excluding suicides) were 34 in 1977. He says that a distressing number of episodes arose in children not involved in the actual task of spraying.

In less advanced countries, on the other hand, statistics are very difficult to obtain. Suspicions that what data there are are misleading have also been voiced on the grounds that many cases go unrecorded because there is often no-one to report them to or they may not be recognised for what they are. It is widely believed that pesticide incidents are more frequent in tropical than in the more industrialised temperate countries but to what extent remains difficult to establish.

Whilst figures on the extent of the problem are difficult to establish in many countries, it is even more difficult to find data about the primary causes of accidents, so that we are led back to our experience and judgement. In this talk I would like to explore with you the main components that I believe contribute to the safe use of products particularly those in which industry is involved. I would then like to make some observations on the direction I feel we should be taking.

Factors that contribute to safety

Three groups of people contribute to the safe use of pesticides - the manufacturer, the control authority and those concerned with the application itself. I am not sure whether bystanders ought to come into the latter category. Their exposure is essentially capricious and their involvement difficult to study, therefore.

Many aspects of pesticide use that contribute to safety are the primary responsibility of the manufacturer although his responsibility is often shared especially during the registration process. The structure of safety planning however must start within the industry. It begins when a new product is discovered. It is at this stage that plans have to be made for developing the basic toxicological data on which decisions will later be made. Following closely on will be the development of formulations, packaging, methods and rates of application to the crop, agreement of special precautions that may be needed and development of the label; these latter two especially in consultation with the registration authority. In some countries there are conditional registration schemes which allow new products to be introduced gradually as the more detailed dossier develops.

Let us then briefly review the main issues directly related to the product to be sold.

First the product must be capable of controlling the pest economically and efficiently. Use of the wrong product so often leads to over-application, and hence the risk of over-exposure and unnecessary hazard.

Then formulation. My colleague Barry Speight (ref. 3) talked to you about the importance of formulation at our last meeting. The primary objective of formulation is to present the product in its most efficient form - a form that is not troublesome to manipulate. Emulsions must be stable enough, wettable powders must stay in suspension and solutions must not deposit solids that block equipment. It must also be of a type that suits the circumstances of use. For some pesticides where circumstances do not favour liquids, solid granules may be a more appropriate presentation because they can often be applied by less demanding techniques - and, incidentally, their dermal toxicity is often lower than that of the corresponding solutions or emulsions.

Packaging is closely linked with formulation. Much has been written about how pesticides ought to be packed but I would make 3 points about packaging. Firstly the pack must withstand the product. Obvious you may say but leaks have been known to develop after prolonged storage in hot conditions. I think we now have the proper techniques, but sound packaging does require that appropriate studies are carried out beforehand. Then pack size. Half empty cans of pesticides are anathema to anyone concerned with safety, and pack size for a given market needs to be considered carefully. There are no ideal solutions - logistically these are not possible but I believe that where possible it is better to err on the side of small rather than large packs. This incidentally reduces the temptation to repack into small second hand unlabelled containers - a serious cause of pesticide accidents in some countries particularly among those who are not occupationally involved. Last but not least the closure. I expect we can all recall how difficult it can be to pour oil out of a large drum without spilling it. How important poor closures are as a contributor to accidents I do not know, except that I have suffered from them myself and have heard of several cases of splashing due to the difficulty of opening cans.

Passing from product issues I would like now to talk about methods of application. These of course must be decided according to the circumstance of use, and many of you will recall the more comprehensive observations made on this subject by Coutts (ref. 4) at the meeting in 1979. In fact, basic principles have changed little over the years and I suppose it is true to say that the vast majority of the world's pesticides are applied by some form of sprayer ranging from a knapsack carried and pumped by the operator himself through to tractor drawn equipment and aeroplane application. In recent years we have seen the development of ultra low volume equipment which varies from simple hand held equipment driven by torch batteries, to the very specialised devices used for aircraft application. It is obvious that the equipment should be suitable for the job and that means not only the pest control objectives but also compatibility with the formulation. The point I would like to stress here however, is the state of maintenance of equipment. Lavers (ref. 5), for example cited a case-study in East Germany where about 7 out of 8 pieces of equipment were found to be faulty in some way. From a purely safety standpoint, the worst equipment hazards are doubtless leaks and blocked spray systems, especially nozzles but as I shall be discussing later, any deficiency in the functioning of equipment leads to increased risks to workers. Proper choice of equipment and then its care and maintenance is a very important contributor to safe use.

These issues I have been speaking about are normally covered by the manufacturer and to some extent the user, but finalisation of safe use recommendations is often done jointly with the authority. Here one is more directly concerned with exposures that will occur when recommended practices are followed. There are, of course, two types of exposure; one from the spray itself and the other from accidental spillage so often caused by sheer carelessness. Spray exposures can be measured, accidental exposures can not. It is normal for decisions on e.g. the need for items of protective clothing to be made on hourly spray deposition rates and the acute dermal toxicity of the diluted spray. Even for quite toxic products, sprays for medium volume equipment are usually so dilute as to have very modest dermal toxicity. Thus, if a product with a dermal LD_{50} of 100 mg/kg body weight were sprayed as a 0.02% suspension, 300 ml of dilute spray would have to be deposited on the person for him to receive only 1/100 of the animal LD_{50}. Unless foreseen effects are of a very cumulative nature, special protection is hardly necessary in such a case because the body can seldom retain this amount of liquid in normal circumstances. The position may be rather different for ultra low volume sprayers (ULV). Here the spray solution can easily contain 10% of the active ingredient so that if the dermal toxicity of the product was unchanged pro-rata by the formulation, the amount of liquid for 1/100 of the LD_{50} would then be reduced to 2/3 ml; a rather different proposition. In a hot country where it is difficult to arrange for effective protective clothing to be worn, very good supervision would be needed to avoid danger with such a product. On the other hand one should recognise that with a hand held ULV machine one man can spray a hectare of land in about 40 minutes compared with 2-3 days for an ordinary knapsack. Moreover the ordinary knapsack can require the application of 1/4 - 1/2 ton of water compared with about 2 kg for the ULV. Safety and convenience do not always go together!

How, on the other hand do we deal with accidental contamination during mixing and filling? This can not be quantified; one is in a risk situation and the approach can only be to recommend procedures that minimise risk. But let it be said here and now that highly poisonous products do cause damage if abused and as we all know, there is no such thing as absolute safety.

Contacts with the user

Having outlined what I believe to be the main contributory factors to safe use, we can now consider the vital issue of contact with the user, the issue on which this conference is concentrating. The first contact, of course is the label. This is of critical importance in that it describes the way in which the product must be used. Good use instructions for a good product, provided they are carefully followed give good pest control, wholesome food and healthy applicators. Read the label. How easy it sounds! Why do labels let us down? I cannot say with any precision but there are the obvious problems; people who cannot read, not being able to put enough on a small label, letters almost too small to read. But I suspect there are other more subtle factors and the most important I believe, is that the reader remains unconvinced of the need for many of the troublesome requirements that do appear on some labels. Moreover, he got away with it many times before so why bother? Labels must clearly not suffer from overkill. They must not cry wolf. Another factor, I believe is the question of bravado especially among some of the younger workers. I have heard of several cases where people have been slightly ashamed of admitting to symptoms or to fear of ill effects and do not want to be seen as over cautious.

The label, then, has its limitations and needs to be complemented by other forms of instruction. What should these be and what should they aim for?

First I would like to make what I believe are two rather fundamental points about accidents. The first is that they are far less likely to happen to people who are thoroughly skilled at their job; people who know what they are doing, who have an approach to their job which recognises that care is needed not only to be safe but to achieve really good results. Up to a point one can even argue that safety is a natural outcome of competence. As an analogy, I would rather ride in a car driven by a successful racing driver than by someone whose driving experience mainly rested on a formidable knowledge of the safety rules. The man who knows his product and its function, who knows how to work out flow rates, who understands how to calibrate equipment and how to achieve good coverage knows about the care that has to be exercised to achieve these goals. He is far less likely to be careless and sloppy than the man who is content with a rough and ready perfunctory application.

The second point is that accidents seldom arise from a single cause. Imagine a man using a poor formulation which continually clogs his jet filters. He keeps having to take them out for cleaning, wastes spray over his clothes and hands and even gets a little in his mouth as he blows through a clogged jet. He is injured as a result and why? Was it the formulation? Was it poor storage of the product causing deterioration? Was it because he did not take care to avoid getting liquid on his hands (very difficult) or changing sodden clothes? Was the equipment badly designed and too difficult to clean? Would he knowingly have taken the risks he did had he been properly informed? Almost any one of the above faults, had they not occurred would have prevented the accident - the chain of events would have been broken.

The most effective education for safety in my experience comes from programmes designed to teach people competent pesticide management overall. In this way the person gets practical experience in safe use procedures while he achieves the objective of pest control at the same time. People who are only taught safety rules can run into unexpected problems when they encounter the practical situation and this may cause them to override what they have learned. The second feature of accidents - their multiple causes, must also be taken into account. The good supervisor must be taught a comprehensive range of safe procedures. Although of course one must keep training as simple as possible it must avoid the trap of putting the student in the position where a little knowledge is a dangerous thing.

The media we can select for teaching fall into several categories, depending partly on the sector of the community we wish to reach. Are we trying to persuade an aeroplane pilot that he ought to know about pest control as well as flying? Are we trying to teach the supervisor or the man who is actually operating the equipment? The media have to be chosen according to the audience. We can employ specific teaching courses where talks may be complemented by practical exercises or we can think of radio programmes, films, illustrative games and many others. An example of a relatively economical demonstration is the slide kit. My colleague Dr. Tordoir will be showing you one we developed in Shell. As you will see, it covers the overall objective of the work and not only the safety aspects. It does not, of course require its listeners to be particularly literate and pictures on a screen always have a certain lure. A second useful contributor I believe is the instruction booklet. These have the great advantage that they can be read at any time and do not require attendance at a meeting at some set time. Moreover, once written they are relatively undemanding of resources.

I also think that there could be a useful place for more short radio broadcasts in some countries, particularly during the spraying season and where there is in anycase a short regular early morning programme on farming topics.

All these media can pay a valuable contribution but there is little doubt that the most effective way of training spraymen is the practical teaching course. It is very demanding of resources especially if one is dealing with aerial application and of necessity limited to people who have far more than just a passing interest in the subject. All the same, a small number of well trained people can themselves help to spread the message.

CONCLUSION

In this talk I have tried to outline some of the components and issues we have to take into account when trying to propagate safe use practices. I have spoken rather briefly of the media we have at our disposal. I would like to make three more points before I finish. The first is that people must be convinced that it is important to acquire competence and to respect safe use practices they must be properly motivated. Secondly, an enormous effort is required to have a real impact; by its nature it never ends. Thirdly, because the subject is potentially very demanding of resource it is vital that all concerned in an country co-ordinate their efforts so that valuable resources can be deployed to maximum effect. Of course, needs are different in different countries but here is a case where the utmost collaboration between industry and authority is needed if the best results are to be achieved.

REFERENCES

1 British Agrochemicals Association, Annual Report and Handbook, 1979-80, p. 26-7.
2 K.C. Barrons, Farm Chems, Oct. (1980) 54-5.
3 B. Speight, Effects of formulation upon the safe use of pesticides, in W.F. Tordoir and E.A.H. van Heemstra (Eds.) Proc. Vth International Workshop of the International Association on Occupational Health, The Hague, Oct. 9-11, 1979, Field worker exposure during pesticide application, Elsevier, Amsterdam, 1980, pp. 29-37.
4 H.H. Coutts, Field worker exposure during pesticide application, in W.F. Tordoir and E.A.H. van Heemstra (Eds.) Proc. Vth International Workshop of the International Association on Occupational Health, The Hague, Oct. 9-11, 1979, Field worker exposure during pesticide application, Elsevier, Amsterdam, 1980, pp. 39-45.
5 A. Lavers, SPAN, 23 (1980) 118-120.

HISTOCOMPATIBILITY ANTIGENS IN THE PREVENTION OF TOXIC ACCIDENTS IN PESTICIDES APPLICATIONS

ARMANDO MACCAGNO

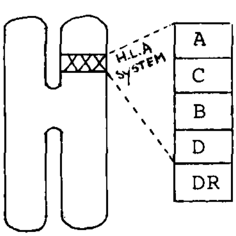
Cátedra de Toxicología, Facultad de Medicina de Buenos Aires, Argentina

Recent research in immunology suggests that independent from nature and amount of a toxic substance, an individual subject on account of his genetic structure could show an adverse reaction from a laboratory chemical.

The H.L.A. system (Human Leucocyte Antigens) (ref. 2) appears to be an important factor in the development of certain diseases and intoxications. However, independent from the behaviour of the genetic marker, this system might also be involved in immunological responses, and in the survival of tissue transplants.

The H.L.A. system consists of antigens on the membranes of the nucleated cells of the organism. It is not yet quite clear whether they are uniformly spread over the surface or occur in clusters. Although they are present on all cells, for practical reasons, only lymphocytes and platelets have been studied. Every human being has his own antigens which like blood groups classify him by making him similar to some individuals and different from others. These antigens are heritable according to a dominating trait, following Mendel's laws. The structure of these antigens is determined by genes belonging to chromosome 6 of the cell nucleus. In this chromosome, the genes are located in the locus (ref. 11) (part of the chromosome reserved for the genes), specifically in four of them, except in the case of the B lymphocyte in which there are give.

They are located in the short arm as follows:



Chromosome 6

Diagram of the distribution of the H.L.A. system

DR is only found in lymphocyte B

The different loci have different series of alleles. The following have been described up till now:

In locus	A	28 alleles
	B	33 alleles
	C	6 alleles
	D	11 alleles
	DR	7 alleles

It is difficult to identify antigens. When one is identified by some investigators, it is studied by a workshop (ref. 3) which confirms or refutes the identification. During this period it is named as follows:

H.L.A.	B	W	17
↓	↓	↓	↓
Name of the system	Name of the locus	Workshop	N^{o} of the antigen

When the monospecific serums which identify it irrefutably are found, it loses the W and becomes a H.L.A. B 17, thus receiving a new specificity patent whereby it is officially recognized.

Antigents with recognized histocompatibility:

Locus A	Locus B		Locus C	Locus D	Locus DR
A1	B5	BW41	CW1	DW1	DRW1
A2	B7	BW42	CW2	DW2	DRW2
A3	B8	BW44	CW3	DW3	DRW3
A9	B12	BW45	CW4	DW4	DRW4
A10	B13	BW46	CW5	DW5	DRW5
A11	B14	BW47	CW6	DW6	DRW6
A25	B15	BW48		DW7	DRW7
A26	B17	BW49		DW8	
A28	B18	BW50		DW9	
A29	B27	BW51		DW10	
AW19	B37	BW52		DW11	
AW23	B40	BW53			
AW24	BW4	BW54			
AW30	BW6				
AW31	BW16				
AW32	BW21				
AW33	BW22				
AW34	BW35				
AW36	BW38				
AW43	BW39				

The association of a given H.L.A. antigen with certain diseases explains the predilection of the carrier for the disease. In spite of this, a H.L.A. antigen (refs. 5,6) is not necessarily a genetic marker of pathology. The population studies made according to the diagram below indicate that the antigens may also protect against a specific disease.

H.L.A. x		exists	does not exist
	present	a	b
	absent	c	d

Mathematical treatment of the values obtained provide a numeral result which may be:
- more than 0.3, which then is known as an Association and believed to create a susceptibility to the disease or intoxication;
- less than 0.2, which is then called Dissociation and is believed to create a protection against the disease or intoxication.

The study of patients (ref. 7) with a certain disease and their histocompatibility-antigens has enable the establishment of the possibility of an association (refs. 1, 9, 10), thus determining the probability of contracting the disease. This may be expressed numerically to the point of saying that a carrier of a given antigen has 5, 10, 20 ...... X greater probabilities than the non-carrier of the H.L.A. Recently, many diseases have in various proportions been shown to be linked to a given histocompatibility antigen.

With this presentation the suggestion is made to determine the H.L.A. histocompatibility-antigens in each pesticide applicator at high risk (e.g. aviation applicators) in order to identify casualty prone individuals and take appropriate actions.

REFERENCES

References are obtainable on request from the author.

LEGISLATION AND PREVENTION IN THE APPLICATION OF PESTICIDES

JORGE DANIEL LOPEZ BOLADO
Palacio de Justicia, Buenos Aires, Argentina

The theme of this meeting i.e. "Education and Safe Handling in the Application of Pesticides" invites specific consideration and comments from the regulatory point of view as well as from the social aspects of the applications of these substances.

In fact, men living in communities require rules and regulations for certain aspects of their lives and a good example is the subject and theme of this meeting. There must be laws that establish rights and obligations, delineating freedoms and limits for the various human activities. Robinson Crusoe, the isolated man, is only a hypothetical case that does not represent reality. In every-day life, there must be laws which regulate matters affecting human relations.

However, it is necessary to point out from the outset, that in general, in various countries a juridical regulation of this subject in a complete and methodical way does not exist. Only minor, isolated problems have been the objective of some legislation and few of them were dealth with in a comprehensible way.

Generally, the laws of the different countries referring to pesticides or fertilizers, prohibit the use of substances capable of adversely affecting human or animal health. Particularly there are strict regulations aimed at preventing contamination with pesticides of crops that will be put on the market. Examples of countries that have enacted such laws are Canada, Chile, France and Argentina. Violators of these rules may be penalized. We believe it to be desirable for every country to enact environmental legislation regulating, among other things, the safe use of pesticides in all respects. For this purpose, countries should contemplate actual legislation existing elsewhere as well as collective experiences and recommendations of congresses and national and international meetings such as this one. When eventually each country will have enacted this complex legislation it will be of great benefit as it will take into account in a comprehensive way the subjects that have our attention in this meeting.

This legislation should appreciate that each country or each region is unique and may differ in many respects; incidences in the environment which may have occurred should be studied and taken into account.

Another important thing is that a solution should be found for the always present conflict between economy and health: the environmental law should establish a good balance between economical and social development and environmental goals.

It should be emphasized, that environmental policy has important social and economic implications and therefore contradictions in the legislations in any of these areas should be avoided at any rate. Unfortunately, this objective may not yet have been effectuated completely in the relevant legislation and in the meantime, we must attempt to get along as well as we can with the realities of the present situation. These realities are given by the laws that address only part of the problems.

Now let us consider the realistic possibility that somebody becomes ill from exposure to a pesticide. The problem then arises of who will be responsible for all involved liabilities?

The approaches to the problem differ. For example: the injured person could file a civil suit demanding indemnification for damages suffered provided he can prove cause and relation between the application of the pesticide and his illness. In case of bad faith or gross negligence in the use of the pesticides administrative sanctions are bound to be taken.

On the other hand, if the cause of the illness is discovered by a medical doctor, and if significant injury is involved, an evocation under criminal law might be initiated and notice should be given to the legal authorities, to the attorney general or to the police department.

The question could be raised why a criminal denouncement? The answer is because any inflicting of injury to the body or damage to health is considered a criminal act. If the causal relation between the source of the contamination and the damage has been demonstrated, there is no doubt that somebody must answer for it, and that, of course, will be the one who did not observe the necessary precautions such as for example, he, who causes gross excess residues of pesticides in agriculture or cattle raising activities.

It is worthwhile to say, that a pesticide manufacturer is not responsible for the lack of care of the user. The responsibility for the injury is then related to negligence. In this framework negligence and lack of experience are the common elements of a criminal act.

What has been said applies to a situation where actual injury has been inflicted to a person, thus in cases of demonstrated illness. However, in general, provisions in the criminal legislation include acts affecting the general public. Even cases which do not result in specific damage or injury should be brought to justice when the activity would have endangered the population. This might, for instance, be the case when there is evidence of contamination of or within the community. So far as to some legal aspects of the misuse of pesticides.

The creation and implementation of legislation dealing with the safe use of pesticides could contribute in an important way to the protection of the health of the public, improving environmental conservation and productivity.

What has been said above suggests that currently we do not have the legislation that satisfies the needs and demands of each country or region and we can only say that there are certain national or regional laws, particularly covering and regulating specific problems, but we don't have that complete legal ordinance aimed to prevent the majority of conceivable mishaps. These gaps in legislation should be filled-up.

In conclusion it should be repeated that the protection of the environment is closely associated with the social and economic development. Therefore socio-economic activities should be expressed in principles of public commitments, in which the health of the population in general should have first priority.

It was stated in an International Law Convention which took place in Hamburg recently: The conflict between short-term economical interest and long-term ecological interest should always be resolved in having the ecological interest prevail.

PESTICIDE RESIDUE ANALYSIS AS AN APPROPRIATE CONTROL OF GOOD AGRICULTURAL PRACTICE

MARIA ELISA W. DE ALMEIDA
Institute Adolfo Lutz, Public Health Laboratory, Sao Paulo, Brazil

ABSTRACT

All pesticides are toxic but their toxicities differ markedly, not only in nature, but also in amount that is required to produce signs of toxicity. Therefore, pesticide application must be followed by measures intended to find out whether the residues, remaining on or in food, are the smallest amounts practicable and whether these are toxicologically acceptable.

Adoption of the "good agricultural practice" allows the correct and adequate pesticide application. On the other hand, monitoring analysis of pesticide residues in food demonstrates whether the residues are within the "maximum residue limits" -MRLs- or "tolerances".

Brazil adopts the MRLs established by the FAO/WHO Joint Meeting on Pesticide Residues -JMPR- and endorsed by the Codex Committee on Pesticide Residues. In some particular cases MRLs are set at a national level for pesticides not yet evaluated by the JMPR.

Analysis of pesticide residues in Brazil began in 1970 and the first monitoring programme was started in 1978 in the State of São Paulo. A few vegetable and fruit samples are analyzed for organochlorine and organo-phosphorus pesticides on a weekly basis.

Farmers and spraymen are receiving with interest the information, given by agronomists of the extension service, how to apply pesticides correctly in order to maintain the residues within the maximum permitted levels or tolerances.

The present results confirm that monitoring pesticide residues in food can be used as an adequate control of the correct and safe pesticide application even in developing countries.

INTRODUCTION

The indiscriminate and excessive use of agricultural pesticides in developing countries is caused by: a) inefficient supervision of the pesticide usage; b) no adequate enforcement of the legislation; c) lack of an efficient network of experts in plant pathology and pest control; d) free sale of highly toxic and/or polluting pesticides; e) commercial pressure by the producing and/or formulating companies.

The excessive and inappropriate application of pesticides results in: a) residues in food above the maximum permitted levels; b) presence of pesticides not permitted in several foods; c) difficulties in exporting food.

Polluting pesticides may remain in soils for long periods and could transfer to edible parts of new cultures.

GOOD AGRICULTURAL PRACTICE

According to FAO and WHO, "good agricultural practice in the use of pesticides is the officially recommended or authorized usage of pesticides under practical conditions at any stage of production, storage, transport, distribution and processing of food and other agricultural commodities, bearing in mind the variation in requirements within and between regions and taking into account the minimum quantities necessary to achieve adequate control, the pesticide being applied in such a manner as to leave residues that are the smallest amounts practicable and that are toxicologically acceptable" (ref. 1).

However, the concept of good agricultural practice must also include: a) selection of the less toxic pesticide among the group of compounds which are permitted to be sprayed on a particular crop; b) observance of the longest possible pre-harvest interval; c) use of the integrated control system (adequate management, use of pest resistant plant varieties, biological control and pesticide application only where there are no other ways for controlling the pests).

RESIDUES, ADIs, MRLs AND POTENTIAL INTAKE

Frequent analyses for detection of the amount of pesticide residues in food reflect whether the good agricultural practice requirements are fulfilled. These analyses depend upon appropriate laboratory equipment, very well trained technicians, availability of pesticide standards, adequate sampling, and standardization of analytical procedures (ref. 2). The observance of this group of requirements is called "good practice in the analysis of pesticide residues".

The concepts of "acceptable daily intake" and "maximum residue limits" or "tolerances" must be taken into account for evaluating the significance of a pesticide residue in food and its importance from the public health point of view.

Acceptable daily intake -ADI-

The concept of ADI is based on the widely accepted fact that all chemicals are toxic but their toxicities vary markedly, not only in nature, but also in amount that is required to produce signs of toxicity. The figure (mg/kg body-weight) is derived from experimental data in laboratory animals and/or appropriate observations in man. It is defined as the amount of a chemical that could be ingested daily without appreciable risk to the consumer, in the light of all the information available at the time of the evaluation. "Without appreciable risk" is taken to mean the practical certainty an injury will not result after a lifetime exposure (ref. 3).

The ADI of a pesticide is a quantitative indicator of the toxicity or safety of the chemical and is the basis for the assessment of potential risks to the consumers. Other measures (maximum residue limits or tolerances, and potential daily intake) are also required.

Maximum residue limit -MRL-

MRL is a fairly new term for what used to be called tolerance; indeed, it still is called thus in many countries. A precise description of MRL or tolerance is provided by the definition approved by the FAO/WHO Joint Meeting on Pesticide Residues and the Codex Committee on Pesticide Residues. "A maximum residue limit is the maximum concentration of a pesticide residue resulting from the use of a pesticide according to good agricultural practice directly for the production and/or protection of the commodity for which the limit is recommended. The MRL should be legally recognized. It is expressed in milligrams of the pesticide per kilogram of the commodity" (ref. 4). This maximum concentration that is allowed in or on a food commodity is established at a specific stage in the harvesting, storage, transport, marketing, or processing of the food, up to the final point of consumption. A maximum residue limit or tolerance is recommended only when the available residue data so allow, and when the toxicity data have been adequately assessed (ref. 3).

Potential daily intake

Potential daily intake of a pesticide is the theoretical intake calculated on the basis of the maximum residue limit and/or extraneous residue limits and the "per caput" consumption of the relevant food commodities per day (ref. 4). Calculations of theoretical intakes of pesticides of the type carried out by the World Health Organization are generally found useful to show that further work on the intake of certain pesticides may be necessary and to establish priorities in cases where such work is needed. More reliable figures could be obtained if the average food consumption figures used hitherto by WHO could be replaced by more reliable national food consumption figures supplied by member states (ref. 3). Market basket studies are also highly valuable to inform on the actual pesticide residues in food ready to be consumed (ref. 5).

Allocation of MRLs

There are risks attached to the consumption of treated crops. Some governments have done no more than control the application of pesticides, but others have developed a system in which, on top of the measures to be taken for pesticide usage, the maximum permitted residues in edible crop are set. In many countries the MRLs are laid down by law and form the criteria for deciding whether foodstuffs meet the required standards or not. These limits are set not only for home produced foodstuffs, but also for those which are imported from other countries. Exports can also be protected if the producer country's MRLs are brought into line with those set by the major importing countries; this may lead to restrictions on the use of pesticides which the government of the exporting country does not consider essential for health reasons (ref. 6).

The FAO/WHO Codex Committee on Pesticide Residues -CCPR- is the forum for international harmonization of MRLs in food commodities intended to be exported.

PESTICIDE RESIDUE PROBLEMS IN BRAZIL

During many years pesticides were registered in Brazil by the Ministry of Agriculture, based only on the efficacy of the formulation against local pests. LD 50's by oral and dermal routes were the only toxicological information required by that time.

Pesticide residue legislation

The first list of tolerances was published by the Brazilian Ministry of Health in 1966. From 1966 to 1974 several other pesticides were added to this list without a complete toxicological evaluation.

A new regulation published by the Ministry of Health in 1974 required, for registration of new pesticides, the presentation of all toxicological data available, including long-term feeding studies and special tests on mutagenesis, teratogenesis, carcinogenesis, and delayed neurotoxic action. This regulation was based on the requirements of the FAO/WHO JMPR for the establishment of ADIs and MRLs.

An Interministerial Working Group on Pesticide Residues in Food is bringing up-to-date the pesticide tolerance list. This Working Group has established tolerances, use patterns, and pre-harvest intervals from 1974 up to the present.

Brazil adopts the MRLs established by the FAO/WHO JMPR which are the same as recommended by the CCPR. However, when a particular pesticide, not yet studied by the FAO/WHO JMPR, is needed in the country the ADI of this pesticide is set at a national level by Brazilian toxicologists who are familiar with the work carried out at the FAO/WHO JMPR. The next step, establishment of residue tolerances in food, is carried out by a group of Brazilian experts, following the same procedures as adopted by the FAO/WHO JMPR.

Pesticide residue analysis

Analyses of pesticide residues in food have been carried out from 1970 up to the present to get information on the problem, but without a monitoring character (Table 1).

TABLE 1

BHC (=HCH) and DDT residues in food; Brazil 1970-1974

Food Commodity	Number of samples	Total BHC (ppm) min.-max.	Total DDT (ppm) min.-max.	Ref
Milk	17	0.007-0.05	-	7
Cheese	4	0.3 -2	-	7
Canned meat	120	0.02 -1.7	-	8
Vegetables	13	0.001-0.1	tr	9
Rice	5	0.005-0.01	-	9
Beans	9	0.004-0.1	tr-0.3	9
Beans	90	0.001-0.9	0.003-1	10
Manioc meal	50	0.001-0.01	0.001-0.6	10

tr = trace amount

A pesticide residue monitoring programme has been put into practice in Brazil (São Paulo State) since 1978. Samples of fruit and vegetables are weekly collected in the São Paulo Central Market (CEAGESP) and sent to the Biological Institute of Sao Paulo where the analyses are performed The results of this monitoring programme are partly summarized in Table 2. All cases of residue levels higher than the tolerances are traced back to find out why the farmers and pesticide applicators are not following good agricultural practice.

TABLE 2
Monitoring analysis of pesticide residues; Brazil, 1978-1980 (ref. 11)

Commodity	Number of samples	Pesticide	Residue (ppm)	MRLs (ppm)
Vegetables	99	none	-	...
Vegetables	12	chlorthalonil diazinon methyl parathion parathion	below the MRLs	
Samples with high residues:				
Leek	1	mevinphos	2.2	1
Kale	1	DDT	0.004	N.P.
Endive	1	DDT	0.02	N.P.
Tomato	1	DDT	0.3	N.P.
"Jilõ"	1	endrin	0.08	N.P.
Cucumber	2	endrin	0.07-0.09	N.P.
Bell pepper	2	endrin	0.01-0.08	N.P.
Fruit	69	none	-	...
Apple	1	malathion	below the MRL	
Samples with high residues:				
Fig	3	DDT	0.02-0.05	N.P.
Guava	2	DDT	0.03-0.6	N.P.
Mellon	2	endrin	0.05-0.4	N.P.
Strawberry	3	aldrin dieldrin endrin dimethoate	0.02-0.03 0.01-0.04 0.04 0.04	N.P.
Peach	1	DDT	0.7	N.P.

N.P. = not permitted

Acceptance of the monitoring programme

Agronomists of the extension service inform the farmers every time the residues are above the tolerances and help them in the safe and adequate use of pesticides.

Several meetings have been organized in different small towns, putting together farmers, pesticide applicators, agronomists from the extension service, pesticide salesmen and toxicologists. Free discussions of the problems, kept at a level of good understanding by the field workers, have been highly successful.

DISCUSSION AND CONCLUSIONS

All pesticides are toxic, but their toxicity varies markedly in nature and in the amount required to produce clinical symptoms. Therefore, all pesticides must be toxicologically evaluated before having an official permission for usage.

The establishment of maximum residue limits -MRLs- or tolerances of pesticide residues in food provides an excellent standard to check whether the pesticide was correctly applied, i.e., whether good agricultural practice was followed.

Potential daily intake calculations and market basket studies are useful to show whether further work on the intake of certain pesticides may be necessary.

The Brazilian experience on pesticide residues monitoring analyses showed around 10% of the results being above the MRLs or tolerances. On the other hand, farmers and spraymen received with interest the information given by agronomists of the extension service on the correct and adequate pesticide application.

The present results confirm that pesticide residue monitoring in food is an adequate control of the correct pesticide application even in developing countries.

REFERENCES

1 World Health Organization, Pesticide Residues in Food, WHO Technical Report Series, 592 (1976) 39-40.

2 W.F. Almeida and M.E.W. de Almeida, Org. Panam. de Salud, Public. Cient., Nr. 358 (1978) 110-117.

3 G. Vettorazzi, Pesticide Residues in Food in the Context of Present and Future International Pesticide Managerial Approaches, in Pesticide Management and Insecticide Resistance, Acad. Press. Inc., New York, 1977.

4 World Health Organization, Pesticide Residues in Food, WHO Technical Report Series, 592 (1976) 41.

5 E. Astolfi, Contaminação por resíduos de plaguicidas clorados na cesta familiar - Repercussao biológica, in Encontro Latino-Americano de Toxicologia, Porto Alegre, Brasil, May 8, 1976.

6 A.J. Pieters, The setting of maximum residue limits in food - their role and their relation to residue data, in H. Frehse & H. Geissbühler, Pesticide Residues (IUPAC, Zurich, 1978), Pergamon Press, Frankfurt, (1979) 66-73.

7 M.E.W. de Almeida and H.H.C. Barreto, Rev. Inst. Adolfo Lutz, 31 (1971) 13-20.

8 W.H. Lara, H.H.C. Barreto and M.Y. Takahashi, Rev. Inst. Adolfo Lutz, 31 (1971) 63-70.

9 W.H. Lara and H.H.C. Barreto, Rev. Inst. Adolfo Lutz, 32 (1972) 89-94.

10 A.M.M. Barreto, Determinação de resíduos de inseticidas organo-clorados em feijão e farinha de mandioca vendidos nos supermercados de Goiânia, Salvador e Belém, Tese de Mestrado, Faculdade de Saúde Pública, Univ. de São Paulo, 1975.

11 M.T.S. Úngaro, C.M.A. Guindani, M. da S. Ferreira, P. Pigati, A.P. Takematsu, L.F.C. Kastrup and T. Ishizaki, O Biológico, 46 (1980) 129-134.

MONITORING OF PROPOXUR EXPOSURE

L. MACHEMER*, A. EBEN* and G. KIMMERLE**
* Institute of Toxicology, BAYER AG, Wuppertal-Elberfeld, Federal Republic of Germany
** Environmental Health Research Center, Mobay, Kansas, USA

INTRODUCTION

Propoxur (2-isopropoxyphenyl-N-methyl-carbamate) is an effective insecticide against plant pests, household pests, stored-product insects and hygiene pests (ref. 1). The compound has widely been used, under the designation OMS-33, not only by the World Health Organization in large-scale field trials in El Salvador, Iran and Nigeria, but is also recommended by other agencies, for the control of malaria (refs. 2, 3).

Propoxur depresses acetylcholinesterase activity in blood, brain and other tissues. This depression is reversible and detectable only for a short time after termination of exposure. On account of the fast and spontaneous onset of reactivation of the depressed cholinesterases, measurement of cholinesterase activity especially after exposure to low propoxur concentrations is however only of limited suitability as a parameter for the determination and assessment of the extent of a preceding propoxur exposure. The objective of the work reported in this paper was to investigate whether determination of one of the main metabolites of propoxur in urine might provide a more sensitive assay for monitoring a propoxur exposure at concentrations well below the level that induces cholinesterase activity depression or even causes somatic effects.

The major routes of metabolism are depropylation to 2-hydroxyphenyl-N-methylcarbamate and hydrolysis of the carbamate linkage to give isopropoxyphenol. The minor metabolic pathways are considered to be ring hydroxylation at the 5 or 6 position; secondary hydroxylation of the 2-carbon of the isopropyl group; and N-demethylation (refs. 4, 5, 6, 7). In exposed persons and in one case of poisoning, 2-isopropoxyphenol was detected in urine (refs. 8, 9).

Therefore, the effect of propoxur on plasma and erythrocyte cholinesterase activities and the elimination of 2-isopropoxyphenol in urine were investigated in experiments on test persons inhalationally exposed to propoxur. These experiments on human volunteers were preceded by model experiments on rats in which the same questions were studied.

METHODOLOGY

Test compound: For the experiments on human volunteers, use was made of aerosols containing 2 % propoxur (100 %), Batch No. 74/66, 13 % methylene chloride and 85 % Frigen 11/12 (30:70) as propellant. For the experiments on rats, chemically pure propoxur was used.

Experimental design: In the rat experiments, groups of 10 male and 10 female SPF albino rats weighing 160 to 180 grams (bred and supplied by F. WINKELMANN Versuchstierzucht GmbH & Co. KG, Borchen, Federal Republic of Germany) were exposed for 6 hours to propoxur aerosols in a dynamic flow inhalation apparatus (ref. 10). The propoxur concentrations were 0.4, 1.2, 9.0, 30.0, 78.0 and 172.0 mg/m^3 air. For aerosolization, propoxur was dissolved in a 1:1 mixture of polyethylene glycol 400 and absolute ethanol. The concentration of propoxur in the chamber air inhaled by the rats was checked by analysis. On termination of exposure, all the rats were placed in metabolism cages for 3 days. The concentration of 2-isopropoxyphenol was determined in the 24-hour urine collected from each of 10 male rats and 10 female rats per group.

In the experiments on human volunteers, four test persons (3 men, 1 woman) of ages ranging from 25 to 50 years were exposed for 4 hours to an average propoxur concentration of 3.0 ± 1.8 mg/m^3 air in a 15-cubic metre room. This airborne concentration was produced and maintained by spraying the 2 % propoxur solution from the aerosol cans into the room at the start of the exposure period and thereafter at 20-minute intervals for 2 seconds each time. The concentration of propoxur in the room air inhaled by the test persons was checked by analysis. The air samples were taken at 10-minute intervals enabling a total of 24 analyses to be performed. Blood samples were withdrawn from the brachial vein pre-exposure, immediately on termination of exposure and at intervals of 30 minutes, 1 hour and 2 hours post-exposure to measure the propoxur level and acetylcholinesterase activity. The 2-isopropoxyphenol concentration in urine was measured at intervals of 8, 24, 48 and 72 hours after initiation of exposure.

Analytical methods: Propoxur was adsorbed from the chamber air on cottonwool and eluted quantitatively with acetone, and determined by gas chromatography using a thermionic nitrogen detector.

Propoxur was measured in blood by gas-chromatographic methods.

2-Isopropoxyphenol,yielded in free form after acid hydrolysis of the urine,was extracted with hexane. The extract was evaporated to dryness, the residue was dissolved in benzene, reacted with trichloroacetyl chloride, and then determined by gas chromatography using an electron capture detector.

Plasma and erythrocyte cholinesterase activities were measured by a modification of a colorimetric method described by PILZ (ref. 11).

RESULTS

The results of the 2-isopropoxyphenol measurements in 24-hour urine on male and female rats after inhalational exposure to propoxur at concentrations of 0.4, 1.2, 9.0, 30.0, 78.0 and 172.0 mg/m^3 air are summarized in Table 1.

The bulk of the metabolite was already eliminated within the first 24 hours. It was only in rats that had been exposed to the higher concentrations that very small amounts of the metabolite were still detectable 3 days after termination of exposure. The results presented in Table 1 indicate an almost linear relationship between the total amount of 2-isopropoxyphenol excreted in the urine and the airborne propoxur concentration.

TABLE 1

2-Isopropoxyphenol excretion in urine of male and female rats after single 6-hour inhalational exposure to 172, 78, 30, 9, 1.2 and 0.4 mg propoxur/m³ air (determined in urine collected from each of 10 rats per sex per dose)

propoxur concentration in mg/m³ air	172	78	30	9	1.2	0.4
days after termination of exposure	2-Isopropoxyphenol, µg/24 hours urine					
	male rats					
1	192	89	65	14.5	3.8	2.4
2	59	22	9	2.5	-	-
3	21	10	-	-	-	-
total	272	121	74	17.0	3.8	2.4
	female rats					
1	216	83	33	12.2	3.8	2.6
2	37	21	7	2.8	-	-
3	16	13	-	-	-	-
total	269	117	40	15	3.8	2.6

Table 2 gives the data for plasma and erythrocyte cholinesterase activity depression and for excretion of 2-isopropoxyphenol in urine.

From the data presented in Table 2, it is evident that significant depression of plasma and erythrocyte cholinesterase activities was measurable only at concentrations of 172 and 78 mg propoxur/m³ air. Exposure to the highest concentration affected the general health condition of the rats and induced cholinergic symptoms. Onset of these symptoms was 30 minutes after initiation of inhalational exposure. The rats recovered very quickly after termination of exposure.

TABLE 2

Depression of acetylcholinesterase (ACHE) in plasma and erythrocytes (means from 5 rats per sex per dose) and 2-isopropoxyphenol excretion in urine (determined in urine collected from each of 10 rats per sex per dose) of male and female rats after single 6-hour exposure to 172, 78, 30, 9, 1.2 and 0.4 mg propoxur/m³ air

propoxur concentration in mg/m³	percent depression of ACHE at termination of exposure		total amount of isopropoxyphenol excreted in urine, expressed in µg
	plasma	erythrocytes	
	male rats		
172	44.0	31.7	272
78	29.2	39.0	121
30	19.3	12.8	74
9	-	-	17
1.2	-	-	3.8
0.4	-	-	2.4
	female rats		
172	31.2	35.1	269
78	17.5	24.1	117
30	14.9	7.3	40
9	-	-	15
1.2	-	-	3.8
0.4	-	-	2.6

Inhalational exposure to 30 mg propoxur/m³ air caused only mild depression of plasma cholinesterase activity. On the other hand, 2-isopropoxyphenol was still detected in the urine of rats inhalationally exposed to a propoxur concentration of only 0.4 mg/m³ air.

In the analogous experiments on human volunteers, analyses performed at 10-minute intervals revealed that the average propoxur concentration in the chamber air inhaled by the test persons was 3 ± 1.8 mg/m³. Four-hour exposure to this concentration did not have any untoward effect on the general health condition of the test persons. Propoxur was not detectable in any of the blood samples taken after termination of the exposure.

TABLE 3

Plasma and erythrocyte cholinesterase activities in test persons after single 4-hour exposure to 3.0 ± 1.8 mg propoxur/m³ air

person	µeq acetylcholine									
	pre-exposure		hours after termination of exposure							
			0		1/2		1		2	
	plasma	ery	plasma	ery	plasma	ery	plasma	ery	plasma	ery
A	2.1	4.2	3.0	3.9	2.8	4.1	2.7	4.1	2.8	3.5
B	2.9	4.9	4.9	5.4	3.2	5.1	3.3	5.1	3.9	4.7
C	3.2	5.1	3.5	5.6	2.9	4.8	3.1	5.0	3.7	4.6
D	3.2	4.0	3.3	4.1	3.6	4.7	4.1	4.1	3.5	5.1

From the results of the plasma and erythrocyte cholinesterase activity measurements presented in Table 3, it is evident that no acetylcholinesterase activity depression was caused.

Table 4 gives the data for excretion of 2-isopropoxyphenol in the urine of the test persons after single 4-hour exposure to propoxur.

TABLE 4

Excretion of 2-isopropoxyphenol in the urine of test persons after single 4-hour exposure to propoxur at a concentration of 3.0 ± 1.8 mg/m³ air

person	A	B	C	D
hours after initiation of exposure	mg 2-isopropoxyphenol in urine			
0 - 8	1.847	2.969	1.664	0.729
8 - 24	0.944	0.745	1.132	0.934
24 - 48	trace	trace	trace	-
48 - 72	-	-	-	-
	2.791	3.714	2.796	1.663

It is evident from the data presented in Table 4 that 2-isopropoxyphenol was excreted at a very fast rate. The major proportion was eliminated in the urine within only 8 hours. The total amount excreted in the first 24 hours was between 2 and 4 mg. Only trace amounts were still detectable at 48 hours after initiation of exposure.

DISCUSSION

In addition to a number of other degradation products, 2-isopropoxyphenol is eliminated via the kidneys as one of the principal metabolites of propoxur. The results of the inhalational toxicity experiments on rats show that there is an almost linear relationship between the total amount of 2-isopropoxyphenol excreted and the airborne propoxur concentrations.

Plasma and erythrocyte cholinesterase activity depression peaked in rats within the first 30 minutes post-exposure. Afterwards, activity increased again at a very fast rate. In the experiments, acetylcholinesterase activity depression was observed only after exposure to the elevated propoxur concentrations of 172 and 78 mg/m^3 air.

On the other hand, determination of 2-isopropoxyphenol elimination in urine proved to be considerably more sensitive. The metabolite was clearly detected down to a concentration of 0.4 mg $propoxur/m^3$ air.

The reported inhalational exposure experiment on test persons produced a similar result. Four-hour exposure to a propoxur concentration of 3.0 ± 1.8 mg/m^3 air neither depressed acetylcholinesterase activity nor had any untoward effect on the general health condition. On the other hand, 2-isopropoxyphenol was clearly detected in urine and the values were between 2 and 4 mg in 24-hour urine.

The results show that quantitative determination of 2-isopropoxyphenol in urine may provide an important indication for the assessment of the magnitude of a propoxur concentration at a workplace. The method would be most useful especially also in cases where failure to take blood samples promptly makes it too late to obtain evidence of acetylcholinesterase activity depression.

The results of the cholinesterase activity determinations simultaneously performed in the described experiments indicated that an exposure to propoxur at concentrations well below the toxic level can be monitored by measuring excretion of 2-isopropoxyphenol in urine.

REFERENCES

1 W. Behrenz and E. Böcker, Blattanex, ein neues aussichtsreiches Hygiene-Insektizid aus der Gruppe der organischen Carbaminsäure-ester, Pflanzenschutznachr. Bayer, 18(1965)53.
2 J.W.Wright, R.F. Fritz, K.S. Hocking, R. Babione, N.G. Gratz, R. Pal, A.R. Stiles and M. Vandekar, Ortho-isopropoxyphenyl-methylcarbamate (OMS-33) as a residual spray for control of anopheline mosquitoes, Bull. W.H.O., 40(1969)67.
3 Safe use of pesticides, 20th report of the WHO Expert Committee on Insecticides, WHO Technical Report Series No. 513, Geneva (1973)17.
4 L.J. Everett and R.R. Gronberg, The metabolic fate of Baygon (2-isopropoxyphenyl-N-methylcarbamate) in the rat, Unpublished report, Chemagro Corporation, Kansas City, USA, 1971.
5 M.H. Balba and J.E. Casida, Synthesis of possible metabolites of methylcarbamate insecticide chemicals, J. Agric. Food Chem., 16(1968)561.
6 H.W. Dorough and J.E. Casida, Nature of certain carbamate metabolites of the insecticide Sevin, J. Agr. Food Chem., 14(1964) 294.
7 J.G. Krishna and J.E. Casida, Fate in rats of the radiocarbon from ten variously labeled methyl- and dimethylcarbamate-C14 insecticide chemicals and their hydrolysis products, J. Agric. Food Chem., 14(1966)98.
8 J.A. Dawson, D.F. Heath, J.A. Rose, E.M. Thain and J.B. Ward, Excretion by humans of phenol derived in vivo from arprocarb, I. Determination by gas chromatography, II. Colorimetric determination, Bull. W.H.O., 30(1964)127.
9 M. Geldmacher-v. Mallinckrodt and G. Schaidt, Mitteilungsbl. GDCH-Fachgruppe Lebensmittelchem., Gerichtschem., 25(1971)349.
10 G. Kimmerle and A. Eben, Metabolism, excretion and toxicology of trichloroethylene after inhalation, 1. Experimental exposure on rats, Arch. Toxicol., 30(1973)115.
11 W. Pilz and A. Eben, Die gleichzeitige Bestimmung der beiden Acetylcholinesterasen im Rattenvollblut bei zwei verschiedenen pH-Werten, Arch. Toxicol., 23(1967)17.

THE INTERNATIONAL REGISTER OF POTENTIALLY TOXIC CHEMICALS: ITS USEFULNESS FOR THE ASSESSMENT AND CONTROL OF HAZARDS FROM CHEMICALS

M. GILBERT+ and J.W. HUISMANS

International Register of Potentially Toxic Chemicals, United Nations Environment Programme, Geneva, Switzerland

ABSTRACT

One of the objectives assigned to the International Register of Potentially Toxic Chemicals (IRPTC) concerns the development of central files containing adequate information for an understanding of environmental hazards caused by toxic substances.

A set of attributes was worked out by IRPTC in the light of its experience and in consultation with expert groups. Instructions for the selection and presentation of data for the Register were then developed and this work, although still susceptible of further improvement, made it possible to start developing data profiles on chemicals. A list of high priority chemicals was assembled: the preparation of data profiles on these substances was initiated last year and is being pursued.

At that stage of IRPTC's development, a substantial contribution from Network Partners was sought to substantiate the compilation of data for the Register and also to ensure the completeness of the information collected.

In the meantime, the problem of storage of the information was addressed. A Data Base Management System was chosen which would allow the most efficient data retrieval from the Register data bank. Access to on-line information systems was also arranged since such facilities are indispensable for the identification of the most recent sources of information relevant to the data profiles under development and for their updating.

It is believed that the content of the IRPTC data bank is comprehensive enough to permit assessment of hazards posed by chemical substances to human health and the environment. Its presentation in a condensed format makes it easy to read and understand. Not only does this facilitate the compilation and dissemination of objective information, but it also encourages the collaboration of network partners which adds to the dynamic character of the Register.

+to whom all correspondence should be addressed

The usefulness of the IRPTC as an information tool at the disposal of its users and some symbiotic aspects of interaction with them are discussed.

THE DATA PROFILE CONCEPT

The data elements considered to be relevant to the International Register of Potentially Toxic Chemicals have been grouped into seventeen files or attributes (Figure 1).

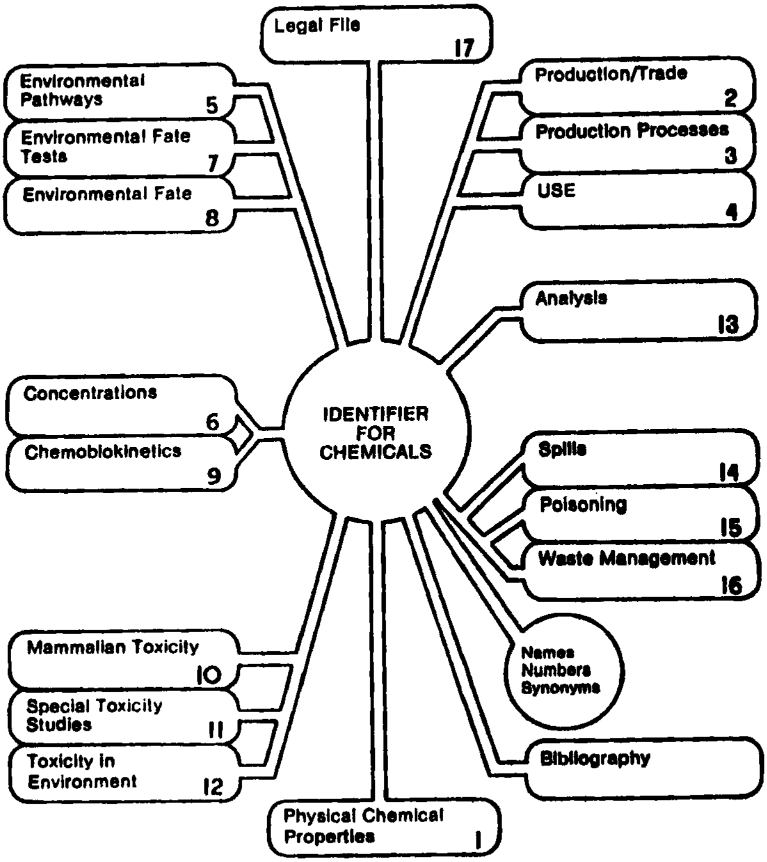


Figure 1. Data elements relevant to the International Register of Potentially Toxic Chemicals.

A first set of attributes which had been recommended by the Nairobi Task Team in 1975 (ref. 1) was modified by IRPTC in the light of its experience and in consultation with expert groups. 'Instructions for the Selection and Presentation of Data for the International Register of Potentially Toxic Chemicals' were then developed and published in 1979 (Register Attribute Series No. 2). This work was carefully studied and reviewed during a meeting of experts convened in Geneva in March 1980. A more elaborate and definite set of Instructions will be published in 1981.

Each file is divided, when appropriate, into subfiles which in turn contain data records. Each record represents a complete item of information and is accompanied by a cited reference. However, in order to contribute significantly to a better understanding of the potential hazards posed by chemicals to man and the environment, no record should be considered on its own merits but merely as part of a whole body of scientific evidence compiled to permit the 'best-informed' judgement of decision-makers. The development and dissemination of these data profiles are the most important objectives of the IRPTC Programme Activity Centre.

As an illustrative example, a full record of the subfile 'Carcinogenicity' is shown in Table 1. The following main entries are included: exposure dose or concentration; exposure period and route of administration; organism, sex and life stage, with numbers in control and experimental groups; target organ(s) with numbers in control and experimental groups showing the effect described; a reference; an evaluation is also entered with its reference. The effect(s) are reported as described in the author's conclusions. Eventually an inconclusive observation or a 'no effect found' result are also reported.

To qualify for entry into the Register, evaluations must have been issued by expert panels, e.g. representing the United Nations, international, governmental or non-governmental scientific organizations. Evaluations prepared by individual or joint authors, without the review of an expert panel, are not included.

SOURCES OF INFORMATION AND RELIABILITY OF DATA

The first step in the preparation of data profiles consist of the identification of pertinent sources of information. However, not only is it necessary to locate comprehensive sources of data on chemicals, but also their reliability has to be ascertained before they are used in the Register.

IRPTC makes as much use as possible of information which has been evaluated by groups of international experts. Clearly, when no evaluated literature, monographs or other criteria documents are available, IRPTC has to use primary sources of data in order to avoid having too many incomplete data fields.

TABLE 1

Carcinogenicity subfile

A complete record in this register subfile may include the following fields:

Test description

- study type
- organism
- route
- sex
- lifestage
- number of organisms exposed
- number of organisms in the control group
- species/strain/system description
- exposure dose/concentration
- exposure period
- exposure type
- intermittence of exposure
- exposure frequency
- exposure comment
- purity grade and/or percentage impurities
- vehicle/solvent
- particle size, formulation and adjuvants
- isotope
- labelled compound/label site
- test conditions
- test method

Test results

- organ/system/tissue affected
- effect
- sex affected
- reversibility/persistence of the effect
- time of onset of the effect
- number of exposed affected
- number of controls affected
- effect comment
- general comments
- evaluations and appraisals

Reference

- secondary reference
- primary reference

Table 2 illustrates the hierarchy followed by IRPTC when searching the scientific literature for information which qualifies best for entry into the Register.

The reader's own requirements and the severity of his own criteria and judgement are, and will remain, the decisive issues in this matter of data reliability. An information system on chemicals should at best indicate the type (evaluated or non-evaluated) of information that it contains. The IRPTC system of citing references uses a special sign to call the reader's attention to the fact that evaluated information is quoted.

USERS

The various groups of users whose information requirements are of major concern to IRPTC are listed in Table 3.

National authorities responsible for protection of human health and the environment represent the most important user group of IRPTC. Decisions to regulate or control chemicals must be based on 'best-informed' judgement.

TABLE 2

Sources of information for preparation of IRPTC Data Profiles

The sources are to be used in the following order of priority:

1 international evaluated monographs and criteria documents, e.g. those of the International Agency for Research on Cancer and the World Health Organization.
2 national evaluated monographs and criteria document, e.g. conclusions of evaluation panels convened by national agencies.
3 national non-evaluated monographs, reviews and criteria documents, e.g. individual articles from symposia organized by national agencies.
4 primary literature, i.e. articles in scientific journals, published information from industry.

TABLE 3

Potential users

1 the decision-making bodies concerned with the protection of human health and the environment from harmful effects of chemicals.
1.1 national authorities.
1.2 international organizations.
1.3 other institutions.
2 public services (inspections, control enforcement).
3 water, air, soil management authorities.
4 scientific community.

Clearly, the task of mastering the mass of information publicly available from the scientific literature and reports prepared by international, national or industrial organizations is a very difficult one indeed.

The International Register aims at providing its readers with a reliable, up-to-date and comprehensive description of the information necessary to assess the risk presented by chemicals to man and his environment.

The scientists involved in experimental research can hardly expect from a computerized data bank like IRPTC such detailed information that it will obviate the necessity of reading the original sources of data. However, the scientific community can use the Register to identify chemical substances which may have the potential for being noxious and for which little or no pertinent research has been performed to elucidate this potential. This is also of interest to both government and industry in the allocation of efforts for chemical research. Moreover, the compiled information may eventually lead to a primary understanding of some cause-to-effect relationships between physical and chemical characteristics of chemicals on the one hand and their biological properties on the other.

LIST OF CHEMICALS

Environmental chemicals are substances which occur in the environment as a result of human activity and which may be present in quantities capable of harming man, other living beings and the environment (refs. 2, 3). A similar definition is used in IRPTC: environmentally dangerous chemicals are chemical substances which enter the environment due to normal activities of man and which, in the opinion of experts, pose a real and urgent threat directly or indirectly to human health and/or the environment, and cannot be easily eliminated from the environment by means of modern technology and current scientific knowledge.

In view of its ongoing activity of data profiles development, IRPTC prepared a first list of selected substances on which data are compiled systematically. It is extremely difficult for an information system such as an environmental chemicals data bank to select chemicals for priority treatment (refs. 4, 5). The development of such a list can be based on two approaches.

Selection criteria can be used for each chemical, such as: production statistics, main use, toxicity to man, ecotoxicity, persistence and biodegradability etc. After data collection, the application of a scoring system to each of the criteria would lead eventually to a list of chemicals ranked as a function of their impact on man and the environment. However, the objective of the first IRPTC listing was not to recommend priorities for further research or to draw the attention of those responsible to newly-identified noxious chemicals. The motivating idea clearly was to collect data on chemicals for which concern has been highlighted at various national and international levels.

This is the reason why IRPTC followed a second approach for the preparation of its working list and made a pool of listings assembled by national and international organizations. Pragmatically enough, IRPTC felt confident that its list would then include compounds which potentially endanger human health and/or the environment.

This list includes approximately 330 chemicals of which 160 are agrochemicals and is available from IRPTC/programme Activity Centre in Geneva, or from the IRPTC National Correspondents. The list is by definition open-ended and, at present, is merely at the initial stage of its development. It will undergo considerable expansion, based inter alia on the suggestions made by National Correspondents, by the International Programme on Chemical Safety and by the IRPTC contributing network partners.

As regards the development of data profiles, it is planned that 150 of these chemicals will be covered by May 1981 and that 100 more compounds will be studied during the second part of 1981.

NETWORK PARTNERS

Data extraction is evidently carried out to the best of IRPTC's capabilities. However, some data fields may be empty because the information is not available and some publications may have escaped IRPTC's attention. There may also be inaccuracies.

In order to work out data profiles using the most reliable and complete information, IRPTC is developing working relationships with 'Network Partners'. From the beginning of its activities, the identification of partners and the implementation of effective collaboration have been of major concern to IRPTC. The potential partners can be identified as:

- the IRPTC National Correspondents
- some national and international institutions
- industries and external contractors.

In collaborating with IRPTC on the data collection undertaking, the contributing network partners can play a very important role by ascertaining the completeness, accuracy and precision of the information collected.

Several mechanisms for a collaborative production of data profiles can be envisaged and various levels of assistance to IRPTC are suggested in Figure 2. Obviously it is essential to adhere to the 'Instructions for the Selection and Presentation of Data for the International Register of Potentially Toxic Chemicals' (ref. 6) in order to avoid too great a heterogeneity of the material submitted to IRPTC.

A most efficient cooperation would consist of the preparation of data profiles using either machine-readable worksheets, now under development, or more textual worksheets presently used by IRPTC staff. The study and review of data profiles prepared by IRPTC could also be most helpful: in this case, the amount of the contributing partner's work could be rather limited, depending on the extent of information contained in his own files. A third useful possibility would permit IRPTC to compare its chemical-related sources of information with the network partner's bibliographical data bases.

Working relationships are being developed with network partners including members of International Groups of Chemical Manufacturers who would be willing to review some of the IRPTC data profiles on chemicals. The crucial question of treatment of unpublished data, in particular proprietary information of a confidential nature is being studied at the moment and the official position of IRPTC in this respect will be published in one of the next issues of the IRPTC Bulletin.

In order to provide reliable, relevant and sufficiently detailed information to assess chemical hazards in the environment, the corresponding IRPTC files may need further development regarding their content and structure. Some of the

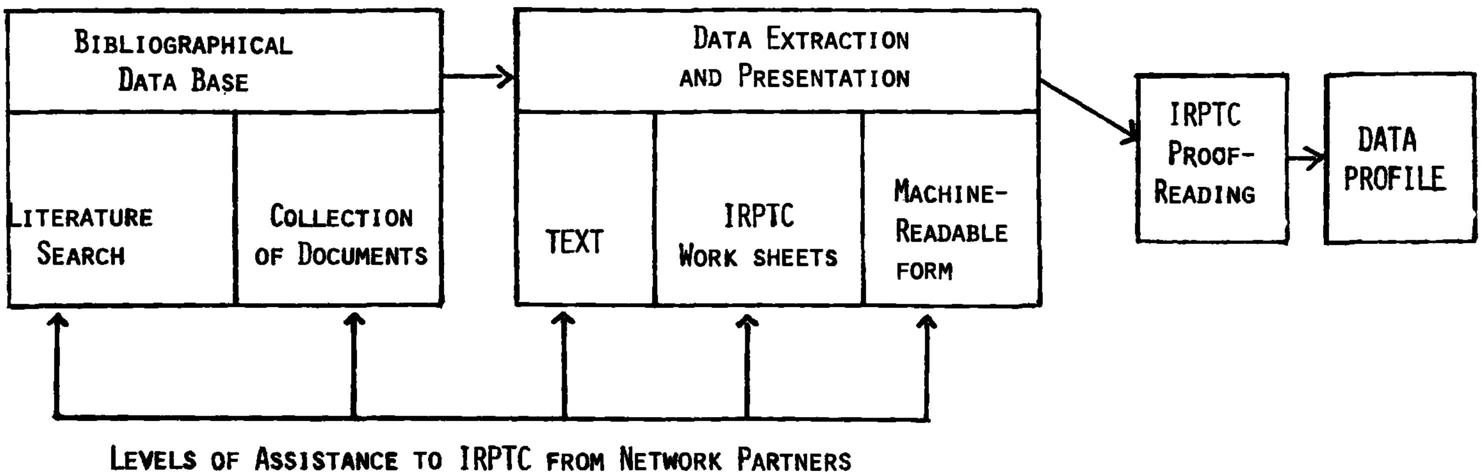


Figure 2. Preparation of data profiles.

files concerned are: pathways into the environment, environmental fate, effects on organisms in the environment (see Figure 1).

The selection and compilation of data for already more than one hundred compounds have permitted IRPTC to identify a certain number of problems regarding the environmental fields of the Register. Inter alia, an important question concerns the possibility of selecting data on specific aquatic and terrestrial species (animal, plants and micro-organisms) because they are accepted as "representatives" of certain ecosystems, because of their sensitivity (indicator organisms) to specified chemical pollutants, and because of their recognized importance as representatives of a certain trophic level or in a food chain in which man also participates. The Working Group on Environmental Pollutants of the Commission on Ecology of the International Union for the Conservation of Nature and Natural Resources (IUCN) has agreed to help IRPTC in the review of the pertinent data fields. The conclusions of this collaborative undertaking may be expected in May 1981.

DATA MANAGEMENT

Rapid growth of documentation received from many sources - IRPTC National Correspondents, national and international organizations, industry, direct acquisitions by IRPTC, material related to the query-answer service - necessitates optimal access to the relevant information it contains. On the other hand, data profiles have to be processed and stored using an adequate software package allowing easy updating and retrieval of information. The terminals now in use in IRPTC's offices are connected to the equipment (IBM 370/158) of the International Computing Centre (ICC), Geneva.

Access to on-line information systems has been established. The data bases available are those hosted by the Lockheed Information System (LIS), by the System Development Corporation (SDC), the National Institutes of Health-Environmental Protection Agency (NIH-EPA) of the United States, and the Medical Literature Analysis and Retrieval System of the National Library of Medicine (MEDLARS-NLM) of the United States. These connections are indispensable tools for the development of the Register (Data Profiles and their updating) and operation of the query-answer service.

Some data bases have already been organized and stored. First, the Register Index: published every 4 months, it consists of the IRPTC list of chemicals as such, and also accompanied by pointers showing on which data fields IRPTC has information in its files. The most important data base contains the IRPTC library records. Approximately 2000 documents have been indexed up to now according to a format and a thesaurus developed by IRPTC. Efficient retrieval capacities provided by the system used allow rapid identification of query-related information available in the IRPTC library; names of chemicals, names of authors, titles of books or scientific journals, assigned keywords, can be used as identifiers. As well as its own library, IRPTC extensively uses the documentation available in the World Health Organization's library.

Having reached the stage of computerization of the data compiled on chemicals, IRPTC had to make a choice of a Data Base Management System which can be adapted to provide the services required by the International Register of Potentially Toxic Chemicals.

The paramount criteria taken into consideration for supporting the implemented action were the following: ease of use for non-EDP specialists; optimal facility for updating; friendly command and query language; linkage between files.

Other criteria not directly relevant to the technical characteristics of the packages have also been scrutinized: possibility of linking to an international network; (automatic) exchange of information with existing data banks.

Considering the above-mentioned parameters and the EDP facilities available in ICC, IRPTC has decided to implement its information bank through a Data Base Management System called 'ADABAS'[+]. The organization of the IRPTC data bank under ADABAS is shown in Figure 1.

A unique and unequivocal identifier is used for each substance, although access can also be provided through a subfile containing names, synonyms, and widely accepted numbering systems. Each file contains various types of information which are used as entry points in the data base.

At the moment, considerable effort is being devoted in IRPTC to the development of formats for data input. Great attention is being paid to this ongoing activity because it will determine the efficiency of the retrieval capacities of the Register data bank. As they are indispensable tools in the hands of contributing partners, these formats will be the subject of future IRPTC publications as soon as they have been completed.

Directly related to the subject treated above, it might be of considerable interest to exemplify what the user can expect from a system which is built up exclusively for his benefit. In order to fulfil its mandate to assure the dissemination of reliable information on chemicals, IRPTC operates a query-answer service. Many questions are quite straightforward, being chemical substance oriented. Frequent requests deal with a complete data profile or some specific data fields about a particular chemical. However, the organization of the system permits the use of factual data as pointers leading to the identification of a chemical or group of chemicals having specific properties.

[+]Help and guidance in the choice and implementation of the software have been obtained from the 'Environmental Chemicals Data and Information Network' project of the Commission of the European Communities. A fruitful exchange of views and challenging discussions with ECDIN are gratefully acknowledged.

Some typical questions are:

- what information is available on the carcinogenicity of chemicals with epoxide ring structures?
- what is the recommended waste management method for polychlorinated biphenyls?
- what is the toxicity of ethylene chloride to animals?
- what is the water solubility of 2,4,5-T?
- what information is available on the environmental effects of chlorofluorocarbons?
- what is the Acceptable Daily Intake recommended by WHO/FAO for fenchlorphos?
- what are the WHO recommendations regarding the levels of heavy metals in foodstuff?

DISCUSSION

1 Misuse of chemicals can greatly potentiate their hazards and insufficient knowledge of biological and physical properties may increase their potential to be noxious. Because of the mass of data to be considered for the assessment and control of hazards from chemicals, a condensed presentation of relevant data seems of value. The abbreviated data presentation proposed by IRPTC allows rapid scanning of the information available on the most significant fields (attributes) pertinent to potential hazards.

Moreover, it helps to identify gaps in existing knowledge concerning the harmfulness of chemicals. In this way, the Register functions, although indirectly, as a suggestion tool for further work. Indeed, its users may exert pressure on national or international organizations to undertake more research in definite areas of concern. The resulting information will then be entered in the data base.

2 The importance of the reliability of data entered into the IRPTC data bank cannot be over-emphasized. Information which has been evaluated by groups of international experts are reported by preference; secondary documents, however, do not exist for the great majority of chemical substances. IRPTC will then seek advice from individual consultants and also from panels of experts. The International Programme on Chemical Safety, sponsored by WHO, ILO and UNEP, with its highly specialized lead institutions can be of very great help in this respect.

Mention to IRPTC of the existence of national or regional working groups evaluating literature related to chemical hazards, and whose activities have been overlooked by IRPTC, would be most welcome.

3 The organization of the Register data base permits the treatment of various types of queries. Hopefully, the readers obtain answers, but it also happens that questions received prompt IRPTC to develop particular data profiles by priority. Likewise, the IRPTC working list of chemicals on which data are being compiled is and will be regularly expanded following the users' suggestions.

IRPTC aims at the collection and dissemination of significant and reliable data on chemicals in order to better understand their health and environmental hazards. In conclusion, it can be said that this objective will only be met successfully if the active collaboration of the users is assured. This is an imperative condition which can lead to mutual benefit.

REFERENCES

1 Report of the Task Team on the International Register of Potentially Toxic Chemicals, Nairobi, 28 July to 9 August 1975, Annex I.
2 F. Geiss and P. Bourdeau, in F. Coulston and F. Korte (Ed.), Environmental Quality and Safety, Academis Press, New York, 5(1976) 15.
3 W.G. Town, J. Powell and P.R. Huitson, Information Processing and Management, 16(1980) 91-108.
4 J.W. Huismans, The International Register of Potentially Toxic Chemicals, Ecotoxicology and Environmental Safety, 4(1980) 393-403.
5 J.W. Huismans, The International Register of Potentially Toxic Chemicals: Its present state of development and future plans, Ambio 7(1978) 275-277.
6 IRPTC, Instructions for the Selection and Presentation of Data for the International Register of Potentially Toxic Chemicals with Sixty Illustrative Chemical Data Profiles, Register Attribute Series No. 2, Geneva, 1979.

PESTICIDES AND EMERGENCY ANALYTICAL TOXICOLOGY

A comparative study of the different analytical methods applied in the detection of pesticides

CARLOS ALBERTO GOTELLI
Cátedra de Toxicología, Facultad de Medicina, University of Buenos Aires, Buenos Aires, Argentina

INTRODUCTION

There is no doubt that it is in the field of clinical toxicology where the help of the analytical laboratory is a relevant aid of most importance and in many cases of decisive significance for the treatment of a poisoned person. Clinical and chemical toxicology constitute a close association which must function in perfect balance and constant communication to achieve common objectives.

The increasing number of substances and drugs which technology brings daily in multiple forms into different aspects of human life (industry, agriculture, the home) has widely increased the contact of the population with potentially toxic substances resulting in an increase in the number and variety of current poisoning cases. This rapid and sometimes uncontrolled increase, due to the lack of standards or special precautions in the use of the different products, makes it even more necessary for the clinician and the biochemical toxicologist to work in a team, in order to establish quickly the etiology of the poisoning and to start effective treatment.

Technology's constant and rapid progress has considerably influenced the development of analytical toxicology, and it is in this field where instrumental analysis, a modern chapter of the analytical chemistry in general, is frequently applied.

Classic conventional methodology has been progressively replaced by the introduction of equipment and instruments of great precision and sensitivity, which enables the accurate identification of a substance in a short time. But it must be kept in mind that this advanced technology requires the support of very complex laboratories, specially trained personnel and a great number of other elements, which as a whole require high operational costs.

CLASSICAL ANALYTICAL METHODOLOGY

General

Pesticides are used extensively in rural areas. There the frequency of pesticide poisonings is increasing but the possibility to establish adequately equipped laboratories is small, as well as the availability of specialized professionals. Therefore, we have reexamined and adjusted classical analytical methodologies to be able to give the analists who have no ultramodern equipment to their disposal, simple but reliable techniques capable to identify a poison.

From the emergency toxicology point of view a basic criterion for the selection of an analytical method is the rapidity of the determination. If we could add to this criterion sensitivity and specificity and if we demonstrate that the technique is well adjusted, we have at our disposal a method of singular usefulness.

Acute poisonings are generally related to considerable uptake of the poison. Generally medical intervention takes place shortly after the poisoning. Therefore the possibility of finding the poison in some biological fluid using analytical methods of moderate sensitivity is great.

The methods that we are studying are generally not capable of detecting organochlorine pesticide residues and in some cases neither the non toxic levels resulting from professional exposure to the substance.

Criteria for the selection of techniques

In all cases we used the rapidity of the process, the sensitivity and the specificity as basic criteria for selecting and studying each technique.

Rapidity of the determination. The possibility to obtain a useful result in the least possible time is the basis of an accurate diagnosis and succesful treatment of an acute poisoning. To be able to act quickly, an analytical technique must essentially employ simple reagents, easy in preparation and stable. The procedure must include only a few steps and the required materials and equipment must not be complicated in handling.

Sensitivity. This is the minimal concentration of a substance which could be detected by an analytical method with the greatest degree of accuracy.

Specificity. This is the characteristic of the method of being able to identify with certainty the investigated substance, differentiating it accurately from other substances with similar properties or behaviour.

Based on these three hallmarks and establishing the minimal operative conditions of a clinical analysis laboratory of the rural areas, bearing also in mind the difficulties in the training and bibliographical support of the professionals in charge of those laboratories, we studied first different methods for their possibility to be used, their build up and maintenance costs, their discriminative capacity and their usefulness for chemical toxicological analysis. Secondly, we analyzed the specific analytical techniques for each pesticide of common use in our country. The results are presented in the Appendix.

Our objective was to make a comparative study with different chemical toxicological analyses, specially applicable to pesticides research taking into account:

1 its costs in infrastructure and per analysis expressed in dollars of 1980
2 sensitivity of each method in relation to obtained results
3 sensitivity related to the rapidity of the determination imposed by the toxicological emergency
4 specificity which permits an accurate diagnosis.

The only way to have reliable statistics in pesticide poisonings, is to collect cases based on laboratory proven cases. This procedure does not lead to counting the dubious cases. The laboratory plays therefore an essential role in the health care of the poisoned person as well as in the collection of reliable data.

Advantages

Traditional methods have the following advantages:

1 experienced technical personnel
2 simplicity and economical accessibility
3 possibility to be implemented in places lacking sophisticated equipment or research facilities.

This does not imply the rejection of new techniques but establishes which objective should be followed and which is the best and most realistic way to achieve the objective.

Conclusion

The toxicological emergency requires a quick and accurate laboratory, this is the meaningful objective. The medicosocial interest must be taken into account, because if not, one could get the paradox of not aiming for quick, economic, accurate and easy diagnostic procedures thinking that only advanced instrumental analytical methods are the sole resource of the toxicological laboratory.

APPENDIX - COMPARISON OF ANALYTICAL METHODS

Part 1. Comparison of costs

Items taken into account for the cost evaluation:
Equipment's amortization time: 5 years
Number of determinations per day: 20
The recorded cost is referred only to the amount spent in reagents. The operative costs such as taxes, maintenance, services, were not taken into account neither those related to the staff (salaries, travel, allowances, fees, etc).

TABLE 1
Spectrophotometry

type	equipment cost US$	cost per determination US$
visible	3,000	0.10 - 1.00
ultraviolet	10,000	0.50
infrared	15,000	0.80
atomic absortion	30,000	1.50 - 5.00

TABLE 2
Chromatography

type	equipment cost US$	cost per determination US$
column	250	0.50 - 1.00
paper	150	0.80
thin layer (T.L.C.)	1,200	0.40 - 1.00
gaseus layer (G.L.C.)	12,000	2.50 - 5.00
liquid-liquid (L.L.C.)	20,000	n.d.

TABLE 3
Electrometric techniques

type	equipment cost US$	cost per determination US$
electrogravimetry	3,500	0.60
potentiometry	3,000	0.50
conductimetry	5,000	0.50
polarography	8,000	0.80
amperometry	3,500	0.50
electrophoresis	1,800	0.80

TABLE 4
Immunoanalysis

type	equipment cost US$	cost per determination US$
free radicals technique	23,000	0.50
radioimmunoassay	15,000	0.50
hemoagglutination	100	0.20
inhibition	10,000	
enzymatical inhibition	10,000	0.75

TABLE 5
Other techniques

type	equipment cost US$	cost per determination US$
fluorometry	20,000	0.50 - 1.00
neutronic activation	n.d.	n.d.

Part 2. Comparison of time performance

Items taken into account for the calculation of the time of performance:

Controlled and properly set technique

Trained operator

TABLE 6
Time of performance

method	organochlorine pesticides	organophosphorus pesticides
colorimetric	7 hours	3 hours
paper chromatography	20 hours	15 hours
thin layer chromatography (TLC)	1 hour	1 hour
gaseous layer chromatography (GLC)	4 hours	3 hours

Part 3. Comparison of sensitivity

TABLE 7
Chromatography; organochlorine pesticides

type	sensitivity	acute intoxication levels	
		blood	urine
column	150 µg		
paper	1 µg		
thin layer (TLC)	0.1 µg	> 2 µg/ml	> 5 µg/ml
gaseous layer (GLC)	1 pg		
liquid - liquid (LLC)	n.d.		

TABLE 8
Chromatography; organophosphorus pesticides

type	sensitivity	acute intoxication levels	
		blood	urine
column	100.0 µg		
paper	5.0 µg		
thin layer (TLC)	1.0 µg	>1 µg/ml	>5 µg/ml
gaseous layer (GLC)	0.1 pg		
liquid-liquid (LLC)	n.d.		

TABLE 9
Metals

metal	sensitivity: colorimetry	sensitivity: atomic absorption	acute intoxication levels: blood	acute intoxication levels: urine
arsenic	1.0 µg/ml	0.5 µg/ml	> 0.5 µg/ml	> 0.4 µg/ml
chromium	0.5 µg/ml	0.01 µg/ml	> 0.5 µg/ml	> 0.5 µg/ml
mercury	1.0 µg/ml	0.2 µg/ml	> 0.4 µg/ml	> 1.0 µg/ml
lead	0.1 µg/ml	0.005 µg/ml	> 1.0 µg/ml	> 1.0 µg/ml
thallium	0.5 µg/ml	0.2 µg/ml	n.d.	> 1.0 µg/ml

REPORT OF RAPPORTEUR

W.F. TORDOIR

PREFACE

The VIth International Workshop of the Scientific Committee on Pesticides of the International Association of Occupational Health was held in Buenos Aires, Argentina, on March 12, 13 and 14, 1981 and in San Carlos de Bariloche, Argentina, on March 16, 17 and 18, 1981.

The subject "Education and Safe Handling in Pesticide Application" had been proposed during the previous Workshop held in The Hague in 1979 and, after further deliberation, was confirmed for 1981.

Forty-three invited experts working in international organizations, governmental agencies, universities, or industry discussed 35 papers prepared by authors from all continents. A few papers were presented by participants on behalf of experts who were unable to attend in person.

The meeting in Buenos Aires was held in the headquarters of the Asociación Médica Argentina (Argentine Medical Association).

OPENING SESSION

Prof. Dr. A. Maccagno, Secretary of the Asociación Médica Argentina, welcomed the participants on behalf of his Association.

Dr. R. Murray, Secretary and Treasurer of the Permanent Commission of the International Association on Occupational Health, expressed his recognition for the work of the Scientific Committee on Pesticides and stressed the very topical nature of the subject of this workshop.

Dr. J.F. Copplestone, Chief of Pesticide Development and Safe Use Unit of the Vector Biology and Control Div. in WHO, reflected on the important effects of previous Workshops on the progress made in the field of Pesticide Control and noted that the place of this meeting was very appropriate in view of the extensive use of pesticides in South America.

In his opening address, Prof. L. Rosival, Chairman of the Scientific Committee on Pesticides, welcomed all participants and, in particular, the representatives of the Permanent Commission, WHO and UNEP.

Prof. Dr. E. Astolfi, as host of the Workshop, expressed his gratitude and pride that the Workshop should take place in his country, this being the first such Workshop outside Europe.

SCIENTIFIC PROGRAMME

The papers presented during the scientific programme can be classified within the following groups:

A) papers dealing with the principles and practice of the education of pesticide applicators, professionals in the field of pesticides and the public;
B) papers on the health hazards associated with the (mis) use of pesticides and on technical subjects resulting in specific advice on educational aspects of the safe use of pesticides;
C) papers devoted mainly to the principles and practice of safe handling, personal protection, exposure monitoring, monitoring of biomedical effects, labelling and safe use instructions;
D) papers on technical subjects with a bearing on safe handling and health protection;
E) papers on miscellaneous subjects.

A) Principles and practice of education

Fifteen papers came within this group.

Two of them dealt with the psychological and pedagogical principles of education, together with the culturally determined factors that influenced the effectiveness of efforts directed towards a change in behaviour.

Knowledge of the student's "entry behaviour", i.e. his level of understanding and his mental attitude was shown to be fundamental to a successful learning process. Surveys carried out in India and Sri Lanka respectively to determine the "entry behaviour" were presented. In both countries it appeared that awareness of the hazards of pesticide handling is not the crucial factor. Measures to improve safe handling should be designed more for achieving a change in attitude.

An outline of an educational campaign in Argentina directed at different age groups and different levels of general education was presented.

Three papers dealt separately with specific educational methods: courses by mail, a slide kit on the hand-held ULV spraying technique and the multi-level modular course in the safe use of pesticides developed by WHO. This last provides a skeleton of instruction which has to be translated and transposed into national terms before being used.

Three papers reported on national programmes on the eduction of various target groups. It appeared that it is sometimes difficult to identify the most appropriate organization, or function, for the conduct of these programmes. Poison Control Centres can play an important role here, not only in the systematic gathering of information on cases of poisoning and providing relevant advice on policy matters to the appropriate authorities, but also in promoting and conducting educational programmes.

A system of mandatory courses leading to the licensing of personnel, both applicators and vendors, has been developed in Canada in order to control effectively the hazards of handling pesticides.

Two papers described the education and training of professionals in the fields of health care and environmental protection. An example was given of a professional journal providing rapid information by publishing reviewed articles and also "news" items. A programme of interdisciplinary courses in Brasil was also discussed.

The requirements for an educational programme in Colombia were systematically analysed and presented.

B) Papers on health hazards associated with the (mis) use of pesticides and on technical subjects with specific educational advice

Nine papers analysed the most important problems associated with the adverse effects of pesticides on health and suggested specific educational measures, or reported on educational programmes currently being carried out in various countries.

The concept of "Agromedicine" was discussed, being an interdisciplinary application of agriculture, applied chemistry and medicine, promoting the maximum production of food and fibre consistent with maintainance of both the health of agricultural workers and of the general public.

Reports from several Latin American countries indicated that the vast amounts of pesticides used stand in sharp contrast to the poor level of understanding of the potential health hazards involved. Not only do the majority of the workers lack the necessary knowledge and discipline, but the responsible authorities and medical professionals are also in the need of suitable education and information.

Very illustrative was the catastrophe in 1966 in the province of Chaco, Argentina, where, due to a disastrous combination of a flood and an excessive use of pesticides to save the crops, a large number of poisonings occurred and many people died. Only after this event were appropriate precautions taken.

One paper paid special attention to the factors that determined skin penetration and recommendations were given for the education of the workers in this respect.

C) Safe handling, personal protection, exposure monitoring, monitoring of biomedical effects, labelling and safe use instructions

Five papers came within this group.

The results of an extensive monitoring programme in Argentina were reported, including environmental, personal, biological and biomedical monitoring of workers handling pesticides in a plant and applying pesticides in the field. The effectivenessof personal protection devices was evaluated.

The monitoring system in use in New South Wales, Australia, in the field and in the factories, was explained. Since the institution of this system a decline in the number of pesticide poisoning cases and in unsatisfactory blood tests has been noted.

The safe handling procedures practised in a large pesticide manufacturing plant were discussed. The occupational health surveillance programme included specialised and sensitive detection techniques and revealed no biomedical effects in the workers when the production process was normal, but subclinical effects were evident when mishaps occurred.

The possible hazards on re-entry to recently sprayed fields were explained. It was suggested that the best method for arriving at responsible re-entry times should be based on an estimate of total exposure measured during field trials.

The role of the pesticide manufacturer and supplier in the promotion of safe use was discussed. Improvement in formulations and packaging might sometimes be possible. Increased co-operation between the manufacturers of pesticides and the manufacturers of application equipment might also offer scope for achieving safer spraying conditions.

D) Technical papers with a bearing on safe handling and health protection

Five papers fell within this group.

One discussed the possible importance of the immunological determination of individual susceptibility to poisoning.

Another paper dealt with legislative requirements that could promote safe handling. In the lively discussion following this paper it was recognized that legislation can be effective only when people are motivated to comply. Awareness of the problems and recognition of the adequacy of the legislative measures are essential for motivation.

Residue analysis in food could be used as a parameter for the evaluation of good agricultural practice and, in an indirect way, for safe handling.

The development of an analytical method for the determination of a urinary metabolite for one of the well known carbamates was presented. It appeared that animal experiments alone were not sufficient to establish a reliable method for biological monitoring. Dose-excretion studies in humans were necessary.

The ambitious programme of the International Register of Potentially Toxic Chemicals was explained and the possible contribution of industry to its data base was discussed.

E) Miscellaneous

A paper on the contribution of chemical analysis to the rapid detection of poisonings was presented.

GENERAL DISCUSSION

In the general discussion it was recognised that the education on safe handling of pesticides should be based on adequate knowledge of the actual health hazards in a given situation.

Information on the intrinsic toxicity of a pesticide and on the actual exposure should form the basis for this health hazard evaluation.

Extensive information on the toxicity is usually provided by the manufacturer or marketing company. However, it was the opinion of several participants that local regulatory agencies sometimes lack the necessary expertise to interpret this information and that there is a need for local experts to assist the authorities, taking into account the local circumstances.

Information on exposure and the consequent biomedical effects should be generated locally when required.

The need for exposure data led to a discussion on the problems and possibilities of generating such information. It was suggested that a working group, or committee, should be set up under the auspices of the Scientific Committee on Pesticides of the International Association of Occupational Health to provide assistance for this purpose.

During the discussion it was also stressed that extensive field studies are not always possible and that, generally speaking, three sources of information could provide the basis for an educational programme:

(i) principles of general hygiene;

(ii) the toxicity and, possibly, the hazard of a compound, derived from information such as that of the WHO classification;

(iii) exposure studies carried out locally and under representative working conditions

Following-up the discussions held earlier in the Workshop, it was suggested that a Code of Practice, or Code of Conduct, might be drafted for companies manufacturing and marketing pesticides. Such a Code could encourage companies to provide informatic on health hazards that became apparent during the use of pesticides and could persuac companies not to commercialise formulations that are known to be unsafe under representative working conditions.

As to the choice of a subject for the next Workshop, it was suggested that the principle theme should be the health aspects of the distribution, transport and storage of pesticides, and the safe disposal of unwanted, or deteriorated materials of this kind.

RECOMMENDATIONS

1. The content of educational programmes on the safe handling of pesticides should be based on: (i) the principles of general hygiene, (ii) an assessment of hazard based on the toxicity (including the classification of toxicity) and on exposure in a given situation.

   The necessary toxicity data can be provided by the manufacturing or marketing company, by regulatory authorities or international organisations. Data on exposure and dose-related effects, however, should be generated locally where worthwhile. Co-operation between industry, international organisations and local institutions is essential.

   Local experts should finally evaluate the health hazards in the light of local conditions.

2. A working group, or committee, under the auspices of the Scientific Committee on Pesticides of the International Association of Occupational Health, consisting of experts from industry, governmental agencies and academia, should be constituted for the implementation and interpretation of exposure monitoring studies, where possible using standard protocols.

3. Before starting an educational programme to improve the safe handling of pesticides, the level of existing knowledge and the attitude of the people concerned should be analysed. Such an analysis will provide an indispensible guide for the design and implementation of an educational programme.

4. Educational programmes should be constructed nationally, or even locally, where it is possible to take cultural factors into account.
   Flexible programmes, such as the WHO multilevel modular course, can provide a skeleton of instruction. These courses have to be translated and transformed into national terms and adapted to national conditions.

5. For the time being it may not be possible in certain areas to educate all pesticide handlers adequately. If this is the case, efforts should be made to educate the responsible field supervisory staff.

6. For the handling of highly toxic formulations a system of training leading to the recognition of application personnel and vendors should be adopted wherever possible.

7. The manufacturers and suppliers of pesticides should be encouraged to contribute as much as possible to safe handling. Several aspects need to be considered, especially formulation, packaging and co-operation between the manufacturers and suppliers of pesticides and of application equipment.

Companies should not commercialise formulations that are known to be unsafe under representative working conditions.+
The formulation of a Code of Practice or a Code of Conduct providing the necessary guidance, in particular in those countries where national legislation is not yet fully developed, may need to be considered.

8. Adequate training and supervision of local sales representatives are needed.

The members of the Workshop were of the opinion that the Pan American Health Organisation is well placed to bring these recommendations to the attention of governments in Latin America.

+UN resolutions nrs. 34/173, January 1980 and 35/176 of February 1981 are relevant

CLOSING REMARKS

L. ROSIVAL, chairman

Ladies and Gentlemen,

We are coming to the end of our Workshop but first of all I would like to extend my thanks to our rapporteur, Dr. Tordoir, who has done an excellent job again. During the past days we discussed topical problems regarding education and a group of heterogenous problems from many aspects of occupational exposure to pesticides. The character of the particular papers is in the report of our rapporteur.

It has been shown and I stressed it in my opening address that education requires a very comprehensive approach based on three main objectives: to inform, to motivate and to set into action.

In the general conclusions and recommendations, formulated under the chairmanship of Dr. F. Gunter, from a workshop, held in Tucson, Arizona, in 1980 entitled "Minimizing occupational exposure to pesticides" there is a short statement reading as follows:

"All field workers must be educated about the hazards of the materials to which they are exposed either as applicators or while working at jobs where they will be exposed to foliar residues".

It is also stated that all manufacturers and formulators of pesticides should have modern health surveillance programs which should result in early warnings and adoption of appropriate protective measures. All this is in full agreement with our recommendations. Our discussions have clearly shown that it is not only a medical but also a very great ethical problem.

As to the first objective of education, to inform people, we must be aware of the fact, that the dangers for our health are often caused by imperfections in our own behaviour, often linked with ignorance and carelesness, which go hand in hand with indequate precautions of the national and other authorities.

In this connection we should not seperate the protection from the promotion of health and we must see it as a comprising effort, which combines the actions in health, education, economics etc.

The second objective is motivating people to comply with the rules for a rational use of pesticides as an integral part of rules for a healthy life. Educational programmes are needed to reinforce the process of development. Radical changes may need to be made in methods of instruction to make them more relevant

to socioeconomic development and to new technologies. As has been stressed in the papers from prof. Astolfi and in other papers, education is a continuous process and education can support health policy.
Motivation may be achieved effectively from good examples and from peer acceptance which illustrates that education is really an every-day practical matter rather than a course of lectures.

The third objective is to set into action. As Etienne Berthed pointed out health education has to convince the man and women who are responsible for taking decisions that health is a basic "raw material" for their country's social and economic development.
In this context, I am convinced that it is not only the problem of educating the public, but also to change the philosophy in the undergraduate and postgraduate teaching in the medical faculties and in other faculties. Our discussions showed clearly, that the aspects of preventive measures have been neglected in many countries sometimes with tragic consequences for the population.

From a practical point of view the WHO Recommended Classification of Pesticides by Hazard gained acceptance. Suggestions should be made by member states and pesticide registration authorities that further guidance should be given on the classification of individual pesticides. In this context the WHO multilevel course on the Safe Use of Pesticides is of utmost importance. In the Latin American countries the Pan American Center for Human Ecology and Health could act as an important focal point in the prevention of or in minimizing adverse effects on human health from pesticide exposure, using inter alia this course in the preventive work.
I think we can fully agree with Dr. Copplestone's conclusions that "we are more likely to be effective in preventing accidental poisoning by pesticides if we concentrate our activities in relevant terms on those areas where hazard is really high than by trying to give blanket and comprehensive coverage to all pesticide users".
We discussed the risks in assessing risks. We know that no human activity can be completely free from risks. Although the risks cannot be totally eradicated they can be measured, investigated, evaluated, controlled and reduced.
Risk assessments should be used to reduce risk and to specify what is acceptable risk.
In evaluating the risks the subjective assessment of risk is important. Especially important points are whether the risks are taken voluntary, whether the hazards are familiar, whether individuals are at risk or the community, the cause of the hazard and the size of the problems. It was shown that some psychological aspects are related very closely to sanitary education. Each educational message interacts with a social context.

An important part of our Workshop has been devoted to present and discuss the various problems that are encountered in the promotion of safe handling of pesticides and the development of legislation. The presentation of these problems indicated on the one hand the great variability of conditions which prevail in the particular countries and on the other hand it was demonstrated how many problems there are which countries have in common and which arise from new scientific knowledge and its application in practice. From the numerous papers dealing with these topics, the majority came from the Latin American countries. Practical examples have been presented showing possible solutions and approaches for different circumstances. I would like to congratulate our colleages from Latin America for their excellent work and I wish them success in their future work.

As mentioned earlier a workshop entitled "Minimizing occupational exposure to pesticides" has been held in Tucson, 1980. The proceedings from this workshop have been published in Residue Reviews Volume 75. It is an excellent survey of this topic with summaries and recommendations dealing with populations at risk, personal monitoring, urinary metabolites, cholinesterase testing techniques for establishing safe levels of foliar residues, federal entry standards, reliability of analytical methodology, reentry field data, closed systems, protective clothing and worker safety.

We appreciate very much the results of the above mentioned workshop and I am sure, that the information available will be of great help also for the future activities of our Scientific Committee.

The recommendations for the solution of the topical problems in education and safe handling of pesticides are the most important outcome of our workshop. As for the future, the organization of workshops in approximately two-year intervals with participation of experts qualified in the respective fields will be of the greates importance. Every workshop will elaborate recommendations that will be published in important international periodicals. The workshops will be further organized in close cooperation with the UNEP, WHO, ILO, COMECON and IUPAC organizations in order to grant transfer of scientific knowledge into the activity of these organisations, and to assure application in practice of this knowledge. Intensification of scientific contacts in this field and mutual information of the situation in various regions of the world will be a closely associated aspect.

It is proposed that the next workshop will be held in Sevilla, Spain and should discuss the problems of distribution, transportation and storage of pesticides and the safe disposal of unwanted or deteriorated pesticides.

I would like to extend my thanks to prof. Astolfi's team and to Mrs. Leny de Smit for the excellent work of the secretariat of our workshop and for the wonderful facilities provided,and to Senor Fabiani and others working in the background for the successful outcome of our deliberations.

LIST OF PARTICIPANTS

Mrs. Dr. L. Albert
Centro Panamericano de Ecología Humana y Salud
Apartado Postal 37-473
Mexico 6, D.F.

Mrs. Dr. M.E.W. de Almeida
Instituto Adolfo Lutz
(Public Health Laboratory)
Caixa Postal 7027
01000 São Paulo, SP
Brazil

Dr. W.F. Almeida
Biological Institute of São Paulo
Caixa Postal 7119
01000 São Paulo, SP
Brazil

Dr. J.F. Amaral
Fundação Universidade Estadual de Londrina
Caixa Postal 2032
Paraná
Brazil

Prof. Dr. E. Astolfi
Facultad de Medicina de Buenos Aires
Cátedra de Toxicología
Ayacucho 1337 - 2ºPiso
1111 - Buenos Aires
Argentina

Mrs. Dr. S.M. Barrios Guanes
National Institute of Technology and Standards
Casilla de Correo 967
Asunción
Paraguay

Mrs. Dr. E. Cernichiari Ph. D.
Rochester University
New York
U.S.A.

Dr. J.F. Copplestone
World Health Organization
Chief Pesticide Development and Safe Use
Division of Vector Biology and Control
1211 Geneva 27
Switzerland

Prof. Dr. D. Córdoba Palacio
Universidad de Antioquia
Apartado Aéreo 1335
Calle 52 B no. 7940
Medellín
Colombia

Dr. P.A. Croce
Hospital "Elizalde"
Centro de Toxicología
Montes de Oca 40
1270 Buenos Aires
Argentina

Mr. H.O. Fourie,
Department of Health, Welfare and Pensions
Private Bag X63
0001 Pretoria
Republic of South Africa

Prof. A. Furtado Rahde
Brazilian Drug and Poison Information System
Ministério da Saúde
Fundação Oswaldo Cruz
Riachuelo 677, ap. 201
90000 Porto Alegre
Brazil

Dr. M. Gilbert
International Register of Potentially Toxic Chemicals of UNEP
Palais des Nations
1211 Geneva 10
Switzerland

Dr. C.A. Gotelli
Facultad de Medicina de Buenos Aires
Cátedra de Toxicología
San Pedrito 220
C.P. 1406
Buenos Aires
Argentina

Dr. R. Goulding
Consultant Toxicologist
36 Ashley Court
Morpeth Terrace
London SW1P 1ER
U.K.

Prof. F.A. Gunther
University of California
Department of Entomology
Riverside CA 92521
U.S.A.

Mrs. Drs. E.A.H. van Heemstra-Lequin
Shell Internationale Research Maatschappij B.V.
Group Toxicology Division
P.O. Box 162
2501 AN The Hague
The Netherlands

Mrs. Dr. J. Higa de Landoni
Facultad de Medicina de Buenos Aires
Avenida Mitre 2067 - 3ºB
1870 Avellaneda
Buenos Aires
Argentina

Dr. K.W. Jager
Shell Internationale Research Maatschappij B.V.
Group Toxicology Division
P.O. Box 162
2501 AN The Hague
The Netherlands

Dr. J. Jeyaratnam
University of Colombo
Faculty of Medicine, Department of Community Medicine
Kynsey Road
Colombo 8
Sri Lanka

Dr. S.K. Kashyap
National Institute of Occupational Health
Meghani Nagar
Almedabad 380 016
India

Dr. J.F.A. Kiss
Universidad de Buenos Aires
Departamento de Psiquiatriá
Baigorria 3058 - 2ºC
1417 Buenos Aires
Argentina

Mr. A. Lopez, Agr. Eng.
Instituto de Ecología
Recursos Naturales y Technología
Street Tucumán 2235
Resistencia - Chaco
C.P. 3500
Argentina

Prof. Dr. J.D. Lopez Bolado
Palacio de Justicia
Juzgado en lo Criminal de Instrucción Nº 5
Talcahuano 550, 3º Piso
C.P. 1013
Buenos Aires
Argentina

Prof. Dr. A. Maccagno
Facultad de Medicina de Buenos Aires
Cátedra de Toxicología
Julián Alvarez 2749, 3ºA
1425 Buenos Aires
Argentina

Dr. L.H. Machemer
Bayer A.G.
Institute of Toxicology
Friedrich-Ebert-Strasse 217
D-5600 Wuppertal 1
Federal Republic of Germany

Ing. J.M.J. Martinez Prieto
Sociedad Argentina de Ecotoxicología
Arcos 1374
1426 Buenos Aires
Argentina

Dr. R. Murray
Permanent Commission of the International Association on Occupational Health
(Secretary-treasurer)
Quality House, Quality Court
Chancery Lane
London WC2A 1HP
U.K.

Prof. Dr. F.W. Oehme
Comparative Toxicology Laboratories
Kansas State University
Manhattan, Kansas 66506
U.S.A.

Dr. C.F. Ottevanger
Shell Nederland Raffinaderij B.V.
Occupational Health Department
P.O. Box 7000
3000 HA Rotterdam
The Netherlands

Dr. C. Pettoruti
Shell Compañia Argentina de Petroleo S.A.
Casilla de Correo 1759
Buenos Aires
Argentina

Mrs. Dr. J. Pronczuk de Garbino
Hospital de Clinicas "Dr. Manuel Quintela"
Centro de Informacion y Asesoramiento Toxicologico (Poison Control Centre)
Agraciada 3354
Montevideo
Uruguay

Prof. Dr. F. Puentes
Universidad Industrial de Santander
Comité Agromédica de Santander y Sur del Cesar
Calle 39
22-62 Bucaramanga
Colombia S.A.

Prof. Dr. M. Repetto
Instituto Nacional de Toxicología
Apartado Postal 863
Sevilla
Spain

Ing. Agr. E.J. Rosenkjaer
Association of Plant Protection and Fertilizers
Charcas 968, 4º Piso, ofic. 8 (1058)
Buenos Aires
Argentina

Prof. Dr. L. Rosival
Research Institute of Preventive Medicine
Limbova 14
Bratislava
Czechoslovakia

Dr. N. Segura, M.D.
Shell Compañia Argentina de Petroleo S.A.
Casillade Correo 1759
Buenos Aires
Argentina

Mrs. Dr. A. Soto
3150, NW 19 Terrace
Miami 33125
Florida
U.S.A.

Dr. R.C. Tincknell
Shell International Chemical Company Ltd.
Shell Centre
London SE1 7PG
U.K.

Dr. W.F. Tordoir
Shell Internationale Research Maatschappij B.V.
Group Toxicology Division
P.O. Box 162
2501 AN The Hague
The Netherlands

Prof. Dr. I. Vassilieff
Universidade Estadual - Campus de Botucatu
Instituto Básico de Biologia Médica e Agrícola
Department of Pharmacology
Paulista "Julio de Mesquita Jilho"
18.619 Rubiao Junior
Sao Paulo
Brazil

Dr. M.R. Zavon
Hooker Chemical Company
222 Rainbow Boulevard North
P.O. Box 728
Niagara Falls, N.Y. 14302
U.S.A.

PREVIOUS WORKSHOPS

Previous workshops organised by the Scientific Committee on Pesticides of the International Association on Occupational Health were held in Amsterdam, Sofia, Cambridge, Bratislava and The Hague.
For easy reference the titles of these Workshops and the publications of reports and recommendations are listed below.

EPIDMIOLOGICAL TOXICOLOGY OF PESTICIDE EXPOSURE
Amsterdam, The Netherlands, 8-10 September 1971
Chairman: Prof.Dr. R.L. Zielhuis
Report and recommendations were published in Archives of Environmental Health 25 (1972) 399-405.

OCCUPATIONAL HEALTH CRITERIA FOR THE EVALUATION OF PESTICIDES
Sofia, Bulgaria, 9-11 April 1974
Chairman: Prof.Dr. F. Kaloyanova
Conclusions and recommendations were published in International Archives of Occupational Health 33 (1974) 335-341.

BIOLOGICAL MONITORING IN EXPOSURE TO CHOLINESTERASE INHIBITORS
Cambridge, U.K., 8-10 September 1975
Chairman: Dr. M.R. Zavon
Report and recommendations were published in the International Archives of Occupational and Environmental Health 37 (1976) 65-71.

EVALUATION OF VARIOUS EXISTING CLASSIFICATIONS OF TOXICITY AND HAZARD, AS FAR AS RELEVANT FOR OCCUPATIONAL EXPOSURE TO PESTICIDES
Bratislava, Czechoslovakia, 23-25 August 1977
Chairman: Prof. L. Rosival
Report and recommendations were published in the International Archives of Occupational and Environmental Health 41 (1978) 287-290.

FIELD WORKER EXPOSURE DURING PESTICIDE APPLICATION

The Hague, The Netherlands, 9-11 October 1979

Chairman: Prof. L. Rosival

The proceedings (including report of rapporteur and recommendations) were published by Elsevier Scientific Publishing Company, Amsterdam-Oxford-New York in 1980, entitled "Field Worker Exposure during Pesticide Application", edited by W.F. Tordoir and E.A.H. van Heemstra-Lequin.

Report and recommendations were published in the International Archives of Occupational and Environmental Health 46 (1980) 183-189, and in Journal of Hazardous Materials 4 (1980) 207-211.