WORKING PAPER 45

Pesticides: Health Impacts and Alternatives

Proceedings of a Workshop Held in Colombo 24 January 2002

Lidwien A. M. Smit, editor

IWMI
International Water Management Institute

FUTURE HARVEST
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Editor: L.A.M. Smit

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Cover photograph by Lidwien Smit shows

Contents

Acronyms

AMC	=	Anti Malaria Campaign
ANOVA	=	Analysis of Variance
CPP	=	Crop Protection Products
CEA	=	Central Environmental Authority
CEC	=	Community Education Centre
CIDI	=	Composite International Diagnostic Interview
DOA	=	Department of Agriculture
EFC	=	The Employers' Federation of Ceylon
FAO	=	Food and Agriculture Organization
ICM	=	Integrated Crop Management
ILO	=	International Labor Organization
IMS	=	Intermediate Syndrome
IPM	=	Integrated Pest Management
IWMI	=	International Water Management Institute
MAMAS	=	Managing Agrochemicals in Multi-use Aquatic Systems
MRC	=	Medical Research Council
NARA	=	National Aquatic Resources Research and Development Agency
NPIC	=	National Poisons Information Centre
OP	=	Organophosphate
OPI	=	Organophosphorus insecticides
OPIDP	=	Delayed polyneuropathy induced by OPI
POP Scale	=	Peradeniya Organophosphorus Poisoning Scale
SEARO	=	South East Asia Regional Office of the WHO
SLCPA	=	Sri Lanka Crop Protection Association
TOCP	=	Tri-orthocresyl phosphate
WHO	=	World Health Organization

INTRODUCTION

The International Water Management Institute (IWMI) has, for many years, been involved in research on pesticide poisoning to analyse the reasons for the high number of pesticide poisoning cases in Sri Lanka and discuss ways of controlling the problem through changes in agricultural practices and community involvement. More recently, research has focused on risk factors for deliberate and occupational pesticide poisoning and on the impact that a shift towards Integrated Pest Management (IPM) will have on the health of farming families.

A workshop on “Pesticides: Health Impacts and Alternatives” was held at the Colombo Hilton Hotel on 24 January 2002. The workshop marked the end of IWMI’s research on pesticide poisoning in Sri Lanka and provided researchers and policy makers from various disciplines such as health, environment, and agriculture an opportunity to share and discuss recent findings and to discuss strategies to reduce pesticide poisoning.

This paper presents the workshop proceedings and includes a resource handbook for Sri Lanka on health impacts of pesticides and alternatives by listing names of relevant institutes, addresses and annotated references.

Part A. Workshop on Pesticides: Health Impacts and Alternatives
Workshop Program

Chairman: Dr. Flemming Konradsen

Time	Topic	Speaker
9:30-9:45	Opening remarks	Ian Makin, IWMI
9:45-10:30	IWMI’s research on acute pesticide poisoning in Sri Lanka	Wim van der Hoek and Flemming Konradsen, IWMI
10:30-10:50	Clinical aspects of acute poisoning	Nimal Senanayake, University of Peradeniya, Sri Lanka
10:50-11:15	TEA BREAK	
11:15-11:45	Psychiatric aspects of deliberate poisoning	Ranil Abeyasinghe, University of Peradeniya, Sri Lanka
11:45-12:15	Health effects of occupational pesticide exposure	Lidwien Smit, IWMI
12:15-12:40	Pesticide legislation policy	G. Manuweera, Pesticide Registrar, Office of the Registrar of Pesticides, Peradeniya
12:40-13:00	Pesticide industry initiatives and safe use policy	U. Gangoda, Sri Lanka Crop Protection Association
13:00-14:00	LUNCH	
14:00-14:30	Integrated Pest Management programme in Sri Lanka Principles of IPM training for farmers	Lakshman Amerasinghe and Henk van den Berg, Department of Agriculture, Gannoruwa, Peradeniya and FAO IPM Project
14:30- 14:50	Managing agrochemicals in multi-use aquatic systems	Graeme Taylor, Institute for Aquaculture, University of Stirling, UK
14:50-15:10	A Minimum Pesticides List	Michael Eddleston, University of Oxford,UK
15:10-16:15	Discussion on Pesticides and alternatives	All participants
16:15-17:30	Informal discussion and drinks	All participants

Pesticide Poisoning: A Major Health Problem in Sri Lanka

Wim van der Hoek, IWMI and Flemming Konradsen,
Department of International Health,
University of Copenhagen, Denmark

Extent of the problem

Acute pesticide poisoning is a serious public health problem in many developing countries. Worldwide incidence has been estimated at one million serious unintentional poisonings each year and in addition two million people hospitalized for suicide attempts with pesticides. Sri Lanka is one of the few developing countries where basic data are available and these show that the majority of poisoning cases are self-inflicted, by mainly young adults living in rural agricultural areas where agrochemicals are easily available. In several agricultural districts it precedes all other causes of death in government hospitals.

Studies in Mahaweli H

In Mahaweli System H a very high incidence of serious pesticide poisoning was observed with 68 percent due to intentional ingestion of liquid pesticides. It is argued that the easy availability and widespread use of highly hazardous pesticides is the most important reason for this high number of poisoning cases. The frequent application of hazardous pesticides in high concentrations was often irrational and posed serious health and financial risks for the farmers. Sales promotion activities and credit facilities promoted this excessive pesticide use, while not being counteracted by an agricultural extension service. Hazardous practices when spraying pesticides were due to the impossibility of applying recommended protective measures under the local conditions, more than to lack of knowledge.

Studies in Uda Walawe

Although it is now well established that the majority of poisoning cases in Sri Lanka are suicide attempts, there is no consensus whether this is completely determined by social and cultural factors or whether it is mainly caused by the easy availability of hazardous agrochemicals. Others say that the prevalence of mental illness is underestimated and accounts for many of the intentional poisoning cases. So far there have been no studies that looked into the risk factors of acute pesticide poisoning and that have tried to establish the relative importance of the different determinants. However, such information is essential to plan effective preventive and control strategies. In fact, it can be stated that the public health community has by and large ignored the subject, despite its importance in terms of morbidity and mortality.

Several studies were done in Uda Walawe. One of these was a hospital-based case control study on agricultural, socioeconomic, and psychological risk factors for the occurrence of pesticide poisoning. A patient diagnosed of pesticide poisoning or treated as such by the attending medical officer was identified as a “case” of pesticide poisoning. Two patients admitted for pesticide poisoning, who attended the laboratory of the Anti-malaria Campaign in the hospital’s out patient department were interviewed and employed as “controls.” Subsequent to their discharge from hospital, the “cases” and “controls” were visited at home by one of the research officers to ascertain detailed information on the agricultural practices adopted by them.

During the one-year study period 242 cases of pesticide poisoning were admitted to Embilipitiya and Chandrikawewa hospitals. Most of the cases (83%) were due to intentional ingestion of pesticides. Males were predominant among intentional, occupational as well as accidental poisoning cases. Out of the 238 patients for whom this information was available 44 (18%) died, all of them suicide cases. Thirty-one (13%) of the 242 patients reported a previous admission for pesticide poisoning and 39 (20%) of the 200 intentional poisoning cases reported a previous suicide attempt. Upon admission 86 (36%) of the pesticide poisoning cases, all males, were under the influence of alcohol. In 149 of the 242 cases the pesticide container was available for inspection. Most of the pesticides were organophosphate insecticides. Analysis of data is still ongoing.

In addition, in-depth interviews took place with a subgroup of the respondents (159 out of 242) from case and control groups. These included questions on mental health, based on the WHO’s Composite International Diagnostic Interview (CIDI).

In the in-depth study the following vulnerability factors were important:

- Economic/social hardships faced by families, which in many cases were worsened by high intake of illicit alcohol by the male head of household.
- Physical and psychological abuse of women in the domestic environment, especially against women living with family-in-laws and without a close social support network.
- Family disagreement over land rights, joint business activities and marriage arrangements, often among siblings or between father and son.
- High unmet expectations by youth to educational opportunities and employment.
- History of poisoning attempts in the family.
- Extra marital affairs or pregnancies.
- Life-threatening disease or permanent disability.
- Long-term depression or poor mental health status.

The poisoning attempt was often triggered by events such as:

- Major “fight” with a close family member (male head often under the influence of alcohol).
- One partner breaking-up an emotional relationship.
- Failed harvest and/or refusal for new loan.
- Harassment episode at school or failed examination.

Conclusions

Self-inflicted poisoning seems an accepted way of dealing with hardship, oppressive conditions, problems of misuse and depression. It is often an alarm signal to close relatives or to “teach others a lesson.”

Current emphasis on programs that promote the safe use of pesticides through education and training of farmers will be ineffective in Sri Lanka because knowledge is already high and most poisoning cases are intentional. Instead, enforcement of legislation to restrict availability of the most hazardous pesticides would result in an immediate health benefit. Improving agricultural extension services to promote alternative nonchemical methods of pest control is the most important strategy, in the long term, to prevent acute pesticide poisoning.

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Acute pesticide poisoning in Sri Lanka: a major public health problem

- IWMI studies in Sri Lanka
- Magnitude of the problem
- Risk factors
- What can be done?

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PESTICIDES: HEALTH IMPACTS AND ALTERNATIVES

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Mahaweli H:
- Document the problem
- Role of pesticides in agriculture and society

Uda Walawe:
- Risk factors
- Occupational exposure

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Study in northern Sri Lanka

- In-depth interviews / participant observations: 30 families. Use, storage, disposal, information sources, decision making
- Background material, key informant interviews
- Review of in-patient records in two hospitals

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Maha	**paddy**	**2½ acre**	**herbicides (3x)**	**US$50**
Yala	**chilies**	**½ acre**	**mixtures**	**US$150**

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Acute pesticide poisoning in a small hospital 1991-1994

- 526 admissions, incidence 2.9 per 1,000 population per year (95% CI 2.32-3.55)
- 42 deaths (case fatality 7.2%)
- Many patients (44.2%) transferred with unknown outcome
- Self-inflicted 68%, spraying 19%, accidental 13%
- Young adults, mostly males

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Leading causes of hospital deaths in Sri Lanka, 1999

Ischaemic heart disease	3,206
Diseases of the gastrointestinal tract	2,979
Cerebrovascular disease	2,930
Pulmonary heart disease	2,561
Neoplasms	2,374
Diseases of the resp. system	2,174
Toxic effects of pesticides	1,847

All causes 32,155

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Acute pesticide poisoning: also a major global health problem

WHO estimate (1990):
- 3 million hospital admissions
- 220,000 deaths
- Two-thirds due to suicides, one-third due to accidental and occupational exposure

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A developing country problem

- The bulk of pesticide use is in Europe, North America and Japan
- But: countries like the US and the UK report fewer than 100 fatal cases per year

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Very large number of different pesticides

- 30 families, 39 different pesticides
- 526 admissions for acute pesticide poisoning in one hospital 1991-1994: 54 different pesticides

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Chemical	Poisoning cases	
	n	%
organophosphates*	312	59.3
endosulfan	42	8.0
carbamates	24	4.6
paraquat	26	4.9
others	59	11.2
unknown	63	12.0
total	526	100
* monocrotophos 72		

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Information sources:
- ✓ **fellow-farmers**
- ✓ **shopkeepers**

No information provided by:
- ✓ **agricultural ext. service**
- ✓ **farmers organizations**

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High awareness of dangers of pesticides and safety precautions, but:
- ✓Excessive spraying
- ✓No use of protective clothing
- ✓Washing spray cans in irrigation canals
- ✓Empty bottles converted for domestic use

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Deliberate self-harm

- Most acute pesticide poisoning cases are intentional
- Use of liquid pesticides is the most common mode of suicide in Sri Lanka
- Suicide rate in Sri Lanka is one of the highest in the world

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Restricting availability will help

- Tranquillizers / sedatives: England – Wales
- CO in domestic gas: England – Wales
- Sharp decline in suicide rates in Samoa after restricting Paraquat
- Seasonal mortality pattern in Sri Lanka
- Sharp decline in war areas

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Risk factors

- Relative importance of agricultural, social, and psychological risk factors
- Case control study
- In-depth analysis of poisoning cases
- Composite International Diagnostic Interview (CIDI)

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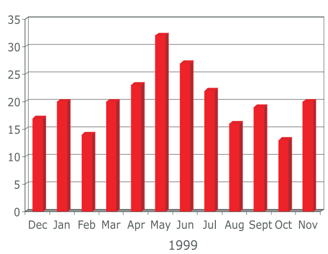
Admissions for pesticide poisoning in Embilipitiya Base Hospital 242 cases



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242 acute pesticide poisoning cases

- 83% were suicide attempts
- Case fatality 18% (all suicides)
- Mostly OP insecticides
- Alcohol intoxication: 86 (36%) of all pesticide poisoning cases (all males)

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Risk factors

	Cases	Controls
% females	37.2%	37.2%
Average age	28.6 yrs	24.0 yrs
Unemployed	22.3%	12.6%
Ended an emotional relationship	23.1%	6.2%
Other family member had pesticide poisoning	34.3%	17.7%

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What has been done about it?

- WWII, miracle technology, very effective promotional campaigns
- 1960s: “Silent Spring”, environmental impacts, establishment of EPA

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1980s

- Human health impacts of OP
- FAO: International Code of Conduct on the Distribution and Use of Pesticides
- FAO / ILO / WHO / GCPF: Global Safe Use Campaign

But:

- Code of Conduct is on voluntary basis / opening of economies
- Safe Use Campaign not appropriate for a country like Sri Lanka

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Are pesticides really necessary?

- Many pest problems are pesticide-induced
- IPM is now considered a cornerstone of sustainable agriculture:
- ✓ Economic benefits for farmers and governments
- ✓ Conservation of natural enemy species and biodiversity
- ✓ Improvement of water and soil quality
- ✓ Health benefits

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Conclusion

- In parts of the developing world pesticide poisoning causes more deaths each year than all infectious diseases
- Best control strategy is to restrict the use of pesticides or phase them out altogether
- (Improved case management in peripheral hospitals is a necessity)

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Studies on Organophosphorus Insecticide Poisoning

Nimal Senanayake,
University of Peradeniya, Sri Lanka

The first proven case of pesticide poisoning was in 1954. By 1980, admissions to hospitals due to such poisoning were over 11,000 per year, of which 75 percent were due to organophosphorus insecticides (OPI). Our attention was drawn to OP poisoning in 1977 by an outbreak of acute polyneuropathy, which affected over 20 young females in the Hill Country. We traced the neuropathy to tri-orthocresyl phosphate (TOCP) which had contaminated *gingili* oil. This finding warned the public and prevented further cases of paralysis (Senanayake and Jeyaratnam 1981; Senanayake 1981).

Epidemiological studies conducted by us defined the magnitude of the health hazards caused by acute insecticide poisoning in Sri Lanka (Senanayake and Karalliedde 1986; Karalliedde and Senanayake 1986; Senanayake and Karalliedde 1988; Karalliedde and Senanayake 1988). In a survey of 37,125 death certificates issued in the Kandy District over 20 years at 5-year intervals beginning 1967, poisoning accounted for 718 (19.3 per 1,000) deaths. The agent in 77 percent of the deaths was a pesticide. Nearly half the deaths had occurred outside the town area, showing a gross underreporting in the hospital-based data. A disturbing increase was seen in the mortality during the 20 years, from 11.8 to 43 per 1,000 deaths (Senanayake and Peiris 1995).

Delayed polyneuropathy induced by OPI (OPIDP) had earlier been limited to a few isolated case reports from different parts of the world. In 1982, we reported the then largest series of OPIDP cases (Senanayake and Johnson 1982), and more subsequently (Senanayake 1985; Senanayake 1990). Methamidophos, the agent responsible for our cases, had been declared safe by standard animal experiments for delayed neuropathic effects. But our findings led the MRC Toxicology Unit in Surrey, England to conduct more animal experiments, which showed that methamidophos was different to other OPI in its neuropathic potential and the mechanism of neurotoxicity of methamidophos was redefined, making an important milestone in our understanding of the mechanism underlying OPIDP.

OP poisoning carried a high overall mortality, and our attention was drawn to the hitherto unexplained deaths, which occurred within a few days after successful management of the initial cholinergic phase. Our clinical observations led to the discovery of yet another phase of the OP symptomatology—an acute muscle paralysis with a high risk of death due to respiratory insufficiency—which we termed the "Intermediate Syndrome" (IMS). Our description of this new syndrome in 1987 in the *NEJM* (Senanayake and Karalliedde 1987) was highlighted by an editorial: *"For several reasons, this description of a new neurotoxicologic manifestation of OP poisoning has features that are of substantial medical and public health importance...* (Davies 1987). Our finding emphasized the need to keep patients under observation after the cholinergic phase of OP poisoning. Subsequent neurophysiological studies have demonstrated that the basic defect in IMS is postsynaptic at the skeletal neuromuscular junction (Sedgwick and Senanayake 1987). A research thesis supervised by us has described the biochemical changes in IMS (Khanal 1997).

The experiments carried out on animals revealed that OPI poisoning during pregnancy caused prenatal and postnatal deaths and congenital abnormalities. We showed, however, that by proper management of the acute cholinergic phase and the IMS, the pregnancy could continue the term unaffected (Senanayake and Karalliedde 1988).

In 1989, at the request of the *British Journal of Anaesthesia*, we reviewed the clinical features and management of OPI poisoning (Karalliedde and Senanayake 1989), and also contributed a chapter on the IMS to the now most authoritative textbook on OP (Senanayake and Karalliedde 1992).

Presentation of data suffered by a lack of objectivity and uniformity due to nonavailability of accepted clinical criteria to grade severity of OPI poisoning. We, therefore, developed the *Peradeniya Organophosphorus Poisoning Scale (POP Scale)* in 1993 (Senanayake et al.1993).

Acute OP poisoning is usually treated with atropine and cholinesterase reactivators such as oximes, but controlled trials to assess the efficacy of oximes had not been done. Our studies cast doubt on the necessity of cholinesterase reactivators for treatment of OP poisoning (de Silva et al. 1992).

Other original observations by us on OPI intoxication in man include isolated bilateral recurrent laryngeal nerve paralysis (de Silva et al. 1994) and extrapyramidal manifestations (Senanayake and Sanmuganathan 1995). The latter highlights that several different areas of the central nervous system can be affected in OP intoxication.

Our work has brought about a considerable change in the management of OP poisoning in Sri Lanka and in other parts of the world where OP intoxication is common. Recognition of the IMS and prompt institution of ventilatory care has saved several hundreds of lives. The identification of new OP compounds with delayed neuropathic effects has helped to minimize the incidence of the disabling OPIDP. For laboratory-based scientists, these clinical descriptions have widened the scope to investigate the neurotoxicity of OPI at ultrastructural and molecular levels.

Intentional Pesticide Poisoning

Social and Personal Characteristics

Methodology - qualitative study

- Case definition
  - *acute pesticide poisoning (intentional)*
- One year study period
- Catchment area of two hospitals in southern Sri Lanka: Embilipitiya and Chandrikawewa
- In-depth interviews
  - *bedside*
  - *with patient and family at home*
- Observational studies
- Key informant interviews

Cases - intentional pesticide poisoning

- 159 cases analyzed *(a sub-sample of the total 244 cases)*
  - 96 (60%) cases male
  - 63 (40%) cases female
  - 30 (19%) cases died

Intentional Poisoning - vulnerability factors

- Economic/social hardships faced by families, in most cases worsened by extremely high intake of illicit alcohol by male head of household
- Physical and psychological abuse of women in the domestic environment, especially against women living with in-laws and without a close social support network.

- Family disagreements over land rights, joint business activities and marriage arrangements (often among siblings or between father and son)
- High unmet expectations by youth to educational opportunities and employment
- History of poisoning attempts in close family

- Extra marital affairs, jealousy, the break-up of engagements, loss of virginity before marriage or pregnancies outside marriage
- Faced with life-threatening disease or permanent disability
- Long-term depression or poor mental health status

The episode - the final "push"

- Major "fight" with close family member *(male head often under the influence of alcohol)*
- One partner breaking-up significant relationship
- Failed harvest and/or rejection of loan application
- Harassment episode at school or failed exam

- The vast majority of episodes were of an impulsive nature
- One-third of all poisoning cases were intoxicated by alcohol when the episode took place (*all male*)
- In the vast majority of episodes the pesticides were easily available within the homestead

The suicide culture

- An accepted way of life *(influenced by the press)*
- An alternative strategy for dealing with hardships, oppressive conditions, problems of misuse and depression
- A sign to close relatives or to "teach others a lesson"

Psychiatric Aspects of Pesticide Poisoning

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Most pesticide poisoning is deliberate and with intention to commit suicide. Hence, the two most important aspects of poisoning are suicide and attempted suicide. Suicide is the ninth commonest cause of death in the world (WHO 1996) and the USA (Peters et al. 1998). In Sri Lanka, suicide was the fourth commonest cause of hospital deaths, while it became the commonest cause of hospital deaths in five rural districts (Health Ministry 1986). By the year 1985 Sri Lanka had achieved the dubious distinction of having the second highest suicide rate in the world and the highest female suicide rate in the world, the rates being 38.2 and 33.0 per 100,000, respectively (Diekstra and Gulbinat 1993).

These rates have been analysed in the context of an extensive community study on suicide carried out in Sri Lanka, which showed that both the quoted rates of suicide were underestimated and the real suicide rate for 1997 was estimated to be 50.1 per 100,000, making it easily the highest in the world (Abeyasinghe 1997a). Significantly this increase of more than 700 percent since 1960 was entirely due to the increase in deaths by poisoning (Abeyasinghe 1997a). In fact, all suicides other than those due to poisoning remained unchanged since 1960.

Youth Suicide

While the adult suicide rate has dropped in many developed countries, youth suicide rate has reached epidemic proportions throughout the world. In the US, between 1952 and 1996, the reported rates of suicide among adolescents and young adults nearly tripled. For young people 15–24 years old, suicide is currently the third leading cause of death, exceeded only by unintentional injury and homicide. More teenagers and young adults die from suicide than from cancer, heart disease, AIDS, birth defects, stroke, pneumonia and influenza, and chronic lung disease *combined* (U.S. Public Health Service 1999).

In Sri Lanka, suicide is the second commonest cause of death in the age group 15–24 years. The youth suicide rate for the age group 15-24 years, increased from 9.47 per 100,000 in 1950 to 79.53 per 100,000 in 1984. The computed suicide rate of 104 per 100,000 in 1997 for Sri Lankan youth, ranks as the highest in the world (Abeyasinghe, 1997b). It is the youth suicide rate that contributed most to increasing suicide rate in the country. For example, the contribution of the age group 15-24 years to suicide in 1950 was 28.6 percent while it increased to 42 percent in 1985 (Abeyasinghe and Bulumulla 1998). As has been described in the WHO SEARO publication (WHO SEARO 2000), this rapid increase was attributed to pesticides newly introduced in the 1960s. The highly toxic substance parathion (Polydol) was taken by a few youth to commit suicide, which then took on epidemic proportions and spread to other parts of the country. This well-known tendency of youth to copy methods used by others to commit suicide included the use of oleander seeds, locally called *kaneru* (WHO SEARO, 2000). Poisoning contributed to 26.9 percent of youth suicides in 1950, which increased to 82.8 percent by 1985.

Causes of Suicide in Sri Lanka

In the extensive community survey of suicides in Sri Lanka, psychological autopsies were carried out on all the cases under study (Abeyasinghe, 1997c). Depression, alcoholism and familial stress emerged as significant causes that deserved careful study. Depression was the primary cause in 46.2 percent of the suicides, while alcoholism emerged as the primary cause of death in 47 percent of the total and 60.8 percent of male suicides. This is a finding that is much higher than in the rest of the world. A remarkable finding among youth suicides was that parental abuse of adolescents accounted for 48.5 percent of deaths in that age group. Two findings that are peculiar to the Sri Lankan suicide scene are: the high rate of alcoholism in male suicides and the alarming rate of familial abuse of adolescents leading to suicide.

Method of Suicide

The same survey revealed that 70 percent of the suicides were carried out using pesticides. While oleander accounted for 11.8 percent of suicides, hanging contributed to 11.3 percent of suicides. Furthermore, only 29.2 percent had used the pesticide available at home, while the majority had bought poison in order to commit suicide. The two common pesticides used as agents of suicide are Endosulphan and Kuretor.

Steps to Reduce the Rate of Suicide in Sri Lanka

The experience in other countries, including that of Finland, clearly indicates that it is possible to control the rate of suicide in a given country by controlling access to the most popular method. Others have reported similar decrease in suicide with restriction of access to poison (Diekstra 1993). It is estimated that an immediate 30 percent reduction in suicide could be achieved in Sri Lanka by implementing the following three simple measures.

1. Control of pesticide sale

In Sri Lanka pesticides are freely available even in grocery stores and are sold with little or no background checking. Some of the possible measures to control sales are: issuing license to buy pesticides, issuing diluted pesticides for those who purchase pesticides in small quantities, restricting sales to well-organised outlets where the sales staff have been trained to detect genuine users.

2. Banning pesticide advertisements

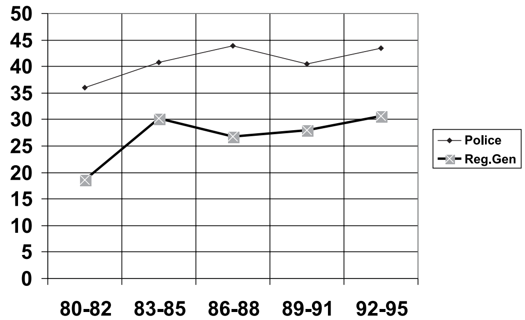
Sri Lanka is the only country where there is prime time advertising of pesticides on TV. The danger here is twofold. One is that the farmer learns about pesticides from the advertisements and the second is that pesticides lose the associated lethality, when it is advertised along with sausages on TV.

3. Controlling media coverage

It is well established that giving prominence to suicide reports tends to encourage suicide in the population (Schmidtke and Hafner 1988; Sonneck 1993). At present the print media continue to publish suicide news in a manner meant to create sensation, rather than creating public awareness of measures to be taken to prevent such tragic incidents. The most common cause and method of suicide are disappointment in love and consumption of pesticide, respectively.

Psychiatric aspects of pesticide poisoning in Sri Lanka

Suicide and attempted suicide



Depression type	Male %	Female %	Total %
Mild	4. 4	6.3	4. 8
Moderate	32. 4	24. 1	30. 6
Severe	14. 7	19. 0	15. 6
Moderate + Severe	47. 1	43.1	46. 2

Type of drinking	Number	Percentage
None	83	28.3
Social drinking	27	9.2
Problem drinking	38	13.0
Dependence	140	47.8

Method	Male %	Female %	Total %
Pesticides	70.2	69.6	70
Kaneru	9.6	19	11.8
Hanging	13.4	3.8	11.3
Drowning	1.7	3.8	2.1
Setting fire	1	3.8	1.6
Gun shot injury	1	0	0.8
Chemicals	1.4	0	1.0
Tablets	3	0	.3
Train	1.4	0	1.1

Pesticide	Frequency	Percentage
Endosulphan	34	48.5
Kuretor	9	12.8
Tamaron	5	7.1
Gramoxone	8	11.4

Age group	Pesticide use as %	Oleander use as %
15-24 years	28.1	30.2
25-34 years	21.2	18.6
35-44 years	15.4	7.0
45-54 years	11.9	7.0
55-64 years	12.3	11.6
65 years and above	8.5	7.5

Place of death	Frequency	Percentage
Home	58	15.5
Outside	49	70.0
Hospital	242	14.0

Place of treatment	Frequency	Percentage
None	129	34.5
Home	5	1.3
Local hospital	49	13.1
Base hospital	113	30.3
Gen. Hospital	54	14.5
Intensive care	4	1.1

Country	Suicide Rate Male	Suicide Rate Female
Greece	3.8	0.8
Italy	7.1	2.2
Sweden	10.0	6.7
Japan	10.1	4.4
Israel	1.7	2.5
UK	12.2	2.3
Germany	12.7	3.4
Czech Republic	16.4	4.3
Hungary	21.1	6.5

Country	Suicide Rate Male	Suicide Rate Female
USA	21.9	3.8
Canada	24.7	6.0
Norway	28.2	5.2
Estonia	29.7	10.6
Finland	33.0	3.2
Latvia	35	9.3
New Zealand	39.9	6.2
Russian Federation	41.7	7.9
Lithuania	44.9	6.7
Sri Lanka	**114.5**	**93.0**

Steps to reduce suicide rate

- Control of pesticide sale e.g., issuing licenses, diluting small quantities and restriction of sales to few centres
- Banning pesticide advertising
- Controlling media coverage

Health Effects of Occupational Pesticide Exposure

Lidwien A.M. Smit
International Water Management Institute (IWMI)

Occupational poisoning caused by exposure to pesticides is poorly documented in Sri Lanka but is assumed to be common (Van der Hoek et al. 1998). Widely used organophosphate and N-methyl carbamate insecticides have acute systemic effects, largely mediated through cholinesterase inhibition leading to an overstimulation and then depression of the nervous system (Namba 1971). Long-term, relatively low exposure to pesticides, particularly organophosphate insecticides, is increasingly suspected of causing chronic adverse effects on the nervous system (Rola and Pingali 1993; Stephens et al. 1995; Wesseling et al. 1997). However, firm conclusions on neuropsychological effects of chronic exposure to pesticides are difficult to draw, as information is scarce, particularly in developing countries (London et al. 1998; Maroni et al. 1999).

IWMI conducted a study on occupational pesticide exposure as part of an ongoing research project in the Uda Walawe Irrigation Scheme. The aims of the study were:

1. to assess neurological symptom prevalence in relation to occupational exposure to cholinesterase-inhibiting pesticides;

2. to determine the extent of acetylcholinesterase inhibition in general farmers and IPM-farmers in a high exposure period compared with a control group;

3. to investigate relationships between symptoms, acetylcholinesterase inhibition, and cholinesterase-inhibiting pesticide exposure.

The study population consisted of 216 farmers, including 122 farmers who had attended IPM demonstrations conducted by the Mahaweli Authority of Sri Lanka. A control group of 55 fishermen was recruited from a fishing community of the Uda Walawe reservoir. Data were collected with questionnaires (symptom status and personal details) and by measuring red blood cell acetylcholinesterase activity in two different periods. The first period was in-between two agricultural seasons, presumably a low exposure period, and cholinesterase activity levels measured during this period were considered baseline values. A second round of data collection took place during the *yala* agricultural season, a high exposure period.

Twenty-four percent of surveyed farmers had suffered at least once from acute occupational pesticide poisoning. Frequently reported acute poisoning symptoms included fainting or unconsciousness, vomiting, nausea, blurred or lost vision, headache, and dizziness. IPM-farmers had more often received training in the safe use of pesticides than other farmers had. IPM-farmers wore significantly more often headgear, long-sleeved shirts and long pants or a sarong during work in the field (Chi square, $p<0.05$) and ate and drank less often during pesticide application (Chi square, $p<0.005$). Personal protective equipment such as spectacles, footwear, gloves or masks were rarely used by both groups of farmers. IPM-farmers spent considerably less time per hectare on spraying insecticides than general farmers during the *maha* agricultural season (10.9 vs. 58.9 hours; Mann-Whitney test, $p<0.001$). Average cholinesterase inhibition during the high exposure season was significantly higher for both groups of farmers (ANOVA, $p<0.001$) as compared to controls (3% inhibition). Average inhibition was higher in general farmers than in IPM-farmers

(11% and 8% respectively; Student's t-test, $p<0.01$). Prevalence of six of sixteen acute insecticide-exposure-related symptoms and two of sixteen long-term neuropsychological symptoms differed significantly between general farmers and controls, whereas prevalence of three acute symptoms and three long-term symptoms differed significantly between IPM-farmers and controls (Cox's regression, $p<0.05$). Further analysis did not reveal an obvious difference in symptom prevalence for general farmers and IPM-farmers. Seven of the sixteen acute symptoms (paleness, dizziness, muscle weakness, staggering, feelings of fear, tremor and nausea) were significantly and positively associated with increased cholinesterase inhibition (>13% inhibition; Cox's regression, $p<0.05$).

Our results suggest that occupational insecticide exposures have a negative impact on the health of farmers in Uda Walawe. A high proportion of farmers suffered at least once from acute occupational pesticide poisoning in the past. Insecticide use seemed to result in depressed cholinesterase levels, and cholinesterase inhibition levels were associated with increased acute symptom prevalence. IPM training seemed to result in less insecticide use, and lower average cholinesterase inhibition levels. However, only a small effect of IPM training on the prevalence of acute pesticide-related symptoms could be determined and no effect was found for chronic symptom prevalence. Within the realities of hot-climate developing countries, safe use campaigns will have limited impact and an overall reduction in pesticide use seems the only option to protect farmers from the adverse effects of pesticides.

Spraying without protective clothing

Photograph by Ronald Loeve

Discarded pesticide bottles in a paddy field

Photograph by Ronald Loeve

Health Effects of Occupational Pesticide Exposure

Lidwien A.M. Smit

Workshop on Pesticides in Sri Lanka - January 24, 2002

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* Occupational poisoning caused by exposure to toxic pesticides: assumed to be a common problem
* Not documented as well as deliberate self-poisoning
* Chronic health effects of acute pesticide poisoning or long-term exposure

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Potentially harmful pesticides are widely used in Sri Lanka:

* **Organophosphates**
  * chlorpyrifos, dimethoate, quinalphos, etc.
* **Carbamates**
  * carbosulfan, carbofuran, fenobucarb, etc.

Organophosphates and carbamates may cause poisoning symptoms by inhibition of acetylcholinesterase

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Enzyme **acetylcholinesterase** breaks down neurotransmitter acetylcholine

Poisoning Symptoms:

* weakness, nausea, vomiting, blurred vision
* unconsciousness, respiratory failure, death

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What strategy will reduce occupational poisoning in Sri Lanka?

Promotion of **Safe Use** and protective clothing?

Integrated Pest Management: less dependence on insecticides?

Restriction of the most harmful pesticides?

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Objectives Occupational Pesticide Exposure Study:

1. Assess symptom prevalence regarding occupational exposure
2. Determine the extent of acetylcholinesterase inhibition
3. Investigate relationships between symptoms, inhibition and exposure

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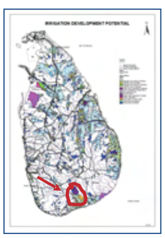
Study population was recruited in the Uda Walawe Irrigation Scheme



* Farmers
* Farmers: IPM demonstration
* Controls: fishing community

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Study periods

* April 2000: Baseline study
  242 farmers (131 IPM farmers)
  55 Controls
* Yala 2000 (July): High exposure study
  216 farmers (122 IPM farmers)
  44 Controls

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Questionnaire

* Personal details
* Cropping details, spray activities last month, protective measure use
* Short-term exposure symptoms
* Long-term exposure symptoms

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Acetylcholinesterase (AChE) test

* 10 µl of blood per test, direct analysis with field photometric kit
* Test in Baseline Period and Yala
* Decrease of AChE activity in Yala with regard to baseline level: inhibition

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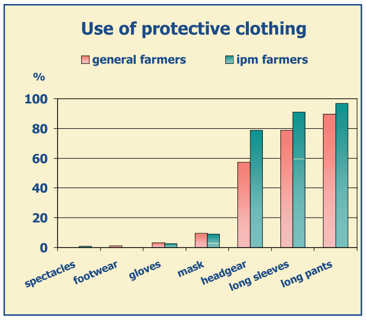
Study Results



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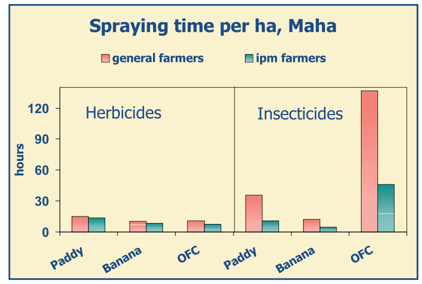

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Previous acute occupational poisoning

* 52 out of 216 farmers **(24%)** reported they had suffered at least once from acute occupational pesticide poisoning in the past

* 35 out of 216 farmers **(16%)** reported they had at least once received medical treatment for occupational pesticide poisoning in the past

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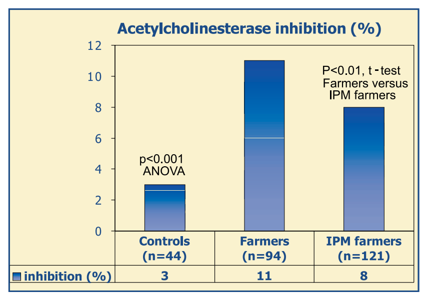

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Short-term exposure symptoms

* Prevalence of 6 out of 16 symptoms differed significantly between general farmers and controls (excessive salivation, paleness, fear, staggering, dizziness and muscle weakness)

* Prevalence of 3 out of 16 symptoms differed significantly between IPM farmers and controls (paleness, staggering, and dizziness)

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Long-term exposure symptoms

* Prevalence of 2 out of 16 symptoms differed significantly between general farmers and controls (painful tingling and being irritated)

* Prevalence of 3 out of 16 symptoms differed significantly between IPM farmers and controls (painful tingling, less interested in sex and often going back to check things)

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Relationship inhibition - symptoms

Seven acute symptoms were significantly and positively associated with increased cholinesterase inhibition (levels above 13% inhibition)

paleness	feelings of fear
dizziness	tremor
muscle weakness	nausea
staggering	

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Discussion

Acetylcholinesterase inhibition levels:

* Associated with farming and insecticide spraying
* Underestimation due to timing of blood sampling?

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Short-term exposure symptoms:

Associated with farming and inhibition levels >13%

* Responder bias? -> Dummy symptoms
* Selection bias? -> All invited farmers/controls participated, high follow-up
* Confounders? -> Alcohol use and smoking was high among the participants. Adjustment for educational level and age

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Long-term exposure symptoms:

More prevalent in farmers than controls

No clear relationships with spraying insecticides or IPM training

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Conclusions

Our results suggest that occupational insecticide exposure has a negative impact on the health of farmers in Uda Walawe:

* acute poisoning
* depressed cholinesterase levels
* increased acute symptom prevalence

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* Protective clothing was not applied (hot climate, ignorance, expensive…)
  disputable whether it is effective!
* IPM demonstrations lead to less insecticide use, less acetylcholinesterase inhibition and lower acute symptom prevalence.
* More intensive training: more reduction of insecticide use -> impact on farmers' health?

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Pesticide Legislation Policy

G.K. Manuweera
Registrar of Pesticides

Pesticide Legislation Policy

Gamini Manuweera

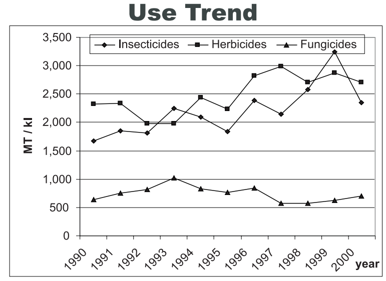
Status Summary

- Pesticides are indiscriminately used
- Farmers are not concerned about health hazards
- Consumers are often misinformed
- Nonfactual statements and biased speculations
- Lack of basic technical data

Today's Situation in Brief

- Persistent chemicals are prohibited
  - Chlorinated hydrocarbon
- Highly hazardous products are not in use
  - WHO class Ia and Ib
- Safer pesticides are promoted (IGR, WG, and SC)
- Quality standards are monitored
- Carbamate, OP and SP are popular

Use Trend



Regulatory Status

Related Govt. Policies

- Establishment of legal provisions on
  - *regulation of pesticides*
  - *environmental contamination*
  - *tariff control*
  - *Worker safety at factory level*
- Conformation to International standards and protocols
- Enforcement of PIC and other conventions
- Highest priority on IPM

Control of Pesticides Act

- Regulation of
  Import, Formulate, Repack, Labeling, Storage, Transport, Sale, Use of treated crop
- Registration of Pesticides
- Technical Advisory Committee
- Officers for field enforcement
- Certification of Dealers

Objectives of Regulation

- Assurance of Health safety
- Minimum Environment Pollution
- Product quality assurance

Policy Decisions

Multi-disciplinary Technical Advisory Committee

Health, Environment, Quality, Agricultural, Legal

- Banning, Rejection, Use restrictions
- Consumer protection
- Control of import
- Determination of end-users
- Prescription of use, handling and storage
- Regulation of distribution

Technical Aspects

- Potential health effects
  * Occupational
  * Accidental/indirect/intentional
  * Food residue
- Environmental issues/residue
- Product quality
- Pest control
  resistance/resurgence

Regulation Criteria

- Chemical control only if there is strong justification
- Only those compatible with Govt. polices (IPM)
- Product should conform to FAO standards
- Risk assessment on WHO Hazard classification
- Reports on internationally accepted protocols (OECD)
- Evaluation of company profile and available facilities for newcomers
- No “me too” registration

- Registration status in other countries
- Advertisements should conform to the laws
- Only in approved containers (size and type)
- Bio-efficacy approval from respective authorities (vet, CDDC, TRI, etc.)
- Registration valid for three years

Banning and Prohibitions

Pesticide	Local Regulatory Decision
EDB	No history of use
Dichloropropane	Banned in 1990
2,4,5-T	Banned in 1984
aldicarb	De-registered in 1990
aldrin	All crop uses prohibited in 1986
Arsenics	Banned for Agricultural use in 1988
Binapacryl	No history of use
bromacil	No history of use

captafol	Banned in 1989
chlordane	Banned in 1996
chlordimeform	Withdrawn from the market prior to 1980
chlorobenzilate	No history of use
DDT	Banned for agri. in ‘70/ vector control in ‘76
DBCP	No history of use
dieldrin	Agricultural uses prohibited prior to 1980
dinoseb	No history of use
endrin	Prohibited prior to 1970
ethyl parathion	Banned in 1984
ethylene dichloride	No history of use as a pesticide
ethylene oxide	No history of use
fluoroacetamide	No history of use
HCH	Banned in 1987
heptachlor	Banned in 1988
HCB	No history of use

Leptophos	Banned in 1988
lindane	All crop uses prohibited in 1986
mercury cpds	Banned in 1987 from agricultural use
methamidophos	Banned in 1995
maleic hydrazide	No history of use
methyl parathion	Banned in 1984
mirex	No history of use
Monocrotophos	Severely restricted from use in 1995
pentachlorophenol	Withdrawn from the market in 1994
Phosphamidon	Withdrawn from the market
quintozene (PCNB)	Banned in 1990
thalium sulphate	Withdrawn from the market prior to 1980
toxaphene (camphechlor)	No history of use

Vector Control

- Legal Restrictions in Malaria Vector Control
  - Products should be recommended by AMC
  - Prohibition or restriction on other uses
    - Banning of malathion and fenitrothiion for agriculture
    - Area restriction on public health uses
  - Direct imports and exclusive supply
    - Conformation to all regulatory requirements

Process of Control

Registration of Products

- Risk/Benefit analysis
  - Product specific technical data
    - toxicology, chemistry, physical properties, etc.
  - Micro and macro economic situations
  - Social and cultural aspects
  - Political aspects

Field Monitoring

Laboratory Testing

Field enforcement

- Authorized officers at field level
- Enforcement officers as a supporting staff
- Dealer certification on training and facilities at outlet
- Prescribed format for stock books and sales receipts
- Prohibition of purchase by children

Regulation on Imports

- Only registered pesticides can be imported
- Pesticides are classified under License in the Customs ordinance
- License Issued by the Controller of Imports only on written approval by the Registrar
- The registrant should apply for import according to a prescribed format
- Limited trail quantities are allowed (10 l/kg)

TRADE NAME

Common name + Strength (g/l or %)

- **USE RECOMMENDATIONS**
  (Crop and pest)
- **DIRECTION OF USE**
  Dilution and rate of application
- **HANDLING PRECAUTIONS**
- **PREHARVEST INTERVAL**
- **FIRST AID**
- **ANTIDOTE**
  and Tel. no. of the Poison Info. Centre
- **NAME AND ADDRESS OF THE REGISTRANT**
- **LEGAL MANDATE *"REGISTERED"***

Colour band and hazard symbols

Colour Bands

RED

EXTREMELY/HIGHLY HAZARDOUS

YELLOW

MODERATELY HAZARDOUS

BLUE

SLIGHLTY HAZARDOUS

GREEN **Or** BLACK

UNLIKELY TO PRESENT ACUTE HAZARD

Other requirements…

- Minimum font size (6 point)
- The full text in both Sinhala and Tamil
- Identity and safety – mandatory in English
- Word "RESTRICTED" across the label

Containers

- Only in approved pack sizes
- Type of container according to the chemical
- Word "POISON" embossed
- "Do not re-use" printed
- Bulk packs for Estate Sector

Challenges

- Work with the available resources
- Technology versus Traditions versus Economy
- Quality assurance of commodity products
- Adulteration at field level
- Control at retail level
- Farmer attitude

Pesticide Industry Initiatives and Safe Use Policy

Upali Gangoda
Sri Lanka Crop Protection Association/Haychem

Since agricultural land is finite, the ever growing world population which is expected to double by year 2020 requires improved agricultural productivity per unit area to meet its needs for food and fibre.

As the population increases the area of cultivatable land decreases:

Year	Area per person
1965	4,000 m^2
1980	3,000 m^2
1988	2,700 m^2
2020	1,600 m^2

In order to increase productivity the following measures should be undertaken:

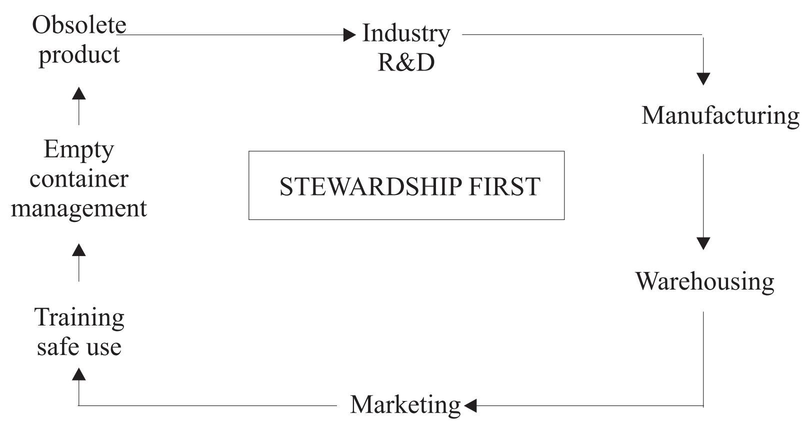
1. Use of high yielding varieties
2. Use of crop protection products (CPP)

These tools are critical to prevent new land from being cultivated and to avoid the accompanying loss of wild life habitat.

In the meantime, Research and Development (R & D) companies are aiming at developing chemicals, which are more eco-friendly. These have the following priorities:

- Target specific
- Breaks down rapidly
- Low dosage rates
- Very low toxicity to mammals
- New chemistry

New CP products require 10 to 12 years R & D before they come to the market. Out of 2,000 new compounds tested only one reaches the market. A new CP product costs US$150 million for toxicological studies and regulatory approval. Since no R & D work is undertaken in Sri Lanka, the companies marketing agrochemicals are into stewardship in order to protect the user, consumer and the environment from adverse effects.



The SLCPA main objective is to ensure CPP are used effectively and in the correct manner. Our target groups for such safe use projects are:

- Schoolchildren
- Farmers
- Agrochemical dealers
- School of Agriculture / university students
- Agricultural Department staff / P.H.I.
- Train the trainers

Other activities conducted by the association are:

- Quiz programs which are televised
- Publication of posters / booklets
- Free issue of safety equipment

Annually we target to train:

- 1,000 schoolchildren (directly)
- 20,000 farmers (directly)
- 150 agro dealers

Through mass media:

- 50,000 – 100,000 farmers
- 500 School of Agriculture students / undergraduates
- 100 Department staff

PESTICIDE INDUSTRY INIATIVES / SAFE USE POLICY

UPALI GANGODA
CHAIRMAN , SAFE USE COMMITTEE

SRI LANKA CROP PROTECTION ASSOCIATION

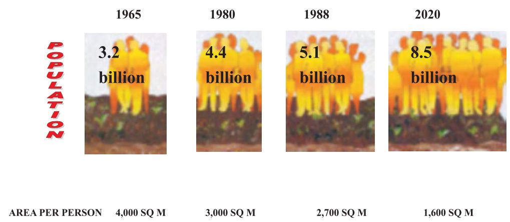
WORKSHOP ON PESTICIDES: HEALTH IMPACTS AND ALTERNATIVES

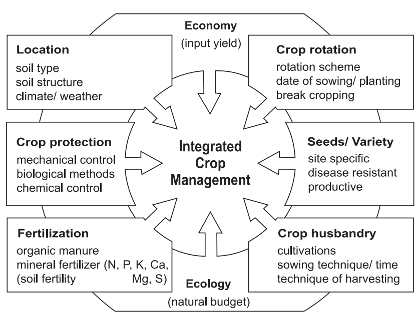
24 JANUARY, 2002

COLOMBO HILTON

SRI LANKA

AS THE WORLD POPULATION INCREASES, THE AREA OF CULTIVATED LAND PER PERSON DECREASES





Yield losses around the world due to plant diseases, pests and weeds

	Possible production	Actual production	Loss
Africa	100	50.7	49.3
Latin America	100	57.2	42.8
Asia	100	52.6	47.4
Europe	100	71.8	28.2

Pesticides cannot prevent all crop losses, but the picture would be a great deal bleaker in their absence

Integrated Pest Management: An Alternative to High-input Agriculture

Henk van den Berg
FAO Program for Community IPM in Asia

Background

Rice production in Asia increased rapidly with the introduction of high-yielding rice varieties in the 1970s. Countries, which had previously imported rice, became self-sufficient in the 1980s. Invariably, the introduced technology, which was transferred through top-down extension systems, relied heavily on subsidised external inputs of fertilizers and pesticides. Pesticides were used together with fertilizers as packaged technologies for blanket application, and the farmers became more dependent on external messages and technologies.

The high production level could not be maintained, however, because many countries suffered serious outbreaks of the rice brown planthopper pest and the rice stemborer pest, which caused crop failures. Contemporary research demonstrated that broad-spectrum insecticides that killed natural enemies and thus disrupted the natural balance in unsprayed rice fields caused these outbreaks.

To reverse the erroneous extension messages of the green revolution, an entirely different approach was initiated to educate field staff and farmers on the ecology of the rice crop in order to make more sound decisions on crop health management. The initiative aimed at training farmers to discover the actual role of pesticides in rice production, and to understand how to grow a healthy crop, instead of relying on blanket extension messages. This training was given in so-called Farmer Field Schools. Farmers participating in the training program reduced considerably the application of pesticides on their crops, but the yields remained the same or improved in some instances.

The Farmer Field School

The farmer field school (FFS) evolved from the concept that optimal learning derives from experience—in the case of farmers through observations in the field. It gives groups of farmers the opportunity to learn about their crop through season-long field observations and exercises. It is an integration of two vital components: nonformal education and crop ecology.

Generally, adults learn best through practical methods closely related to their own day-to-day situation. Moreover, adults learn best by experiencing, by finding out for themselves. Having observed or experienced something directly is more convincing than receiving the information from someone else. Observing the relationships between organisms in a crop or studying the effect of damage on yield will provide farmers with direct experience, which is not easily forgotten and can be integrated into their farming methods. The field school curriculum is hands-on, field-oriented and puts the learner in control of her/his own learning.

There are four principles on IPM in a field school. (i) Grow a healthy crop, (ii) Observe the field regularly, (iii) Conserve natural enemies, and (iv) Farmers become experts in their own fields. In the course of the field school, a fifth principle can usually be added i.e. farmers work together as a group.

A farmer field school is conducted from the time of planting until harvest. The farmer group does weekly field observations of their rice crop (a local practice and an IPM plot) in order to closely monitor the development of the crop and the condition of pests, diseases, microclimate and weeds. By conducting these observations, farmers learn that growing rice is not just about inputs and outputs, but that they are dealing with an agro-ecosystem with various interdependent components. If the role of natural enemies or microclimate is not recognized, for example, it may cause farmers to make poor management decisions for their crops. Only by learning to understand the interrelationships in the crop ecosystem can farmers make better decisions.

It is imperative that farmers make their own decisions on crop management. Attempts to transfer decision tools or rules to farmers not only put farmers at the receiving end, but are also technically ineffective. Blanket recommendations or messages do not deal sufficiently with the issue of on-farm variability. The extent of variation between locations (e.g., depending on the planting history, closeness to an irrigation canal) and fluctuations over time is such that decision making is best done per farm at regular intervals.

Field school activities are conducted in groups, which stimulates farmers to learn from each other, to discuss and defend their viewpoints and, perhaps more importantly, to strengthen cooperative action between farmers. Strong group activities are important where management decisions in one field may influence neighboring fields. Furthermore, working in groups is the first step towards communitive action. Special group dynamic exercises conducted at FFS sessions further help strengthen group activities.

The role of the facilitator is not to teach but to provide the opportunities under which the participants can learn to allow the farmers to find out from first-hand experience. The trainer does not deliver lectures but introduces an activity, explains the process and sets the farmers to work. His role is to get the participants to find out by themselves; every short-cut to the learning process is seen as a missed opportunity. During the group presentations, the facilitator fills in with questions rather than solutions. The role of the facilitator demands confidence and skills. Facilitation methods are a major aspect of the training-of-trainers. Without this intensive training-of-trainers, the farmer field school would probably revert back to the situation of lectures and field demonstrations.

A farmer field school has 15–30 farmer participants who meet in the field for 4–5 hours every week from planting until harvest of the crop. Two treatment plots are established to compare the farmer practice with the IPM practice. The weekly curriculum typically consists of an activity called "agro-ecosystem analysis," followed by a "group dynamics" exercise and a "special topics" exercise.

In the activity on agro-ecosystem analysis, farmers learn to observe the condition of their crop, to analyse their observations, and to present their findings to others in the group. The farmers divide into small groups of 4–6 farmers. Each group observes 10 rice hills per plot. They record the growth stage, plant condition, damage symptoms, weather condition, insects, spiders, diseases and weeds.

On large sheets of newsprint paper, the groups draw the plant condition, the climate, weeds, soil conditions, and the complex of pests and natural enemies. Observations on plant damage, insect feeding behaviour and predation are used to understand the relationships. A comprehensive evaluation of the condition of the crop, and measures thought necessary is added to the drawing. Each group presents its findings for discussion with the other groups. External sources of information are only consulted after the discussion has taken place. Finally, a consensus is reached on the management practices in the IPM plot during the coming week.

Group dynamics exercises are meant to maintain motivation and strengthen group cohesion. Moreover, these exercises deal with problem solving, communication, leadership and team building and, therefore, help farmers to develop their organizational skills.

Finally, exercises on special topics are a technical part of the curriculum, which are linked to the growth stage of the crop or selected according to local problems. It emphasises certain aspects of the plant or agro-ecosystem to support the farmers in their agro-ecosystem analysis to make better decisions. Special topics cover a range of issues including crop physiology, field ecology, food webs, life cycles, rat management, health and safety, fertilizers, water management, weed management and economic analysis.

In addition to comparing the Farmer Practice versus IPM treatment, two types of supporting studies are conducted in a farmer field school. First, in order to learn about the strong ability of the rice plant to compensate for insect attack, a study is usually conducted on the simulation of the stemborer pest attack or the leaffeeding pest attack on rice. This is done by clipping rice tillers, or rice leaves, in marked 1 m^2 plots; plots with different levels of de-tillering or defoliation or with different times of de-tillering are compared with the control. Plant growth and yield are observed in each plot. The results aid in making better crop management decisions.

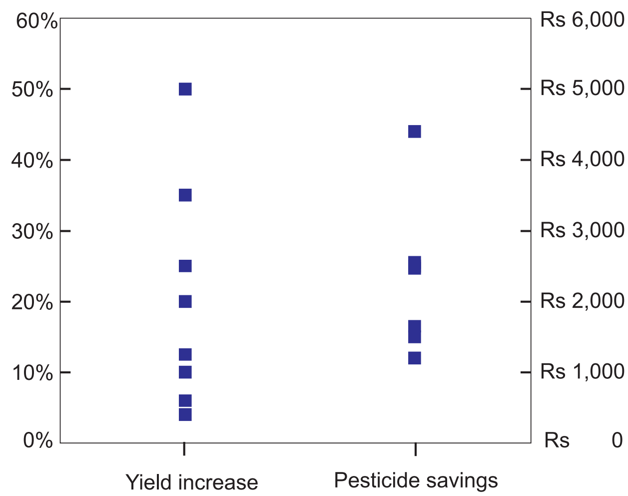
Second, in order to learn about the behavior, function or development of insects and spiders, farmers conduct various “insect zoo” studies. Insect zoos are little cups or cages with insects subjected to study by the farmers. The results from their observations help farmers to make more sense of their agro-ecosystem analysis.

Follow-up Activities

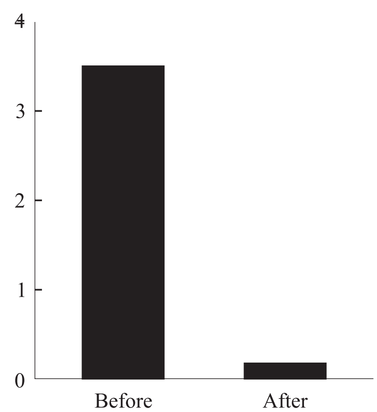
The farmer field school provides a basic training on how to manage a crop-ecosystem and how to work together as a group of farmers. Because the training increases farmers’ skills to study, organize and plan, it often provides a strong impetus for further development. Field school graduates are often compelled to do further activities, such as addressing the problems within their farming communities, conducting experiments on specific issues, or carrying out educational activities for other farmers.

The IPM Program has provided follow-up training activities to address these needs. The activities helped farmers to further adapt their acquired knowledge according to the circumstances in their own communities, and to understand their situation better to prioritize actions by which it can be improved. The follow-up training helps in strengthening farmer group activities, experimentation and networking at the village and subdistrict level. After a farmer field school, farmers often form IPM clubs or networks. In addition, selected farmers who graduated from field schools were given additional training to become trainers themselves and conduct their own farmer field schools; currently, more field schools in the region are being conducted by farmers than by trainers. Hence, farmers are increasingly taking ownership of Community IPM activities in their own areas, and a gradual transition is taking place from “farmer as recipient of technology” via “farmer as IPM expert” to “farmer as implementor of community-based IPM activities”. Self-mobilizing IPM programs that are run by farmers, not by program staff, and supported by local authorities are already found in several countries in Asia.

The impact of IPM, according to farmers, includes personal, social, economic and environmental benefits. Most notably, cooperation among farmers improves after the FFS. Besides IPM in rice-based cropping systems, FAO is currently also conducting Regional IPM programs in vegetables and cotton.



Average yield increase and savings on pesticide inputs (per acre). Each data point represents a separate district. 2001.



Average insecticide applications before and after the FFS. 1999

On large sheets of newsprint paper, the groups draw the plant condition, the climate, weeds, soil conditions, and the complex of pests and natural enemies

Farmers learn to observe the condition of their crop

INTEGRATED PEST MANAGEMENT (IPM)

IPM, AN ESSENTIAL PART OF ICM, IS A DYNAMIC SITE-SPECIFIC STRATEGY FOR MANAGING INSECTS, WEEDS, DISEASE AND OTHER PESTS IN THE MOST COST-EFFECTIVE, ENVIRONMENTALLY SOUND AND SOCIALLY ACCEPTABLE WAY.

MECHANICAL

BIOLOGICAL

CHEMICAL

SRI LANKA CROP PROTECTION ASSOCIATION (SLCPA)

INDUSTRY INITIATIVES / SAFE USE POLICY

Promotion of

Safe, Effective and

Environmentally responsible

handling of pesticides

Safe, Effective and Environmentally responsible handling of pesticides

Legislation

New Products

Improved application techniques

More targeted use with the aid of IPM

Changes in formulation

Training of farmers and dealers

Packaging

Development of modern Crop Protection products

Regular introduction of New Products

Efficacy
- High and Reliable biological activity
- High selectivity
- Rapid onset of action
- Subsequent distribution in the plant
- Optimal duration of action
- Good crop tolerance
- Low risk of resistance

User Friendliness
- Low rate of application
- Low acute toxicity
- Low toxicity of long-term exposure
- Safe packaging
- Long storage stability
- Good formulation properties

Development of modern Crop Protection products

Regular introduction of New Products

Environmental safety
- Low toxicity to beneficial organism
- Good environmental degradability
- Low soil mobility
- No significant residues in foodstuff and animal feeds

Economic viability
- Favorable cost / Benefit relationship for the user
- Suitability for use in IPM
- Broad range of application
- Innovative product characteristics
- Competitiveness
- Patentability

Safe, Effective and Environmentally responsible

handling of Plant Protection products

Changes in formulation

Development of improved formulations:

EW, WG, and FS

Improved application techniques

Introduction of improved Packaging

Safe, Effective and Environmentally responsible handling of Plant Protection products

Training of farmers, Dealers, Extension Officers and Schoolchildren

1991 -2001 trained approximately 750,000 target groups on safe use of pesticides

Safe, Effective and Environmentally responsible handling of Plant Protection products

Schoolchildren training programs
Radio and TV quiz programs

1992 -Anuradhapura / Nuwara
1994 - Mahaweli System B and C
2000 - Nuwara-Eliya and Badulla
2001 -Southern Province

Safe, Effective and Environmentally responsible handling of Plant Protection products

Training of Farmers, Dealers, Extension Officers and Schoolchildren

Distribution of training materials:

Safe use booklet - 22,500 nos
Safe use posters 107,500 nos

Distribution of protective clothing

Protective clothing kits - 3,050 nos

all the groups involved in agriculture
could only be achieved by a concerted effort of
responsible handling of pesticides
Safe, Effective and Environmentally

Project Overview: Managing Agrochemicals in Multiuse Aquatic Systems (MAMAS)

David Little and Graeme Taylor
Institute of Aquaculture, University of Stirling, U.K.

Currently, a major difficulty facing the establishment of sustainable management plans in complex environmental systems in the tropics, is the lack of sufficient relevant information on important ecological, hydrological and land-use processes that underpin the various values generated by natural resources. By applying baseline information from two study sites, this project aims to develop cost-effective tests and other environmental diagnostic tools that can ultimately be used in an Integrated Risk Assessment Model, leading to the development of policy guidelines for the management of agrochemical use in multiuse aquatic systems in Asian countries.

Specifically, this project will aim to –

- Ascertain desirable protection goals, and identify “reference” and “target” sites through a preliminary risk assessment. Realistic worst case scenarios and risk ranking of pesticides in terms of both environmental impact and human health criteria.
- Investigate the impact of specific land-management practices and seasonal factors on pesticide fate within the systems.
- Develop a battery of simple, cost-effective and relevant environmental diagnostic bioassays, which will be evaluated under field conditions.
- Disseminate bioassay techniques through preparation of standard operating procedures (in both English and local languages), and train local researchers through workshops.
- Through chemical analysis, and verification through established modelling methods, obtain information on the fate and distribution of agrochemicals within the systems.
- Study the effects of agrochemical contamination on aquatic organisms within the systems through ecotoxicity testing, which will be verified through duplication of tests in the laboratory and in-situ, and comparison of results to those obtained using physiological modelling.
- Use data gathered as inputs to develop a Decision Support System to evaluate local risks to target areas, and investigate the potential effectiveness of mitigation measures.
- Train local researchers in risk assessment and risk mitigation procedures.
- Derive policy guideline proposals for sustainable management of the agro-ecosystems, and for the administration of pesticides, utilizing a participatory approach to ensure such measures are both realistic and acceptable to end users.

MAMAS

- Managing Agrochemicals in Multiuse Aquatic Systems
- EC Inco Dev Research Project
- 1 January 2002-31 December 2004
- Three EU and two Asian countries

Managing Agrochemicals in Multiuse Aquatic Environments

Participation:

- University of Stirling (UOS), Scotland (Coordinators)
- National Aquatic Resources Research and Development Agency (NARA), Sri Lanka
- University of Peradeniya (UOP), Sri Lanka

Managing Agrochemicals in Multiuse Aquatic Environments

- Asian Institute of Technology (AIT), Thailand
- Kasetsart University (KASET), Thailand
- Alterra Green World Research, Wageningen Univesity and Research centre (ALTERRA), The Netherlands
- University of Aveiro, Portugal

Managing Agrochemicals in Multiuse Aquatic Environments

Specific Objectives

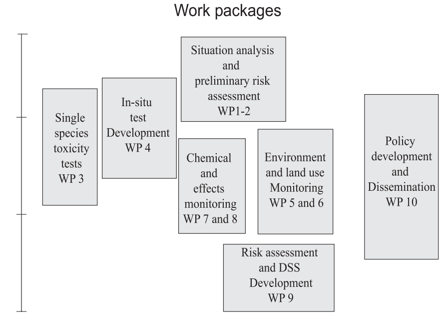
- Develop an improved understanding of a complex situation in an interdisciplinary way
- Perform a preliminary risk assessment
- Develop worst-case scenarios through modelling
- Identify desirable protection goals using criteria developed with stakeholders

Managing Agrochemicals in Multiuse Aquatic Environments

- Develop simple, cost-effective and locally relevant environmental bioassays
- Verify and validate bioassays and models in the lab and field
- Increasing capacity to understand the impacts of agrochemicals
- Develop an appropriate decision support system for local risks

Managing Agrochemicals in Multiuse Aquatic Environments

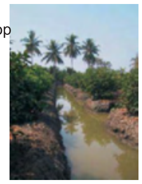
Work packages

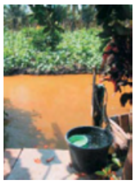


Managing Agrochemicals in Multiuse Aquatic Environments

Thai Sites

1. Monoculture crop
   - industrial scale
   - fish production
   - more stable





2. More crop diverse
   - heavy pesticide use
   - fish production
   - more dynamic

Managing Agrochemicals in Multiuse Aquatic Environments

Sri Lanka sites

Kalankuttiya-Meegelawa tanks as a focus

- Rice (Maha) chilli/onion (yala)
- Drainage tanks, active fishing

Managing Agrochemicals in Multiuse Aquatic Environments

Risk

- Environmental
- Economic
- Health

Additional activities
- Interactions between risks
- Ranking of importance

Managing Agrochemicals in Multiuse Aquatic Environments

Environmental Risks

- Fish infarming systems and aquaculture
- Biodiversity,Ecosystem sustainability and function

Economic Risks

- Risk of fish death in aquaculture
- Reduced productivity, leading to poorer livelihood outcomes
- Lower value, or perceived value, of products affected by pesticides (high value domestic and export markets)

Managing Agrochemicals in Multiuse Aquatic Environments

Health Risks

- Drinking water
- Eating fish
- Occupational?

Managing Agrochemicals in Multiuse Aquatic Environments

A Minimum Pesticides List

Michael Eddleston
Centre for Tropical Medicine, University of Oxford, U.K., and
Department of Clinical Medicine, University of Colombo, Sri Lanka

Hundreds of active pesticide ingredients and tens of thousands of formulations are used worldwide for the control of agricultural pests and disease-carrying vectors (Farm chemicals handbook '99 1999). 1.5 million tons are manufactured and distributed each year, producing business worth close to 30 billion US dollars (Wood McKenzie's agrochemical service 2001). However, the majority of pesticides are toxic to humans and the environment, the World Health Organization classifying their toxicity from Class Ia (extremely hazardous) to Class III (slightly hazardous) and then "active ingredients unlikely to present acute hazard" (WHO 2001a). Most Class I technical grade pesticides are banned or used for only limited purposes in the highly regulated industrialized world. This is not the case in the developing world where Class I pesticides are often freely available in an environment in which resources are not available for their safe use (Bull 1982).

In some parts of the developing world, pesticide poisoning causes more deaths than infectious diseases. Of the 600,000 deaths that result from self-harm in the developing world each year (Murray and Lopez 1996), the WHO estimates that 200,000 are due to poisoning with pesticides (WHO 1990)— the easy availability of highly toxic pesticides in rural communities has made them a popular and lethal method of self-harm. Pesticide use and storage is also poorly regulated and frequently dangerous—numerous accidental poisonings occur each year following exposure at home or work (Bull 1982).

A further problem with uncontrolled pesticide use is the induction of pest-resistance. Studies have shown that intense pesticide use to kill resistant pests induces more pest-resistance until further increases in pesticide use actually reduce agricultural yield (Bull 1982). This effect has resulted in the complete loss of crops from particular regions of the world—e.g., the reliance on increasing doses of chemical pesticides in Nicaragua induced multi-pesticide-resistant bollworm pest and white fly pest that destroyed the cotton crop (Murray 1994).

Governments and agricultural workers have responded by encouraging integrated pest management (IPM) systems. IPM encourages the use of fewer pesticide applications together with older more environmentally friendly methods of pest control (Murray 1994). The most toxic pesticides and those with greatest local resistance are identified; their use is then restricted and a regimen of decreased applications implemented in order to protect natural enemies of the pests. This results in reduced pesticide use, increased productivity and profitability, and fewer deaths from poisoning. The Global IPM Facility of the Food and Agriculture Organization (FAO) is now developing the *Integrated Pest and Plant Management-2015* project which aims to promote IPM on a global scale by 2015.

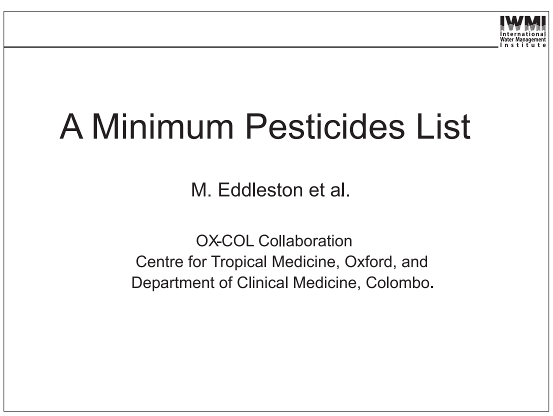
In 1985, following much debate about the harmful effects of pesticides on human health and environment, the FAO produced a voluntary Code of Conduct for the pesticide industry in an attempt to limit the harmful effects of pesticides on humans and the environment (FAO 1990). However, deaths continue today and the problem gets worse. Thousands of pesticide preparations are available in an uncontrolled fashion—over 100 different preparations were being used by just 300 farmers around the Sri Lankan town of Embilipitiya during 1999–2000 (L Smit in preparation). Pesticides can be bought from local food shops, often decanted cheaply into unlabelled bottles (Van der Hoek 1998). Their use is strongly promoted to farmers without educating the farmer on how to use them correctly. Successful promotion and past short-term benefits have entrenched the belief in farmers, that pesticides should be used at frequent intervals throughout the year, often on a calendar basis without regard to the presence or absence of specific pests. A lack of government resources in the developing world prevents the code from being effective.

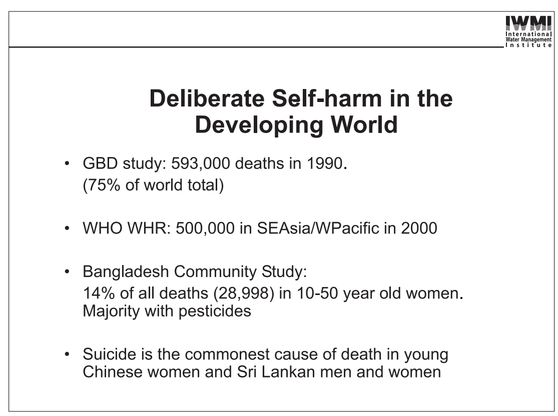
The World Health Organization (WHO) has recommended that access to highly toxic pesticides be restricted (WHO 2001b); where this has been done for paraquat and parathion, total suicide rates have fallen. Perhaps this approach can be extended, using the WHO's Essential Drugs List as a model? Since the List was established in 1977, the purchase, distribution, and use of a limited number of "essential" drugs have rationalized drug use in many developing countries (WHO 2000).

An analogous Minimum Pesticides List could be produced using explicit, transparent, evidence-based methods. It would identify a restricted number of relatively less dangerous pesticides to do specific tasks within the context of an integrated pest management system. A template containing examples plus expert opinion and evidence would then be applied at the country level to create an area specific Minimum Pesticide List with a sense of local ownership. Implementation at the local level would be tailored to local needs and problems (e.g., particular soil conditions or a major self-poisoning problem with a particular pesticide).

The Model List would not be prescriptive but advisory, giving under-resourced governments basic information that should allow them to determine which pesticides are currently useful for their agricultural needs. Unbiased assessment and comparison of pesticides, using an explicit and transparent evidence-based approach, would supply an enormously useful tool for both governments and small-scale farmers.

The ultimate public health and environmental aim must be to reduce the use of chemical pesticides to a minimum. In the meantime, development of a Minimum Pesticides List might encourage the use of safer pesticides. Such a switch should reduce the death rate from poisoning in the developing world just as the switch from barbiturates to benzodiazepines has already reduced the number of deaths from poisoning with medicines.





Are pesticides responsible for these deaths?

Area	Date	Source	Deaths	Poison (pest)	Physical
Matlab	76-86	Community	56	70% (ng)	30%
Jaffna	80-89	Coroner's records	612	82% (71)	17%
Jaffna	84	Hospital	22	95% (55)	5%
Colombo	85	Coroner's records	157	61% (53)	33%
Galle	?85	Judicial inquest	223	82% (73)	19%

Anuradhapura		Hospital	213	100% (85)	n/a

Problems with Pesticides and Solutions

- Bull (Oxfam) 1982-reported immense scale of environmental, occupational, and deliberate poisoning.
- FAO 1985-developed a *Code of Conduct* pesticide industry. Its stated aim was to establish:
- "...Voluntary standards of conduct for public and private entities engaged in or affecting the distribution and use of pesticides, particularly where there is no or inadequate national law to regulate pesticides (Article 1.1).

"pesticides whose handling and application require the use of uncomfortable and expensive protective clothing and equipment should be avoided, especially in the case of small-scale users in tropical climates" (Article 3.5).

National governments were called upon to:

"Allocate high priority and adequate resources to the task of effectively managing the availability, distribution and use of pesticides in their countries" (Article 3.7).

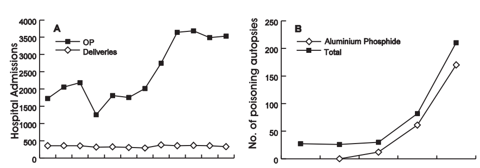
They were noted to have overall responsibility for regulating the distribution and use of pesticides (Article 3.1).

Introduction to the Code by the FAO Director:

In the absence of effective pesticide registration processes and of a governmental infrastructure for controlling the availability of pesticides, some countries importing pesticides must heavily rely on the pesticide industry to promote the safe and proper distribution and use of pesticides. In these circumstances, foreign manufacturers, exporters and importers … must accept a share of the responsibility for safety and efficiency in distribution and use

CropLife *Safe Use Initiative*
IPM Facility: *Integrated Pest and Plant Managemen-2015*

The pesticide problem now



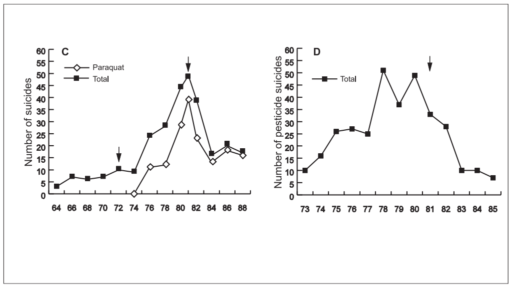
The WHO's approach

WHO recommends "restroctomg access to common methods of suicide" (WHR 2001).

Successful examples:

- *Samoa* and Paraquat
  (50/100,00 cases in 1982 to 15/100,000 cases in 1984)
- *Rosario, Argentina, and parathion*
  (16 deaths in 90-95 to 4 deaths in 96-99)
- *Jordan* and parathion
  (58 poisoning autopsies in 1978 to 10 in 1984)

Reduction of deaths with restricting availability of pesticides



The WHO' s Essential Drugs List

- Developed in 1977 to encourage the rational use of pharmaceutica

  "the use of the appropriate drug at the right time in the correct dosage for the correct length of time, at a price that the popul could afford".

- The Model List today contains more than 300 pharmaceuticals that should satisfy the health needs of the majority of the people fo majority of the time.

- Where it has been adopted, it has led to better supply of import drugs, more rational prescribing, lower costs, and easier qualit assurance, procurement, storage, distribution and dispensing

Could the EDL act as a model for producing a Minimum Pesticides List?

- The current situation with pesticides has some similarities to that of pharmaceuticals in the 1970s.
- Hundreds of active ingredients and thousands of formulations are available and promoted by both manufacturer and distributor as being essential for crop production.
- Rational use with so many pesticides is difficult.

  Since many argue that no pesticide is everywhere 'essential', the list would be a model Minimum, rather than Essential, Pesticide List.

Tasks in producing a Minimum Pesticides List

- Identify minimum use of pesticides within an integrated pest management system.
- Tabulate active pesticide ingredients according to comparative efficacy, safety, convenience, and cost.
- Apply a template containing examples plus expert opinion and evidence at the country level to create an area specific MPL with a sense of local ownership.
- List second line pesticides to deal with local problems of pest resistance.

The Model List would be advisory, giving under resourced governments basic information that should allow them to determine which pesticides are currently useful for their agricultural needs.

Possible advantages of a MPL

- Unbiased assessment and comparison.
- Active registration process, with subsequent reduction in number of pesticides.
- Easier medical management.
- Easier government regulation.
- Removal of most dangerous pesticides from practice.

Needs
- To be introduced alongside IPM practices.
- Requires strategies for controlling pesticide use e.g., prescriptions?

Discussion

The discussion following the presentations focused mainly on strategies to reduce deliberate and occupational pesticide poisoning. A central question was whether more research is needed or whether we already know enough to implement effective measures to reduce pesticide poisoning cases and deaths. The Director of the National Poisons Information Centre made an appeal to stop doing research and instead make the necessary resources available to save the lives of patients. The need for more resources for treatment, enforcement of legislation and implementation of IPM was acknowledged, but others felt that there are still many unanswered questions for which research is needed. We should prioritize research, avoid duplication, and the research has to point out which interventions are successful to reduce mortality and morbidity caused by pesticide poisoning. A few speakers argued for a more clear emphasis on translating research into action and policy changes. There is clearly a need to improve case management, but even here there is a need for more research.

An important question to address is whether reducing availability of pesticides within a household will reduce the incidence of suicide. It was mentioned that suicide is more a cultural problem than a pesticides problem and should be dealt with accordingly. However, usually removing easily available self-harm methods has an impact, so efforts should be targeted on restricting availability as well. A Minimum Pesticides List could help to restrict the availability of the most toxic pesticides. Some highly toxic pesticides have already been banned: the Registrar of Pesticides has banned all Ia and Ib pesticides (pesticides classified by WHO as extremely hazardous and highly hazardous). It would be interesting to see whether these restrictions in the past had an effect on the number of deaths from deliberate self-harm. There is a need at the moment to ban some other pesticides such as Paraquat, which are notorious for causing fatal poisonings. Some queried the effectiveness of banning certain pesticides. For example, the Board of Investment (BOI) can bypass the Registrar of Pesticides and allow new companies to use certain banned pesticides.

To reduce occupational pesticide poisoning both “safe use” and “risk reduction” strategies and Integrated Pest Management (IPM) were discussed. A major problem appears that farmers are aware of health hazards but don’t take action to protect themselves adequately. A large amount of pesticides is used in the public health sector (Anti Malaria Campaign) as well. AMC spraymen don’t like to use gloves and other protective gear, which they consider as impractical clothing. And even after fining them for not wearing their protective gear some still continue to show some reluctance in using them. AMC spraymen, however, are stimulated to wear protective clothing and are provided with it, whereas individual farmers don’t have any incentive to use protective gear. Protective kits made of cotton were distributed free of charge among 1,000 farmers in Mahaweli H, but none of them was seen using it. Some research was done to develop protective gear applicable to tropical conditions. Another problem for smallholders is that they need to hire spraying equipment on a daily basis, which makes them exceed thresholds for spraying.

Impacts of “safe use” strategies seem limited in countries with climatic conditions like Sri Lanka. Implementation of IPM would lead to less intensive pesticide use and may be a better way to protect farmers from adverse effects of pesticides. Successful IPM training would help to change farmers’ attitude towards pesticides and stop potentially irrational use of pesticides. In some parts of Sri Lanka farmers are trained to use IPM for rice, whereas IPM for vegetables is still in its infancy. It is important to train farmers in IPM for vegetables because pesticide input in vegetable cultivation is very high. One whole season is needed to give farmers adequate training.

More knowledge on other potential benefits of IPM such as reduction of suicide, environmental impacts and crop yield increase would be needed. It would also be interesting to get more knowledge on what the farmer community has to say about using pesticides. This might help to understand how the pesticide culture is linked to suicide culture. The difference between IPM and non-IPM farming families was studied in a case-control study by IWMI to determine risk factors of suicide in Uda Walawe. Unfortunately the number of families trained in IPM was too low to take into account in the analysis.

As for crop yield, it has been shown that IPM increases yield. Among farmers and the Department of Agriculture (DOA) confidence in IPM has to improve—the DOA wants to know for certain that IPM does not lead to decreasing crop yield. Although Sri Lanka has abolished all subsidies aimed at increasing use of agrochemicals in the agricultural sector, the top priority in agricultural policy is a quick increase in rice yields through high input farming methods. IPM is accepted as an appropriate pest management strategy but it still has a lower priority than yield increases because implementation of IPM takes a long time. More research could provide indisputable evidence of yield increases to stimulate implementation of IPM on a large scale.

Another important issue to address is the exposure risk for consumers of crops containing pesticide residues. There is a general lack of information on pesticide residues in food in Sri Lanka. The Office of the Registrar of Pesticides is doing a study on the presence of residues in crops. Consumers should know more about the potential hazards of pesticide residues in food. Consumer pressure could help to influence policy decisions to reduce agrochemical use in Sri Lanka.

The last discussion topic was the role of media in promoting or preventing pesticide use. There is a lack of attention in the media for communicating urgent aspects of IPM and organic farming. Media only show paid advertisements that promote the use of pesticides. Counter programs should be introduced to discourage and prevent the use of pesticides. And, if possible, ban all forms of advertising promoting agrochemicals on television.

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Mr. E. Weerapperuma	Sunday Observer Newspaper	

Part B. Resource Handbook on Pesticides in Sri Lanka

Relevant Organizations in Sri Lanka

AMC (Anti Malaria Campaign)

Contact person: Dr. W.P. Fernando, Director
Address: 555/5, Elvitigala Mawatha, Colombo 5
Tel.: 01-588408
Fax: 01-585360

CARE

Address: 134, Havelock Road, Colombo 5
Postal address: P.O. Box 1024, Colombo
Tel.: 01-500783
Fax: 01-587572
Website: http://www.care.org

CEA (Central Environmental Authority)

Address: 104, Robert Gunawardena Mawatha, Battaramulla
Website: http://www.ccom.lk/fem

CEC (Community Education Centre)

Contact person: Mrs. Anita Fernando
Address: 117, Palahene, Malabe
Tel.: 01-789459
E-mail: cec@lankanet.jca.apc.org

DOA (Department of Agriculture)

Contact person: Dr. L. Amerasinghe, Deputy Director, Plant Protection, Plant Protection Service
Postal Address: P.O. Box 22, Gannoruwa, Peradeniya
Tel.: 08-388316
Website: http://www.gov.lk/Agriculture/Agridept

Department of Labor

Dr. W. R. de Alwis, Commissioner of Labor (Occupational Health)
Address: 97 Jawatta Road, Colombo 5
Tel.: 01-588757, 01-581657
Fax: 01-582731
E-mail: sldohl@lanka.ccom.lk
Website: http://www.labour.gov.lk

Department of Labor, Division of Occupational Hygiene

The mission of the Division of Occupational Hygiene of the Department of Labor is to *"promote the health and safety of all workers in all occupations by controlling hazards present in the work environment and work process"*.

The functions of the division are to:

Provide an advisory service to control hazards and eliminate or minimize risks to health and safety; Perform environmental assessment such as measurement of heat, light, noise, dusts, chemicals in air and water;

Perform biological measurement such as heavy metals in biological samples, cholinesterase level, ventilatory function, and audiometry;

Conduct education and training programs such as safe use of chemicals and pesticides;

Provide information services on safety and health such as chemical safety data sheets;

Conduct and support research in related fields.

The division has a fully equipped library with a large collection of books and scientific journals related to occupational safety and health and environmental pollution. The laboratory has field measurement equipment, AAS, GLC and spectrophotometer. The staff consists of medical officers and scientific officers with post graduate qualifications in relevant fields and foreign training. Services of the division are provided statutorily and on request free of charge.

EFC (The Employers' Federation of Ceylon)

Contact person: G. Dassanayake, Director General
Address: 385 J 3, Old Kotte Road, Rajagiriya
Postal address: P.O. Box 858 Colombo
Tel.: 01-867966
Fax: 01-867942

FAO (Food and Agriculture Organization of the United Nations)

Contact persons: Henk van den Berg, IPM Scientific Officer & Coordinator for South Asia and Hector Senerath, National Expert; FAO IPM Project
Postal address: P.O. Box 22, Gannoruwa, Peradeniya
Tel.: 074-476155
Fax: 074-476155
E-mail: hvdberg@sltnet.lk, hecsen12@sltnet.lk
Website: http://www.communityipm.org

ILO (International Labor Organization)

Contact person: Ms. Claudia Coenjaerts, Representative to Sri Lanka
Address: 202 and 204, Bauddhaloka Mawatha, Colombo 7
Tel.: 01-500539
Fax: 01-500865
E-mail: colombo@ilocmb.un.lk
Website: http://www.ilo.org

Institute of Epidemiology

Contact person: Dr. P.A. Kulathilake
Address: 231, de Saram Place, Colombo 10
Tel.: 01-681548

IWMI (International Water Management Institute)

Contact persons: Dr. F.P. Amerasinghe, Theme Leader Water, Health and Environment and Ms. Lidwien Smit, Consultant
Address:127, Sunil Mawatha, Pelawatte, Battaramulla
Postal address: P.O. Box 2075, Colombo
Tel.: 01-787404, 01-784080
Fax: 01-786854
E-mail: F.Amerasinghe@cgiar.org, L.Smit@cgiar.org
Website: http://www.cgiar.org/iwmi/health/pesticide

Lanka Jatika Estate Workers' Association

Contact person: M.S.A.H. Mohideen, Administrative Secretary
Address: 60, Bandaranaikepura, Sri Jayewardenapura Mawatha, Welikada, Rajagiriya
Tel.: 01-865138
Fax.: 01-862262

Mahaweli Authority of Sri Lanka

Contact person: G.W. Liyanage, Director Agricultural Development
Address: 500, T.B. Jayah Mawatha, Colombo 10
Tel.: 01-691164
Fax: 01-695051
E-mail: palikalu@slt.lk
Website: http://www.mahaweli.org

Ministry of Agriculture and Livestock

Contact person: Mr. L.K. Hathurusinghe, Deputy Director
Address: 82, Rajamalwatta Road, Battaramulla

Ministry of Environment and Natural Resources

Contact person: Anura Jayathilake, Deputy Director
Address: Parisara Piyasa, 104, Robert Gunawardena Mawatha, Battaramulla
Tel.: 01-887453
E-mail: envpolmg@sltnet.lk
Website: http://www.ccom.lk/fem

Ministry of Health

Contact person: Dr. C.K. Shanmugarajah, Director Primary Health Care
Address: 357 Dean's Road, Colombo 10
Website: http://www.lk/health/ministry.html

NARA (National Aquatic Resources Research and Development Agency)

Contact person: Dr. N. Suresh Kumar, Environmental Studies Division
Address: Crow Island, Mattakuliya, Colombo 15
Tel.: 01-522000
Fax: 01-522881
E-mail: environstudies@yahoo.com
Website: http://www.nara.ac.lk

NPIC (National Poisons Information Centre)

Contact person: Prof. Ravindra Fernando, Head and Dr. W.D.A. Shantha de Silva
Address: National Hospital, Colombo 10
Tel.: 01-686142, 01-686143
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National Poisons Information Centre

The National Poisons Information Centre (NPIC) was established on the first of January 1988, with the assistance of the International Development Research Centre, Canada, under the Ministry of Health Services. Prof. Ravindra Fernando, Professor of Forensic Medicine and Toxicology, Faculty of Medicine, University of Colombo, established NPIC and is Head of the Centre since then. NPIC is a full member of the World Federation of the Association of Clinical Toxicology and Poison Control Centres which is an association affiliated to the World Health Organization. The Centre is located at the National Hospital of Sri Lanka, Colombo, adjoining the Medical Intensive Care Unit.

Activities of the Centre are to:

Maintain a database on all chemicals, pesticides and drugs used in Sri Lanka and also on poisonous plants and venomous snakes and other creatures in Sri Lanka;

Provide patient management advice to doctors and other health workers;
Provide general information on chemical safety and possible health hazards to public;
Facilitate in-service training to health staff on modern techniques of management of poisoning;
Conduct awareness programs on chemicals, pesticides, and drugs safety;
Conduct research;
Publish books, handouts, posters and leaflets on management, prevention and first-aid of poisoning;

Work in coordination with the following authorities:

- Department of Forensic Medicine and Toxicology, Faculty of Medicine, Colombo
- The Central Environmental Authority
- Occupational Health Division of Ministry of Labor
- Department of Government Analyst
- Sri Lanka Standard Institute
- Industrial Technology Institute (ITI)
- The Crop Protection Council of Sri Lanka (National association of pesticides manufacturers linked to the Global Crop Protection Federation)

Registrar of Pesticides

Contact persons: Dr. G.K. Manuweera, Registrar of Pesticides and Dr. L. Aponso, Assistant Registrar of Pesticides
Address: Office of the Registrar of Pesticides, 1056 Colombo – Kandy Road, Peradeniya
Postal address: P.O. Box 49, Peradeniya
Tel.: 08-388076, 08-388135
Fax: 08-388135
Email: pest@slt.lk, lalim@sltnet.lk
Website: http://www.gov.lk/Agriculture/Agridept/SCPP/opr_index.htm

SLCPA (Sri Lanka Crop Protection Association)

Contact person: Mr. Hiran S. Weerasekera, Chairman
Address: Harrison Chemical (Pvt) Ltd., 7 Braybrooke Place, Colombo 2
Tel.: 074-792644
Fax: 075-352741
Website: http://www.apcpa.org/SriLanka.htm

Sumithrayo Sri Lanka

Contact person: Mrs. Lakshmi Ratnayake
Address: 60/7, Horton Place, Colombo 7
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University of Colombo, Department of Clinical Medicine

Contact person: Prof. M. H. Rezvi Sheriff
Address: Faculty of Medicine, Kynsey Road, Colombo 8
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E-mail: rsheriff@emed.lk

University of Colombo, Department of Community Medicine

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University of Colombo, Department of Psychological Medicine

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http://www.cmb.ac.lk/academic/medi/dept/psymed/psymed.htm

University of Oxford, Centre for Tropical Medicine

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Email: d.c.little@stir.ac.uk, gjt1@stir.ac.uk, djb1@stir.ac.uk
Website: http://www.stir.ac.uk/Departments/NaturalSciences/Aquaculture/

WHO (World Health Organization)

Contact person: Dr. Kan Tun, WHO Representative
Address: 226 Bauddhaloka Mawatha, Colombo 7
Tel.: 01-502841, 01-502842, 01-502319
Fax: 502845
E-mail: wr@who.lanka.net
Website: http://www.who.int

Literature related to pesticides in Sri Lanka [Annotated]

Deliberate Self-poisoning

Berger, L.R. 1988. Suicides and pesticides in Sri Lanka. *Am J Public Health* 78: 826–8.

Chandrasena, R. 1981. A transcultural evaluation of “self-poisoning” in Sri Lanka. *Int J Soc Psychiatry* 27: 119–23. (Sixty-four self-poisoning patients in Kandy were compared with similar patients in Western countries. The survey revealed that the major cause self-poisoning among the patients in Western countries was inter-personal disputes and that in the case of Kandy it was disputes between patient and kin.)

De Silva, P. ed. 1989. *Suicide in Sri Lanka*. Kandy, Sri Lanka: Institute of Fundamental Studies. [Papers presented at an IFS workshop on suicide in Sri Lanka.]

De Silva, H.J,; N.Kasturiaratchi; S.L Seneviratne; D.C Senaratne; A. Molagoda: and N.S.Ellawala. 2000. Suicide in Sri Lanka: Points to ponder. *Ceylon Med J* 45: 17–24.

Eddleston, M.; M.H. Sheriff; and K. Hawton. 1998. Deliberate self-harm in Sri Lanka: An overlooked tragedy in the developing world. *British Medical Journal* 317: 133–5. (This paper discusses the importance of research to improve medical management of acute self-poisoning and to find ways of reducing deliberate self-harm.)

Ellawala, N. 1994. The Sumithrayo strategy for the reduction of suicide in Sri Lanka. *Crisis* 15: 53–4, 56.

Ganesvaran, T.; S. Subramaniam; and K.Mahadevan. 1984. Suicide in a northern town of Sri Lanka. *Acta Psychiatr Scand* 69: 420–5. (Suicide mortality in a northern town of Sri Lanka for the year 1982 is examined. The commonest method was self-poisoning by consuming agrochemicals and insecticides of organophosphorus type. Easy availability of these dangerous agrochemicals and rapid social and political changes appear to be of equal importance in producing this high rate of suicide.)

Hettiarachchi, J.; G.C. Kodithuwakku; and N.Chandrasiri. 1988. Suicide in southern Sri Lanka. *Med Sci Law* 28: 248–51.

Hettiarachchi, J.; and G.C. Kodithuwakku. 1989. Self-poisoning in Sri Lanka: Factors determining the choice of the poisoning agents. *Hum Toxicol* 8: 507–10. (A prospective study of 97 consecutive admissions following self-poisoning revealed that easy availability of the agrochemicals together with the lack of knowledge regarding their lethality were the main causative factors determining the choice of poisoning agents.)

Hettiarachchi, J.; and G.C. Kodituwakku. 1989. Self poisoning in Sri Lanka: Motivational aspects. *Int J Soc Psychiatry* 35: 204–8. (A study of motivational aspects of self-poisoning in 97 consecutive patients showed that the intention of suicide in them was not greater than those of the developed countries. Improving family relations may help in the prevention of self-poisoning. However the impulsive nature of the act might prove prevention a difficult task.)

Kearney, R.N; and B.D. Miller. 1985. The spiral of suicide and social change in Sri Lanka. *J Asian Stud* 45: 81–101.

Kearney, R.N.; and B.D. Miller. 1988. Suicide and internal migration in Sri Lanka. *J Asian Afr Stud* 23: 287–304.

La Vecchia, C.; F. Lucchini; and F.Levi . 1994. Worldwide trends in suicide mortality, 1955–1989. *Acta Psychiatr Scand* 90: 53–64. (Patterns and trends in suicide mortality for the period 1955–89 for 57 countries were analysed. Suicide rates were second highest for men and highest for women in Sri Lanka over the period 1985–1989.)

Lester, D. 1989. A regional analysis of suicide: The USA versus Sri Lanka. *Soc Psychiatry Psychiatr Epidemiol* 24: 143–5. (A regional analysis of suicide rates in the districts of Sri Lanka was carried out, and the results compared to an earlier regional analysis of suicide rates in the states of the USA.)

Marecek, J. 1998. Culture, gender, and suicidal behavior in Sri Lanka. *Suicide Life Threat Behav* 28: 69–81. (A study in which ordinary Sri Lankans were asked as to how they account for suicidal behavior and what practices they recommend to assist suicidal individuals to overcome it.)

Ratnayeke, L. 1996. Suicide and crisis intervention in rural communities in Sri Lanka. *Crisis* 17: 149–51, 154.

Senanayake, N.; and H. Peiris. 1995. Mortality due to poisoning in a developing agricultural country: Trends over 20 years. *Hum Exp Toxicol* 14: 808–11. (Mortality due to poisoning in the Kandy District showed an increasing trend during the 20 years, from 11.8 to 43 per 1,000 deaths, which paralleled the increase in suicide figures in the country.)

Somasundaram, D.J; and S. Rajadurai . 1995. War and suicide in northern Sri Lanka. *Acta Psychiatr Scand* 91: 1–4. (A study on the effect of war on the suicide rate in Jaffna town for the 10-year period from 1980 to 1989 is reported. It is hypothesised that war may function as an alternate to suicide. The use of agrochemicals for suicidal purposes declined during war, while alary seeds became more popular. The method chosen may reflect availability and cultural popularity.)

Occupational Poisoning

Botterweck, G. ed. 1988. *Use of pesticides and health hazards in the plantation sector*. Colombo, Sri Lanka: Friedrich-Ebert-Stiftung.

Chester, G.; G. Gurunathan; N.Jones; and B.H. Woollen. 1993. Occupational exposure of Sri Lankan tea plantation workers to paraquat. *Bull World Health Organ* 71: 625–32. (Absorption of the herbicide paraquat by mixer-loaders and spray operators on a Sri Lankan tea plantation was assessed over five consecutive days of spraying. Despite the evidence of dermal exposure, no paraquat was detected in the workers' urine.]

Dharmawardene, L.I. 1994. Pesticide poisoning among farmers in a health area in Sri Lanka. *Ceylon Med J* 39: 101–3. (This study aims to determine the incidence and the prevalence of pesticide poisoning among agricultural workers in the area of the Kelaniya Medical Officer of Health.)

Employers' Federation of Ceylon (EFC). 1998. *Occupational Safety and Health in the Tea Plantation Sector in Sri Lanka, 1996–1997*. ILO/EFC Plantation Safety and Health Monitoring Project 1997. (A compilation of Occupational Safety and Health information and accident data from 161 tea growing and manufacturing estates, including data on pesticide exposures.)

Gnanachandran, S.; and C. Sivayoganathan . 1989. Hazards associated with the spraying of pesticides to chilli and brinjal in the Jaffna district. *Trop Agric Res* 1: 132–41.

Goonetilleke, G. 1994. Agricultural accidents in north central Sri Lanka. *Ceylon Med J* 39: 25–9.

Herath, H.M.S.S.D.; and R. De Alwis Seneviratne . 1990. Pesticidal poisoning in Sri Lanka. In: *Occupational Health, an introductory course for health care workers, ed.* H.M.S.S.D. Herath. Colombo, Sri Lanka: Ministry of Health.

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