Symposium On
Risk Assessment Of Pesticide Residues
In Water And Food
October 28-29, 2003, New Delhi

Conclusions and Recommendations

A Symposium on Risk Assessment of Pesticide Residues in Water and Food was held in New Delhi on 28-29 October 2003. It was sponsored by ILSI-INDIA and ILSI-Risk Sciences Institute, and co-sponsored Indian Council of Medical Research and Industrial Toxicology Research Center. Over 200 delegates from academia, government and industry participated in the Symposium which was addressed by 33 renowned scientists from India and abroad. The Symposium was inaugurated by Shri. N T Shanmugam, Minister of State, Ministry of Food Processing Industries, Government of India.

There was increasing public concern about pesticide contamination in water, water based products and food. In this context it was necessary to have in-depth discussion on pesticides usage, pesticide residue standards, the regulatory system, capacity building and surveillance and monitoring mechanism.

The Symposium offered scientific inputs and national and international experiences in the context of which a proper risk assessment of pesticide residues contamination could be made and an effective control system involving farmers, industry and government could be brought into force and maintained over time to minimize risk and maximize safety consistent with cost.

Why Pesticides?

It was recognized that the use of pesticides is principally necessitated to reduce loss of food production in the agricultural sector. This loss from insect, weed and fungi infestation, in India, is estimated at 7 per cent in

respect of pulses and up to 25 per cent in respect of oilseeds. The total loss from infestation may amount to over Rs.300 billion a year.

The loss in production from infestation is controlled with the use of insecticides, herbicides and fungicides. Presently, 186 pesticides are registered with Central Insecticides Board though currently only 84 are actually in use in agriculture. Cotton consumes the maximum followed by rice and wheat. A substantial part of pesticides and other agricultural chemicals leach into and contaminate ground and surface water. The All India Network Project on Pesticide Residues of ICAR is expected to generate data which may help setting up standards and provide information to all concerned about the levels and safety of pesticide residues in food and water.

Apart from agriculture, pesticides have a major use in vector control. This also affects the regulation of pesticide residues in water and food.

A Question of Safety

Pesticide consumption in India is not excessive in comparison with other agricultural countries. Per hectare use is only about 440 gms. Many other countries use pesticides even more intensively. While pesticides use is necessary, there is concern on the part of the consumer about their health effects, since they may leave residues in food and water. Hence the regulatory system had to take into consideration:

- Acceptable daily intake (ADI) which is a level based on toxicological and related data. (The ADI sets a level of pesticide residues consumption expressed in mg / kg of body weight that can be consumed throughout the entire life span without adverse health effects).

- Maximum Residue Level (MRL) normally obtained from analysis of data from supervised field trials and related laboratory trials to establish a residue limit for a pesticide per crop.

The ADI sets out the criterion for health safety. The MRL is a limit for a residue of a pesticide on or in a particular raw agricultural commodity. MRLs have to be sufficiently low so that the total amount of residues of a pesticide in foods reaching the consumer does not exceed ADI or pollute the environment, while ensuring that the farmer, adopting good agricultural practices (GAP) gets adequate pest control.

All pesticides do not leave residues and all residues do not reach the consumer. The stipulated levels for ADI are many times lower than the "no observed effect level" (NOEL), since a safety factor of 100 is normally used. This margin also ensures that any short term accidental increase in pesticide residues does not cause health problems. To arrive at realistic estimation of residue consumption in comparison to ADI, food consumption data and related residue data are urgently needed.

Health Hazards

Pesticides can create serious health problems. Chronic effects include neurotoxicity, immunological effects, reproduction effects, developmental effects, carcinogenicity, etc, though these aspects are taken into consideration before the registration of the pesticides. The kind of problem depends on the variable toxicity of different pesticides, the way they enter the body through inhalation, ingestion or absorption through skin as also the frequency of exposure.

The health effect of pesticide residues is much less severe. Science based information about health risk is important to provide assurance to the public.

After the ban on DDT and HCH for agricultural use, their levels of residues in cereals, milk, etc. have significantly fallen. If the use of these persistent pesticides were eliminated in health vector control activities, residues in food and water would be further reduced in food and drinking water.

Limits for Residues

Most countries have imposed regulatory limits in the form of standards (which are enforceable) and guidelines (which are desirable levels) for different pesticides. These may be derived from scientific data based on the need to control problems in crop production, and take into account the limit and the toxic hazard or legislative enactment or both. The object is to minimize risk at reasonable cost.

There are no universally accepted standards. The most widely accepted and adopted safety limits are those set by the FAO / WHO, Joint Meeting on Pesticide Residues (JMPR) and the Codex Alimentarius Commission. JMPR recommendations have been developed using international peer reviewed data and taking into consideration occurrence, treatability, detectability and effect. A specific principle is the limits should not be lower than the analytical limits of quantification (LOQ) achievable in qualified laboratories under routine operating conditions.

In respect of water, for instance, the limit is arrived at considering body weight of 70 kg, consumption of 2 liters of water, with pesticide residues in water not exceeding 10 per cent of ADI. Further, the guidelines are subject to water being aesthetically pleasing without significant health risk. National and regional standards may differ depending on local conditions. Short term deviations do not mean that water is unsuitable for consumption and exceedances are only a signal for investigation.

A number of countries follow FAO / WHO guidelines. The methodology adopted, for example, in New Zealand, Australia, Canada is similar with some differences to suit local conditions. (for illustrative list of limits for different pesticides see Appendix)

The maximum contaminants levels (MCLs), in the US, take into account:

- taste and odour,
- treatment feasibility ,
- cost of treatment, and
- analytical detection.

In India, under the present Prevention of Food Adulteration Act, no specific standards for pesticides in water (bottled) have been prescribed. However, the current regulations require that pesticide residues should be ‘below detectable level’. In respect of different kinds of foods, tolerance limits have

been set for pesticides under PFA. These more or less conform to Codex with some variations for local conditions. It was noticed that there are similar differences in standards for pesticides residues in other countries.

Treatment Technologies

In water treatment two classes of technologies are prevalent**.** One, 'removal technologies' like chemical coagulation and clarification, absorption onto activated carbon and filtration through membranes; and two, 'destruction technologies' like oxidation and high-pH hydrolysis. The use of these technologies is dependent on the type of pesticide being removed as also the composition of water. Information provided in the Symposium showed that all common water treatment systems fail to remove all residues of pesticides from drinking water.

Suggested Action Plan

The Symposium suggested the following Action Plan.

- In a country like India where sources of food and water are so diverse, prevention of pesticide contamination to the level at which it becomes hazardous or illegal, is preferable to subsequent remediation of excessively contaminated foods and water.

- There is a strong need to educate farmers, industry, trade and the public about the choice of pesticides and their judicious use. Farmers should be trained to adopt 'good agricultural practices'.

- Efforts should be made to promote use of natural pesticides, biological control, and encourage integrated pest management, organic farming and use of safer pesticides. Use of chlorinated pesticides in public health vector control activities should be immediately discontinued.

- Storage, handling, transportation, spraying etc., should necessitate enough caution to minimize contact with pesticides.

- Systems for pre-registration of pesticides have to be rigorous in order to minimize subsequent problems. The registration of pesticides, labeling, etc. and the conditions imposed therein should be strictly enforced.

- Regular surveys should be made to assess total exposure to pesticide residues through different food products and water and water based products. This will enable establish priorities in minimizing risk of exposure.

- The purpose of establishing standards/guidelines should be clearly set out to ensure effective compliance. Similarly, the methods of detection and treatment should be specifically described.

- The regulatory limits should be derived from scientific data bringing out the relationship between the limit and the toxic hazard rather than made as an ad hoc decision.

- The FAO / WHO guidelines and CODEX MRLs, which are followed by most countries, constitute a good basis for setting out standards for pesticide residues. These should be modified only to take into account local conditions. JMPR should be approached to develop guidelines for pesticides for which such guidelines do not exist at present.

- A pesticide residue limit should not be set at a level lower than the limit of quantification of a practical analytical method in an accredited laboratory under routine operating conditions. While all efforts should be made to have very sensitive analytical methods, it would be futile to prescribe limits which cannot be detected. For testing, the most appropriate international standards, like ISO, should be adopted along with collaboratively developed methods of analysis, like those published by the Association of Official Analytical Chemists (AOAC).

- An effective and credible system of surveillance and monitoring should be in place to collect data, prevent misuse of pesticides, develop priorities in the selection and use of pesticides and thereby minimize risk to health and environment.

- Producing and making available adequate supplies, if affordable, good quality and safe foods and water for consumption can never be totally risk free, although risks can be minimized by good quality control practices. Reduced risk is inversely related to cost. Therefore reasonable safety has to be ensured at specified cost.

- Enforcement of regulations presupposes adequate infrastructure consisting of well equipped specialized laboratories and trained manpower. Currently, both are inadequate. Hence immediate efforts should be made at capacity building.

- Accreditation of laboratories which meet highly technical analytical needs has to be expeditiously undertaken and laboratories encouraged to adopt ‘good laboratory practices’ and ‘good analytical practices’ including sampling. Laboratories should participate in proficiency studies on samples sent to the laboratories.

- A high level scientific advisory committee made up of well known experts from related research organizations should be constituted to advise government on all aspects of pesticide use and safety measures.

- There should be a periodic review of pesticides in use, their contamination of food and water, treatment of pesticides and the regulatory system.

APPENDIX

(ppb)

Pesticide	WHO	US (MCL)	NZ (MAV)	CANADA (MAC)	AUSTRALIA (HV)
Carbofuran	7	40	8	90	30
2.4-D	30	70	40	100	30
Lindane	2	0.2	2		20
Malathion		100		190	50
Simazine	2	4	2	10	20