

## STANDARD SETTING ON PESTICIDE RESIDUES TO ENSURE FOOD SAFETY

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### ABSTRACT

*This article highlights some aspects of pesticides contamination in foods and the Government of Nepal's experience in setting MRLs of pesticide on Food. Use of pesticides in agriculture crop has a great concern to all. According to the provision conferred by Food Law, Government of Nepal fixes MRLs of pesticide on food products. Potential products liable for pesticide use gets priority in standard setting. The problem of pesticides begins at the farm level and continues at different stage of handling and storage. Therefore, effective coordination between stakeholders working with different stages of food handling must collaborate to solve this problem. In this connection, some major issues and recommendations in managing proper use of pesticides are highlighted.*

**Key words:** Pesticides, maximum residue limits (MRLs), Food safety and quality

### INTRODUCTION

Pesticides are chemical substances defined as poisons and used in certain circumstances to kill specifically targeted pests (Wassemann, 1972). These highly stable compounds can last for years and decades before breaking down. They circulate globally, and persistent pesticides released in one part of the world can be transported through a repeated process of evaporation and deposit through the atmosphere to regions far away from the original source (Williams, 2000).

Pesticides are toxic in nature and do not differentiate between targeted and non-targeted species, and hence should essentially be subject to safe and judicious use. Due to injudicious and indiscriminate use of pesticides, many accidents have occurred in different parts of Nepal, and presence of pesticides in foods, fruits, vegetables environment and even in mothers milk is a matter of grave concern (FAO/WHO, 2005).

Of all the pesticides released into the environment every year by human activity, persistent pesticides are among the most dangerous. They are highly toxic, causing an array of adverse effects, notably death, diseases and birth defects among human and animals. Specific effect can include cancer, allergies and hypersensitivity, damage to the central and peripheral nervous systems, reproductive disorders, and disruption of the immune system. (Strict, 1981; Maroni, 1990)

### OBJECTIVE

The general objective of the paper is to present the provision of standards setting for the pesticide residue limits in ensuring the food safety. The specific objectives are:

To assess the use of pesticides

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- To present pesticide residue data in food
- To make people aware of pesticide effects on human and environment
- To provide the mechanism of setting standards of pesticide residue limits in food
- To assess the capability in controlling pesticide residues

## **METHODOLOGY**

National experience of standards of the pesticide residue limits for ensuring food safety was prepared under the framework of legal provision and secondary data of pesticide used and pesticide residues analysis (AOAC). The sources of secondary data are research papers, annual reports of DFTQC, Journal of Food Science and Technology Nepal (JFSTN) etc.

## **PESTICIDES IN NEPAL**

Until the 1950s, Nepalese were unaware of modern chemical pesticides and were dependent upon traditional organic techniques for killing pests. Chemical pesticides were first introduced to this country in 1955 when Paris Green, gamaxone, and nicotine sulphates were imported from USA for malaria control. DDT made its first impact in 1956. This was soon followed by a variety of other organochlorines (1950s), organophosphates (1960s), Carbamates (1970s), and Synthetic pyrethroids (1980s).

The Nepal Malaria Eradication Program (NMEP) in the 1950s was the first major channel to utilize pesticides in Nepal. The chemical pesticides, provide through the grant assistance by USAID, were initially in limited quantity, primarily used for the control of vector-borne diseases. As a result of this program, there was ninety nine percent reductions of malaria cases which was completed in early seventies.

The establishment of Department of Agriculture, initiated the application of chemical pesticides for crop protection during the mid of the 1960s. Since then, the use of pesticides for plant protection has steadily increased. Increasing demands for chemical pesticides resulted in private dealerships selling and distributing pesticides throughout the country.

In 1977, the Nepal Pesticides and Chemical Industries Pvt. Ltd. (NEPCIL) was established in Bahadurgunj to supply BHC dust, malathion, Nepcil parathion among others locally. The Indian representative such as Crop Health Production Ltd., Excel Industries Ltd., Cyanamid India Ltd., Bharat Pulverizing Mills Ltd. were the main suppliers of pesticides in Nepal. Organizations like the Cotton Development Board (CDB) and Nepal Malaria Eradication Programs were also authorized to purchase pesticides from foreign distributors. Presently, Indian Pesticide dealers cross the open border freely, selling pesticides in the Terai region and in major towns of Nepal (Palikhe, 2001).

## **PREVIOUS STUDY ON PESTICIDE RESIDUES**

A total of one thousand and thirty four samples of different food commodities during 1995-2004 were analyzed for detection of organochlorine (DDT, BHC) and organophosphorus (malathion, parathion, methyl parathion) pesticide residues. Among all samples analyzed 12.1% of the total samples were detected with the residues of pesticides which included malathion (3.9%), BHC (3.1%), Methyl parathion (2.8%), DDT (1.8%) and parathion (0.3%). Commodity-wise detection of pesticide residues showed the highest level of contamination in root vegetables (11.9%) followed by leafy vegetables (10.9%) (DFTQC, 1995).

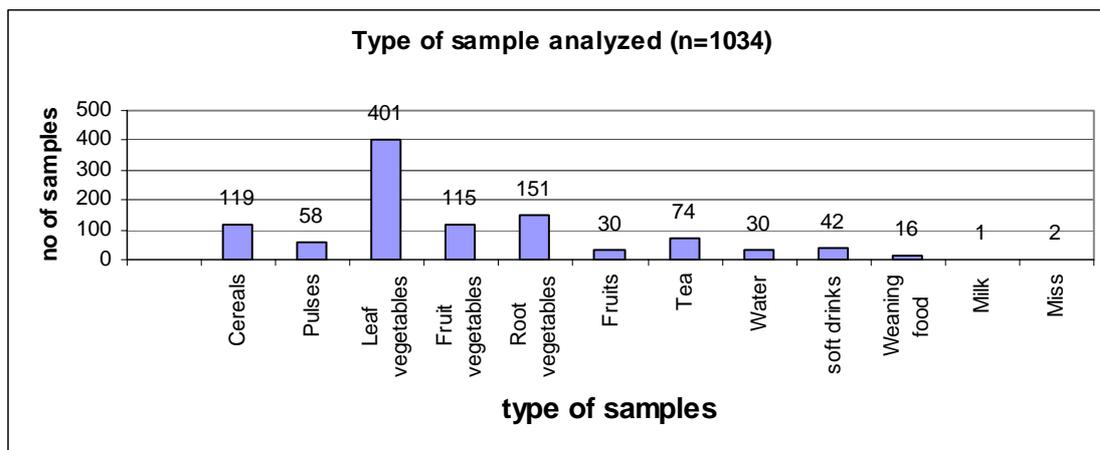


Fig 1: Type of samples analyzed for pesticide residues

### RISKS DUE TO PESTICIDE RESIDUES IN HUMAN HEALTH AND ENVIRONMENT

#### Effect on human health

The adverse health effects of pesticide misuse are a global phenomenon causing an estimated 10,000 illnesses worldwide (Dahal et al., 1994). Thus, they pose potential risks to all human beings. The health cost of pesticide problems can be described as:

- 1 Acute poisonings of farmers and distributors
- 2 Chronic health problems due to prolonged exposure to pesticides
- 3 Pesticide residues on food

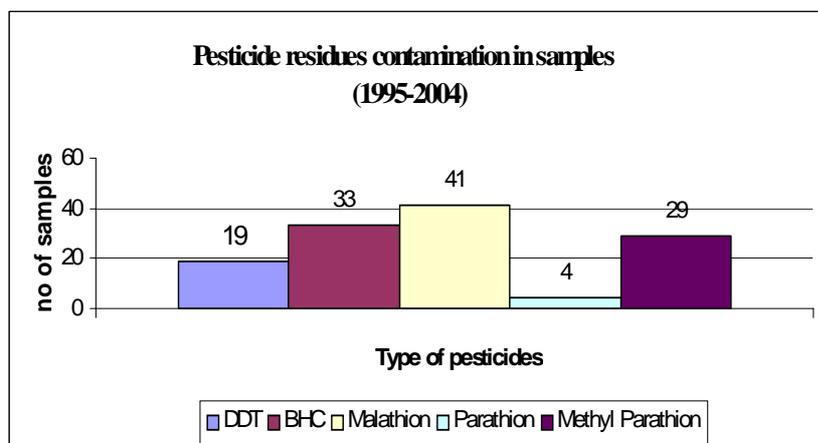


Fig 2 : Pesticide residues contamination in food samples

Some acute pesticide poisonings were reported by hospitals in Kathmandu valley. Many of whom were farmers. Fishing bait is another dangerous practice, which is seriously becoming health hazards in Palpa, Chitwan and Dang. Similarly, some of the more acutely toxic substances such as endrin and endosulphan were reportedly used for fishing. Some sporadic cases of fatal pesticide poisoning had been reported in local newspapers (Gorkhapatra, 1989). Several studies show that sometimes even if framers and distributors do not die quickly death from pesticide misuse, they are still at risk of chronic health problems due to their prolonged exposure to pesticides. The study also indicates that long-term exposure to most pesticides causes serious health problems, which may occur months or years after initial exposure. The effect of pesticides such as organochlorine (OC), organophosphorus (OP), carbamates may cause cancer, tumors, birth defects, blood disorders etc. Studies done in the United States

had shown that farmers were more likely to contract certain kinds of cancer than non-farmers. The fifty five cancer-causing pesticides had been identified as those leaving the organochlorine such as BHC, DDT, aldrin have long term residual effects than other pesticides. (Giri, 1998).

#### *Effect on environment*

Pesticides, especially the organochlorine and organophosphate tend to persist in the environment, causing several types of damages including lowering of biodiversity, soil contamination, and water contamination. Once released into the environment, pesticides tend to build up in the fatty tissues of living organisms, causing serious harm to the health of species and a potential loss of bio-diversity. Excessive use of persisting pesticides in the fields also have caused surface and underground water contamination are illustrated by records of some international studies. Methyl bromide one of the mostly used pesticides for soil fumigation in many countries have also been identified as the major contributor of ozone depletion. (Giri, 1998)

#### **STANDARDIZATION COMMITTEE OF MRLS ON PESTICIDES RESIDUES**

A food standardization committee is formed to carry out the functions as specified in the Food Act and this Regulation (GoN, 1967). The committee is to set the quality standard and limit of quantity of the food and advice Government of Nepal regarding the quality standard and quantity maintained and observed (Annex-2). The committee may invite, where considered necessary, an expert in the concerned field, to take part, as an observer, in the meeting of the committee. The committee may form, as necessary, a sub-committee for any specific function. The functions, duties, powers and procedures of such sub-committee shall be as specified by the committee. The committee may frame necessary by-laws to set its procedures. Provided, however, that such by-laws shall come into force only upon approval of Government of Nepal. The committee shall liaise with Government of Nepal, generally through the Ministry of Agriculture and Cooperatives. Till 2008, Government of Nepal has set the mandatory pesticide residue limits as per Food Law and Regulation. The name of pesticides, food commodity, and their maximum residue limits (MRLs) are notified for public in Nepal Gazette (Annex-4).

#### **CONCLUSIONS AND RECOMMENDATIONS**

Pesticides are the potential health hazards, which have drawn attention of food quality control agencies, certification bodies, international community and trading partners. Due to the lack of regular monitoring scheme of MRL on pesticides, it has affected the export of tea, honey and other food commodities in the recent years. Similarly, the certification of organic foods has faced problem due to the absence of this monitoring scheme.

For the improvement in present situation regarding the pesticide use, pest resistant to pesticides, environmental contamination, and health hazard to farmers as well as the consumers from the toxic chemicals, the following recommendations are suggested.

Farmers or producers of agro-food products should follow good agriculture practices, which takes account of proper use of certified chemicals within the approved amount or limited dose. The misuse and abuse of such chemicals increases the resultant residues problems in food products as well as environmental pollution. Nepal needs to develop NEPAL GAP

considering the benchmark standard of GLOBAL GAP. IPM, the tool to help farmers to get rid of pesticides, should be implemented to the field level with intensive programs.

Pesticide residues is arising a prominent issue on the food safety and environmental pollution. In order to control the resultant residue problem in foods and promotion of food trade in international market, a national pesticide residues monitoring program should be implemented.

There should be a coordinating team of public private partnership for close monitoring of appropriate use of pesticides at the field level.

A regular training /workshop about the use and safety measures of pesticide should be given to farmers, retailers, distributors and all the pesticide workers. Multimedia awareness activities in local language should be massively conducted.

Laboratory capacities and facilities should be strengthened in order to cope the newly emerged challenges of contaminants as wells as harmonization of analytical methods for settlement of dispute in the reliability of the results.

The gap between the availability and the requirement is very wide, which demands the exchange visits, training and other academic opportunities in the field of food safety and quality as well as laboratory analysis.

In order to protect the consumers against the biological, chemical, and environmental contamination of food, the food safety should encompass the control over all stages of food production, processing and distribution of foods. There is need of development of the ability to follow the movement of food through specified stages of production, processing and distribution.

Scientific evaluation of potential adverse effects resulting from human exposure to food borne hazards. Risk analysis is relatively new applied science based on sound scientific footing to protect consumer's health by Appropriate Level of Protection (ALOP). Necessary data and information for the food standardization should be base on risk analysis of particular food commodity.

Export potential products have been reduced in current year due to pesticide residues and other inorganic residues that comes from agricultural practice (JNSF, 2007). So horizontal standards of pesticide residues should be enforced in the agro products especially those for exportable products to facilitate trade as well as for the production of safe food.

Codex Contact Point and National Codex Committee should be strengthened with the participation from wide range of stakeholders such as industry, academics and consumers, for the development of national database and evaluation of the implications of international food standards.

There should be a permanent regional forum among SAARC countries on Food Safety and Quality to make common regional agendas in issues related to food trade, standards, quality and safety in international forum and Codex System.

There is thrust of resources and assistantship to attain the international and regional food safety forum and meetings to upgrade the capacity building.

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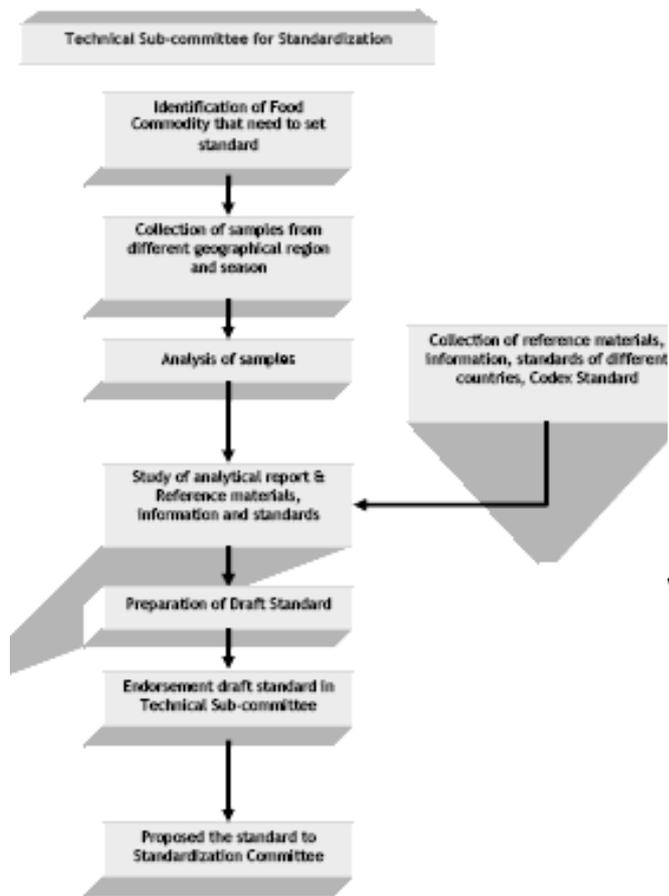
## ANNEXES

### Annex 1: Standardization committee of maximum residue limits (MRLs) on pesticides

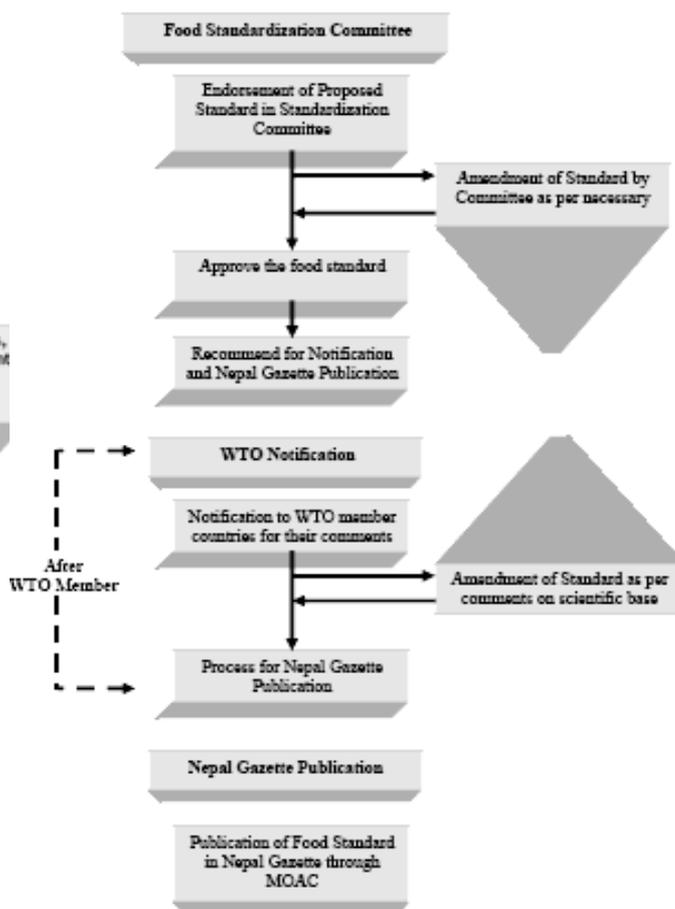
1	Secretary, Ministry of Agriculture and Cooperatives	Chairperson
2	Representative, Ministry of Law and Justice	Member
3	Representative, Ministry of Industries	Member
4	Representative, Ministry of Commerce	Member
5	Representative, Ministry of Supplies	Member
6	Representative, Ministry of Home	Member
7	Representative, Ministry of Health	Member
8	Representative, Kathmandu Metropolitan City	Member
9	Food industry entrepreneur (1) nominated by Fed. Industries and Com.	Member
10	As nominated by the Ministry of Supplies among food consumers (1)	Member
11	Director General, Department of Food Technology and Quality Control	Mem. secretary

(Source GoN, 1967)

Annex-2



Annex-3



Annex-4: Food commodity and maximum pesticide residue limits (MRLs)

Pesticide type	Food commodity	Max residue limit (mg/kg)
1. Aldrin, dieldrin	Food Grains, legumes and pulses	0.01
	Skimmed Milk Powder Whole Milk Powder	0.15
2. Benomyl	Processed Drinking Water	0.03
	Skimmed Milk Powder	0.1
3. Carbaryl	Whole Milk Powder	0.1
	Food Grains, legumes and pulses	1.5
4. Carbendazim	Food Grains, legumes and pulses	0.50
	Skimmed Milk Powder	0.1
5. Carbofuran	Whole Milk Powder	0.1
	Food Grains, legumes and pulses	0.10
6. Chlordane	Skimmed Milk Powder	0.1
	Whole Milk Powder	0.1
7. Chlorfenvinphos	Food Grains, legumes and pulses	0.02
	Processed Drinking Water	0.03
8. Chlorpyrifos	Skimmed Milk Powder	0.05
	Whole Milk Powder	0.05
8. Chlorpyrifos	Food Grains, legumes and pulses	0.025
	Skimmed Milk Powder	0.2
	Whole Milk Powder	0.2
8. Chlorpyrifos	Food Grains, legumes and pulses	0.05
	Skimmed Milk Powder	0.01
	Whole Milk Powder	0.01

Pesticide type	Food commodity	Max residue limit (mg/kg)
9. Cypermethrin	Skimmed Milk Powder	0.05
	Whole Milk Powder	0.05
10. DDT	Food Grains, legumes and pulses	Absent
	Skimmed Milk Powder	0.02
	Whole Milk Powder	0.02
	Processed Drinking Water	1
11. 2-4D	Food Grains, legumes and pulses	0.01
	Skimmed Milk Powder	0.05
	Whole Milk Powder	0.05
	Processed Drinking Water	100
12. Diazinon	Food Grains, legumes and pulses	0.05
13. Deltamethrin/ Deltamethrin	Food Grains, legumes and pulses	0.50
14. Dichlorvos	Food Grains, legumes and pulses	1.0
15. Dithiocarbamates	Food Grains, legumes and pulses	0.2
16. Edifenphos	Skimmed Milk Powder	0.05
	Whole Milk Powder	0.05
17. Ethion	Skimmed Milk Powder	0.5
	Whole Milk Powder	0.5
18. Fenthion	Food Grains, legumes and pulses	0.10
	Skimmed Milk Powder	0.01
	Whole Milk Powder	0.01
19. Fenitrothion	Food Grains, legumes and pulses	0.02
	Skimmed Milk Powder	0.05
	Whole Milk Powder	0.05
20. Fenvalerate	Skimmed Milk Powder	0.05
	Whole Milk Powder	0.05
21. Heptochlor	Food Grains, legumes and pulses	0.01
	Skimmed Milk Powder	0.15
	Whole Milk Powder	0.15
	Processed Drinking Water	0.1
22. Hexachlorobenzene	Processed Drinking Water	0.01
23. Hydrogen Cyanide	Food Grains, legumes and pulses	37.05
24. Hydrogen Phosphide	Food Grains, legumes and pulses	0.02
25. Inorganic Bromide	Food Grains, legumes and pulses	25.0
26. Lindane	Food Grains, legumes and pulses	0.01
	Skimmed Milk Powder	0.01
	Whole Milk Powder	0.01
	Processed Drinking Water	3.0
27. Malathion	Food Grains, legumes and pulses	4.0
28. Monocrotophos	Food Grains, legumes and pulses	0.025
	Skimmed Milk Powder	0.02
	Whole Milk Powder	0.02
29. Oxydemeton methyl	Food Grains, legumes and pulses	0.02
30. Paraquat dichloride	Food Grains, legumes and pulses	0.025
31. Phenthoate	Food Grains, legumes and pulses	0.05
	Skimmed Milk Powder	0.01
	Whole Milk Powder	0.01
32. Phorate	Food Grains, legumes and pulses	0.05
	Skimmed Milk Powder	0.01
	Whole Milk Powder	0.01
33. Phosphamindon	Food Grains, legumes and pulses	0.05
34. Pirimiphos-methyl	Skimmed Milk Powder	0.05
	Whole Milk Powder	0.05
35. Pyrethrins	Food Grains, legumes and pulses	Absence
36. Trichlorfon	Food Grains, legumes and pulses	0.05