

Perspective on pesticide residues in food and environment and its Regulation in Crop Protection

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ABSTRACT: Farmers use pesticides to kill pests in crops as it helps to increase agricultural productivity. But rampant abuse of pesticides results in Pesticide residues in some component of the environment after its application, spillage or dumping. Pesticide residues may pose significant risks to human beings & environment if, it exceeds the maximum residues levels (MRLs). There is efficient monitoring system which regularly tests food items for pesticide residues to ensure that it does not exceed (MRLs) and there is no potentially adverse effect on humans and environment before they can be licensed and sold. Some of the government agencies involved in the regulation are The Central Insecticides Board and Registration Committee (CIBRC), The Codex Committee on Pesticide Residues (CCPR) and Environmental Protection Agency (EPA). The objective of this paper is to give an overview of work that has been done on pesticide residue and how the overuse of pesticide can be controlled by obeying regulations.

Keywords: Maximum residues levels (MRLs), Pesticide

I. INTRODUCTION

Pesticides constitute the key control tactics for management of pests and diseases and the productivity of crops depends on their effective control. Together with high-yielding crop varieties and fertilizers, pesticides have helped the Indian farmers in achieving a substantial increase in agricultural productivity [1] The term pesticide covers a wide range of compounds including insecticides, fungicides, herbicides, rodenticides, molluscicides, nematocides, plant growth regulators and others. These pesticides can be generally classified into four main chemical groups: organophosphate (OP), organochlorines (OC), carbamates/ dithiocarmates (EBDC), and synthetic pyrethroids. About 5.2 billion Pounds of pesticides used worldwide [2] Concern for pesticide contamination in the environment in the current context of pesticide use has assumed great importance [3] Although there are positive benefits to the use of pesticides in promoting agricultural production, some also have drawbacks or side-effects, such as potential toxicity to humans and other animals, and negative impacts on the ecological environment [4] Adverse health effects of pesticides exposures includes acute and persistent injury to nervous system, lung damage, injury to the reproductive organs, dysfunction of immune and endocrine systems, birth defects, and cancer [5] They do play an immunosuppressive role for aquatic fishes and amphibians causing decline of species and number in total [6] It has been estimated that only 0.1% of applied pesticides reach the target pests, leaving the bulk of the pesticides (99.9%) to impact the environment. [7] The pesticide may drain into surface waters or volatilize into the air. From the air it may deposit on humans, wildlife or plants or on the soil. From the animals or plants where it was applied the pesticide may leak into groundwater. Studies also reported presence of pesticides in surface water and groundwater close to agriculture lands over the world [8] these processes are illustrated in Fig 1. The persistence of the pesticide depends on its physical and chemical properties (partition coefficients, degradation rates, deposition rates) and the characteristics of the environment. Pesticide residues that occur in crops at harvest depend on some factors like the initial deposit, its distribution and coverage and its disappearance after application and Meteorological conditions illustrated in (Fig.2).

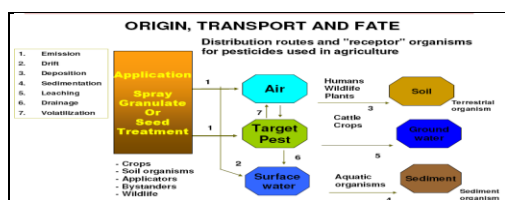


Fig1

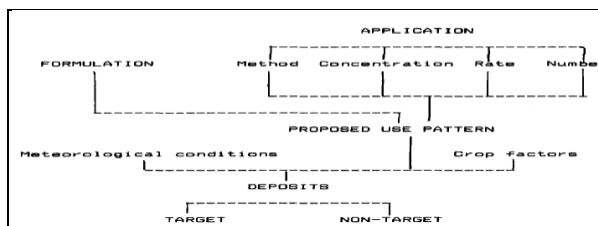


Fig2

Pesticide residues which are the deposits of pesticide active ingredient, its metabolites or breakdown in some component of the environment after its application, spillage or dumping results from the rampant abuse of pesticides. If right dose of pesticides are applied most of the problems can be prevented and for this purpose the pesticides must undergo extensive efficacy, environmental, and toxicological testing to be registered by governments for legal use in specified applications. Pesticides and their contamination of food products are regulated through some concept like Maximum Residue Limits (MRLs), Average daily intake (ADIs) and Good Agricultural Practices (GAPs). Maximum residue levels are the highest levels of residues expected to be in the food when the pesticide is used according to authorized agricultural practices [9]. Exceeding the MRL can indicate over-use of pesticides to prevent adverse effects on public health it is a must to establish control measures in order to ensure MRLs to be respected [10]. This paper is an attempt to show that “the right dose differentiates the poison and remedy” and how pesticide residues in food are regulated in India and abroad.

II. REGULATORY SYSTEM OF CONTROLLING PESTICIDE USE

The public concern about residual pesticides in the environment and their impacts on human health is rising as a result, there is a push on promulgating the legislative frameworks for controlling/restricting their uses and distributions based on the environmental, food and health risks posed by these chemicals. Therefore, Various National and International organizations/ Bodies [EPA, FDA and USDA, UN Food and Agriculture Organization (FAO), UNEP etc.] are working for formulations and amendments of related Acts and for issues for utilization of the pesticides. Each country adopts their own agricultural policies and Maximum Residue Limits (MRL) and Acceptable Daily Intake (ADI). The level of food additive usage varies by country because forms of agriculture are different in regions according to their geographical or climatical factors.

2.1 PESTICIDE REGULATION IN INDIA:

Various government agencies are involved in the regulation of the pesticide industry in India. The Ministry of Agriculture regulates the manufacture, sale, transport and distribution, export, import and use of pesticides through the 'Insecticides Act 1968' and the rules framed there under. The Central Insecticides Board (CIB), advises the Central and state governments on technical matters. The approval of the use of pesticides and new formulations to tackle the pest problem in various crops is given by the Registration Committee (RC) while the Union Ministry of Health and Family Welfare monitors and regulates pesticides residue levels in food. It also sets maximum residue limits (MRL) of pesticides on food commodities.

In India, the pesticides regulations are governed under the following Acts/Rules:

1. The Insecticides Act 1968 and Rules 1971
2. Prevention of Food Adulteration Act 1954
3. The Environment (Protection) Act 1986
4. The Factories Act 1948
5. Bureau of Indian Standards Act 1986
6. Air (Prevention & Control of Pollution) Act 1981
7. Water (Prevention & Control of Pollution) Act 1974
8. Hazardous Waste (Management & Handling) Rules 1989

2.2 PESTICIDE REGULATION IN THE UNITED STATES

In the United States, the U.S. Environmental Protection Agency registers pesticides under the Federal regulations, including the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and the Federal Food, Drug and Cosmetic Act. The registration process includes product efficacy assessments, assessments of risks to human health and ecological risk assessments [11]. The US Food and Drug Administration (FDA) is then responsible for monitoring pesticide levels on fruits and vegetables, while the US Department of Agriculture (USDA) is charged with the task of surveying pesticide residues in meat, eggs, and dairy products.

2.3 PESTICIDE REGULATION BY THE CODEX ALIMENTARIUS COMMISSION (CAC)

The Codex Alimentarius is recognized by the World Trade Organization as an international reference point for the resolution of disputes concerning food safety and consumer protection. The Codex Alimentarius Commission established jointly by the United Nations' Food and Agriculture Organization and the World Health Organization in 1963, sets non-binding consensus-based MRLs, as well as other food standards to protect health and ensure fair trade practices [12]. Codex standards cover all the main foods, whether processed, semi-processed or raw. In addition, materials used in the further processing of food products are included to the extent necessary for achieving the principal objectives of the code protecting the health of consumers and facilitating fair practices in the food trade. Codex provisions concern the hygienic and nutritional quality of food, including microbiological norms, food additives, pesticide and veterinary drug residues, contaminants, labelling and presentation, and methods of sampling and risk analysis. As well as individual standards, advisory codes of practice, guidelines and other recommended measures form an important part of the overall food code. The Codex Alimentarius can safely claim to be the most important international reference point in matters

concerning food quality. Its creation, moreover, has generated food-related scientific research and greatly increased the world community's awareness of the vital issues at stake – food quality, safety and public health. Its principle objective is to protect the health of consumers and to facilitate the trade of food by setting international standards on foods (i.e. Codex Standards) and other texts which can be recommended to governments for acceptance.

III. COMPARISON OF MRL STATUS OF COMMON PESTICIDES (Mg/Kg)

S.No	Pesticide	Commodity	Codex standard	EU standard	EPA standard
1	Fipronil	Fruits	0.05	0.005	
		Pulses	1	0.005	
		Wheat	0.002	0.005	0.005
		Milk	0.02	0.005	1.50
2	Endosulphan				
		Tomato	0.5	0.05	1.0
		Potato	0.05	0.05	0.2
		Milk fats	0.1	0.05	2.0
		Cucumber	1	0.05	1

Source: European Commission: Plant Protection – Pesticide Residues.

http://ec.europa.eu/food/plant/protection/pesticides/index_en.htm

Codex - www.codexalimentarius.net

There is field recommended dose (FRD) of almost all the registered pesticides so only the correct dose guarantees optimum pest control whilst also keeping all the risks to minimum and then the MRLs value will also be in the range.

IV. CONCLUSION

Pesticides are poisonous and have the potential to be harmful to humans if ingested in sufficient quantities, handled or sold by untrained people but, when used properly they constitute an important input in vegetable and fruit production in order to produce economically marketable products. The use of pesticide can be controlled by obeying regulation related to it. An efficient monitoring system which regularly tests food items for pesticide residues is a strong incentive for farmers to use chemicals wisely. MRLs of commodity should not exceed the given limit and this can be avoided by inculcating in the growers, the necessity to strictly follow the recommended and correct ways of using pesticides. Even public must also be alert as pesticide residue cannot be detected in vegetables with naked eyes the best they can do is to soak the vegetables in water and wash them thoroughly before cooking as studies has shown that washing of agricultural produce can reduce the levels of residues. In nutshell even though excessive use of pesticide is hazardous for human beings and environment the problem can be minimised if pesticides are used judiciously

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