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PESTICIDES RESIDUE: HEALTH IMPACTSAND REGULATION

S. R. Sharma[1], Nitin Varshney[2]

[1]Division of Plant Breeding & Genetics, RARI, Durgapura,Jaipur.

[2]Division of Sample Survey, ICAR-IASRI, New Delhi

Background

Chemical pesticides have become the important form of pest control from post-World War II era. There are two classifications of pesticides, first-generation pesticides and second-generation pesticide. The pesticides which were made up of compounds such as arsenic, mercury, and lead and used prior to 1940 known as first-generation pesticides. These were soon abandoned because they were highly toxic and ineffective. The second-generation pesticides were composed of synthetic organic compounds and their growth accelerated in late 1940s after Paul Müller discovered DDT in 1939. The effects of pesticides such as aldrin, dieldrin, endrin, chlordane, parathion, captan and 2,4-D were also found at this time. Those pesticides were widely used due to its effective pest control. However, in 1946, people started to resist to the widespread use of pesticides, especially DDT since it harms non-target plants and animals. People became aware of problems with residues and its potential health risks. In the 1960s, Rachel Carson wrote *Silent Spring* to illustrate a risk of DDT and how it is threatening biodiversity.

Pesticides

A pesticide is a substance or a mixture of substances used for killing pests (*i.e.* organisms dangerous to cultivated plants or to animals). Around 275 pesticides have been registered for use in agriculture in India as of October 2016, against various pests and diseases. These pesticides can be broadly classified into Insecticides (used against insect pests), Herbicides (for killing & controlling weeds), Fungicides (against diseases) and others. Based on their chemical composition they may be classified as organophosphate compounds, organ chlorines, synthetic pyrethroids, carbamates, bio-pesticides etc.According to WHO, classification of pesticides based on their acute toxicity defines as Class I (a) – Extremely hazardous, demarcated in red, Class I (b) – Highly Hazardous, symbolized by an yellow triangle, Class II – Moderately Hazardous, marked by a blue triangle and Class III is known as “Slightly Hazardous” while the remaining class is supposed to be “Not likely to be Hazardous”.

Pesticide residue

Pesticide residue refers to the pesticides that may remain on or in food after they are applied to food crops, these terms according to “The Gold Book" (1997). Many of these chemical residues, especially derivatives of chlorinated pesticides, exhibit bioaccumulation which could build up to harmful levels in the body as well as in the environment, studies by the Walter (2009). Persistent chemicals can be magnified through the food chain and have been detected in products ranging from meat, poultry, and fish, to vegetable oils, nuts, and various fruits and vegetables.

In India the highest level of DDT residues found was 2.2 mg/kg. The proportion of the samples with residues above the tolerance limit was maximum in Maharashtra (74%) followed by Gujarat (70%), Andhra Pradesh (57%), Himachal Pradesh (56%) and Punjab (51%). In the remaining states, this proportion was less than 10%. Data on 186 samples of 20 commercial brands of infants formulae showed the presence of residues of DDT and HCH isomers in about 70 and 94% of the samples with their maximum level of 4.3 and 5.7 mg/kg (fat basis) respectively. Reported by Pesticide, Residues & Regulation in India (2007).The average total DDT and BHC consumed by an adult were reported to be 19.24 mg/day and 77.15 mg/day respectively. Fatty food was the main source of these contaminants. In another study, the average daily intake of HCH and DDT by Indians were reported to be 115 and 48 mg per person respectively which were higher than those observed in most of the developed countries. These finding were also reported by Kole *et al.,* (2002)

Reasons for agricultural pesticide residues being high in India

- Indiscriminate use of chemical pesticides
- Non-observance of prescribed waiting periods
- Use of sub-standard pesticides
- Wrong advice and supply of pesticides to the farmers by pesticide dealers
- Continuance of DDT and other uses of pesticides in Public Health Programs
- Effluents from pesticides manufacturing units
- Wrong disposal of left over pesticides and cleaning of plant protection equipments
- Pre-marketing pesticides
- Treatment of fruits and vegetables

Health Impacts

Many pesticides achieve their intended use of killing pests by disrupting the nervous system. Due to similarities in brain biochemistry among many different organisms, there is much speculation that these chemicals can have a negative impact on humans as well, Marina *et al* (2008)**.** There are epidemiological studies that show positive correlations between exposures to pesticides through occupational hazard, which tends to be significantly higher than that ingested by the general population through food, and the occurrence of certain cancers, also reported by Christos *et al.,* (2011). Although most of the general population may not exposed to large portion of pesticides, many of the pesticide residues that are attached tend to be lipophilic and can bio-accumulate in the body, Walter, (2009).

Regulations

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.

International Regulations

Some countries use the International Maximum Residue Limits-Codex Alimentations to define the residue limits; this was established by Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO) in 1963 to develop

international food standards, guidelines codes of practices, and recommendation for food safety. Currently the CODEX has 187 Member Countries and 1 member organization (EU).

European Union

In September 2008, the European Union issued new and revised Maximum Residue Limits (MRLs) for the roughly 1,100 pesticides ever used in the world. The revision was intended to simplify the previous system, under which certain pesticide residues were regulated by the Commission, others were regulated by Member States.

Law in India

India is one of the most dynamic generic pesticide manufactures in the world with approximately 60 technical grade pesticides being manufactured indigenously by around 125producers consisting of large and medium scale enterprises (including 10 MNCs) and more than500 pesticide formulators spread over the country.

The Insecticides Act, 1968 and Insecticides Rules, 1971 regulate the import, registration process, manufacture, sale, transport, distribution and use of insecticides (pesticides)with a view to prevent risk to human beings or animals and for all connected matters, throughout India. All insecticides (pesticides)have to necessarily undergo the registration process with the Central Insecticides Board &Registration Committee (CIB & RC) before they can be made available for use or sale. The Pesticides Management Bill, 2008 was introduced in the Rajya Sabha on October 21,2008. Following items are covered in compulsory licensing list because of hazardous nature: http://cibrc.nic.in/

- Hydrocynanic Acid & its derivatives
- Phosgene & its derivatives
- Isocynates & Di-isocynates of hydrocarbon

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