Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(3): 330-333

Received: 18-03-2018
Accepted: 19-04-2018

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A review: Pesticide residue: Cause of many animal health problems

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Abstract
Pesticides play a sensitive role in agriculture as they are applied in order to protect crops, but they can have negative impacts on environment and human health. They help farmers to reduce production costs and risks, and to survive in a highly competitive market but pesticides can contaminate soil, water, turf and other vegetation. Pesticide residue in feed may cause serious problems in dairy animals which could results in the loss of production.

Keywords: Pesticide residue, contamination, animals feed

Introduction
Pesticides are chemicals to control a variety of pests that can damage crops and livestock and reduce farm productivity. Pesticides play a sensitive role in agriculture as they are applied in order to protect crops, but they can have negative impacts on environment and human health. While global pesticide use has grown to 3.5 billion kg active ingredients per year, a significant portion of the chemicals applied has proved to be excessive, uneconomic or unnecessary both in industrialized and developing countries. India is now the second largest manufacturer of pesticides in Asia after China and ranks twelfth globally for the consumption [8]. There has been a steady growth in the production of technical grade pesticides in India, from 5,000 metric tonnes in 1958 to 102, 240 metric tonnes in 1998. Pesticides are now found in every habitat on earth and are routinely detected in both marine and terrestrial animals. Pesticides in freshwater supplies have become a serious and increasingly costly concern with detected levels often exceeding the set limits and also animal feeds are routinely subjected to contamination from diverse sources, including environmental pollution and activities of insects and microbes. Animal feed may also contain endogenous toxins arising principally from spraying pesticides against pests. to strengthen quality competitive aspects of animal products. Feed and fodder offered to animals are often contaminated with pesticide residues [15, 16] and after feeding, these residues pass through the body systems [14]. The term "feed" is generally used in its widest context to include compound blends of different kind of ingredients as well as forages. With such a broad perspective, it is necessary and more instructive to introduce some focus. The pesticides cover a wide range of compounds including insecticides, fungicides, herbicides, rodenticides, molluscicides, nematicides, plant growth regulators and others.

Types of pesticides
Organophosphate pesticides: Organophosphate (OP) compounds are a group of pesticides that includes some of the most toxic chemicals used in agriculture. OP toxicity is due to the ability of these compounds to inhibit an enzyme, acetyl cholinesterase at cholinergic junctions of the nervous system. Most organophosphates are insecticides like diazinon, malathion, coumaphos.

Organochlorine insecticides: It includes pesticides like DDT, chlordane, aldrin, dieldrin, heptachlor etc compounds.

Carbamate pesticides: These pesticides also affect the nervous system by disrupting an enzyme system. There are several subcategories within the carbamates like Aldicarb, carbofuran, carbaryl, carbosulfan etc are the example of carbomates

Pyrethroid pesticides: Some of the commonly used pyrethroid are Deltamethrin, cypermethrin, permethrin.

Sources of pesticide residues in animals

Major important sources of the pesticide residues is feeding on contaminated harvested crops [31]. Other sources include direct application on animals for control of external parasites where the pesticides are absorbed dermally and also through licking [19]. Pesticide poisoning of animals commonly associated with human error. Errors include improper dosage, use of improper compounds or formulations, use of treated seed as feed, improper spraying and improper storage and disposal of pesticide containers [18].

Current use of pesticides in agriculture

Pesticides are used to protect crops and livestock from various pests, diseases, competition from weeds and parasites, thus contributing to increased agricultural production. They help farmers to reduce production costs and risks, and to survive in a highly competitive market. Global pesticide use has grown over the past 20 years to 3.5 billion kg active ingredients per year, amounting to a global market worth $45 billion [13]. Whereas the consumption of pesticide in India is about 600 g/ hectare, while that of developed countries is touching 3000 g / hectare which is far lower than many other developed countries, but still the problem of pesticide residue is very high in India. A significant portion of the chemicals applied has proved to be excessive, uneconomic or unnecessary both in industrialized and developing countries [4]. Pesticides that may contaminate feeds originate from most of the major groups, including organ chlorine, organophosphate and pyrethroid compounds. Herbicides account for 42%, insecticides 27%, fungicides 22% and disinfectants and other agrochemicals 9% of global pesticide sales whereas in India 76% of the pesticide used is insecticide and use of herbicides and fungicides is correspondingly less heavy [8]. The main use of pesticides in India is for cotton crops (45%), followed by paddy and wheat

Pesticide residues in food chain

Items	Pesticide residues detected
Soil and water	Permethrin, cypermethrin, fenvelerate, deltamethrin, DDT, Aldrin, Dieldrin, BHC, Heptachlor, Lindane, Endosulfan
Air	DDT, BHC
Fodder (Lucerne	Monocrotophos, Phosphomidon, Endosulfan
Cattle feed	Cypermethrin, DDT, BHC
Pasture & Hay	DDT, Aldrin, Dieldrin, BHC, Heptachlor, Lindan
Rice, wheat flour, oils	DDT, BHC
Dairy Products, Baby milk powder, Butter, Ghee, Cow/ buffalo milk	DDT, BHC, HCB, PCB, Heptachlor
Meat, Eggs	DDT, heptachlor, PCB, Carbaryl
Liver, Kidneys, Hair, skin	Cypermethrin
Vegetables	Endosulfan
Adipose tissue of man	BHC, DDT, PCB, HCB, Heptachlor, Aldrin
Human breast milk	BHC, DDT, Aldrin, Heptachlor, HCH
Blood of man	BHC, DDT, Aldrin, Heptchlor, HCH

Pesticides and the environment

A large part of the pesticides applied to crops are either taken up by the plants and animals or are degraded by microbial or chemical pathways. A considerable fraction of the amount applied, however, is dispersed into the environment, by air drift, leaching and run-off so that they are found in soils, surface and ground water [21]. Pesticides can contaminate soil, water, turf and other vegetation. In addition to killing insects or weeds, pesticides can be toxic to a host of other organisms including birds, fish and beneficial insects. Repeated application leads to loss of biodiversity. Many pesticides are not easily degradable, they persist in soil, leach to groundwater and surface water and contaminate wide environment. Depending on their chemical properties, they can enter the organism, bio-accumulate in food chains and consequently influence the environment. Pesticides in freshwater supplies have become a serious and increasingly costly concern, with detected levels often exceeding the set limits (in the EU: 0.1 μg l–1 for any individual active ingredient, or 0.5 μg l–1 for total pesticides). In Switzerland, 70% of surface waters had pesticide levels above the official limit [11]. Pesticides are now found in every habitat on earth and are routinely detected in both marine and terrestrial animals [7].

Pesticides: pollution and toxicity

The projected household demands for food until 2020 show that the demand for food grains is likely to be doubled, for vegetables more than 2.5 times and for fruits 5 times. Thus, increase in the consumption of pesticides is likely to be at least two to three times more in years to come [36]. The practices of using any biologically active compound poses potential problems of toxicity (Hayes, 1991). The most important effects of the synthetic pesticides, especially organophosphate pesticides are water and soil pollutions, as well as the contamination of vegetables, fruits, milk, food products and other living organisms [32, 33]. The sources of contamination are closely related to anthropogenic pollution, such as domestic and industrial discharges, agricultural chemical applications and soil erosion due to deforestation (Bhattacharya *et al*., 2003). Effects of pesticides have been reported in milk, feed, cottonseed, different fruits, vegetables and fish meal at different intervals [34, 35]. This can also occur through direct contact with the compound during manufacture, formulation or use.

Influences of pesticide on livestock animals

Domestic and wild animals may also have adverse effect on the health depending on how and where the compound is used and its persistence after use, but this is usually accidental [1]. Animals can gather these substances from contaminated feed and water. Correspondingly, owing to the lipophilic nature of these pesticides, milk and other fat rich substances are the key items for their accumulation. Kaphalia and Seth [6] observed amongst all meat products, greatest contamination was observed in chicken muscle followed by goat and beef collected in Lucknow, India. The cumulative occurrences of pesticide residues in the meat and milk are of a great concern

for ensuring food safety and human health. Higher contents of organo-chlorine pesticide residues have been reported in meat [12] and milk samples collected from different locations of the country [5]. Pests may also develop resistance to pesticides [9].

Pesticides have been associated with serious adverse effects in birds, man and animals like causing carcinogenicity [10], teratogenicity [3], immunosuppression [20] embrotoxicity, infertility and birth defects [22] and several others like Hepatotoxicity, Nephropathy, Mutagenicity and Hypersensitivity etc.

Pesticides in the environment may play an important role in contributing to underlying causes of fertility problems in dairy livestock [28, 29],. In females the pesticide exposure induced alterations which include poor reproductive behavior, sub-fecundity, infertility, pregnancy loss, growth retardation, intra-uterine fetal demise and ovarian failure [24, 25, 27]. Certain pesticide residues have the adverse impact of on reproductive system, and such pesticide residues are known as 'reproductive toxicants' or 'endocrine disrupters'. These toxicants modulate or upset reproductive hormone milieu by acting at a variety of sites including hypothalamus, pituitary and reproductive organs [26] Pesticide residues can be detrimental to male reproductive system by causing toxicity to sperm plasma membrane [28, 30].

Benefits of pesticides

Pesticides, when used properly, improve health and agricultural production with negligible side effects [17]. They contribute unswervingly to health through the control of vector borne diseases like malaria, bilharzia, trypanosomiasis and leishmaniasis etc and thus improve the economy of the farmer via increasing food and fiber production and through the protection of many materials during storage [23]

Pesticides banned in India

Name of the Pesticide	
Alachlor	aMethoxy ethyl Mercury Chloride(MEMC)
Aldicarb	Methyl parathion
Aldrin	Maleic Hydrazide
Benzene Hexachloride (BHC)	Menazone
Benomyl,	MehtomyI 12:5% L
Calcium cyanide	Mehtomyl 24% L
Captafol 80% Powder* Use banned	Nicotine Sulphate
Carbaryl	Nitrofen
Chlordane	Paraquate Dimethyl Sulphate
Chlorobenzilate	Pentachloro nitrobenzene (PCNB)
Cibromochloropropan	Pentachlorophenol (PCP)
Copper Acetoarsenite	Phenyl Mercury Acelate (PMA)
Dieldrine	Phorate
Endrin	Phosphamidon 85% SL
Dichlorvos,	Sodium Methane Arsonate (MSMA)
Ethylene Dibromide	Sodium cyanide
Ethyl Mercury Chloride	Tetradifon
Ethyl Parathion	Toxafen
Fenarimol,	Thiometon
Fenthion	Trichlotfo
Heptachlor	Trichloro acetic acid (TCA)
Linuron	Tridemorph

Source: Government of India Gazette Notification, (2003 & 2016) [2]

Conclusion

Pesticides have become increasingly popular for agricultural, industrial, livestock husbandry and home use and represent a significant potential health risk for human and livestock. Organic farming is the better and fruitful option to combat the problems related to pesticide residue. Establishing regulatory standard and management practices of using the pesticides are the alternative ways to prevent the adverse effect of pesticide residue on the environment.

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