DR ROHIT BARGAH

PESTICIDES

Pesticides:

Pesticides are chemical compounds used to control various types of pests. It is extensively used in agriculture and households to eradicate pest infestations. Several pesticides are proven to be toxic even at very low doses. In general, a pesticide is a chemical or a biological agent such as a virus, bacterium, antimicrobial, or disinfectant that deters, incapacitates, kills, pests. It is commonly used to eliminate or control a variety of agricultural pests that can damage crops and livestock and reduce farm productivity. The most commonly applied pesticides are insecticides to kill insects, herbicides to kill weeds, rodenticides to kill rodents, and fungicides to control fungi, mold, and mildew. Hence, advances are being made to use natural products to control pests including bio-control agents such as plant extracts and microbes.

Pesticides play an important role in agriculturally dependant countries like India, Egypt and other developing countries . Although they improve the plant quality and yield of the agricultural products, they have a certain serious effects on the environment. Millions of tons of pesticides are applied annually in modern agriculture but less than 5% of these products are estimated to reach the target organisms.

A Brief History:

Pesticides are not recent inventions! Many ancient civilizations used pesticides to protect their crops from insects and pests. Ancient Sumerians used elemental sulfur to protect their crops from insects. Whereas, Medieval farmers experimented with chemicals using arsenic, lead on common crops.

The Chinese used arsenic and mercury compounds to control body lice and other pests. While, the Greeks and Romans used oil, ash, sulfur, and other materials to protect themselves, their livestock, and their crops from various pests.

However, pesticide use has become much more common in modern times, and an enormously wider variety of substances is being used. At least 300 insecticides, 290 herbicides, 165 fungicides, and many other pesticidal chemicals are available in more than 3,000 different formulations. Strictly speaking, a pesticide is a product that consists of a formulation of several chemicals – the "active ingredient" attacks the pest, while various "inert ingredients" enhance its effectiveness. Even larger numbers of "commercial products" are available, because many involve similar formulations manufactured by different companies.

Meanwhile, in the nineteenth century, researchers focused more on natural techniques involving compounds made with the roots of tropical vegetables and chrysanthemums. In 1939, Dichloro-Diphenyl-Trichloroethane (DDT) was discovered, which has become extremely effective and rapidly used as the insecticide in the world. However, twenty years later, due to biological effects and human safety, DDT has been banned in almost 86 countries.

Definition of Pesticides:

The Food and Agriculture Organization (FAO) has defined pesticide as:

any substance or mixture of substances intended for preventing, destroying, or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals, causing harm during or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances that may be administered to animals for the control of insects, arachnids, or other pests in or on their bodies.

Examples of pesticides:

pesticides are fungicides, herbicides, and insecticides. Examples of specific synthetic chemical pesticides are glyphosate, Acephate, Deet, Propoxur, Metaldehyde, Boric Acid, Diazinon, Dursban, DDT, Malathion, etc.

Characteristics of Pesticides:

Physical and chemical characteristics of pesticides determine a pesticide's interaction with the environment. Some of these characteristics are described in the Physical and Chemical Properties of a pesticide's Safety Data Sheet (SDS).

1. **Solubility:** Solubility is a measure of the ability of a pesticide to dissolve in a solvent, which is usually water. Pesticides that are highly soluble in water dissolve easily. Such pesticides are more likely to move with water in surface runoff or to move through the soil in water than less-soluble pesticides. Pesticides with a value of 100 ppm or less are considered relatively insoluble, while pesticides with values greater than 1,000 ppm are considered very soluble.

   Table 2. Agrochemical solubility in water (DIAS, 2010)

Classification	Solubility category	(ppm)
1.	Insoluble	<1
2.	Very low	1 – 10
3.	Low	11 – 50
4.	Intermediate	51 - 150
5.	High	151 - 500
6.	Very high	500 - 5000
7 .	Extremely high >	5000

2. **Adsorption:** Adsorption is the process whereby a pesticide binds to soil colloids, which are microscopic inorganic and organic particles in the soil. Colloid is derived from the Greek term meaning glue-like. These particles have an extremely large surface area in proportion to a given volume. It has

been calculated that 1 cubic inch of colloidal clay may have 200–500 square feet of particle surface area. Pesticide molecules with positive charges are more tightly adsorbed to negatively charged soil particles. A pesticide that adsorbs to soil particles is less likely to move from the application site than a chemical that does not adsorb tightly to the soil.

Table 5. Classification of pesticides according to the strength of adsorption by organic matter

Adsorption	Adsorption force(Co- efficient)
Very strong	- > 5000
Strong	- 600 - 4900
Moderate	- 100 - 599
Weak	- 0.5 - 99

3. Persistence: Persistence is the ability of a pesticide to remain present and active in its original form during an extended period before degrading. A chemical's persistence is described in terms of its half-life, which is a comparative measure of the time needed for the chemical to degrade. The longer a pesticide's half-life, the more persistent the pesticide. Persistent pesticide residues are sometimes desirable because they provide long-term pest control and reduce the need for repeated applications. However, some persistent pesticides applied to soil, plants, lumber, and other surfaces or spilled into water or on soil can later harm sensitive plants or animals, including humans. It is especially important to prevent persistent pesticides from moving off-site through improper handling, application, drift, leaching, or runoff.

4. Volatility: Volatility is the tendency of a pesticide to turn into a gas or vapor. Some pesticides are more volatile than others. The likelihood of pesticide volatilization increases as temperatures and wind increase. Volatility is also more likely under conditions of low relative humidity. The potential for a pesticide to volatilize is measured by its vapor pressure. This measurement may be described in units of Pa (Pascals) or mmHg (millimeters of mercury). Pesticides that have high vapor-pressure values are more volatile. Vapors from such pesticides can move off-site and cause injury to susceptible plants. Some volatile pesticide products carry label statements that warn handlers of the product's potential for vapor movement.

Table 3. Molecules classified by volatility and expressed as the log of vapor pressure (SILVA; FAY, 2004).

Volatility	**Log of vapor pressure**
Very high	- 3
High	- 4 to -3
Moderate	- 5 to -4
Low	- 6 to -5
Very low	- 7 to -6
Extremely low	- 7

Table 1. The Physical and Chemical Properties Section of a Pesticide's Material Safety Data Sheet (MSDS).

PHYSICAL AND CHEMICAL PROPERTIES:

Appearance and Odor:	- Amber colored liquid with slight phenoxy odor.
Boiling Point:	- >212°F (>100°C)
Solubility in Water:	- Soluble
Density:	- 9.0 pounds/gallon
Specific Gravity:	- Not determined
Evaporation Rate:	- Not determined
Vapor Density:	- Not determined
Freezing Point:	- 32°F (0°C)
Vapor Pressure:	- Not determined
pH:	- 8.0–9.2
Viscosity:	- Not determined

Types of Pesticides:

These are grouped according to the types of pests.

1. **based on the intended target of the use**:

(i) **Fungicide**: Fungicide is used against fungi that cause diseases and other damage to crop plants and animals.

(ii) **Herbicide:** Herbicide is used to kill weeds, which are unwanted plants that interfere with some human purpose; most use in agriculture and forestry is intended to release crop plants from competition, while horticultural use is mostly for aesthetics.

(iii) **Insecticide:** Insecticide is used to kill insects that are pests in agriculture, horticulture, or forestry, or that spread diseases such as mosquito vectors (a path by which a disease is spread) of malaria, yellow fever, and encephalitis.

(iv) **Bactericides:** Bactericides, disinfectants, and antibiotics are used to control infections and diseases caused by bacteria (Note that antibiotics are not actually classified as “pesticides” under the Pest Control Products Act).

(v) **Rodenticide:** Rodenticide is used to control mice, rats, gophers, and other rodents that are pests in agriculture or around the home.

(vi) **Algicide:** Algicide is used to kill unwanted growths of algae, for example, in swimming pools.

(vii) **Acaricide :** Acaricide is used to kill mites that are pests in agriculture, and ticks that are vectors of ailments such as Lyme disease and typhus

(viii) **Molluscicide:** Molluscicide is used to kill snails and slugs in agriculture and gardens, and aquatic snails that are vectors of diseases such as schistosomiasis

(ix) **Nematicide:** Nematicide is used against nematodes, which can damage the roots of agricultural plants

(x) **Avicide :** Avicide is used to kill birds, which are sometimes considered pests in agriculture

(xi) **Piscicide:** Piscicide is used to kill fish, which may be pests in aquaculture

2.Based on how biodegradable they are:

Pesticides can also be considered as:

(i) Biodegradable: The biodegradable kind is those which can be broken down by microbes and other living beings into harmless compounds.

(ii)Persistent: While the persistent ones are those which may take months or years to break down.

Another way to classify these is to consider those that are chemical forms or are derived from a common source or production method.

2. On the basis of Chemical structure pesticides:

Because almost all pesticides are chemicals, they can be categorized according to similarities in chemical structure. A few “non-chemical” pesticides are based on microbes, and are discussed later under “Biological Pesticides.”

(i)Inorganic pesticides: Inorganic pesticides are compounds that contain toxic elements such as arsenic, copper, lead, or mercury. They are highly persistent in terrestrial environments, being only slowly dispersed by leaching and erosion by wind or water. Recently, inorganic pesticides have been widely replaced by synthetic organics. Prominent examples include Bordeaux mixture, a complex of copper-based compounds that is used as a fungicide to protect fruit and vegetable crops, and arsenicals such as arsenic trioxide, sodium arsenite, and calcium arsenate, which are used as herbicides and soil sterilants. Paris green, lead arsenate, and calcium arsenate are used as insecticides.

(ii) Organic pesticides: Organic pesticides are mostly synthesized chemicals, but some are natural toxins produced by certain plants that are extracted and used as pesticides. Important examples include the following:

(i) Organophosphate:

Most organophosphates are insecticides, they affect the nervous system by disrupting the enzyme that regulates a neurotransmitter.

(ii) Carbamate:

Similar to the organophosphorus pesticides, the carbamate pesticides also affect the nervous system by disrupting an enzyme that regulates the neurotransmitter. However, the enzyme effects are usually reversible.

(iii) Organochlorine insecticides:

They were commonly used earlier, but now many countries have been removed Organochlorine insecticides from their market due to their health and environmental effects and their persistence (e.g., DDT, chlordane, and toxaphene).

(iv) Pyrethroid:

These are a synthetic version of pyrethrin, a naturally occurring pesticide, found in chrysanthemums(Flower). They were developed in such a way as to maximise their stability in the environment.

(v) Sulfonylurea herbicides:

The sulfonylureas herbicides have been commercialized for weed control such as pyrithiobac-sodium, cyclosulfamuron, bispyribac-sodium, terbacil, sulfometuron-methyl Sulfosulfuron, rimsulfuron, pyrazosulfuron-ethyl, imazosulfuron, nicosulfuron, oxasulfuron, nicosulfuron, flazasulfuron, primisulfuron-methyl, halosulfuron-methyl, flupyrsulfuron-methyl-sodium, ethoxysulfuron, chlorimuron-ethyl, bensulfuron-methyl, azimsulfuron, and amidosulfuron.

(vi) Organometallic pesticides: Synthetic organometallic pesticides are used as fungicides and include organomercurials such as methylmercury and phenylmercuric acetate.

(vii) Triazine pesticides: Triazine pesticides are used as herbicides and sometimes as soil sterilants. Prominent examples are atrazine, simazine, and hexazinone.

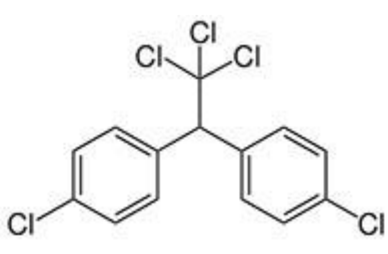
3. Bio –pesticides (Non-chemical):

The bio pesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. Biological Pesticides are formulations of microbes that are pathogenic to specific pests and so have a narrow spectrum of toxicity in ecosystems. The best examples are insecticides based on the bacterium Bacillus thuringiensis , types of which are used against moths, flies, and beetles. Insecticides based on nuclear polyhedrosis virus (NPV) and insect hormones have also been developed.

Table 1.1. Some Important Pesticides.

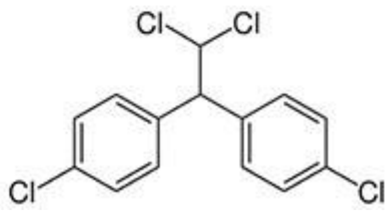
Class	Major Use	Examples
1. Inorganic Pesticides		
(a) Bordeaux mixture	fungicide	tetracupric + pentacupric sulphate (copper sulphates)
(b) arsenicals	herbicides & insecticides	arsenate
2. Organic Pesticides		
(a) organics extracted from plants (plus laboratory analogues)	mostly insecticides	nicotine, nicotine sulphate, neonicotinoids, pyrethrum, red squill, rotenone, strychnine
(b) organomercurials	fungicides	phenyl mercuric acetate, methyl mercury, methoxyethyl mercuric chloride
(c) phenols	fungicides	trichlorophenol, pentachlorophenol
(d) chlorinated hydrocarbons	insecticides	DDT, DDD, TDE, methoxychlor
lindane	insecticide	lindane
cyclodienes	insecticides	chlordane, heptachlor, aldrin, dieldrin
chlorophenoxy acids	herbicides	2,4-D, 2,4,5-T, MCPA, silvex
(e) organophosphates	insecticides	diazinon parathion, methyl parathion, fenitrothion, malathion, monocrotophos, phosphamidon
(f) carbamates	mostly insecticides	carbaryl, aminocarb, carbofuran, aldicarb, methiocarb
(g) triazines	herbicides	simazine, atrazine, hexazinone, cynazine, metribuzin
(h) amides	herbicides	alachlor, metolachlor
(i) thiocarbamates	herbicides	Butylate
(j) dinitroaniline	herbicide	Trifluralin
(k) organophosphorus compound	herbicide	Glyphosate
(l) acetaldehyde polymer	molluscicide	metaldehyde
(m) pyrethroids (synthetic)	insecticides	cypermethrin, deltamethrin, permethrin, tetramethrin

- Chemical Structure of some important pesticides:



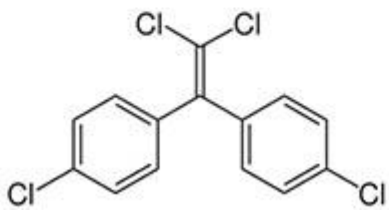
DDT or 2,2-bis-(p-chlorophenyl)-1,1,1-trichloroethane

(insecticide)



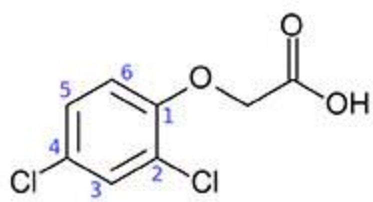
DDD or 2,2-bis-(p-chlorophenyl)-1,1-dichloroethane

(insecticide)

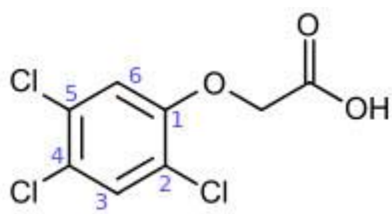


DDE or 2,2-bis-(p-chlorophenyl)-1,1-dichloroethylene

(non-insecticidal metabolite of DDT and DDD)

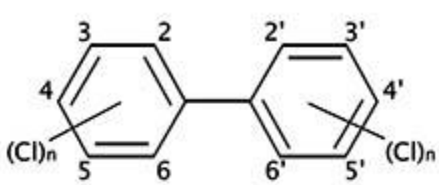


2,4-D or 2,4-dichlorophenoxyacetic acid (a herbicide)



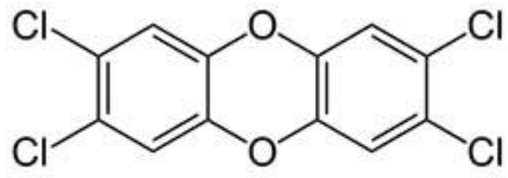
2,4,5-T or 2,4,5-trichlorophenoxyacetic acid

(herbicide)



PCBs or polychlorinated biphenyls

(electrical insulating fluid)



TCDD or 2,3,7,8-tetrachlorodibenzo-p-dioxin

(a trace contaminant)

Benefits of Pesticides:

The major advantage of pesticides is that they can save farmers. By protecting crops from insects and other pests. However, below are some other primary benefits of it.

- Increased yields of crops, because of protection from diseases, competition, defoliation, and parasites.
- Controlling human/livestock disease vectors and nuisance organisms.
- Controlling organisms that harm other human activities and structures.
- Revention of much spoilage and destruction of stored food.
- Avoidance of certain diseases, thereby conserving health and saving the lives of millions of people and domestic animals.

Effects of Pesticides:

- The toxic chemicals in these are designed to deliberately released into the environment. Though each pesticide is meant to kill a certain pest, a very large percentage of pesticides reach a destination other than their target. Instead, they enter the air, water, sediments, and even end up in our food.

- Pesticides have been linked with human health hazards, from short-term impacts such as headaches and nausea to chronic impacts like cancer, reproductive harm.
- The use of these also decreases the general biodiversity in the soil. If there are no chemicals in the soil there is a higher soil quality, and this allows for higher water retention, which is necessary for plants to grow.
- Ecological damage associated with the conversion of natural ecosystems into agricultural ones. Eco-toxicological damage caused by the use of pesticides.

Effect of pesticides on the human health and environment:

Pesticides affect the human health which has been linked to a wide range of human health hazards, ranging from short-term impacts such as headaches and nausea to chronic impacts like cancer, reproductive harm, and endocrine disruption. Acute dangers such as nerve, skin, and eye irritation and damage, fatigue, and systemic poisoning can sometimes be dramatic and even occasionally fatal also. Pesticides affect children and there is now considerable scientific evidence that the human brain is not fully formed until the age of 12 years and childhood exposure to some of the most common pesticides on the market may greatly impact the development of the central nervous system. Moreover, children have more skin surface than adults, thus they absorb greater amounts of these substances through their lungs and intestinal tracts. Long term low dose exposure to pesticide causes immune suppression, hormonal disruption, diminished intelligence, reproductive abnormalities and carcinema .The impacts of pesticides on the environment have been well known where they are toxic to living organisms and they can accumulate in water systems, pollute the air, and in some cases they have other dramatic environmental effects. The use of pesticide can damage agricultural land by harming beneficial insects, soil microorganisms, and worms, which naturally limit pest populations, necessary for soil health in addition they weakened plant root systems and immune systems and reduced concentrations of essential plant nutrients in soil such as nitrogen and phosphorous. The major environmental concern of used pesticides is their capacity to leach down to subsoil and contaminate the ground water or if immobile, they would persist on the top soil where it could accumulate to toxic level in the soil and become harmful to microorganisms, plants, animals and man . The quality of soils, ground water, and coastal waters as well as the air are factors that affect pesticide contamination and degradation. Although pesticides are harmful, they are still used to fight the palm weevil.

Degradation processes of pesticides:

Degradation processes break down pesticide compounds into simpler and often less-toxic chemicals. Some pesticides break down rapidly—in a matter of days or even hours. Other pesticides can be detected in the environment for a year or more. Pesticides are degraded by the following processes

(Figure 1):

(i)Chemical degradation is the breakdown of chemicals by processes that do not involve living organisms, most commonly by hydrolysis, a reaction with water.

(ii) Microbial degradation is the process in which chemicals are degraded by soil microorganisms, such as fungi and bacteria.

(iii)Photo-degradation is the breakdown of chemicals in reaction to sunlight. Water and temperature both affect the degradation of pesticides. Warm, wet conditions can increase the speed of pesticide degradation; cool, dry conditions slow the degradation process.

Table 7. Half-life classes (Degradation)

Class	Half-life peried ($T_{1/2}$)	Maximum time(Hours)
1	5 < 10 hours	-
2	17 (≈1 day)	10-30
3	55 (≈2 days)	30-100
4	170 (≈1 week)	100-300
5	550 (≈ 3 weeks)	300-1000
6	1700 (≈ 2 months)	1000-3000
7	5500 (≈ 8 months)	3000-10000
8	17000 (≈ 2 years)	10000-30000
9	55000 (≈ 6 years)	30000-100000
10	> 11 years	> 100000

A Legislative History of the Pesticide Residues Amendment:

Section 402 of the Food, Drug and Cosmetic Act (FDC Act) includes a "flow-through" provision under which approval of a tolerance for pesticide residue in a raw agricultural commodity under the terms of section 408 serves as substitute approval of the residue in processed food under section 409. If the concentration of the residue in the processed food is still below section 408 tolerances, then no independent section 409 approval is required.

The standards for approval under sections 408 and 409 are markedly different, however. Section 408 uses a type of risk/benefit balancing— weighing the need for an adequate food supply against the need to protect the consumer's health. Section 409 includes the "Delaney Clause," which flatly prohibits approval of a food additive found to induce cancer in humans or animals.

The combination of the section 402 "flow-through" provision and the different standards in sections 408 and 409 creates an anomalous situation whereby a potentially carcinogenic pesticide residue can become a lawful additive to food in spite of the Delaney Clause. As long as the residue does not exceed the section 408 tolerance, the pesticide need not meet the more exacting Delaney standard found in section 409. This anomaly has become increasingly significant in recent years, because some previously approved pesticides have proved carcinogenic in animal studies.

In considering the 1958 Food Additives Amendments, Congress appeared anxious to avoid reopening the pesticide residues debate settled in the 1954 Pesticide Residues Amendments. Hence, bill drafters and witnesses at hearings universally limited, or even precluded, applicability of the proposed food additive standards to pesticide residues.

- **The Delaney Committee Report:**

On June 30, 1952, the House Select Committee to Investigate the Use of Chemicals in Foods and Cosmetics (Delaney Committee) culminated its two-year investigation into the "nature, extent and effect of the use of chemicals" in food and food production. The committee recommended that the House pass legislation to control the flow of chemical substances into the nation's food supply.[1] Chairman Delaney included in the report testimony from the National Cancer Institute (NCI). The testimony noted that "a large number of chemical compounds induce cancer in animals," and concluded that "any estimate of the possible injurious properties of chemicals added to nutrients consumed by men should include careful testimony for their carcinogenic properties in several species of animals prior to approving their use in food.The committee report also criticized existing legislation directed at pesticide residue control, and concluded that new, more effective legislation was necessary.

Pesticide Law and Regulations:

The primary federal statutes that give the EPA the authority to regulate pesticides are the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug, and Cosmetic Act (FFDCA). This page includes a brief overview of the major rules and regulations pertaining to pesticides. New and proposed rules are published in the Federal Register and are then codified into the Code of Federal Regulations (CFR). For more information, see the resources below or contact NPIC for assistance.

- **Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)**: Gives the EPA authority to regulate the sale, use and distribution of pesticides.
- **Federal Food, Drug, and Cosmetic Act (FFDCA)**: Gives the EPA authority to set limits on the amount of pesticide residues allowed on food or animal feed. These limits are called tolerances.
- **Food Quality Protection Act of 1996 (FQPA)**: This act amended FIFRA and FFDCA by increasing the safety standards for new pesticides used on foods. FQPA also required older pesticides and previously established tolerances to be periodically re-assessed using the new, tougher standards.
- **Pesticide Registration Improvement Act (PRIA)**: Establishes the fees and time-lines associated with pesticide registration actions.
- **Endangered Species Act (ESA)**: Requires the EPA to assess the risk of pesticides to threatened or endangered species and their habitats.

- **The Insecticides Act, 1968 (Act No.46 of 1968)** :An Act to regulate the import, manufactures, sale, transport, distribution and use of insecticides with a view to prevent risk to human beings or animals and for matters connected therewith. [2nd September 1968]
- **Food, Agriculture, Conservation and Trade Act (1990 Farm Bill):**

This act required that certified (licensed) private applicators maintain records, comparable to the records kept by commercial applicators, regarding the use of restricted use pesticides. The USDA Agricultural Marketing Service (AMS) was designated to administer the Federal Pesticide Recordkeeping Program. While there is no standardized Federal form for maintaining records, there is certain information that must be recorded within 30 days following the pesticide application. This gives the applicator flexibility in creating forms and format to fit their particular situation. The information that must be recorded includes:

(i) The brand or trade name and EPA registration number of the restricted use pesticide that was applied;

(ii) The total amount of the restricted use pesticide applied;

(iii) The location of the application, the size of the area treated, and the crop, commodity, stored product, or site to which a restricted use pesticide was applied;

(iv) The month, day and year when the restricted use pesticide application occurred;

(v) The name and applicator identification number of the certified applicator who applied or who supervised the application of the restricted use pesticide; and

(vi) Application(s) of restricted use pesticides in a total area of less than one-tenth of an acre (4356 sq. ft or 66 ft x 66 ft) occurring on the same day shall require brand/trade name, EPA registration number, total amount applied, designation of "spot application" for location and date of application.

- **Montana Pesticides Act 1971:**

The Montana Pesticides Act (MPA), Title 80, Chapter 8, Sections 8-8-101 through 80-8-306, MCA was enacted in 1971 and is subdivided into three major areas of responsibility:

(i) Registration of pesticides;

(ii) Licensing of pesticide applicators, operators and dealers; and

(iii) Enforcement and administrative procedures.

- **The Agricultural Pesticides Ordinance,1971 (II of 1971)**
- **The Insecticides (Amendment) Bill, 2015**

- **The Insecticide (Amendment) Bill 2000:**

Pesticides are regulated under the Insecticides Act of 1968 and Insecticides Rules of 1971. In May 2000, the Insecticide (Amendment) Bill 2000, was passed under the shadow of suicide deaths of farmers because of spurious pesticides. This amendment made the punishment for adulterated pesticides more stringent. But it did little to clean up the regulations to register pesticides and to monitor this poison industry. The insecticide act regulates the import, manufacture, sale, transport, distribution and the use of insecticides to prevent any risk to people and animals. The registration committee, constituted under Section 5 of the act, registers an insecticide after verifying its efficacy and safety to human beings, animals and the environment. The Central Insecticides Board (CIB) based in Faridabad, Haryana, advises the Union and state governments on technical matters. In 2001, a total of 2,718 applications were received for registration, of which 1,439 were approved, according to the government.

Reports indicate that a new Pesticides Management Bill 2020 is ready to be introduced into the Parliament in this session, with the earlier 2008 version proposed to be withdrawn by the government. The current state of regulation of pesticides in India, using the extant law called Insecticides Act 1968, has not caught up with post-modern pest management science nor has taken cognizance of a huge body of scientific evidence on the ill effects of synthetic pesticides. It is high time that new legislation is brought in – however, what is unclear is if the Pesticides Management Bill 2020 has indeed overhauled its approach to regulation as needed.