Lecture 25 : PESTICIDE COMPATIBILITY

- In pest control treatment, two or more pesticides, fungicides or even fertilizers are sprayed or applied in the same operation to minimize cost of labour.
- Before mixing two different chemicals, their physical and chemical properties should be well understood.
- Incompatible pesticides should not be mixed. Only compatible pesticides can be mixed.

Incompatability of pesticides may be of following types

a. Chemical incompatibility

Chemical compounds in the two pesticides react with the another producing a different compound, reducing the pesticidal activity of the pesticides (Degradation of active ingredient).

b. Biological incompatibility (Phytotoxic incompatibility)

The mixed product exhibit phytotoxic action, which independantly is not phytotoxic.

c. Physical incompatibility

The physical form of the pesticides change, and one of them become unstable or hazardous for application (agglomeration, phase separation, explosive reaction, etc.).

HAZARDS CAUSED BY PESTICIDES

The adverse effect caused by pesticides to human beings during manufacture, formulation, application and also consumption of treated products is termed as the hazard.

Pesticide hazard occurs at the time of

a. Manufacturing and formulation
b. Application of pesticides
c. Consumption of treated products

Examples of hazards caused by pesticides

1. In Kerala, in 1953, 108 people died due to parathion poisoning
2. 'Bhopal Gas Tradedy' in 1984 at Bhopal where the gas called Methyl isocyanate (MIC) (an intermediate involved in manufacture of carbaryl) leaked killing 5000 people and disabling 50,000 people. Totally 2,00,000 persons were affected. Long term effects like mutagenic and carinogenic effects are felt by survivors.
3. Cases of Blindness, Cancer, Liver and Nervous system diseases in cotton growing areas of Maharashtra where pesticides are used in high quantity.
4. Psychological symptoms like anxiety, sleep disturbance, depression, severe head ache in workers involved in spraying DDT, malathion regularly.

5. Endosulfan - causing problem due to aerial spraying in cashew in Kerala - recent controversy - yet to be studied in detail.

Safe handling of pesticides

1. Storage of pesticides :

a) Store house should be away from population areas, wells, domestic water storage, tanks.

b) All pesticides should be stored in their original labeled containers in tightly sealed condition.

c) Store away from the reach of children, away from flames and keep them under lock and key.

2. Personal protective equipment

a) Protective clothing that covers arms, legs, nose and head to protect the skin.

b) Gloves and boots to protect hands and feet.

c) Helmets, goggles and facemask to protect hair, eyes and nose.

d) Respirator to avoid breathing dusts, mists and vapour.

3. Safety in application of pesticides

Safe handling of pesticides (Fig.68) involves proper selection and careful handling during mixing and application.

a) Pesticide selection : Selection of a pesticide depend on the type of pest, damage, losses caused, cost etc.

b) Safety before application :

i. Read the label and leaflet carefully.
ii. Calculate the required quantity of pesticides.
iii. Wear protective clothing and equipment before handling.
iv. Avoid spillage and prepare spray fluid in well ventilated area.
v. Stand in the direction of the wind on back when mixing pesticides.
vi. Do not eat, drink or smoke during mixing.
vii. Dispose off the containers immediately after use.

c) Safety during application

i. Wear protective clothing and equipment.
ii. Spray should be done in windward direction.
iii. Apply correct coverage.
iv. Do not blow, suck or apply mouth to any spray nozzle.
v. Check the spray equipment before use for any leakage.

d) Safety after application

i. Empty the spray tank completely after spraying.

ii. Avoid the draining the contaminated solution in ponds, well or on the grass where cattle graze.
iii. Clean the spray equipment immediately after use.
iv. Decontaminate protective clothing and foot wear.
v. Wash the hands thoroughly with soap water, preferably have a bath.
vi. Dispose off the containers by putting into a pit.
vii. Sprayed field must be marked and unauthorized entry should be prevented.

First aid : In cane of suspected poisoning; call on the physician immediately. Before calling on a doctor, first aid treatments can be done by any person.

Swallowed poison

i. During vomiting, head should be faced downwards.
ii. Stomach content should be removed within 4 h of poisoning.
iii. To give a soothing effect, give either egg mixed with water, gelatin, butter, cream, milk, mashed potato.
iv. In case of nicotine poisoning, give coffee or strong tea.

Skin contamination

i. Contaminated clothes should be removed.
ii. Thoroughly wash with soap and water.

Inhaled poison

i. Person should be moved to a ventilated place after loosing the tight cloths.
ii. Avoid applying frequent pressure on the chest.

III. Antidotes and other medicine for treatment in pesticide poisoning

S.No.	Antidote / Medicine	Used in poisoning due to
1.	Common salt (Sodium chloride)	Stomach poison in general
2.	Activated charcoal (7g) in warm Magnesium oxide (3.5g) water Tannic acid (3.5g)	Stomach poison in general
3.	Gelatin (18 g in water) or Flour or milk power (or) Sodium thiosulphate	Stomach poison in general
4.	Calcium gluconate	Chlorinated insecticide, Carbon tetrachloride, ethylene dichloride, Mercurial compound

5.	Phenobarbital (or) Pentobarbital intravenous administration	Stomach poison of chlorinated hydrocarbon insecticides
6.	Sodium bicarbonate	Stomach poison of organophosphate compounds
7.	Atropine sulphate (2-4 mg intramuscular / intravenous administration) or PAM (Pyridine-Z aldoxime-N-methliodide)	Organophosphate Compounds
8.	Atropine sulphate (2-4 mg intramuscular / intravenous administration)	Carbamates
9.	Phenobarbital	Synthetic pyrethoid
10.	Potassium permanganate	Nicotine, Zinc phosphide
11.	Vitamin K1 and K2	Warfarin, Zinc phosphide
13.	epinephrine	Methlyl bromide
14.	Methyl nitrite ampule	Cyanides

Impact of Pesticides in Agroecosystem

The following are some problems caused by pesticides in agro-eco system

1. Pesticide residues
2. Insecticide resistance
3. Insect resurgence and secondary pest outbreak
4. Toxicity to non target organism

1. Pesticide residues

The pesticide that remains in the environment after application causes problems to humans and non-target organisms (Already dealt in theory - Read) e.g. Residues of DDT, HCH in milk, vegetable above MRL.

2. Insecticide resistance

Insecticide resistance is the development of an ability to tolerate a dose of insecticide, which would prove lethal (kill) to majority of the individuals of the same species.

This ability is due to the genetic change in pest population in response to pesticide application.

Insecticide resistance in insect pests in India

	Name of pest	Common name	Insecticides to which resistant
1.	*Aphis craccivora*	Aphid	Carbamates, OP, Cypermethrin, Endosulfan, Monocrotophos
2.	*Bemesia tabaci*	Whitefly	
3.	*Helicoverpa armigera*	Cotton boll worm	OP, Synthetic pyrethroid, *Bacillus thuringiensis*
4.	*Plutella xylostella*	Diamond back moth on cabbage, cauliflower	Abamectin, Bt, OP compounds

Simple resistance **:** Insect develops resistance only against the insecticide to which it is exposed

Cross resistance **:** Insect develops resistance not only to exposed insecticide but also to other related insecticides to which it is not exposed.

Pest Resurgence

Tremendous increase in pest population brought about by insecticides despite good initial reduction in pest population at the time of treatment.

Insecticides lead to pest resurgence in two ways.

After initial decline, resistant population increase in large numbers

Killing of natural enemies of pest, cause pest increase

e.g. Quinalphos, phorate - Cause resurgence of BPH in rice

Carbofuran - Leaf folder in rice

Secondary pest outbreak

Application of a pesticide against a major pest, kills the natural enemies of minor or secondary pest. This causes the outbreak of a secondary pest.

e.g. Use of synthetic pyrethroids against bollworms in cotton killed natural enemies of whitefly causing an outbreak of whitefly which was a minor pest till then.

Toxicity of non-target organisms

i. Natural enemies : Predators and parasitoids are killed loading to pest outbreak

ii. Bee toxicity : Bees are important pollinators. Killing bees reduce crop productivity

iii. Soil organisms : Soil organisms like microbes, arthropods, earthworm,

			etc. are required for maintaining soil fertility. These are killed by some pesticides e.g. DDT, HCH
iv.	Fishes	:	Pesticides from treated surface run off to nearby lakes and kill the fishes

Hence while choosing an insecticide it should be safe (causing less harm) to these organisms.

Specific IPM practices for rice and cotton. Biotechnology in pest management.