(Ent-714) Insecticide Toxicology Credit Hours 3(2-1)

Lecture # 8 Delivered by Dr. Hassan Yasoob

Topic:- Mammalian and Phytotoxicity of insecticides

Phytotoxicity is the damage inflicted on plant growth as a result of a toxic compound. Trace metals, pesticides, salinity, allelochemicals, or phytotoxins compounds are responsible for such damage. With certain spray mixtures and insecticides the phytotoxic reaction causes damage to the plant.

Phytotoxicity Symptoms of Herbicides in Different Crops & Plants

Plants that manifest phytotoxic reactions include the following symptoms:
1) **Abnormal Growth**. Certain parts such as the aerial roots or suckering, or perhaps the entire plant will experience excessive growth.
2) **Chlorosis**. Spots or tip margin or leaf yellowing appears.
3) **Leaf Distortion**. The leaf crinkles, curls, or appears to be cupping.
4) **Stunting**. The plant in its entirety is reduced in size, or specific parts such as the fruit, roots, or flowers may look smaller in comparison to the rest of the plant.

Testing Pesticides Used in Agriculture

For avid growers wanting to deflect problem insects while preserving their plants, formulating an effective insecticide that causes little effect to plants is beneficial. Having such claims with proven statistics and data that back the results of applying various chemical mixtures that don't harm plants is essential. Separating the injuries caused to plants from the chemical application to insect damage, nutrient deficiency, and temperature effects, are all taken into account during Snell Scientifics Phytotoxicity Tests. Using only vibrant and well established plants that are healthy, well fed, and thriving can provide accurate results for your insecticide.

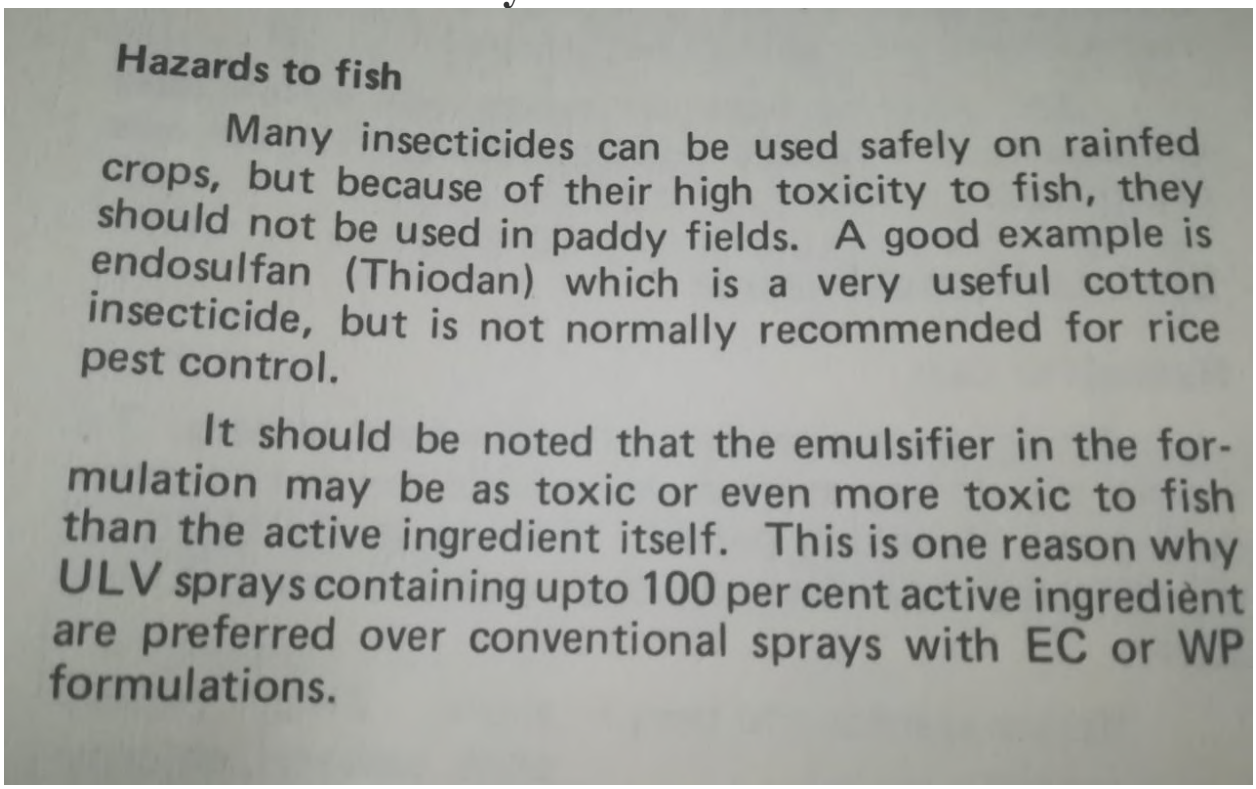
Pesticide Formulation

When formulating pesticides for outdoor use and growing plants, avoiding phytotoxicity is critical. Given the need to avoid this, the data is what reveals the inert and adjutants used in pesticide formulation. As a part of the research involves much of the ground work, the trials and tests performed by Snell Scientifics, LLC are a major contributor to the details and statistics attained. In addition to only testing pesticides on healthy plants that show no sound of stress, or need for water as wilted plants are very sensitive to spray injury. We also ensure that temperatures are monitored as sprays will dry too quickly or remain wet in extreme temperatures.

Phytotoxicity in Plants

Phytotoxicity occurs in the plants after the applied sprays or drenches contaminate the plants cells; negatively impacting their cellular components like chloroplasts, which will inhibit the leaf function and respiration, remove the waxy cuticle layer that offers protection, as well as effecting the plants hormonal system and cause osmotic imbalance in the roots. Because miscalculation of rates and products used in tank mixes can increase penetration into cells or leaves, simple over-application can be a common problem. With the tests we perform, we can collect all pertinent data concerning that issue as well.

Mammalian Toxicity



Hazards to fish

Many insecticides can be used safely on rainfed crops, but because of their high toxicity to fish, they should not be used in paddy fields. A good example is endosulfan (Thiodan) which is a very useful cotton insecticide, but is not normally recommended for rice pest control.

It should be noted that the emulsifier in the formulation may be as toxic or even more toxic to fish than the active ingredient itself. This is one reason why ULV sprays containing upto 100 per cent active ingredient are preferred over conventional sprays with EC or WP formulations.

Classification	LD 50 for rats (mg/kg body weight)			
	Oral		Dermal	
	Solids	Liquids	Solids	Liquids
Extremely hazardous	≤ 5	≤ 20	≤ 10	≤ 40
Highly hazardous	5–50	20–200	10–100	40–400
Moderately hazardous	50–500	200–2000	100–1000	400–4000
Slightly hazardous	> 500	> 2000	> 1000	> 4000

Note: ≤ means "equal to or less than", > means "greater than"

Pyrethroids rated according to their oral toxicity in rats:

Degree of hazard	Active ingredient	LD 50 (mg/kg)	
Moderately hazardous	allethrin	920	
	bioallethrin	425-575	
	cypermethrin	303	
	fenvalerate	300-630	
	NRDC 161 (Decis)	135	(formerly: decamethrin*)
	permethrin	430-4000	(depending on ratio of cis/trans-isomers)
Slightly hazardous	phenothrin	> 500	
	bioresmethrin	7070	
	resmethrin	750	(dermal LD 50 is 2000 mg/kg)
	tetramethrin	> 4640	
	botanical pyrethrins	1800	

** Note: The name "decamethrin" is unacceptable and should not be used. (See also footnote in Chapter 2), page 10).*

Acute oral LD 50 values for some common drugs and chemicals as compared with some values for pesticides:

Substance	Species	Oral LD 50 (mg/kg)		Dermal LD 50 mg/kg	
		Male	Female		
botulin	man	0.00005	–	–	
chloropicrin	rat	0.8	–	–	
KCN (kalium cyanide)	man	1	–	–	
parathion (methyl- or ethyl-)	rat	3.6	13	21-67	
adrenaline	man	10	20	–	
endrin	rat	18	–	15	
methidation	rat	25	54	155	
zinc phosphide	rat	40	46	–	
nicotine (botanical)	rat	50	–	140	
DDT	rat	120	250	25	
paraquat	rat	157	207	480	(rabbit)
aspirin	man	500	650	–	
atrazine	rat	1,869	3,080	7,500	(rabbit)
pyrethrin (botanical)	rat	1,800	–	1,800	
malathion	rat	2,800	–	–	
NaCl (common salt)	man	3,750	–	–	
ethanol (liquor-alcohol)	man	4,000	–	–	
glyphosate	rat	4,320	–	–	
maneb	rat	6,750	–	1,000	
captan	rat	9,000	–	–	

TABLE 2.2 MAMMALIAN TOXICITIES OF SOME INSECTICIDES

Name of insecticide	Acute oral LD_{50} for rat (mg/kg)	Acute dermal LD_{50} (mg/kg)	Toxicity class according to WHO
Organochlorines			
DDT	113-118	2510 (♀ rats)	II
dicofol/kelthane	595-578	>5000 (rabbits)	III
Endosulfan	70	395 (rabbits)	II
Gamma-HCH	88-270	900-1000 (rats)	II
Heptachlor	147-220	200-2000 (rabbits)	II
Methoxychlor	6000	2000 (rabbits)	III
Orgsnophosphates			
Acephate	1030-1477	>10000 (rabbits)	III
Azinphos-ethyl	12	500 (rabbits)	1b
Azinphos-mthyl	9	150-200 (rats)	1b
Chlorfenvinphos	10	31-108 (rats)	1b
Chlorpyrifos ethyl	135-163	>2000 (rats)	II
Chlorpyrifos methyl	>3000	3700 (rats)	III
Diazinon	1250	>2150 (rats)	II
Dichlorvos	56-108	75-108 (rats)	1b
Dicrotophos	17-22	111-136(rats)	1b
Dimethoate	387	>2000 (rats)	II
Disulfoton	2-12	3.6-15.9 (rats)	1a
Fenitrothion	1700-1720	810-840 (rats)	II
Fenthion	250	586-800 (rats)	II
Malathion	1375-2800	4100 (rabbits)	III
Methamidophos	13-15.6	69-122 (rabbits)	1b
Methidathion	25-54	297-1663 (rats)	1b
Mevinphos	3-12	4-90 (rats)	1a
Monocrotophos	14	336 (rats)	1b
Oxydemeton	50	130 (rats)	1b
Parathion ethyl	2	71-76 (rats)	1a
Parathion methyl	3	45 (rats)	1a
Phenthoate	249-270	>5000 (rats)	II
Phorate	1.6-3.7	2.5-2.6 (rats)	1a
Phosalone	120	1500 (rats)	II
Phosphamidon	17.4	374 (rats)	1a
Phosphamidon	17.9-30	374-530 (rabbits)	1a
Pirimiphos-methyl	1414	>2000 (rats)	III
Profenofos	358	3300 (rats)	II
Quinalphos	71	1750 (rats)	
Triazophos			

Butoxycarboxim	458	>2000 (rabbits)	
Bytocarboxim	153-215	360 (rabbits)	Ib
Carbaryl	500-850	>4000(rats)	Ib
Carbofuran	8	>2000 (rats)	II
Carbosulfan	185-250	>2000 (rats)	Ib
Cartap	325-345	>1000 (mice)	II
Fenobucarb	632-657	10250 (rabbits)	II
Furathiocarb	53	>2000 (rats)	II
Isoprocarb	450	>500 (rats)	Ib
Methomyl	30-34	>2000 (rabbits)	II
Pirimicarb	142	>2000 (rats)	Ib
Thiodicarb	66	>2000 (rabbits)	II
			II

Synthetic Pyrethroids

Allethrin	900-2150	2660-4390 (rabbits)	III
Alphamethrin	79-400	>2000 (rats)	II
Betacyfluthrin	500	>500 (rats)	Ib
Betacypermethrin	166-178	>5000 (rats)	II
Bifenthrin	54.5	>2000 (rabbits)	II
Cycloprothrim	>5000	>2000 (rats)	III
Cyfluthrin	500	>5000 (rats)	Ib
Cyhalothrin	114-166	1000-2500 (rats)	II
Cypermethrin	250-4150	>4920	II
Deltamethrin	135->5000	>2000(rats)	II
Esfenvalerate	75-88	>5000 (rats)	II
Fenpropathrin	66.7-70.6	>2000 (rabbits)	II
Fenvalerate	451	1000-3200 (rats)	II
Flucythrinate	67-81	>1000(rabbits)	Ib
Fluvalinate	261-282	>2000 (rabbits)	II
Lamda-cyhalothrin	56-79	632-692 (rats)	II
Permethrin	430-4000	>2500 (rats)	II
Resmethrin	>2500	>3000 (rats)	III
Theta-cypermethrin	3200-7700	>5000 (rats)	III
Tralomethrin	99-3000	>2000 (rabbits)	II
Zeta-cypermethrin	105.8	>2000 (rabbits)	Ib

NATURAL INSECTICIDES

Azadirachtin	>5000	>2000 (rabbits)	III
Nicotine	50-60	50 (rabbits)	Ib
Pyrethrins (Pyrethrum)	1030-2370	5000 (rabbits)	II
Rotenone	132-1500	>5000 (rabbits)	II
Sabadilla	4000	-	III

NEW CHEMISTRY INSECTICIDES

Abamectin			
	10		

Etofenprox	>42880	>2140(rats)	III
Fenoxycarb	>10000	>2000(rats)	III
Flufenoxuron	>3000	>2000(rats)	III
Gossyplure	>5	>2000(rats)	Ib
Hexaflumuron	>5000	>5000(rats)	III
Imidacloprid	450	>5000(rats)	II
Indoxacarb	268-1723	>5000(rabbits)	II
Lufenuron	>2000	>2000(rats)	III
Metdyfenozide	>5000	>5000(rats)	III
Novaluron	>5000	>2000(rats)	III
Pymetrozine	5820	>2000(rats)	III
Pyriproxyfen	>5000	>2000 (rats)	III
Spinosad	3783-75000	>2000 (rabbits)	III
Tebufenozide	>5000	>5000 (rats)	III
Teflubenzuron	>5000	>2000 (rats)	III
Thiomethoxam	1563	>2000 (rats)	III