

# Target Specialty Products Aquatic Weed Meeting April 6-8, 2010

## The Fate of Pesticides in the Environment

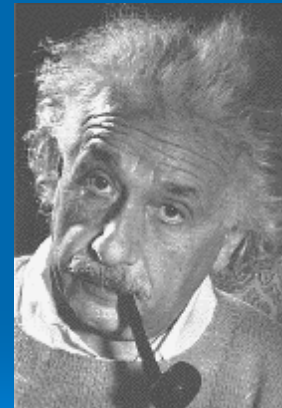
Target Specialty Products  
Aquatic Weed Meeting

April 6-8, 2010  
Michael Blankinship

 **Blankinship & Associates, Inc.**  
Agricultural & Environmental  
Consultants

The periodic table is color-coded by blocks: s-block (yellow/green), d-block (purple), p-block (various colors), and f-block (blue). It includes atomic numbers, symbols, and names for each element, along with phase indicators (Solid, Liquid, Gas) and mass numbers for common isotopes.

$$\begin{aligned}
 66. \quad & 9x^2 - 6x + 37 = 0 \\
 & a = 9, b = -6, c = 37 \\
 & x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
 & = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(9)(37)}}{2(9)} \\
 & x = \frac{6 \pm \sqrt{36 - 1332}}{18} = \frac{6 \pm \sqrt{-1296}}{18} \\
 & = \frac{6 \pm 36i}{18} = \frac{1 \pm 6i}{3} = \frac{1}{3} \pm 2i
 \end{aligned}$$



You don't have  
to be Einstein  
to put  
chemistry and  
toxicology to  
work for you

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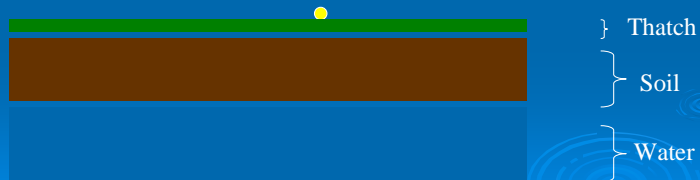
## Today's Talk

- Environmental Fate
- Toxicology & Risk
- Case Study
- Questions
- Quiz

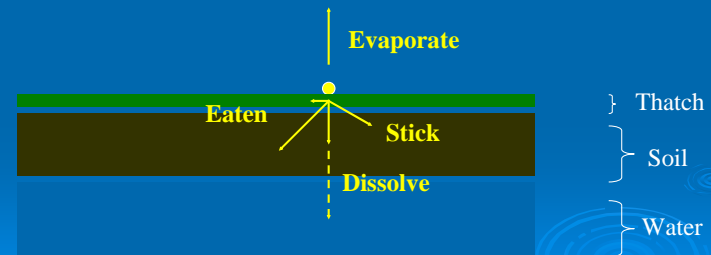
## Environmental Fate

- What Is It ?
- How Do You Use It ?

### Environmental Fate: What Is It?

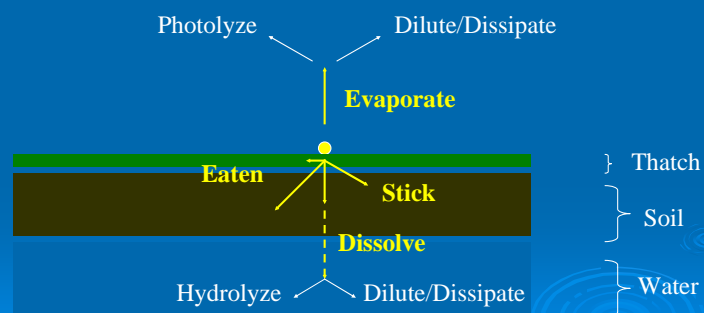


### Environmental Fate: What Is It?



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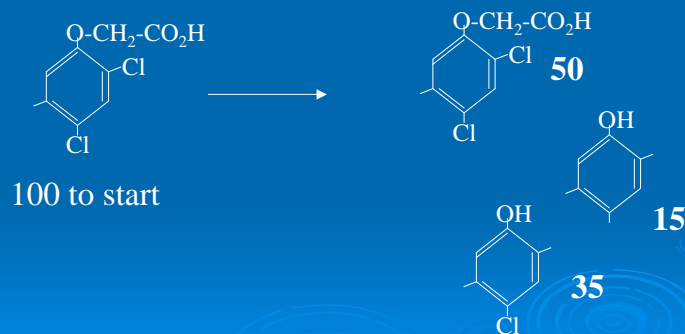
## Environmental Fate: What Is It?



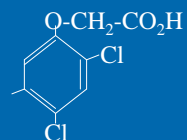
Term	Also Known As:	Measured By:
<b>Stick</b>	Adsorb	Adsorption Coefficient
<b>Eat</b>	Metabolize	Half Life
<b>Evaporate</b>	Evaporate/ Volatilize	Vapor Pressure
<b>Dissolve</b>	Solubilize	Solubility

**“SEED”**

## Tasty.....Lets Eat!



## Tasty.....Lets Eat !



100 molecules Today

50 molecules Tomorrow

Half Life ( $t_{1/2}$ ) = 1 Day



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<b>Term</b>	<b>Also Known As:</b>	<b>Measured By:</b>	<b>What is Good Number?</b>
<b>Stick</b>	Adsorb	Adsorption Coefficient	High
<b>Eat</b>	Metabolize	Half Life	Low
<b>Evaporate</b>	Evaporate/ Volatilize	Vapor Pressure	Low
<b>Dissolve</b>	Solubilize	Solubility	Low

### The 2 faces of Triclopyr....

<b>Product/Active Ingredient</b>	<b>Solubility (mg/L)</b>	<b>Vapor Pressure (x 10<sup>-8</sup> mm Hg)</b>
Garlon 4 (Triclopyr BEE)	<b>7</b>	<b>360</b>
Garlon 3A (Triclopyr TEA)	<b>400,000</b>	<b>1</b>

## Toxicology & Risk

- 2 Important Terms
- 2 Key Concepts
- How Do You Use It ?

## Toxicology Terms

- LC<sub>50</sub>
  - Lethal Concentration that kills 50% of a test population
  - Typically expressed in mg/L
- LD<sub>50</sub>
  - Lethal Dose that kills 50% of a test population
  - Typically expressed in mg/Kg of animal body weight



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**Key Concept #1:**  
**“The Dose Makes The Poison”**

**“The Dose Makes The Poison”**

*“All things are poison and nothing is without poison”.  
“It is the dose only that makes a thing not a poison.”  
Paracelsus, 1567*

**ALCOHOL IMPAIRMENT CHART**

Drinks	APPROXIMATE BLOOD ALCOHOL PERCENTAGE								
	Body Weight in Pounds								
	100	120	140	160	180	200	220	240	
0	.00	.00	.00	.00	.00	.00	.00	.00	ONLY SAFE DRIVING LIMIT
1	.04	.03	.03	.02	.02	.02	.02	.02	IMPAIRMENT BEGINS
2	.08	.06	.05	.05	.04	.04	.03	.03	DRIVING SKILLS SIGNIFICANTLY AFFECTED
3	.11	.09	.08	.07	.06	.06	.05	.05	
4	.15	.12	.11	.09	.08	.08	.07	.06	POSSIBLE CRIMINAL PENALTIES
5	.19	.16	.13	.12	.11	.09	.09	.08	
6	.23	.19	.16	.14	.13	.11	.10	.09	LEGALLY INTOXICATED
7	.26	.22	.19	.16	.15	.13	.12	.11	
8	.30	.25	.21	.19	.17	.15	.14	.13	CRIMINAL PENALTIES
9	.34	.28	.24	.21	.19	.17	.15	.14	
10	.38	.31	.27	.23	.21	.19	.17	.16	

Your body can get rid of one drink per hour.  
One 1½ oz. of 80 proof liquor, 12 oz. of beer or 5 oz. of table wine = 1 drink.

**Key Concept #2**

**Risk = Toxicity x Exposure**

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## Exposure

- Dermal (Absorption)
- Oral (Ingestion)
- Inhalation (Inhalation)
- But, what happens to the chemical on the way to the receptor.....?

## To Manage Risk...

- You Can't Change Toxicity...
- ...So Manage Exposure
  - Understand Environmental Fate
  - Read the Label
  - Use BMPs, Buffer Zones, and Drift Control
  - Make An Informed Chemical Selection

## Case Study

- Aquatic Use of Glyphosate



## Aquatic Toxicity

USEPA Classification	Acute Aquatic LC <sub>50</sub> (mg/L)
Practically Non-Toxic	>100
Slightly Toxic	10-100
Moderately Toxic	1-10
Highly Toxic	0.1-1
Very Highly Toxic	< 0.1



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### Glyphosate Aquatic Toxicity

Organism	LC <sub>50</sub> (mg/L)	USEPA Classification
Fathead Minnow	97	Slightly Toxic
Juvenile Pink Salmon	14	Slightly Toxic
Juvenile Coho Salmon	27	Slightly Toxic
Rainbow Trout	140	Practically Non-Toxic
Water Flea	750	Practically Non-Toxic

Risk: Exposure is ???

➤ **Example:**

- AquaMaster®
- Apply at Maximum label rates
- What are the resulting water concentrations?

### Risk: Resulting Water Concentrations

Assume: 3 inches of water and 50 % Plant uptake

Chemical	Resulting water concentration (mg/L)
AquaMaster®	4
Cygnat Plus®	1.3

### Risk: The Last Step

➤ **Example:**

- We know the toxicity
- We now know the exposure
- We conservatively estimate no degradation
- What is the risk?



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Risk: The Last Step

- Use the “Hazard Quotient”
  - $HQ = \frac{\text{Expected Concentration}}{LC_{50}}$
  - If  $HQ < 1$ , not likely a problem
  - If  $HQ > 1$ , maybe a problem

Risk: The Last Step

Assume: 3 inches of water and 50 % Plant uptake

Pesticide	HQ
AquaMaster <sup>®</sup>	$4/14 = 0.29$
Cygnat Plus <sup>®</sup>	$1.3/31 = 0.04$

You Can't Change  
Toxicity...

...So Manage Exposure

- Pick Your Chemical Wisely
- Be Aware of Sensitive Receptors
- Use BMPs



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Questions?

➤ **Michael Blankinship**

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