

# Insects, plant pathogens & other speciality crop challenges

Quick review of your region:  
diagnosis & management

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## Can and Can't do

### Can Do

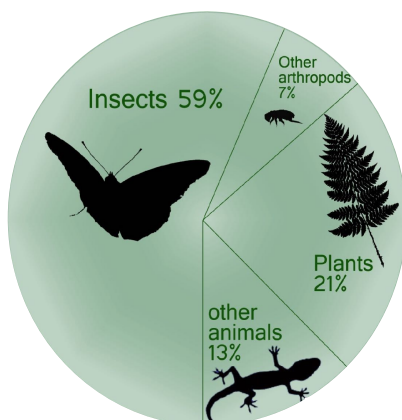
- Provide possible diagnoses for different problems
- Provide promising management strategies based on the possible diagnoses
- Provide evidence-based solutions based on my past experiences

### Can't Do

- Provide accurate diagnosis for all crop challenges
- Provide the silver-bullet solution to management
- Provide completely novel solutions

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## The most diverse life form on the planet



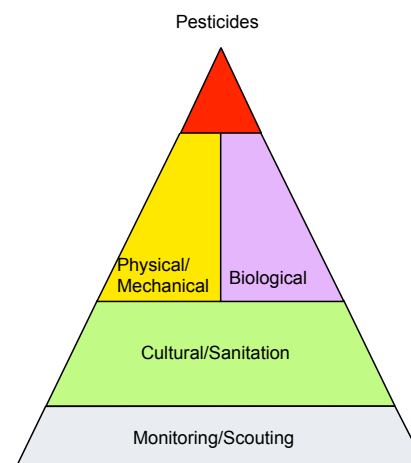
Recent estimates of species diversity

- 1.2 million species described
- Total estimated species count: 8.7 million (Eukaryotes)
  - 2.2 million marine
- 86% of existing species undescribed (96% of marine species) (Mora et al. 2011)

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## IPM Pyramid



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## Integrated Pest Management

- Minimize impact on the environment
- Minimize impact on human health
- Maintain or increase soil fertility
- Long-term pest management
- Prevent pesticide-resistant pests
- Strives to maximize long-term returns/savings

## Integrated Pest Management

- Strives to maximize long-term returns/savings

### **Abamectin 18C:**

\$1,570 / 250 mL bottle

@ 300 mL/ha

~\$56.52 per application (for 10 m x 30 m area)

Spray every 2 days over 6 week crop (lettuce)

\$1,186.92 / 300 sq. m.

## Pesticide Stewardship



## Pesticide modes of action

- Nervous system poisons
- Metabolic inhibitors
- Hormone mimics
- Physical poisons
- Repellents
- Attractants

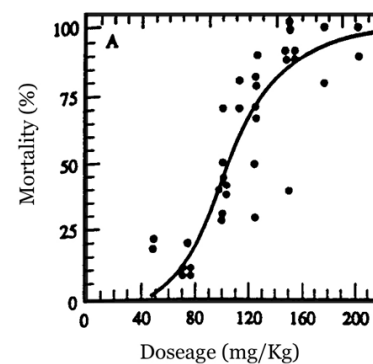


## The dose makes the poison

- Paracelsus (1493-1541)
- “All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy.”



## Dose-Response Curve



Real dose-response curve for DDT

## EPA Pesticide Toxicity Classes

	Extremely Toxic	Very Toxic	Moderately Toxic	Slightly Toxic
<b>Toxicity Category</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>
<b>Signal Word</b>	<b>Danger</b>	<b>Warning</b>	<b>Caution</b>	<b>Caution</b>
<b>Oral LD<sub>50</sub> (mg/Kg)</b>	0 – 50	50 – 500	500 – 5,000	> 5,000
<b>Equivalent Lethal Dose for 150 lb human</b>	Less than a teaspoon	Teaspoon to an ounce	Ounce to a Pint	Pint to a quart or more

## Pesticide Safety



### Acute toxicity

Rapidly produced toxicity, usually resulting from a single exposure

### Chronic toxicity

Toxicity due to slow-action or long-term exposure to a poison

## Pesticide Safety



### Possible chronic effects:

- Carcinogenicity-cancer
- Mutagenicity-genetic mutation
- Teratogenicity-birth defect
- Oncogenicity-tumors
- Reproductive effects
- Delayed neurological effects

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$$\text{Toxicity} \times \text{Exposure} = \text{Hazard}$$

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### Deviate from the label?

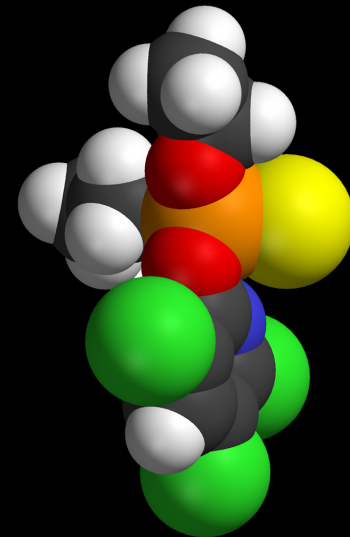
- Very little
- Can use on pests not listed only if the site of application is listed
- In most cases you can use **LOWER** rate than on the label



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### Classifying insecticides by chemical class

- Organo-phosphates
- Carbamates
- Botanicals
- Pyrethroids
- Neonicotinoids
- Others



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## Organophosphates

- Many formerly common pesticides
- chlorpyrifos (Dursban)
- diazinon
- acephate (Orthene)
- malathion
- Disappearing from market



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## Botanicals

- Pesticides derived from plants
  - pyrethrins
  - neem extracts & oils
  - rotenone
  - Mint oils
  - citrus oils
  - clove oil
  - other essential oils



Neem seed

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*Chrysanthemum cinerariifolium*  
*C. coccineum*

## Pyrethrins

- From ground-up flowerheads of pyrethrum daisies
- A natural combination of six compounds: pyrethrins I and II, jasmolin I and II, and cinerin I and II
- More uses approved than any other insecticide
- Usually includes a “synergist” to keep insects from detoxifying it



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## Pyrethroids

- Synthetic chemicals based on pyrethrins chemistry
- Broad spectrum replacements for Dursban®, diazinon
- Low in toxicity to birds and mammals, but hazardous to fish in some settings
- i.e. Karatax & Fastak



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## Pyrethroids

- Recognize by suffixes: -thrin or -ate
- Examples:
  - Esfenvalerate
  - Permethrin
  - Bifenthrin
  - Cyfluthrin
  - Allethrin
  - Sumithrin
  - Others



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## Neonicotinoids

- New class of systemic pesticides
  - imidacloprid (Bayer)
  - dinotefuran (Spectracide?)
- Effective against
  - Homoptera
  - Coleoptera (chewing, boring)
  - Thysanoptera
- Relatively low in mammalian, bird toxicity
- i.e. Pronto



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## Organic vs. synthetic

- “organic” pesticides include products derived from natural sources
- Synthetic pesticides are human-produced



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## Are organic products inherently safe?



Giant hogweed



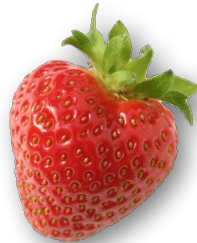
Poison ivy

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## Even plants have carcinogens!

- Tobacco (leaf) - 7 carcinogens
- Strawberry (fruit) - 7 carcinogens
- Onion (bulb) - 6 carcinogens
- Tea (leaf) - 6 carcinogens
- Carrot (root) - 6 chemicals
- Cauliflower (leaf) - 5 chemicals
- Grapefruit (fruit) - 5 chemicals



Source: Phytochemical Database, USDA - ARS - NGRL  
<http://www.ars-grin.gov/duke/activity.html>

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## Low impact pesticides

- Pesticides with minimal impact on people and on beneficial organisms, including beneficial insects

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## Low impact pesticides

- Insecticidal soaps & oils
  - Kill small and soft-bodied insects and mites. Contact insecticide with short residue
  - Examples: Safer's soap, Sunspray Ultrafine Spray Oil, vegetable and neem oils

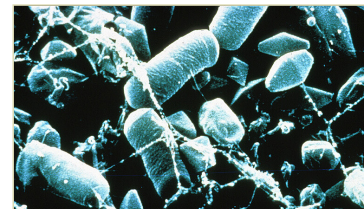


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## Low impact pesticides

- Microbe-derived
  - Consisting of, or derived from microbes. The best are low in toxicity to humans and non-pathogenic to non-target organisms.



– Examples: *Bacillus thuringiensis* products, spinosad

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## Low impact pesticides

- Botanicals
  - Derived from plants. Although some active ingredients are toxic, generally formulated as a low percentage a.i. and degrade quickly in the environment.
  - Examples: pyrethrum, neem extract, essential oils, others...



## Low impact pesticides

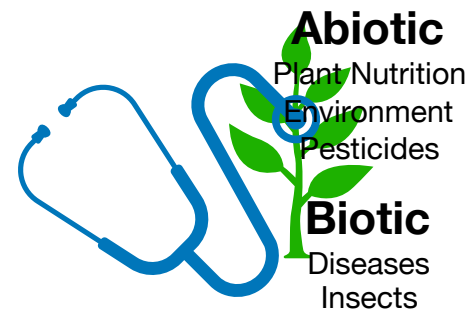
- Insect growth regulators
  - Based on insect hormones unique to arthropods
  - Disrupts reproduction, molting, other growth processes
  - Excellent safety record
  - Products for fire ants, white grubs, fleas, others



## Chemical Rotation

- Switching the target of our pesticide from week to week
- To prevent pesticide-resistant pests!
- Maintain effective pesticides in our tool belt

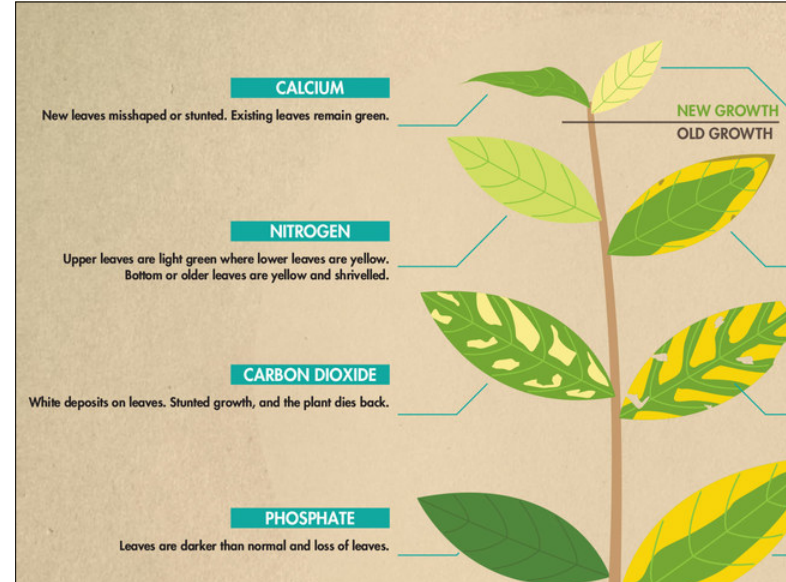
## Plant Health



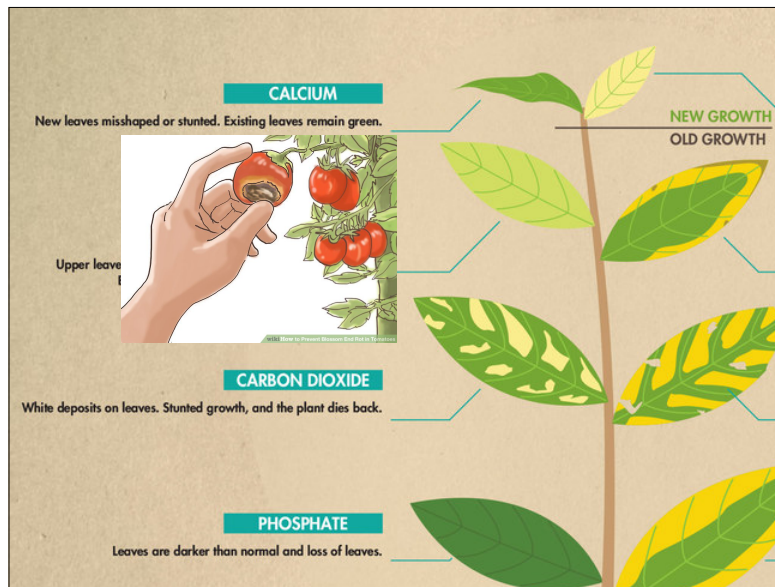
# Plant nutrition deficiency



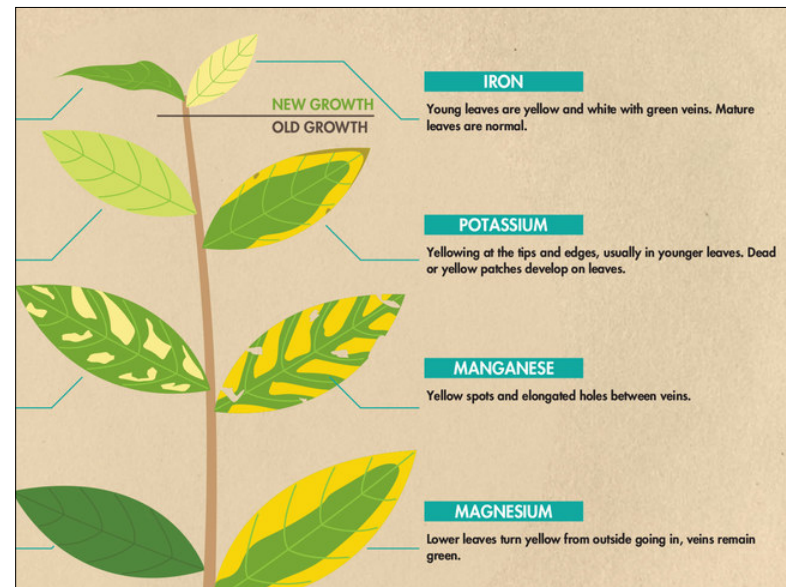
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**TRIVIA!**  
**Plant nutrition deficiency**



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**TRIVIA!**  
**Plant nutrition deficiency**



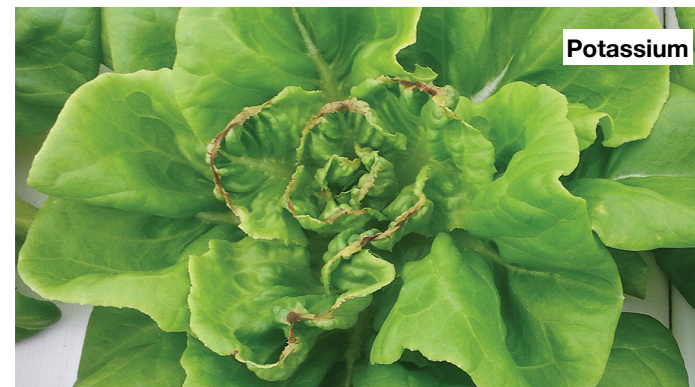
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**TRIVIA!**  
**Plant nutrition deficiency**



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**TRIVIA!**  
**Plant nutrition deficiency**



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