IPM

A Primer

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IPM

This presentation will cover:

- IPM -- What is it?
- IPM Concepts and Strategies
- Components of IPM program

Integrated Pest Management

- IPM is a sustainable approach to managing pests which combines biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks.

  "Risk Reduction"

Integrated Pest Management

- Holistic approach that is ecologically based – involves knowledge of crop, of the biology and life cycles of pests and other organisms within the ecosystem and the impact of environment.

IPM

- IPM is a philosophy, a way of thinking, a way of approaching pest management.

Integration -- different levels

- Integration of knowledge, information
- Integration of insect, disease, weed management --> crop management

IPM

- Integrated Pest Management is an important component of

Sustainable Agriculture

Sustainable Agriculture

economically viable, environmentally sound and socially acceptable agriculture;

enhances profits, protects the environment, and improves the quality of life.

IPM

Types of “Pests”

- Insects & Mites (Arthropods)

- Pathogens -- disease causing organisms (fungi, bacteria, nematodes, viruses, etc.)

- Weeds

- Vertebrate "pests" -- birds voles, deer, etc.

Phylloxera

Bird damage

ALS

GBM

IPM

- **Management** --

  involves planning,

  involves monitoring,

  involves application of knowledge and information

IPM

An IPM program
is based on
knowledge
and is
information-driven.

IPM

Historical Perspective
in
U.S. Agriculture

IPM

- IPM historically developed within Entomology as response to over-reliance and overuse of synthetic insecticides across all crops post- WWII.

- Insect management became 'Calendar-based'

IPM

- The sole reliance of insecticides for insect pest management led to:
  - Selection of resistance in pest populations
  - Destruction of beneficial species
  - Resurgence of target pest populations
  - Outbreaks of secondary pests
  - Hazards to humans and the environment

  - **“Pesticide Treadmill”**

IPM

- In the late 1960's -early 1970's -- entomologist started to emphasize **Integrated Pest Management for insect pests** -- integrating cultural, biological, physical, mechanical, genetic and regulatory methods with pesticide options to manage insect pests below "economic injury levels".

- **Concepts of "Economic Injury Level"** and **"Action Threshold"** developed

"Tolerance"

- The concept of **Tolerance of Pest Damage** is also an important one in IPM.

- The goal is **not to kill every last bug** out there but to **manage populations** at **tolerable levels** -- and that tolerance level is called the **Economic Injury Level**

Economic Injury Level

"the lowest pest population density that will cause economic damage" (Stern, et. al. 1959)

"… where the loss caused by the pest equals in value the cost of available control measures." (NAS 1969)

Action Threshold

"the density at which control measures should be applied to prevent an increasing pest population from reaching the economic injury level" (Stern, et. al. 1959)

IPM

- Started with insect pest management

- Philosophy, Concepts, Techniques applied to:

  Disease Management

  Weed Management

  Vole Management

  etc.

Components of an IPM Program

- Knowledge and use of crop biology, pest biology/behavior and life cycles
- Monitoring techniques
- Action thresholds
- Use of appropriate management tools (considering non-target effects, resistance management, etc.)
- Record-keeping

Biology

For example, it is important to

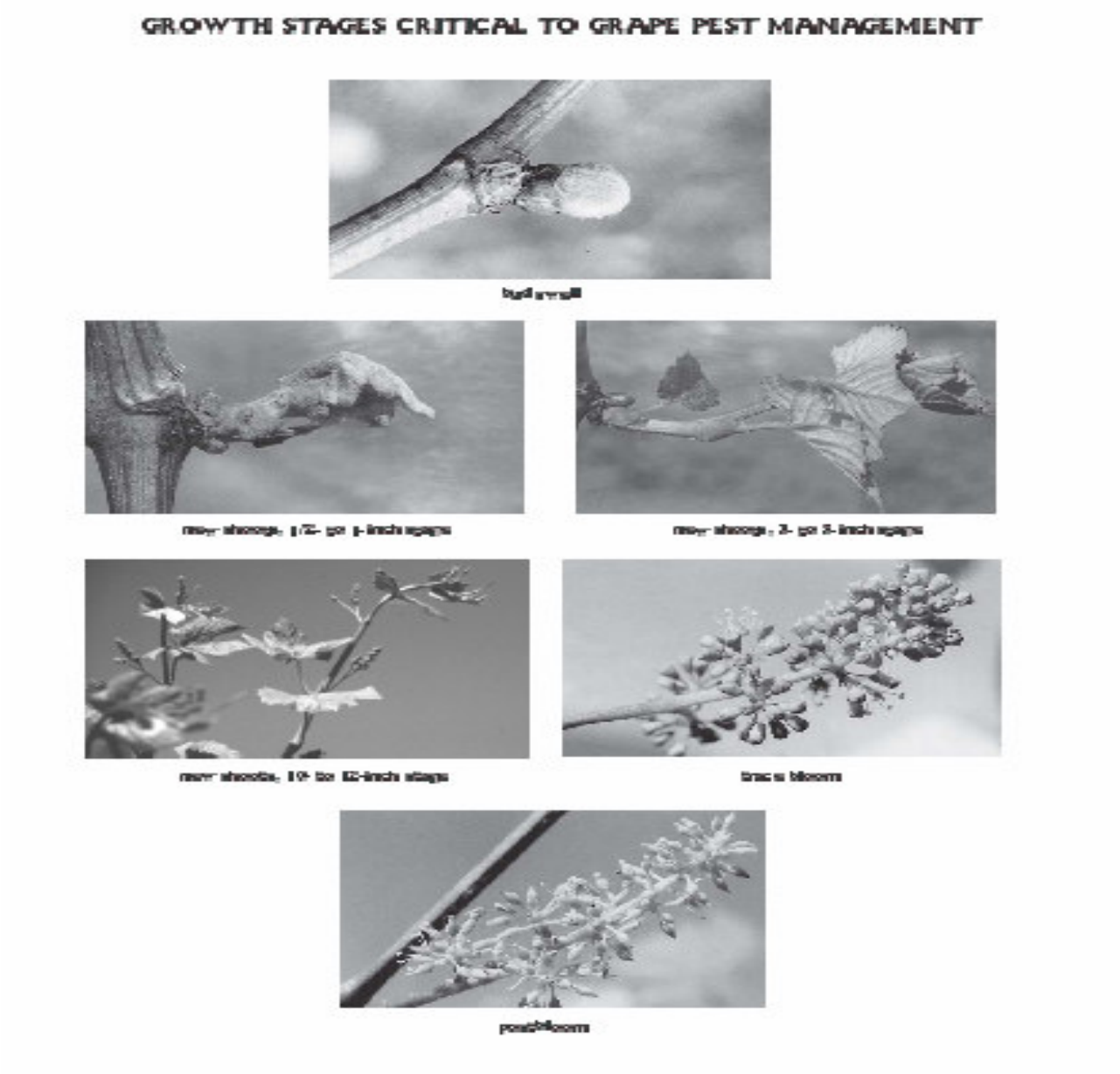
Integrate

Grape Vine Growth Stages

With

- Pest Development
- Susceptibility to Damage

Grape Vine Phenology



2004 NY-PA Grape Pest Management Guidelines

Temperature and Growth

Temperature is an important environmental factor that impacts:

- Plant Growth
- Insect Growth
- Pathogen and Disease Development

Degree Day Calculation

Temperature, in the form of accumulated Degree Days (heat units), can be calculated and related to plant, insect and pathogen development:

$$DD = \frac{\text{Max.Temp} + \text{Min. Temp}}{2} - \text{Base}$$

Example:

$$\frac{72 + 58}{2} - 50 = 15 \text{ DD}$$

An Example of how Degree-Days are used:

The Lake Erie Regional Grape Program

Phenology Dates and Corresponding Growing Degree Day Accumulations

	Average Bud Break and dates				Average Bloom and dates				Average Veraison and dates			
Average	Date	Julian	Jan. GDDs*	Apr. GDDs*	Date	Julian	Jan. GDDs	Apr. GDDs	Date	Julian	Jan. GDDs	Apr. GDDs
Ave	5/5	125.46	132.00	107.21	6/16	166.98	607.73	584.29	8.24	235.83	1990.60	1969.44
SD	8 days	8.05	27.07	30.72	6 days	6.37	34.55	31.71	6 days	6.17	126.02	122.18
MIN	4/19	109	91.0	45.5	5/31	151	517	513	8/5	217	1718.5	1714.5
MAX	5/20	140	182.5	172	6/26	177	658.5	648	9/3	246	2276.5	2245.5

	Bud Break				Bloom				Veraison			
Year	Date	Julian date	January GDDs*	April GDDs**	Date	Julian date	January GDDs	April GDDs	Date	Julian date	January GDDs	April GDDs
2005												
2004	5/2	122	153.5	114	6/8	159	652	612.5	8/23	235	2010.5	1971
2003	5/5	125	112	95	6/25	176	624	607	9/2	245	2096	2079
2002	4/19	109	145.5	129.5	6/20	171	643.5	627.5	8/25	237	2242	2226
2001	5/1	121	139	137	6/13	164	592.5	590.5	8/19	231	2045.5	2043.5
2000	5/3	123	109.5	45.5	6/12	163	596.5	532.5	8/22	234	1912	1848

http://lenewa.netsync.net/public/PhenDate.htm

Pathogen and Disease Development

Temperature affects growth of Pathogens

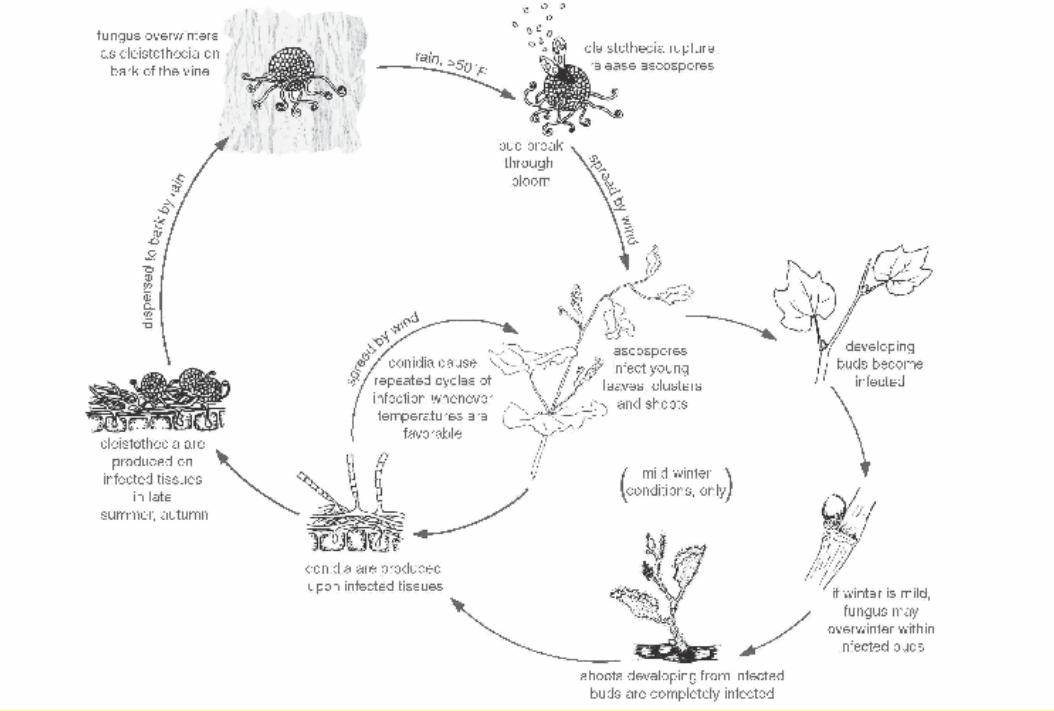


Table 1. Approximate generation time for powdery mildew at different average temperatures

Temperature, F	Days
44	32
48	25
52	16
54	18
59	11
63	7
74	6
79	5
86	6
90	*

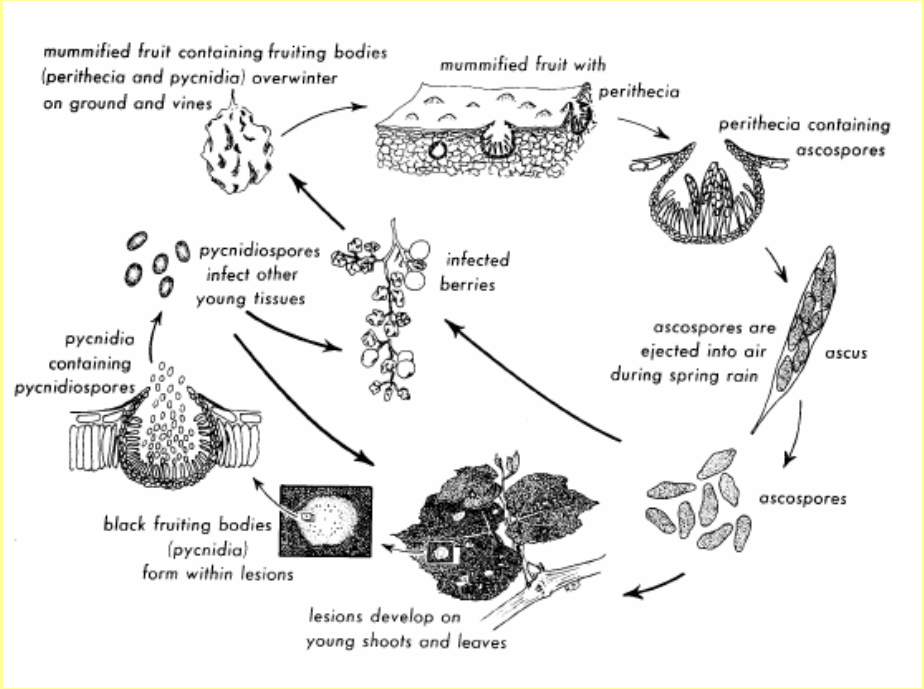
Data of C. J. Delp (University of California, Davis, 1954).
* Little or no disease development while temperatures remain above 90°.

Powdery Mildew

NYS IPM Fact Sheet

Pathogen and Disease Development

Leaf Wetness is also important in disease development of certain pathogens



DISEASE CYCLE

The black rot fungus overwinters in mummified fruit (Fig. 7) on the vine and on the ground. Spring rains trigger release of airborne ascospores from the mummies and infection of green tissue results if temperature and length of leaf wetness are conducive. Pycnidia form within lesions and produce pycnidiospores that are spread by rainfall. These pycnidiospores cause infection of green tissue if the requirements of temperature and leaf wetness duration are satisfied (Table 1). At an average temperature of 21 C (70 F) the

Table 1. Leaf wetness duration and temperature necessary for infection by the black rot fungus.

Temperature (C)	(F)	Hours of leaf wetness required for infection
7.0	45	No infection
10.0	50	24
13.0	55	12
15.5	60	9
18.5	65	8
21.0	70	7
24.0	75	7
26.5	80	6
29.0	85	9
32.0	90	12

R. A. Spotts, Ohio State University.

Black Rot

NYS IPM Fact Sheet

Management Guides – pull it all together (plant growth and disease & insect development)

New York and Pennsylvania pest management guidelines for grapes: 2004

IMMEDIATE PREBLOOM (just before blossoms open)	**Phomopsis cane and leaf spot; fruit and rachis infections)**	Dithane DF, Dithane M-45, Manzate 75DF, Penncozeb 80WP	3–4 lb	[31]
		OR Dithane F-45, Manex II	2.4–3.2 qt	
		OR Captan 50WP	2–4 lb	
		OR Captan 80WP	1.25–2.5 lb	
		OR Captec 4L	1.5–2.0 qt	
		OR Abound 2SC	11–12 fl oz	
		OR Sovran 50WG	3.2–4.0 oz	
		OR Ziram 76DF	3–4 lb	
		OR ^Pristine 38WG	8-10.5 oz	

[31] Fruit infections typically occur during the bloom and early postbloom period, then remain dormant until preharvest. Severe fruit rot can develop at harvest if the bloom through pea-sized berry period is wet and fungicidal protection is absent, particularly in vineyards with a previous history of disease. Rachises also remain susceptible during this period. Abound and Sovran appear to be less effective than ziram, captan, or mancozeb products under heavy disease pressure. Flint appears to be equivalent to Abound and Sovran, although it is not labeled for Phomopsis. Local data on Pristine are lacking. CAUTIONS: (1) DO NOT USE ^PRISTINE ON CONCORD GRAPES (CAUSES INJURY). (2) AT PRESS TIME, ^PRISTINE, WAS NOT YET APPROVED FOR USE IN NEW YORK. DO NOT USE IN NEW YORK UNTIL REGULATORY APPROVAL IS GRANTED.

Black rot	Dithane DF, Dithane M-45, Manzate 75DF, Penncozeb 75DF, Penncozeb 80WP	3–4 lb	[32]
	OR Dithane F-45, Manex II	2.4–3.2 qt	
	OR Nova 40WP	4–5 oz	
	OR Elite 45DF	4 oz	
	OR Flint 50WG	1.5–2.0 oz	
	OR Sovran 50WG	3.2–4.0 oz	
	OR Abound 2SC	11–15 fl oz	
	OR Ziram 76DF	3–4 lb	
	OR ^Pristine	8-10.5 oz	

[32] Do not delay sprays beyond this stage. The immediate prebloom through early postbloom periods are critical for management of black rot. Although several other fungicides have some activity against black rot, the listed products are those that we recommend at this critical time. CAUTIONS: (1) DO NOT USE ^PRISTINE ON CONCORD GRAPES (CAUSES INJURY). (2) AT PRESS TIME, ^PRISTINE, WAS NOT YET APPROVED FOR USE IN NEW YORK. DO NOT USE IN NEW YORK UNTIL REGULATORY APPROVAL IS GRANTED.

Powdery mildew	Liquid Sulfur 6L	read the label	[33]
	OR Wettable Sulfur (several formulations)	read the label	
	OR Nova 40WP	4–5 oz	
	OR Rubigan 1E	3 fl oz	
	OR JMS Stylet Oil	1.5–2.0% conc., read the label	
	OR Procure 50WS	5–6 fl oz	

Components of an IPM Program

- Knowledge and use of crop biology, pest biology/behavior and life cycles
- Monitoring techniques
- Action thresholds
- Use of appropriate management tools (considering non-target effects, resistance management, etc.)
- Record-keeping

Example of Insect Monitoring and Action Thresholds

Table 3. Management Procedures for Grape Berry Moth and Eastern Grape Leafhopper.

GBM risk category	Recommended Sampling Times and Treatment Thresholds				Recommended Time to Spray[2]	
	Grape Berry Moth		Eastern Grape Leafhopper[1]		Grape Berry Moth	Eastern Grape Leafhopper
	Sampling	Threshold[1]	Sampling	Threshold		
High risk	•4th week of August	•15% damaged clusters	•4th week of August	•10 per leaf	•Ten days post bloom •Early August • BOS Late August	BOS Late August
Intermediate risk	•3rd week of July	•6% damaged clusters	•3rd week of July •4th week of August	•5 per leaf •10 per leaf	•10 days post-bloom •BOS Early August	•BOS Early August •BOS late August
Low risk	•3rd week of July	•6% damaged clusters	•10 days post-bloom •3rd week of July •4th week of August	•Stippling + adults •5 per leaf • 10 per leaf	•BOS Early August	•BOS 10 days post-bloom •BOS Early August •BOS Late August

1 An insecticide treatment is recommended if damage levels exceed the stated threshold. Consult Cornell Pest Management Recommendations for selection of appropriate insecticide.

2 BOS = Based On Sampling. BOS sprays are those made only when the results of sampling confirm that damage exceeds the stated threshold. Sampling often will demonstrate that a BOS treatment is not needed.

NYS F&LS Bull 138, 1991

Use of Appropriate Materials

Prevention vs Intervention -- an IPM goal is to develop or design a system to **prevent problems** so you do not have to intervene

There are various types of intervention tactics and varying **levels of toxicity** associated with different tactics, i.e.,

toxicity to **pest/pathogen**,

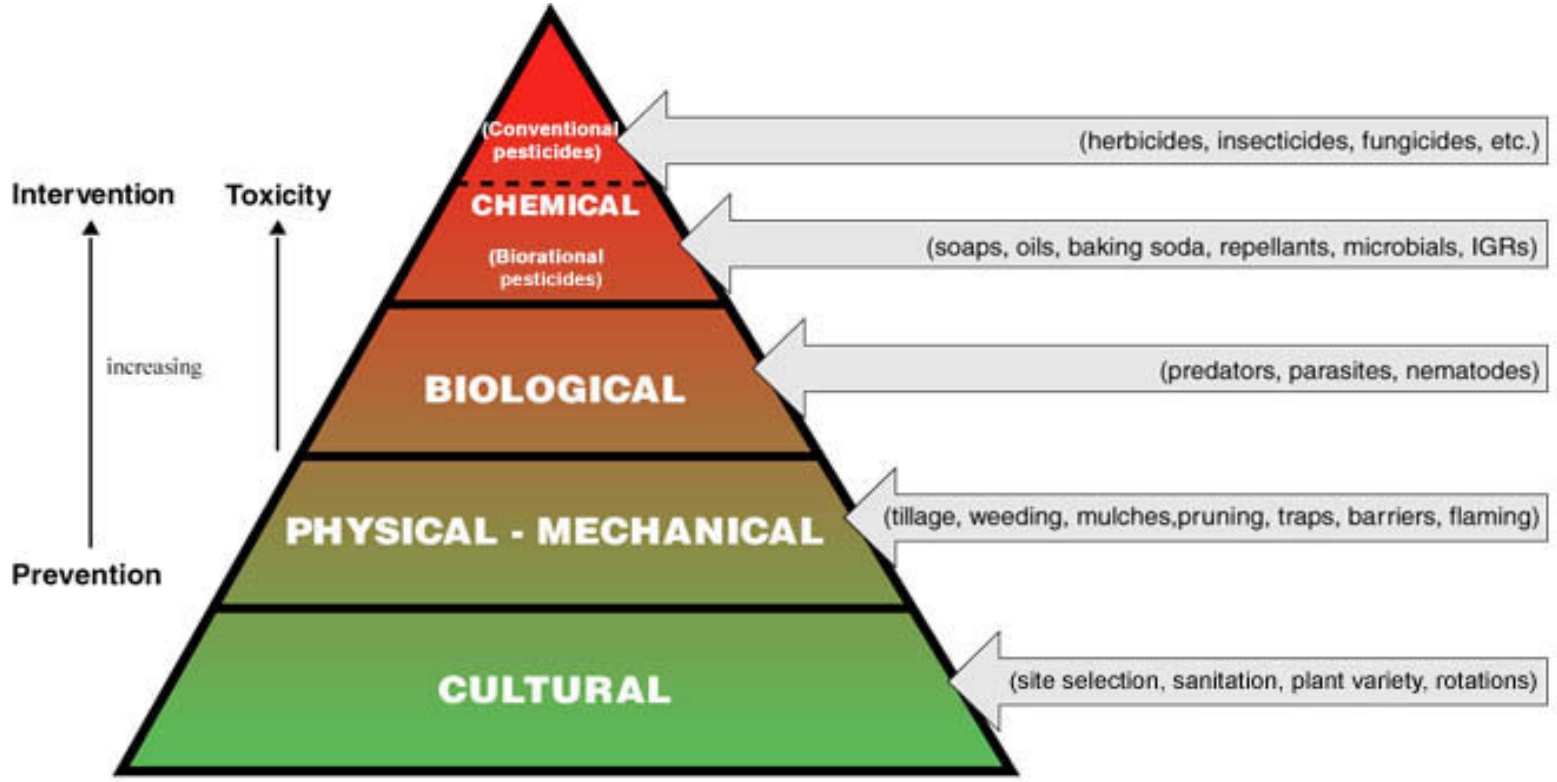
toxicity to **applicator**,

toxicity to **environment** (non-target impacts);

toxicity to **consumer/general public**

If a pesticide is warranted, the most appropriate material should be selected based on knowledge of its effectiveness, its potential risk to applicator and environment, and potential for resistance development.

Levels of Prevention and Intervention



Pyramid of IPM Tactics

Plants

PENNSTATE College of Agricultural Sciences

PA IPM

Intervention Terminology

What is a Pesticide ?

According to EPA which is the agency that regulates all pesticides in the U.S., a **pesticide** is ***any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pests.***

"Pests" -- includes insects, mice or other animals, unwanted plants (weeds), fungi or microorganisms such as bacteria and viruses, etc.

Intervention Terminology

Types of Pesticides: (based on target)

Insecticides
Miticides
Fungicides
Bactericides (Antibiotics)
Herbicides
Rodenticides

Intervention Terminology

There are many terms that are used to describe pesticides:

“Conventional” vs. “Biopesticides” (“Reduced-Risk”)

“Conventional” [inorganic, organic] vs. “Organic”

“Synthetic” vs. “Organic”

Intervention Terminology

"Biopesticide" -- certain type of pesticide derived from animals, plants, bacteria, and certain minerals

1. **Microbial pesticides**
2. **Plant-pesticides**
3. **Biochemical pesticides**

"Conventional" -- generally synthetic materials that directly kill or inactivate the pest.

Intervention Terminology

“Conventional” pesticides

inorganic -- do not contain carbon (e.g., sulfur, copper, lime sulfur, etc.)

organic – contain carbon (e.g., most pesticides)

“Organic” pesticides – approved by the National Organic Program (NOP)

inorganic -- sulfur, copper, etc.

organic -- contain carbon (e.g., potassium bicarbonate, etc.)

Intervention Terminology

"Synthetic" pesticides

dictionary = artificial, human-made, not natural

"Organic" pesticides – *approved by the National Organic Program (NOP)*

Natural

Can be "synthetic" - must be on the "approved" list

My Opinion:

A pesticide is a pesticide …

is a pesticide…. is a pesticide.

Must look at the properties and characteristics of the material to determine appropriate use.

Those properties and characteristics include:

Target Efficacy -- will it do the job it is intended to do ??

Non-Target Considerations

Human toxicity -- acute dermal, oral, respiratory LD_{50} ; Signal Word (Danger/Poison; Warning; Caution)

Environmental Fate and Toxicity -- avian, fish, aquatic invertebrates, honeybees, natural arthropod predators and parasites.
[Pollution Prevention]

Other Considerations: will it have multiple uses; compatibility with other materials; phytotoxicity; ease of application; any resistance problems?; number of applications to be effective and dose; cost ; etc.

Knowledgeable Pesticide Selection and Use

Effectiveness

Toxicity

Non-target Impacts

Resistance Management

Pollution Prevention

Pesticide Use

Bottom line is that pesticides should be used **judiciously** - use the most appropriate material for the situation with the least non-target impacts, use in a manner that will delay development of a resistant population, and follow the **4 R's"**

right material

at the right time,

in the right amount,

and in the right way

Safe Use of Pesticides

- Read the Label – the label is the LAW on how the material is to be used and stored
- If you do not know what the following mean– you should not use the material:

PPE

REI

PHI

Pesticide Alternatives

-Cultivar resistance

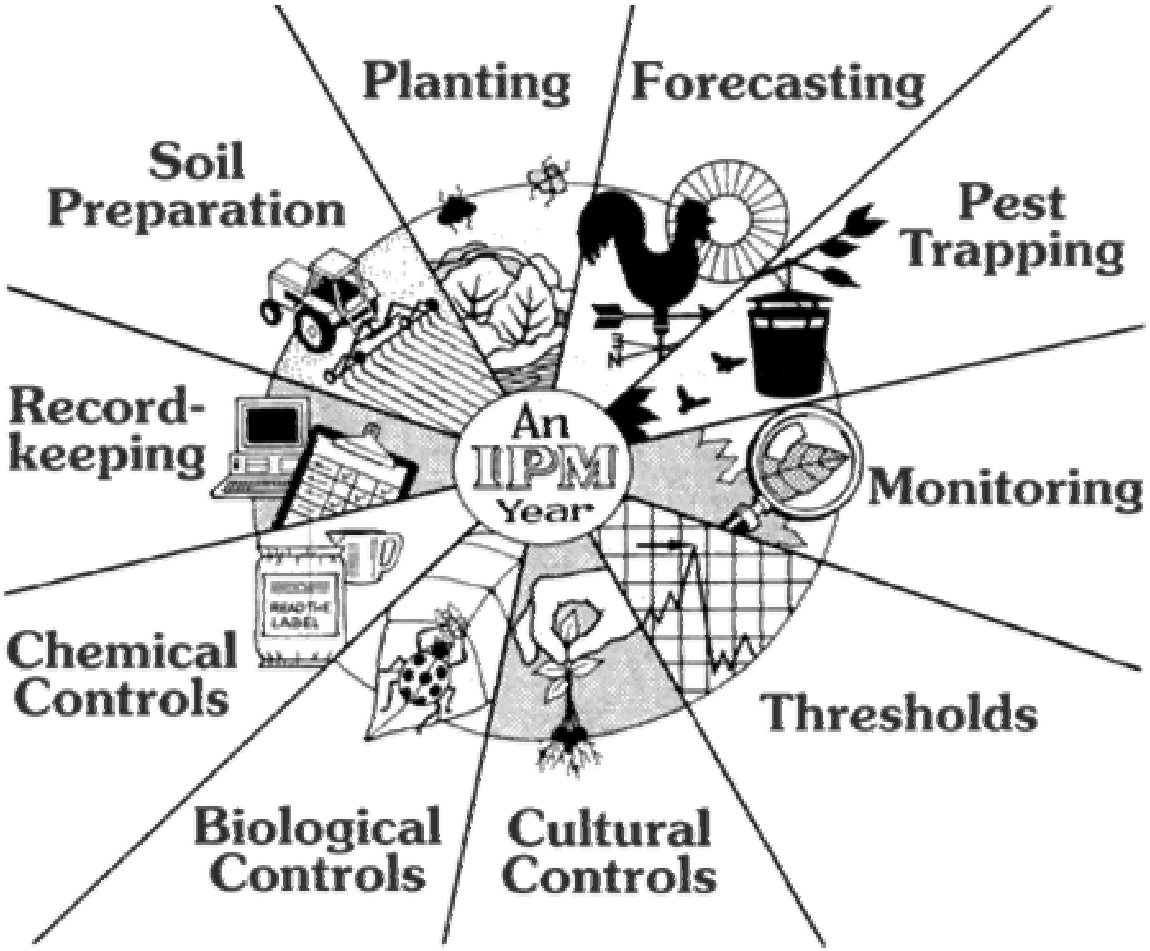
-Sanitation

-Pruning, Shoot Positioning, Leaf Removal

-Determining the need to intervene and when to intervene

Knowledge can substitute for pesticide use

The many components of an IPM program



"IPM Wheel" by Carrie Koplinka-Loehr, NY IPM Program

Recordkeeping

- Essential in any business
- Essential in IPM

  Growth Stages

  Weather Conditions

  Monitoring Results

  Documentation of pesticide use

  Liability/Legal Issues

IPM Continuum

Where are you on this continuum?

Basic IPM Practices

Bio-Intensive IPM

Thank you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