Sustainability and Pest Management in Viticulture

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What is Sustainability?

To Endure without Failing!
How do we do Pest Management?

By Implementing Pest Management Strategies that:

- Maintain vine health
- Reduce crop loss
- Minimize human risk
- Lesson environmental impact
- Improve vineyard economics
Integrated Pest Management (IPM) is the key to Sustainability.

To Implement IPM Strategies we need a working knowledge of the pest complex.

#1 Pest identification (Flea beetle)

#2 Know the biology (Life cycle)
Scout your vineyard
Things you need to know!

**When:** Should you scout your vineyard for damage or the presence of pests.

**Where:** In the vineyard or on the vine would you expect to encounter pests.

**How:** Identify the insect, the damage it inflicts and determine if control measures are warranted.
The Use of Insect Monitoring Devices are an Important Part of any IPM Program

These devices will provide an indicator of pest’s activity and help in the timing of protective sprays

Devices currently available for grape pests.

1. Grape berry moth trap and lure.
2. Grape root borer trap and lure.
4. Rose chafer trap and lure.
5. Yellow sticky traps for leafhoppers.
6. Redbanded leaf roller trap and lure.
Cultural practices may reduce pest pressure by proper management of:

- the grape canopy, weeds, sod or soil,
- adjacent fields, fence rows, & wood lots
Sources of information for scouting procedures.


Ohio State University Extension, available at ph. 614-292-1607 or email: pubs@ag.osu.edu

http://www.oardc.ohio-state.edu/grapeipm

Attend annual workshops held by the Ohio Grape Team.
SUGGESTED TIME TO SCOUT VINEYARD FOR DAMAGE OR PRESENCE OF SPECIFIC PESTS

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<thead>
<tr>
<th>DORMANT</th>
<th>BUD SWELL</th>
<th>BUD BREAK TO BLOOM</th>
<th>BLOOM</th>
<th>FIRST COVER TO VERAISON</th>
<th>VERAISON TO HARVEST</th>
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<td>MAR</td>
<td>APR</td>
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- GRAPE FLEA BEETLE
- PHYLLOXERA
- GRAPE BERRY MOTH
- ROSE CHAFER
- LEAFHOPPERS
- MITES
- GRAPE ROOT BORER
- Multicolored Asian Lady Beetle

Japanese Beetle
The History of Pesticides

500 BC  First known pesticide elemental sulfur
100 BC  Hellebore (herb) used by the Romans
900 AD  Arsenic used by the Chinese on garden pests
1690   Tobacco used as contact insecticide
1821   Sulfur reported as fungicide for mildew
1858   Pyrethrum first used in U.S.
1880   Lime sulfur used in Calif. against San Jose scale
1892   Lead arsenate first used to control gypsy moth
1912   Zinc arsenite first recommended as insecticide
1917   Nicotine sulfate first used (Black Leaf 40)
1942   First batch of DDT shipped to the U.S.
1946   Organophosphate insecticides developed (parathion)
Since WWII chemical pesticides have become the most important form of pest management.

The “first generation” pesticides were highly toxic compounds like, arsenic and hydrogen cyanide.

These were abandoned because they were ineffective, too toxic or too residual causing environmental damage.
One of the first synthetic organic pesticide was the chlorinated hydrocarbon, **DDT**.

Invented by the Swiss chemist Paul Muller in 1939. It was hailed as a miracle!
DDT cont.
• It was broad spectrum.
• It was persistent.
• It was insoluble.
• It was inexpensive and easy to apply.

Grape yields increased as did other crops. Diseases such as malaria were controlled as never before. (Malaria is now on the increase as vectoring insects have developed resistance to currently used pesticides.)

In 1948 Muller was awarded the “Nobel prize”. Organophosphate Parathion introduced in 1946.
Then in 1962 Rachel Carson’s best selling book “Silent Spring” warned of the effects of chlorinated hydrocarbons, such as DDT, on the fragile ecosystem. (Think Sustainability!)

Non-target organism were dying as a result of direct toxicity, (ex. fish and birds) and indirect toxicity, which was related to the persistence.

Two principles of indirect toxicity

1. **Bioconcentration** - accumulation of a compound in an organism’s tissues.
2. **Biomagnification** - an increase in the concentration up the food chain.
New Pesticides - The “second generation” pesticides included familiar contact insecticides, such as:

Organophosphates, Carbamates, Pyrethroids, etc.

The new classes of pesticides were generally:

1. less persistent
2. more water soluble (Temik)
3. and often more acutely toxic (Temik)

A solution to one problem often create new ones!
Congress passed the **Food Quality Protection Act of 1996** establishing a single health based standard for all pesticides in all foods. (Chlorpyrifos)

As a result many pesticides are considered a health risk and are banned from use in various food crops.

Example: in grapes, parathion, methyl parathion, guthion and still others under review.

Pest control practices are evolving rapidly. Some pesticides that will be used for decades to come are currently in use or in the early stages of development, while others have yet to appear.

The market for “natural” or environmentally benign pesticides has given rise to the development of pesticide alternatives called biorationals. These agents and organisms are currently being pursued in laboratory and field studies and will become the pesticides of the future.
What are Biorationals?

The EPA identifies “biorational pesticides” as inherently different from conventional pesticides, having fundamentally different modes of action and reduced risk of adverse effects.

When used for specific pests they have little or no affect on non-target organisms.
Biorationals have been classified into two distinct classes.

(1) biochemical (hormones, enzymes, pheromones and natural agents like insect and plant growth regulators).

(2) microbial (viruses, bacteria, fungi, protozoa and nematodes).

In 1994, the Biopesticide Pollution Prevention Division was established by the EPA. The EPA describes “biopesticide” as agents or organisms derived from natural materials (animals, plants, bacteria, canola oil, neem) and even certain minerals (baking soda).
Biopesticides cont.

EPA places biopesticides into three categories:

- **Microbial pesticides** (bacteria, fungi, viruses or protozoa).
- **Biochemicals** – natural substances that control pests by nontoxic mechanisms (insect pheromones).
- **Plant-Incorporated protectants** - (primarily transgenic plants (\textit{Bt} corn & beans).

Biorational and biopesticides are similar but not identical.
The EPA classifies transgenics as biopesticide and not biorationals.

Biorationals lack the broad formally agreed criteria needed to be classified as biopesticides.

A product must meet formal EPA criteria and be reviewed by an expert committee before being approved as a biopesticide.
Biorationals/ Biopesticides/ Soft pesticides:
Aza-Direct, Neemix, (azadirachtin or neem)
Pyrellin, (pyrethrins plus rotenone)
SpinTor, Entrust, (spinosad)
DiPel, (B. thuringiensis)
Mycotrol, (Beauveria)
Rotenone, (rotenone)

Insect growth regulators (21st century pesticides)
Applaud, (buprofezin)
Intrepid, (methoxyfenozide)

Nicotinoids (21st century pesticides)
Provado, Admire --- (imidacloprid) 0
Venom --- (dinotefuran) 1
Assail --- (acetamiprid) 7
Pesticide Alternatives that may Provide an Environmental Friendly Choice for your Pest Control Strategies.

**Pheromone lures** for mating disruption (grape berry moth and grape root borer).

**Mass trapping** with pheromone traps to reduce population. (Rose Chafer)

**Physical barriers** (black plastic under trellis and mounding of soil around vine trunk to help control the grape root borer).

**Biological pest control:** entomopathogenic nematodes (grape root borer, white grubs), milky spore disease (white grubs), *Bt* (grape berry moth), lady beetles (aphids, mites)
Total pesticide use in the U.S. declined in the 80’s due in part to:

* Land idled from production.
* Introduction of newer products applied at lower rates per acre.
* Implementation of IPM systems particularly for insects.

In the 90’s use has increased - in part due to idled land returned to production.
Current Trends in Pesticide Use.

* N. America uses about **30%** of world total.
* Europe about **27%**.
* Japan about **12%**.
* Developing nations including China **31%**.

In the U.S.  **62%** of planted acreage is treated annually with some kind of pesticide.

(93% of row crops)
Are pest losses decreasing?

Insects, plant pathogens, and weeds now reduce U.S. crop production by about 37% per year.

Losses in the 1940’s were estimated to be about 30%.

Pesticide use has increased ten-fold since the 40’s.
Why are crop losses roughly stable despite the increase in pesticide inputs?

1. Cosmetic standards have changed (what’s considered a loss today would not of been a few decades ago).

2. Pesticide resistance (caused by repetitive use of a compound rather than altering chemicals).

3. Decrease in the use of crop rotation.

4. Knowledge that pesticide protection exists promotes choices that necessitate the use of pesticides. (Growing plant varieties known to be less resistant due to other favorable characteristics).
5. The increased mobility of crops and pests. (introductions into new areas).

% of pests non-native to U.S.

- Insects 40%
- Weeds 40%
- Plant pathogens 70%

6. The use of reduced tillage (Conservation till) to control soil erosion allows pests to build up on crop residues that would normally be plowed under, also gives weeds a chance. This practice has given rise to the increase in herbicide use in the U.S.
7. The reduction in crop genetic diversity.

**Monoculture** - plants are very apparent to pests when they are grown in monoculture.
Natural Pest Controls:

1. Genetic resistance - most plants are genetically resistant to most pests. Pesticides remove pressure for plants to evolve resistance.

The knowledge that pesticide controls exists may decrease the pressure for breeders to emphasize pest resistance.

2. Natural diseases and predators of the pests.
> Pesticides can have direct effects on predators, parasites, competitors, and diseases.
3. There can also be *indirect* effects on plant feeders. If the food supply of the natural predators (the pests) declines because of the use of pesticides. It can result in a decline in natural enemies. If pesticide treatments are stopped then pest populations rebound at even higher levels because of a lack of natural enemies.

4. Host availability. In nature epidemics subside when pests eat or kill so much of the host population that they starve themselves. The use of pesticides keeps this from happening. Hosts are kept alive and surviving pests have a steady food supply. **Major factor in developing pest resistance to pesticides!**
We hope that the information presented in this presentation will assist you in the development of your pest management strategies and in the long term sustainability and profitability of your business.

Special thanks to the Ohio Grape Industry Program and their support of fundamental research & development!
Know Your Grape Pests
Visit the New Web Site
http://www.oardc.ohio-state.edu/grapeipm/

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