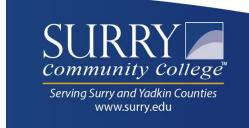
Pre to Post-Harvest Vineyard IPM

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IPM Approaches and Tools

Cultural: alter environment, host plant, or behavior of pest

- Site selection
- Variety selection
- Canopy and crop load management
 - Nutrient management
- Vineyard floor management





Optimum Canopy Management

- Balanced-crop: moderate shoot growth and optimum yield
 - Canopy drying and spray penetration
 - Moderate acidity and low pH
 - Developed tannins
 - Good skin pigment development
 - Distinct varietal character
 - Good winter hardiness and bud fruitfulness





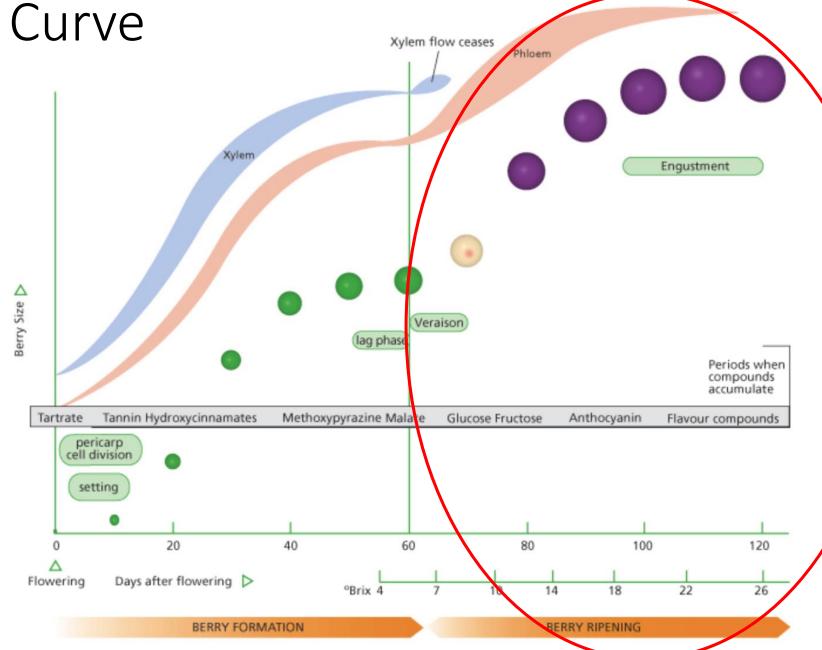
Eichhorn-Lorenz PhenologicalStages

MAJOR STAGES E-L number ALL STAGES 1 Winter bud 2 Bud scales opening 3 Wooly bud ± green showing Budburst; leaf tips visible 4 Budburst First leaf separated from shoot tip 2 to 3 leaves separated; shoots 2-4 cm long 4 leaves separated 12 Shoots 10 cn 5 leaves separated; shoots about 10 cm long; Inflorescence clear inflorescence clear 5 leaves separated 13 6 leaves separated 14 7 leaves separated 8 leaves separated, shoot elongating rapidly; single flowers in compact groups 10 leaves separated 12 leaves separated; inflorescence well developed, single flowers separated 18 14 leaves separated; flower caps still in place, but cap colour fading from green 19 Flowering begins About 16 leaves separated; beginning of flowering (first flower caps loosening) 10% caps off 30% caps off 23 Flowering 17-20 leaves separated; 50% caps off 50% caps off (= flowering) 80% caps off Cap-fall complete Setting; young berries enlarging (>2 mm 27 Setting diam.), bunch at right angles to stem Young berries growing Berry formation Bunch at right angles to stem Berries pepper-corn size (4 mm diam.); bunches tending downwards Berries pea-size (7 mm diam.) 31 Berries pea-siz Bunches hanging down Beginning of bunch closure, berries touching (if bunches are tight) Berries still hard and green 34 Berries begin to soften; Sugar starts increasing Berries begin to colour and enlarge 35 Veraison Berry softening continues Berries with intermediate sugar values Berry colouring begins Berries not quite ripe 38 Harvest Berries harvest-ripe Berries ripe Berries over-ripe After harvest; cane maturation complete Beginning of leaf fall 47 End of leaf fall

Berry Growth Curve

Double Sigmoid "S" Curve

- 3 Major Phases
 - 1.) Formation
 - 2.) Lag
 - 3.) Ripening



Post-Bloom

 Berries become resistant to black rot, powdery mildew and downy mildew about 6 weeks post-bloom

 Rachises, leaves and shoots must remain protected from black rot until about veraison

 Rachises, leaves and shoots must remain protected from powdery and downy mildew all season!

IPM Approaches and Tools

Chemical: synthesized, conventional pesticides



- Miticides
- Nematicides
- Fumigants





• Rodenticides



IPM Approaches and Tools

Biological: use of beneficial organisms that feed on, parasitize, or compete with pests.

- Insects
- Fungi
- Bacteria
- Nematodes



Grazing animals



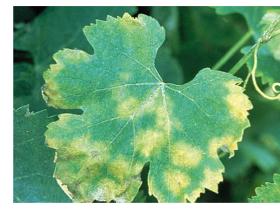


Biopesticides: natural materials, suppress but do not eliminate pest population

Sex pheromones, microbial pesticides, plant-incorporated protectants

Downy Mildew

- Captan: watch your seasonal use limit, back off close to harvest
- Phosphorus Acid Products: not great for raging downy mildew
- Copper Products: back off close to harvest
 - We rotate with Cueva when there's a dry period and canopy still clean
- Watch your PHIs on Ranman and Ridomil products
- Remember Mancozeb has 66 day PHI
 - Post-harvest option if you haven't exceeded season use limit





Powdery Mildew

- Sulfur: back off close to harvest
 - Post-harvest option if temps between (80 65° F)
- 14 day PHI on many products that are labeled for powdery mildew
 - FRACs: 3,7,11, and FRAC 13 (Quintec) and FRAC: U13 (Gatten)
- When pressure is low and canopy is still clean we use the biologic Problad Verde (formerly Fracture) and product with powdery "suppression" (ie. Elevate) as both have short PHI.
- Potassium bicarbonate products (ex.: Kaligreen) are another option, but do not tank mix with phosphorus acid.
- Stylet Oil: don't tank mix or use within 2 weeks of sulfur or captan.
 - Decent post-harvest option.



Botrytis

- Pre-bloom through fruit set peak window for infection that remains latent until ripening.
- Be especially diligent in tight cluster varieties
 - Use canopy management as a tool!
- Many products labeled for botrytis at high risk of resistance development, and documented resistance with many products
- Infections from veraison to harvest do not have latency period
 - Prevent wounds, scout often during ripening, careful with foliar N after veraison
- Watch your PHIs: many products labeled for botrytis are 7-14 day PHI



Other Fungal Fruit Infections

Phomopsis and Black rot: managed with early season preventative sprays

- Bitter and Ripe rot: infections remain latent until ripening
 - Mancozeb, Captan, FRACs 11 and 12 have some efficacy





Sour Rot

• Critical to limit wounds: sunburn, Grape berry moth strikes, sunburn, etc.

 Antimicrobial products: (Oxidate, Serenade, Double Nickle, Problad Verde) are an option and have short PHI.

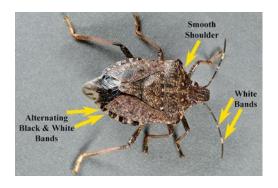
 Critical to control fruit flies that are a component of sour rot development



Insects

- Remember to rotate between IRAC codes, watch your PHIs and seasonal use limits. Be scouting for...
 - Multicolored Asian Lady Beetle
 - Brown Marmorated Stink Bug
 - Fruit Flies
- We have incorporated an organic product (Entrust, IRAC: 5) for fruit fly control. But fruit flies are much less problematic if wounds are prevented!







Birds and Mammals

- Vineyard site selection:
 - Consider this when you are in the site evaluation stage
 - Is there habitat in the immediate area?
 - Shelter, food, water
- Scare
 - Visual
 - Auditory
 - Predatory

- Repel
 - Smell/taste
- Exclude
 - Physical or electrical barrier
- Trapping and lethal
 - Baited trap
 - Take with firearm





Weeds

• Chemical: remember to rotate between HRAC codes and watch your PHIs and seasonal use limits.

• Non-chemical options: in a portion of the vineyard we use cover cropping, mowing, and mechanical disturbance with suckering machine.









Systemic Diseases

- Pierce's Disease: scouting from veraison to harvest
 - Our protocol: vines with four PD symptoms (leaf scorch, matchstick petioles, green islands, shriveled fruit) are marked, decapitated and removed during dormant season.

- Leaf roll and Red blotch viruses: scouting from veraison to harvest
 - So far our vines that are showing symptoms of virus have been confirmed positive for red blotch and are limited to one block of one variety; therefore, virus does not appear to be spreading via vector, and likely came from infected nursery stock.

Other News...

- Chlorpyrifos were banned in February 2022
 - We have been successfully managing Grape root borer with pheromone disruption for 4 years.
- Captan is under review...possible label changes in future

- Spotted lanternfly has established population in Forsyth county
 - Grapes are one of their favorite host plants

Harvest

- Harvest time dependent on
 - Intended wine style
 - Chemistry
 - Aromas and flavors
 - Phenolic development
- Weather
- Labor
- Disease pressure, mainly bunch rots!
 - Botrytis
 - Sour rot
 - Ripe rot
 - Bitter rot!
- Depredation pressure
 - Birds
 - Mammals
- Post-harvest critical fungicide sprays to reduce overwintering inoculum
 - Powdery Mildew
 - Downy Mildew



Thank you for your attention!

Questions?

