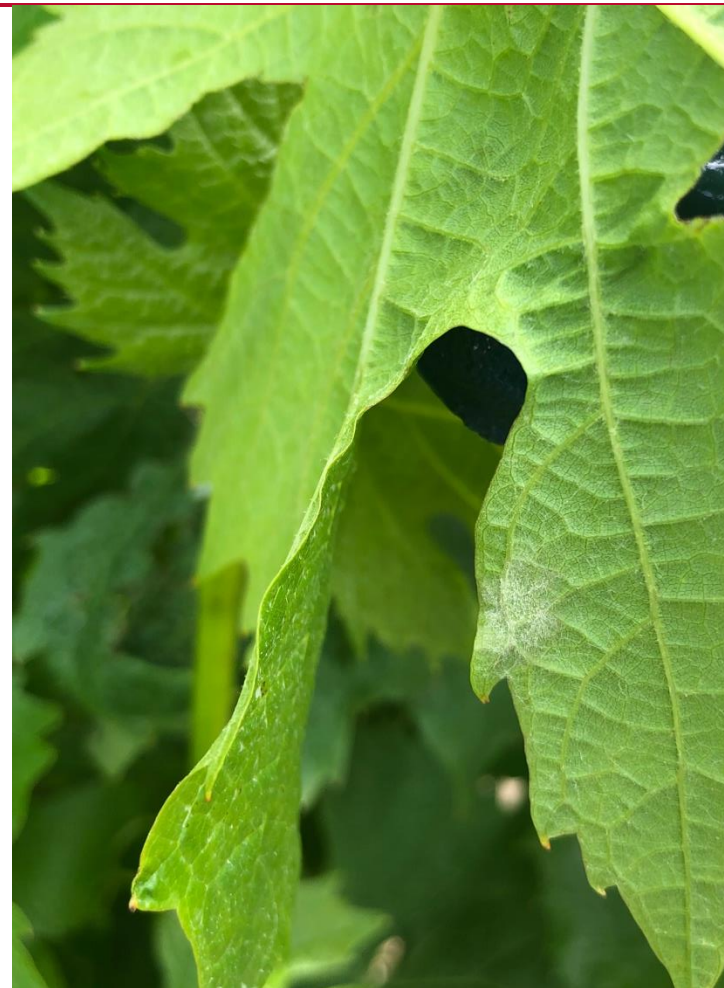




UNIVERSITY OF GEORGIA
EXTENSION

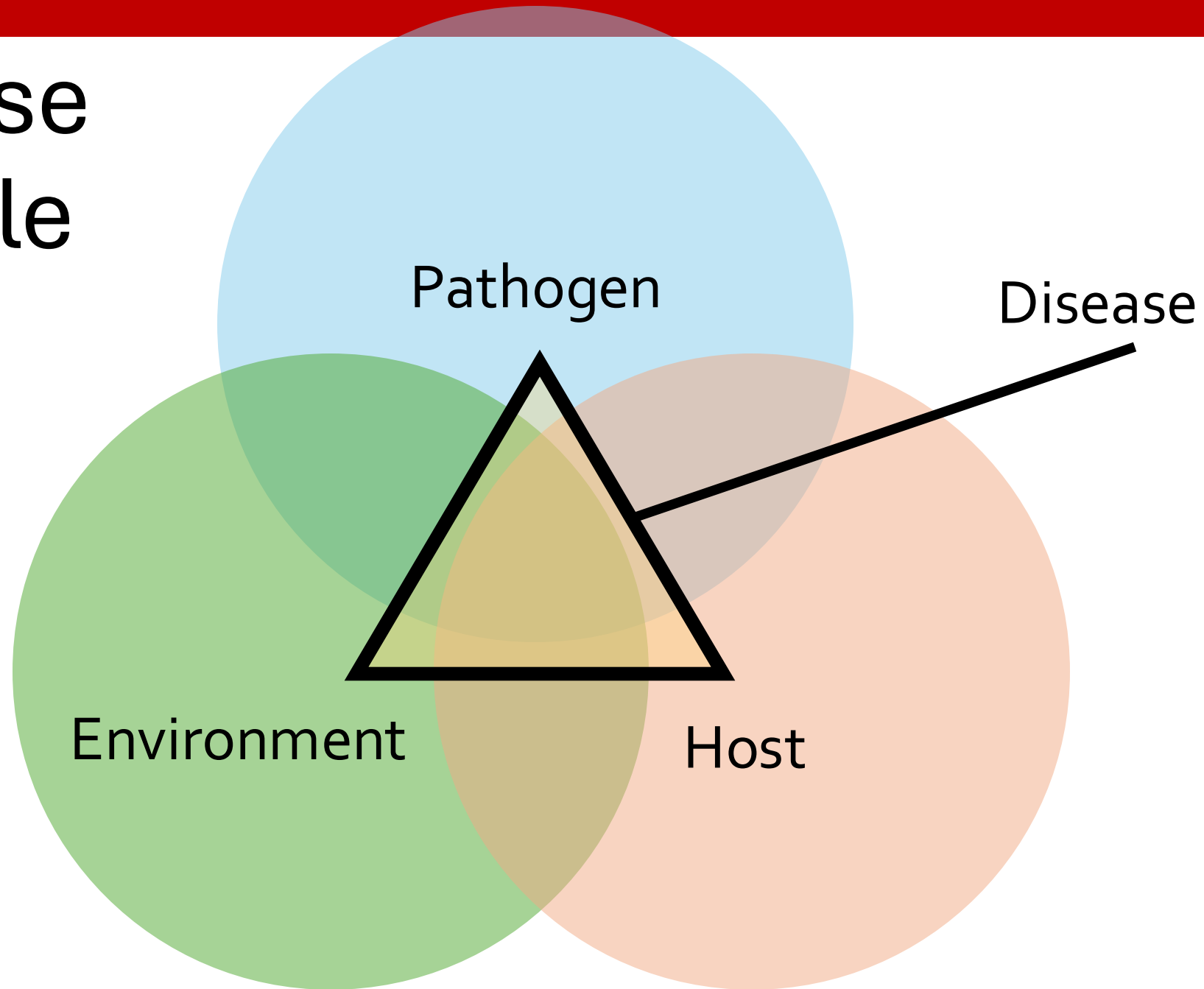
Effective Spraying for Fungicide Stewardship



Dr. Sarah Lowder
sarah.lowder@uga.edu

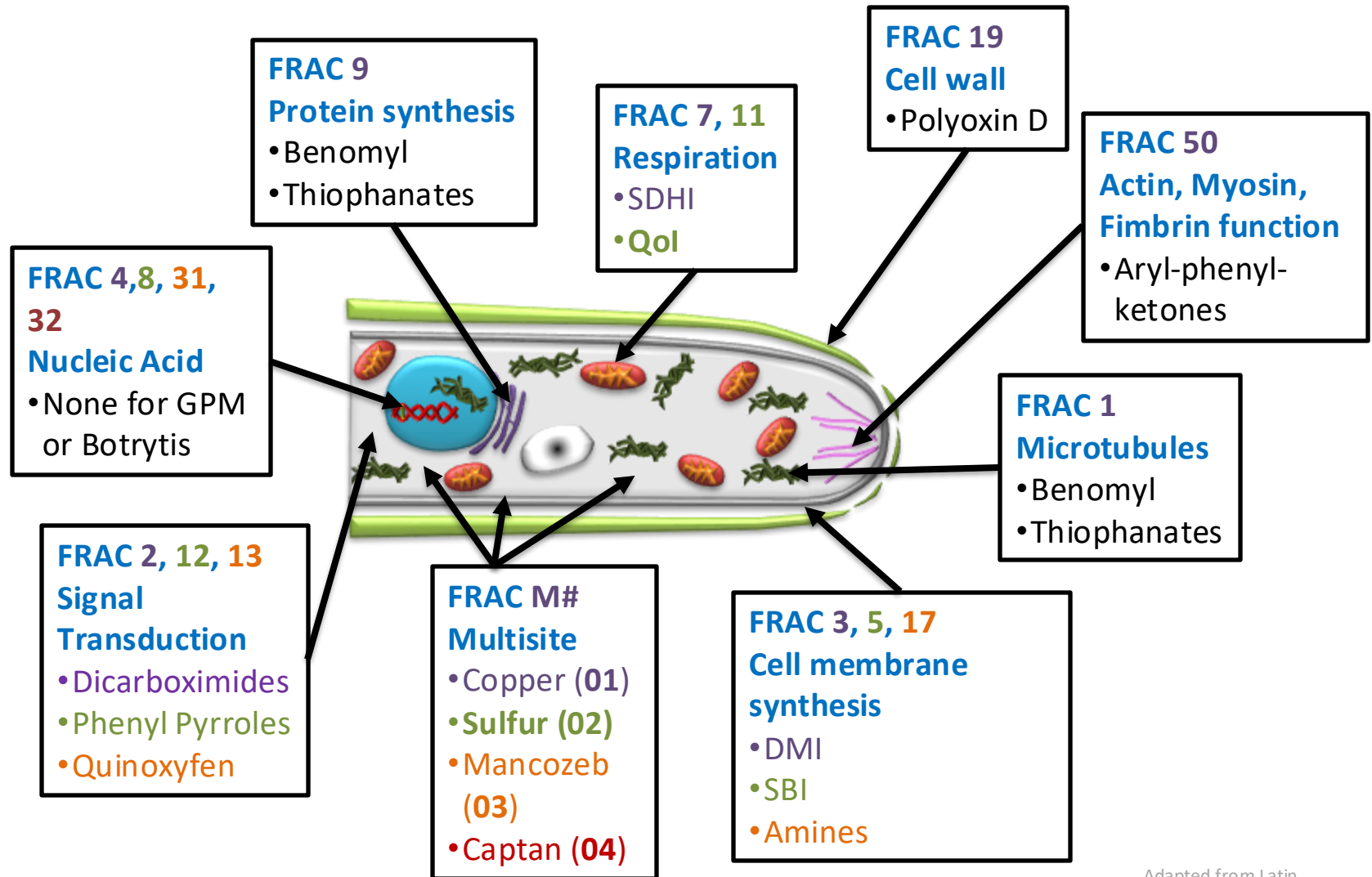
UGA Extension Viticulture Specialist
and Asst. Professor of Horticulture

Disease Triangle



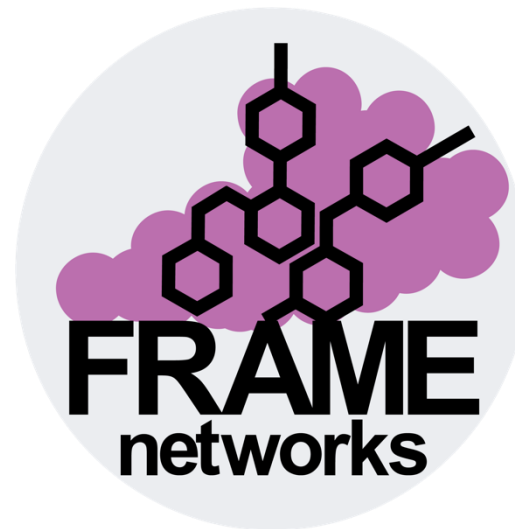
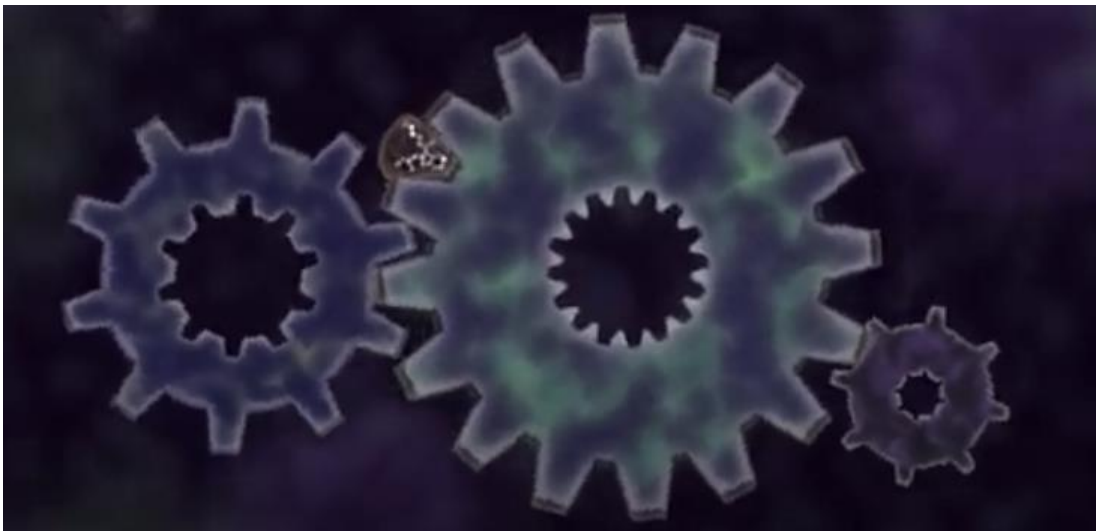
Fungicide Mode of Action

Fungicide
Resistance
Action
Committee
www.frac.info



Fungicide Resistance

- Genetic change in the fungus that leads to reduced sensitivity to a fungicide
- Governed by a single gene or multiple genes
- Occurs when there is a shift in the fungal population from predominately sensitive isolates to predominately resistant isolates



What an animation on how fungicide resistance works - https://youtu.be/AvluVPj_cB4?si=24h6_64x74sdu-J-

Resistance Action Committee

- FRAC, IRAC, HRAC
 - www.frac.info/home
 - <https://irac-online.org/>
 - <https://www.hracglobal.com/>
- Grouped materials by MOA
- Rank resistance risk
- Goal - assist in MOA rotation and resistance management
- Number codes vs. Letter codes vs. Number/letter codes



Types of Resistance

on an individual level

“High risk”



Control

No Control

Qualitative or sudden

Example) FRAC 11

“Medium risk”



Control

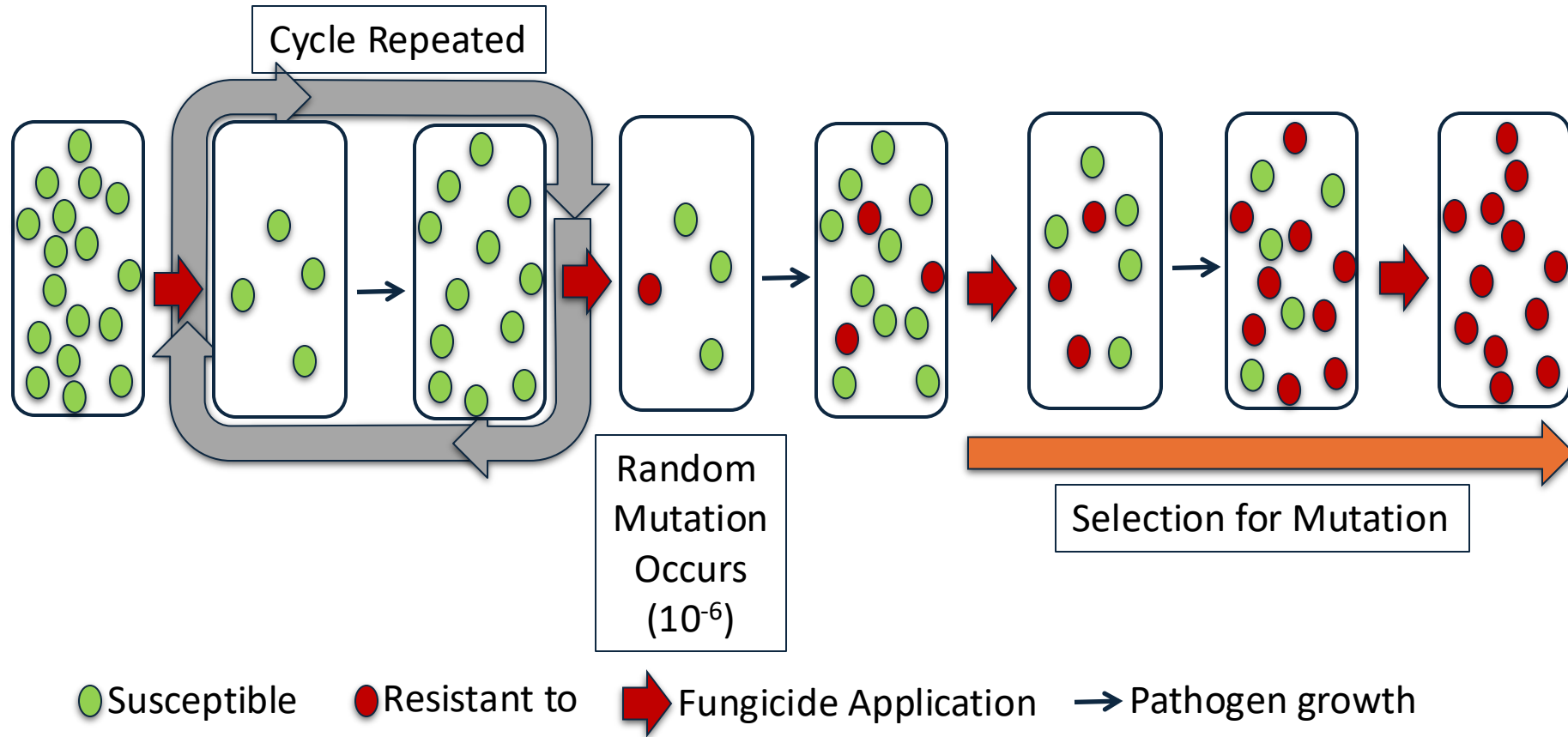
No Control

Moderate
Control

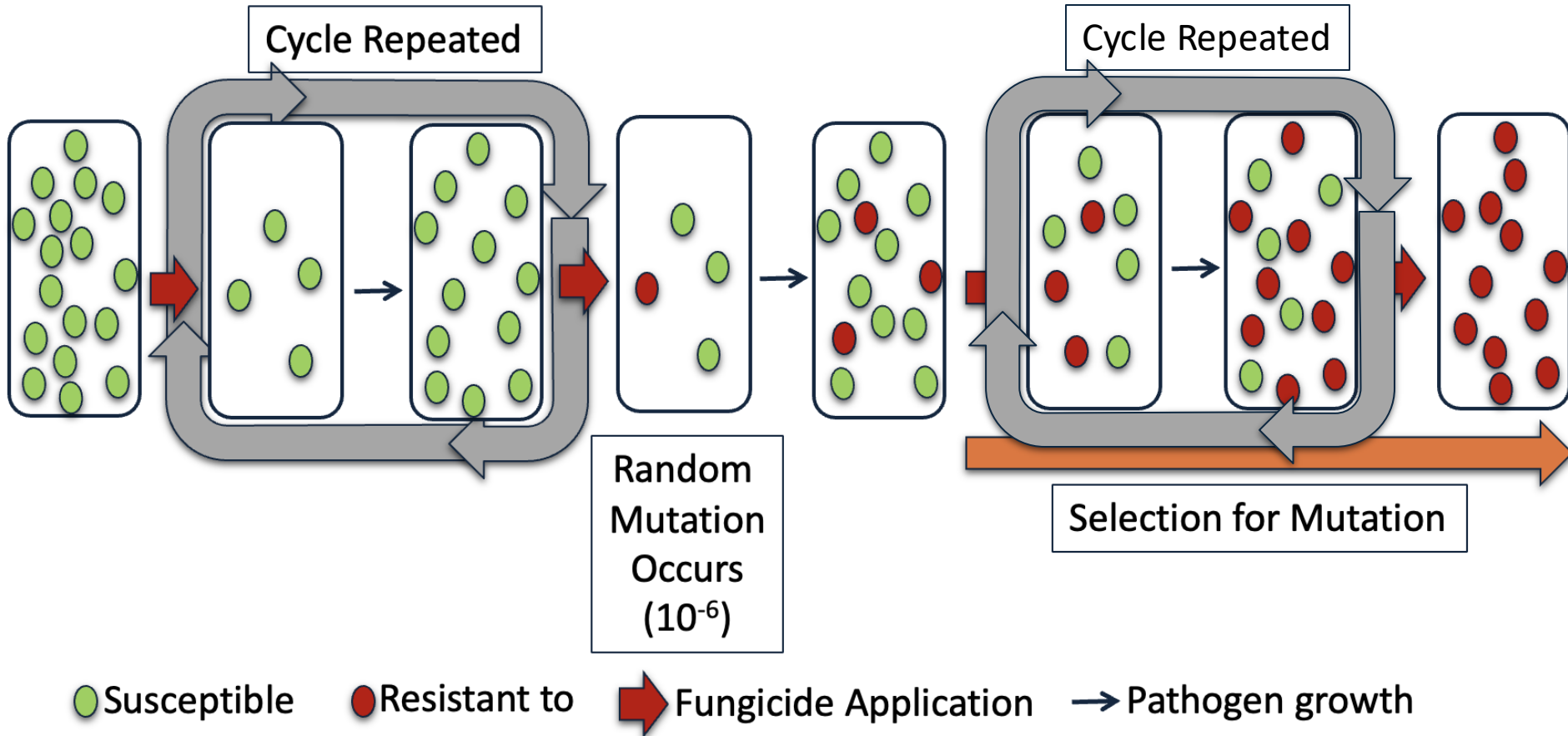
**Quantitative or
gradual/rate dependent**

Example) FRAC 3, 7

Qualitative (sudden) Resistance Development



Medium risk products take longer



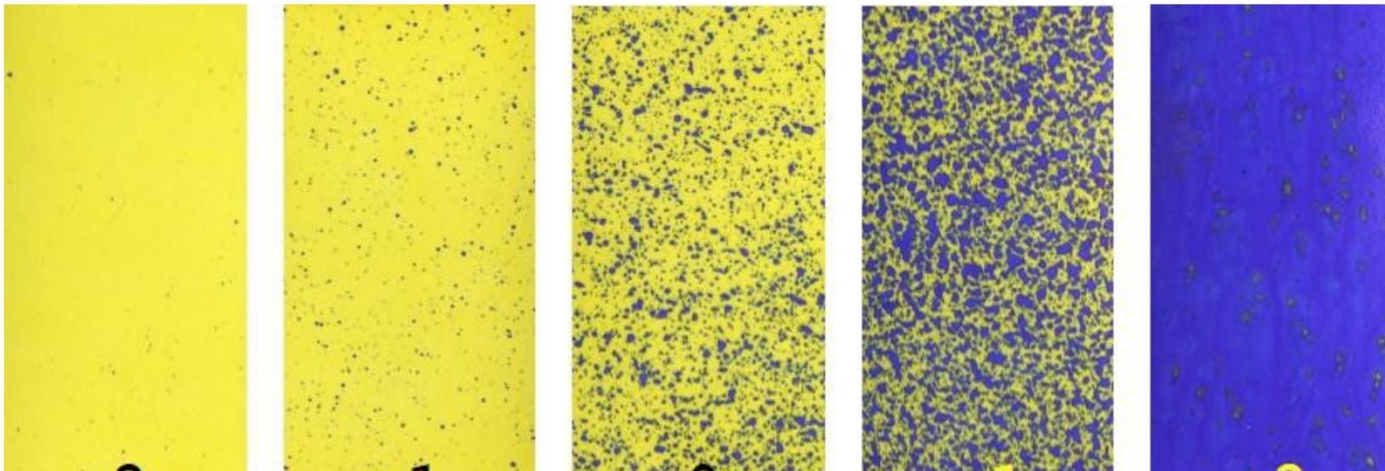
Risk of Resistance

Low Risk	Medium Risk	High Risk
<p>sulfur, oils, potassium, bicarbonates, materials of biological origin</p> <p>FRAC codes with an “M”</p>	<p>Metrafenone (FRAC 50), fenhexamid (FRAC 17), quinoxifen (FRAC 13),</p> <p>DMIs (FRAC 3): fenarimol, myclobutanil, difenconazole, tebuconazole</p> <p>SDHIs (FRAC 7): boscalid, fluopyram, benzovindiflupyr, Isofetamid</p>	<p>Cyflufenamid (FRAC U06)</p> <p>QoIs (FRAC 11): azoxystrobin, pyraclostrobin, kresoxim-methyl, trifloxystrobin</p>

High risk products are not bad; you just have to use them properly

Using the right tool for the job can save you a lot of pain...

- And using water sensitive spray cards can be a great tool to make sure your chemical is getting where it is supposed to be going!!!



Things that can look like resistance:

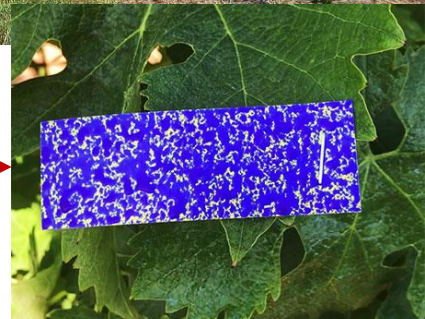
Poor spray coverage

Due to:

- Improper calibration
- Overextended application intervals
- Low rates or application volume
- Missing sections of the canopy (e.g. suckers, inside the canopy on horizontally divided)
- Overly fast driving speed
- Other reasons



SNAPCARD App
can help estimate
coverage



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SNAPCARD App
can help estimate
coverage

Fungicide Rotations

Within a season

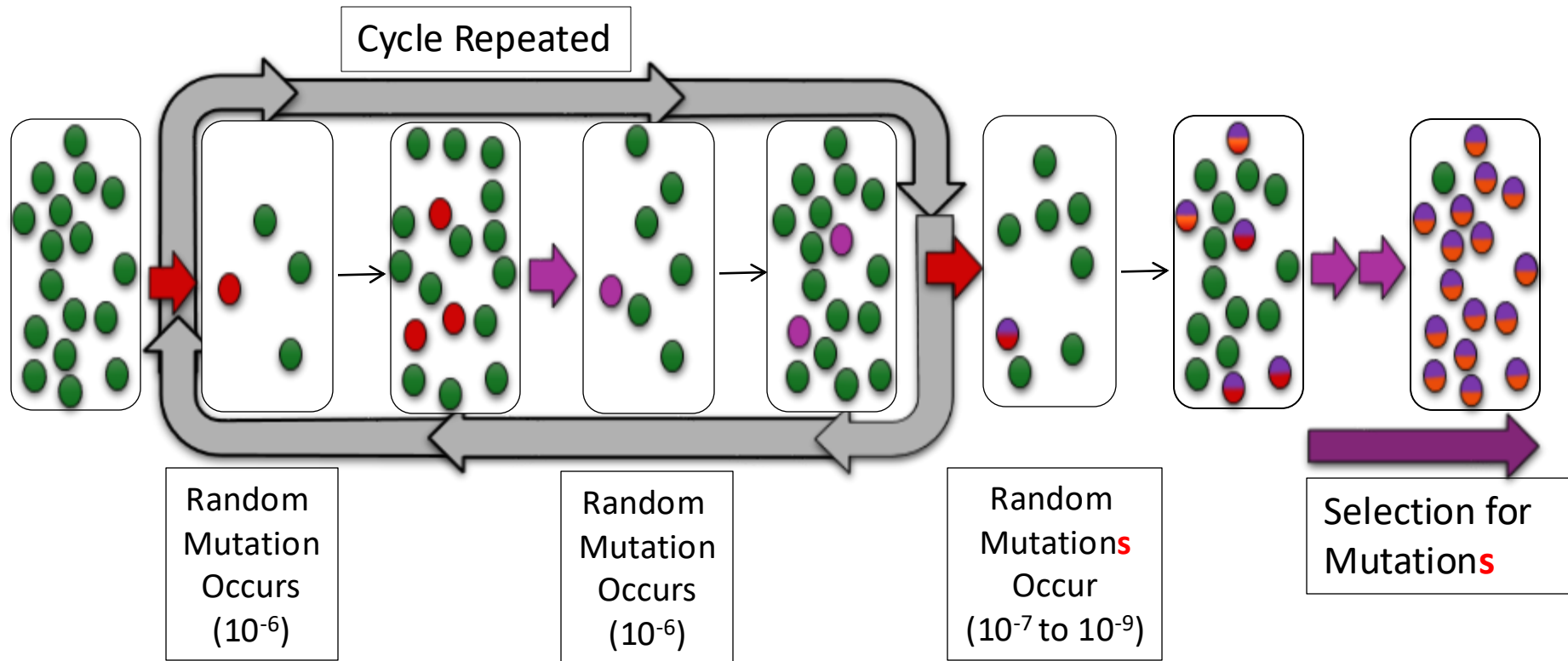
- Disease management principles still apply
- Synthetics early season vs. late season
 - Early season – may not have all resistant isolates, but might lose disease control if subsequent sprays are inappropriate
 - Late season – may avoid disease control loss during “critical window” but might select for ore resistant isolates for next year



Within a rotation

- Tank mix with contact products (if appropriate)
- Ensure proper coverage and water volume

Spray 1	Product A
Spray 2	Product B
Spray 3	Product C
Spray 4	Product A
Spray 5	Product D
Spray 6	Product E

Resistance Development with Fungicide Rotations



● Susceptible ● Resistant to  Fungicide Application → Pathogen growth
● Resistant to  Fungicide Application

Tank Mixing

Tank mixing = applying 2 (or more) different MOAs simultaneously

Some product formulations pre-mix

- Pristine, Luna Experience, Quadris Top, etc.

Can be used to:

- target multiple diseases and/or
- as a resistance management tool

Spray 1	Product A + Product B
Spray 2	Product C + Product B
Spray 3	Product D+ Product B
Spray 4	Product A+ Product B

Tank Mixing

Tank mixing = applying 2 (or more) different MOAs simultaneously

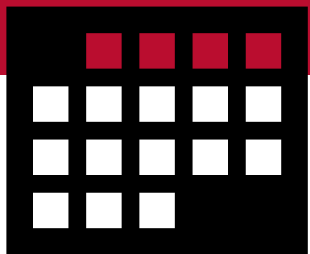
Some product formulations pre-mix

- Pristine, Luna Experience, Quadris Top, etc.

Cheap tank mix is the addition of a contact

- Example: 3lbs of sulfur, 0.5-1% oil
- **Check for phytotoxicity**
- **Check for chemical incompatibility**

Spray 1	Product A + Product B
Spray 2	Product C + Product B
Spray 3	Product D+ Product B
Spray 4	Product A+ Product B



Spray Timing

Calendar start

- Starting program based on a set date

Phenology start

- Starting program based on plant development

Phenology – adjusted calendar sprays:

Designing a program that considers **when the host is most susceptible** and **when a pathogen thrives**, but also considers **how the chemistry functions (intervals, activity)**



Spray Intervals

Calendar intervals

- Setting spray program based on days listed on the label
- Best for diseases where continuous coverage is needed (powdery and downy

Phenology intervals

- Setting spray program based on key time periods
- Best for diseases where punctuated times of control are needed (Botrytis bunch rot, Phomopsis)



**Spray intervals may differ,
based on target disease**
Adjusting based on plant
growth speed is ideal



Rotations: You need more than “to just get by”

- Planning a program with rotation can be different than executing one with a good rotation scheme
 - Sometimes an extra spray is needed
 - Sometimes a spray is skipped
 - Is your rotation “change-proof”?
- How many different high-resistance risk FRAC groups do you have?




Resistance management recommendations:

- **Take care of your sprayers** (calibrate, replace nozzles, check tank volume)
- **Rotate** fungicides
- **Tank mix** with different FRAC Groups
- If resistance suspected – **avoid using those products during critical window**



More resources for fungicide stewardship

		Grapevine Development								
		3" shoots	10" shoots	Pre-bloom	Full bloom	Fruit set	Pea-size	Bunch closure	50% veraison	100% veraison
										
Season Program (FRAC groups)		M02	M02	3 / 40 + M02	7 / 11 + M02	13 + M03	50 + 21	7 + 33	21	3 / 9
Target Disease	Powdery mildew	M02	M02	3 + M02	7 / 11 + M02	13	50	7		3
	Downy mildew			40	11	M03	21	33	21	
	Botrytis bunch rot				7 / 11			7		3 / 9

Good Fruit Grower article with Michelle Moyer and Charlotte Oliver (WSU), Phil Brannen (UGA), Tim Miles (MSU), Sarah Lowder, and Melanie Lewis Ivey (Ohio State)



<https://www.goodfruit.com/good-to-know-dialing-in-disease-control/>

**Read the label,
the label is the law**

Photo: Ric Bessin



Label Information

- Active ingredient(s) (AI)
- Chemical group(s) (FRAC code)
- Precautionary statements and required PPE
- Return entry interval (REI)
- Application methods
- Crops rates
- Limitations on each application

Active Ingredient*:

metrafenone: (3-bromo-6-methoxy-2-methylphenyl)(2,3,4-trimethoxy-6-methylphenyl)methanone. 25.20%

Other Ingredients: 74.80%

Total: 100.00%

*This product contains 2.5 lbs active ingredient per gallon

Group 50 Fungicide

Precautionary Statements

Hazards to Humans and Domestic Animals

Caution. Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks

Follow the manufacturer's instructions for cleaning and maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.



Southeast Regional Muscadine Grape

INTEGRATED
MANAGEMENT
GUIDE

2024



Southeast Regional Bunch Grape

INTEGRATED
MANAGEMENT
GUIDE

2023

*A Guide for Managing Diseases, Insects,
Weeds, and Wildlife in Grapes in the Southeast*

<https://extension.uga.edu/publications/detail.html?number=AP126-3>

<https://extension.uga.edu/publications/detail.html?number=AP131-1>

