

Viticulture

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 Western Campus
 Grand Junction, CO

viticulture.colostate.edu

Amateur Winemaker Workshop



**ENGAGEMENT
AND EXTENSION**
 COLORADO STATE UNIVERSITY

1

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COLORADO STATE UNIVERSITY
 EXTENSION

Learn more about CSU's Principles of Community and our Land Acknowledgement at col.st/OWMJA.



2



3



4



5



6



7

What is the Viticulture Extension Specialist?

- First position of its kind at CSU – 50% CSU, 50% industry (YOU)
- Role – Anything pertaining to outreach
 - Workshops, webinars, factsheets, grower forums/interactive spaces
 - On-site consultations and issue follow-ups
 - Assist local extension offices with grape questions and training
 - Research areas that can't be addressed by Dr. Caspari



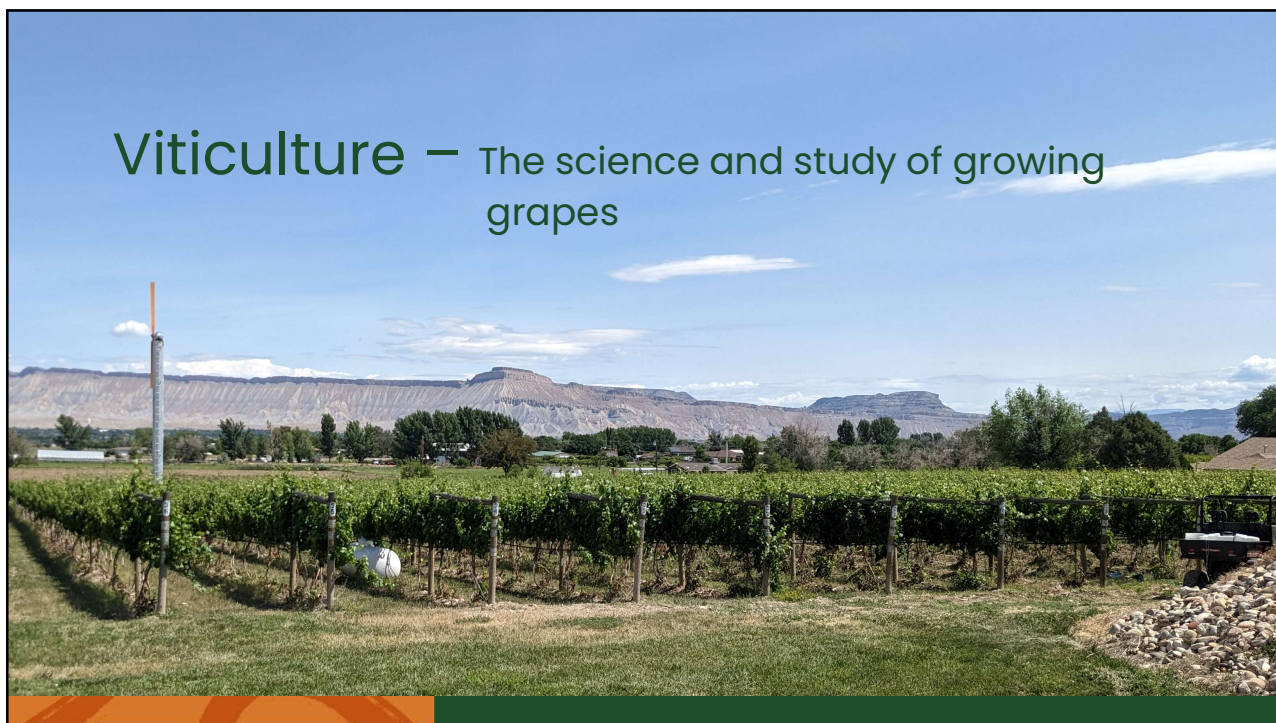
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Viticulture –



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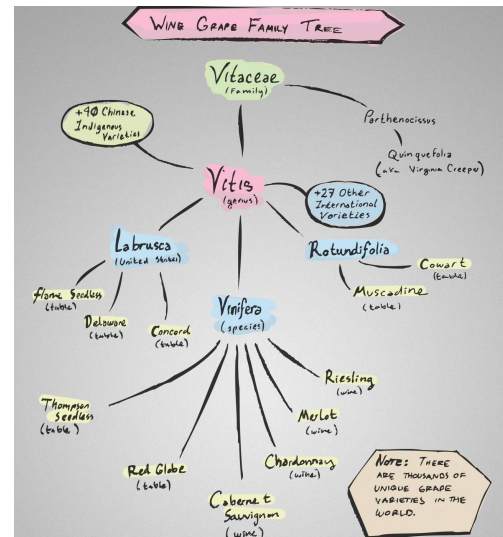
Viticulture – The science and study of growing grapes



10

What is a grape?

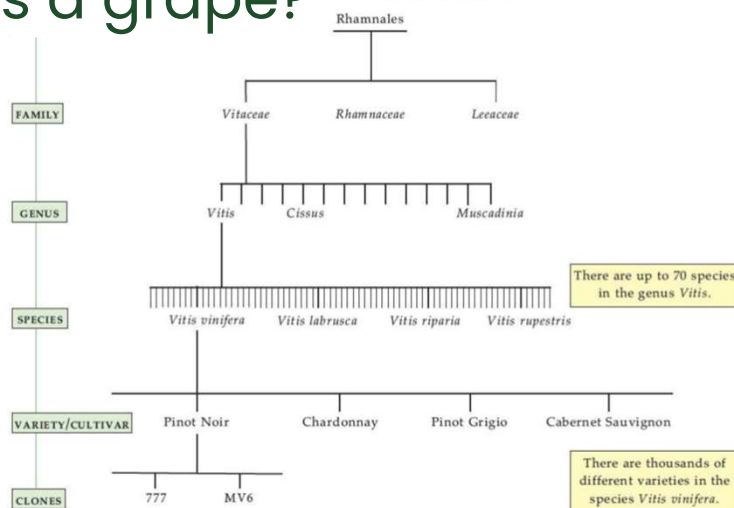
- *Vitis vinifera*
- Two subgenera
 - *Euvitis* – 38 chromosomes
 - *Muscadinia* – 40 chromosomes
- Deciduous liana with loose bark and alternating, lobed leaves
- Found in temperate regions worldwide
- Dual domestication assumed 11,000 yrs ago
- Interbreeding is common



Graphic courtesy of Wine Folly

11

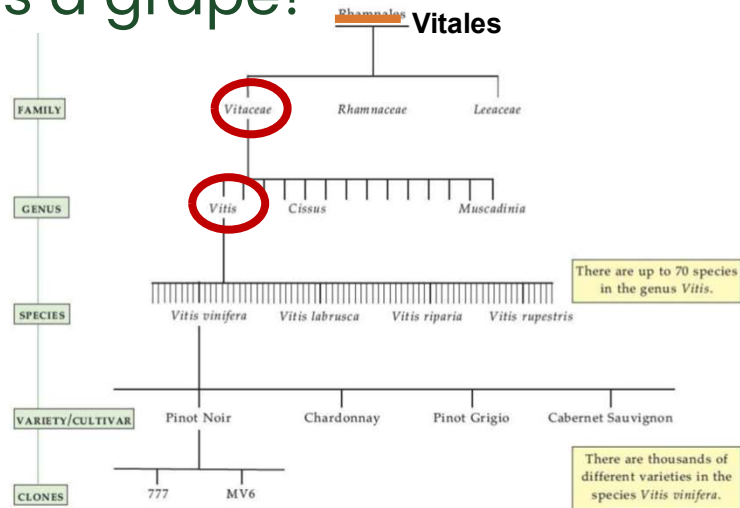
What is a grape?



Graphic courtesy of The Grapevine

12

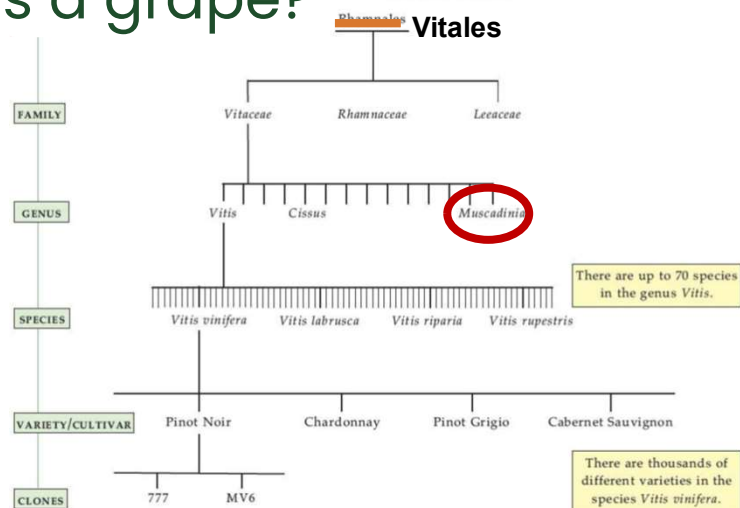
What is a grape?



Graphic courtesy of The Grapevine

13

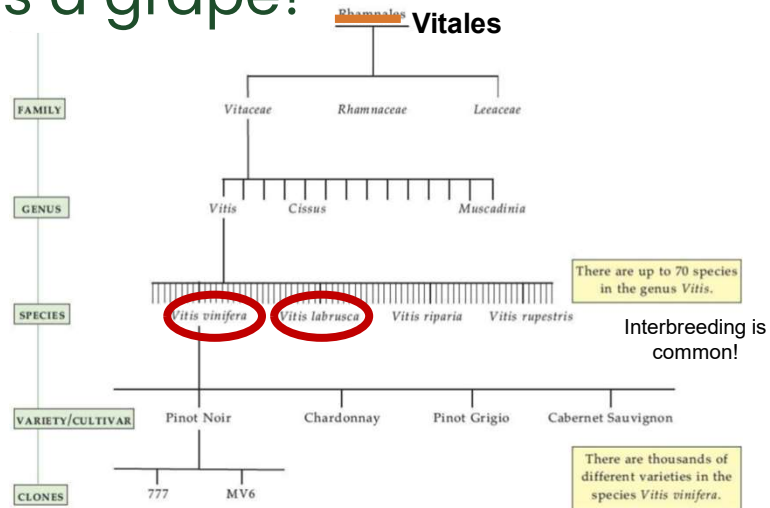
What is a grape?



Graphic courtesy of The Grapevine

14

What is a grape?



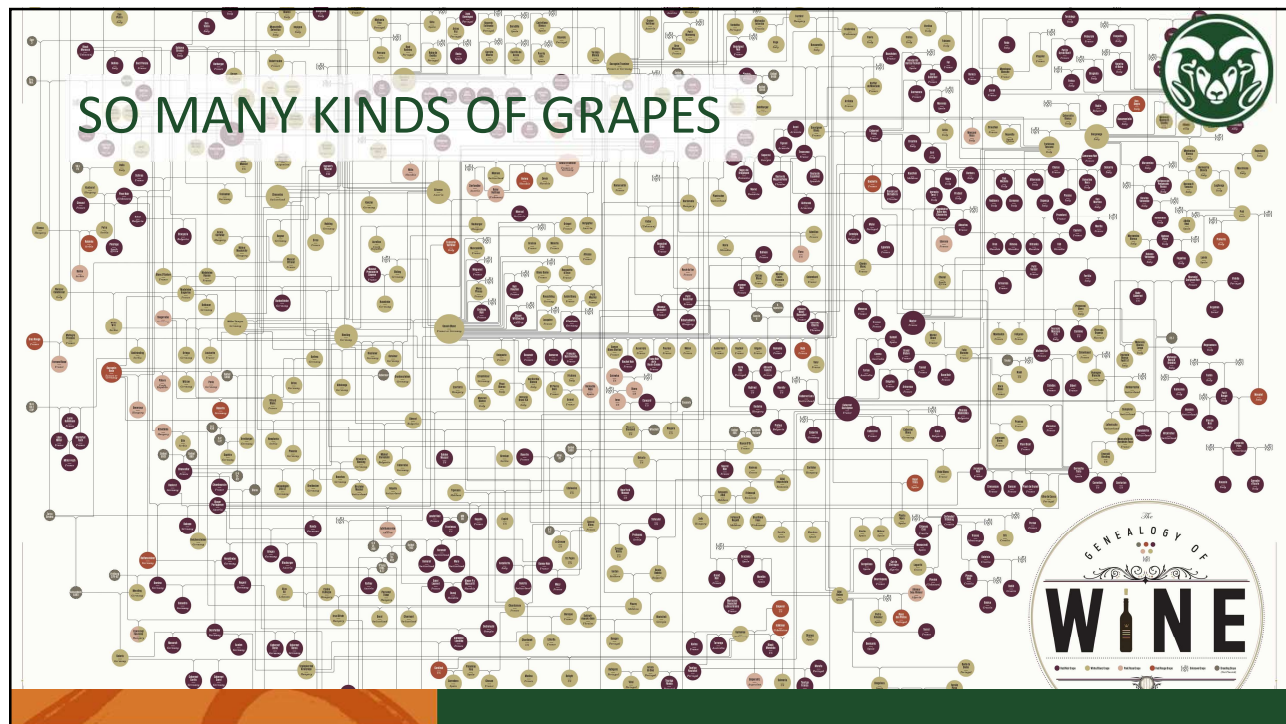
Graphic courtesy of The Grapevine

15

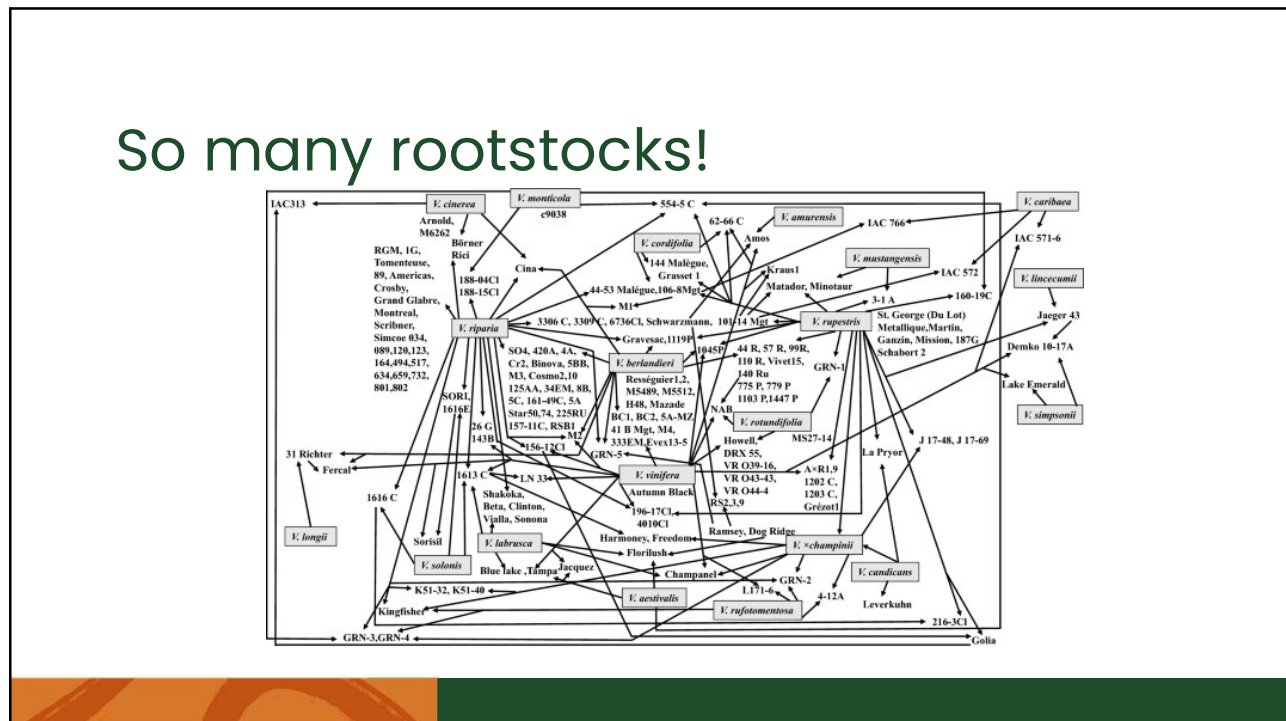
SO MANY KINDS OF GRAPES



16



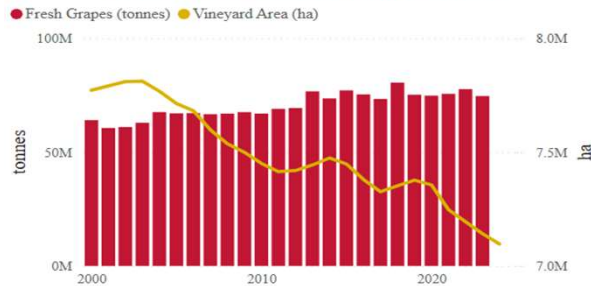
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18

Global Grape Production

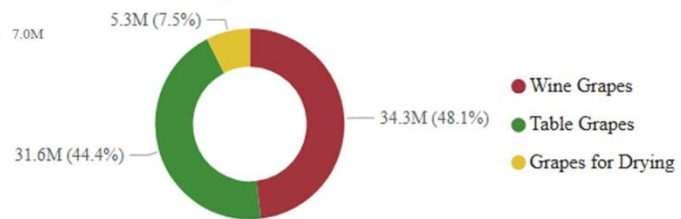
Fresh Grapes Production & Vineyard Area



- 1st – Spain (930)
- 2nd – France (783)
- 3rd – China (753)
- 4th – Italy (728)
- 5th – Turkey (402)
- 6th – USA (385)

In kha

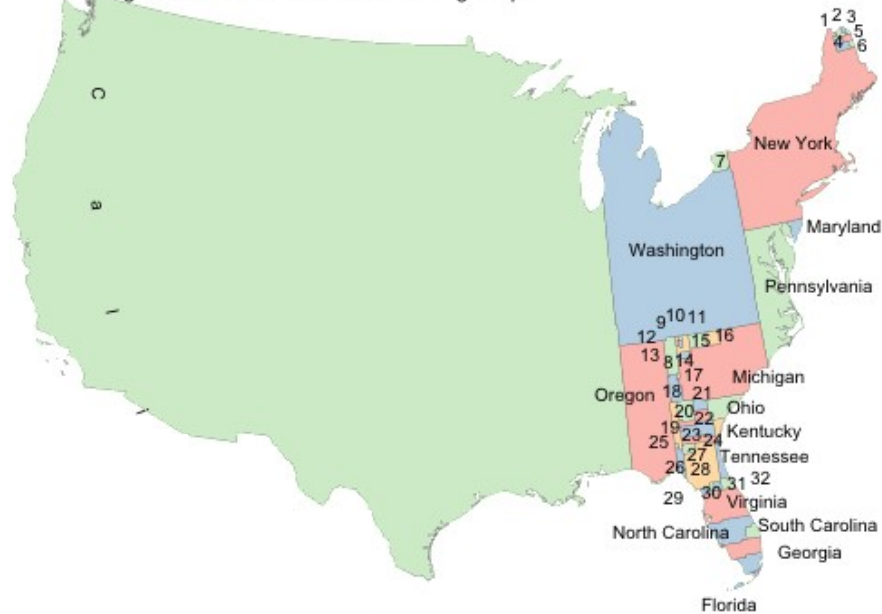
Grapes Production (tonnes)



Graphs Courtesy of OIV (www.oiv.int/what-we-do/global-report?oiv)

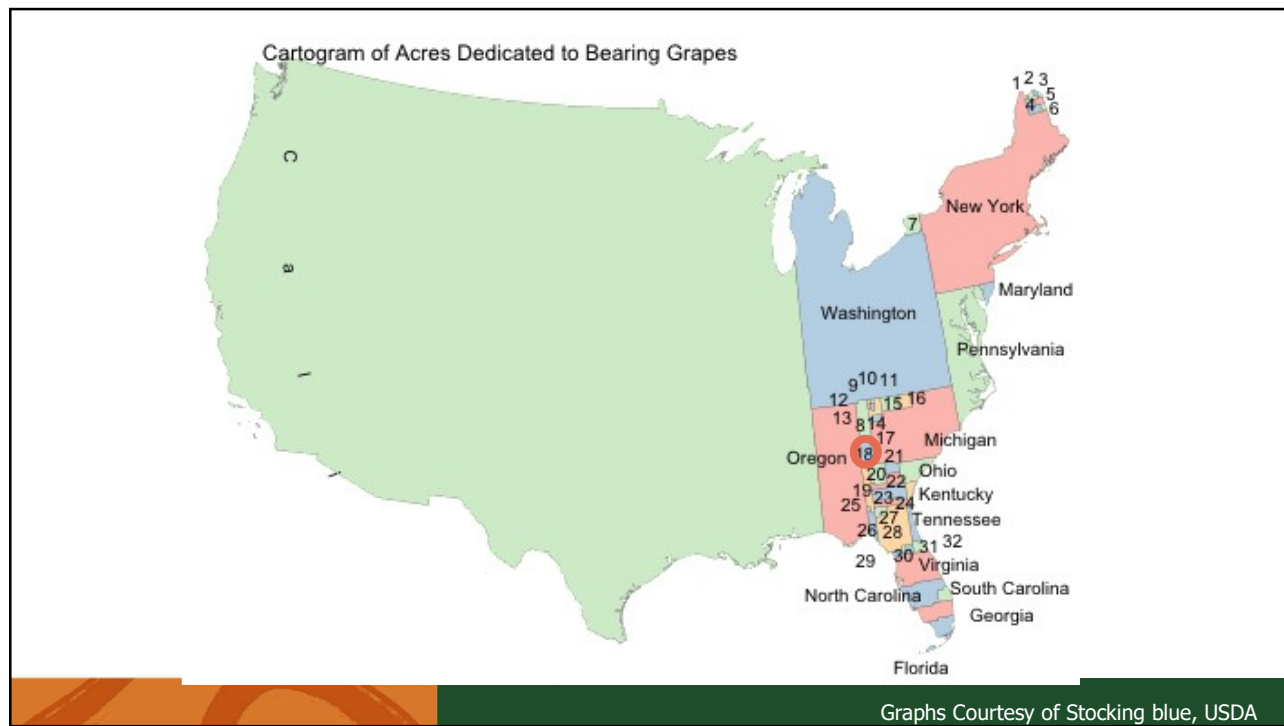
19

Cartogram of Acres Dedicated to Bearing Grapes

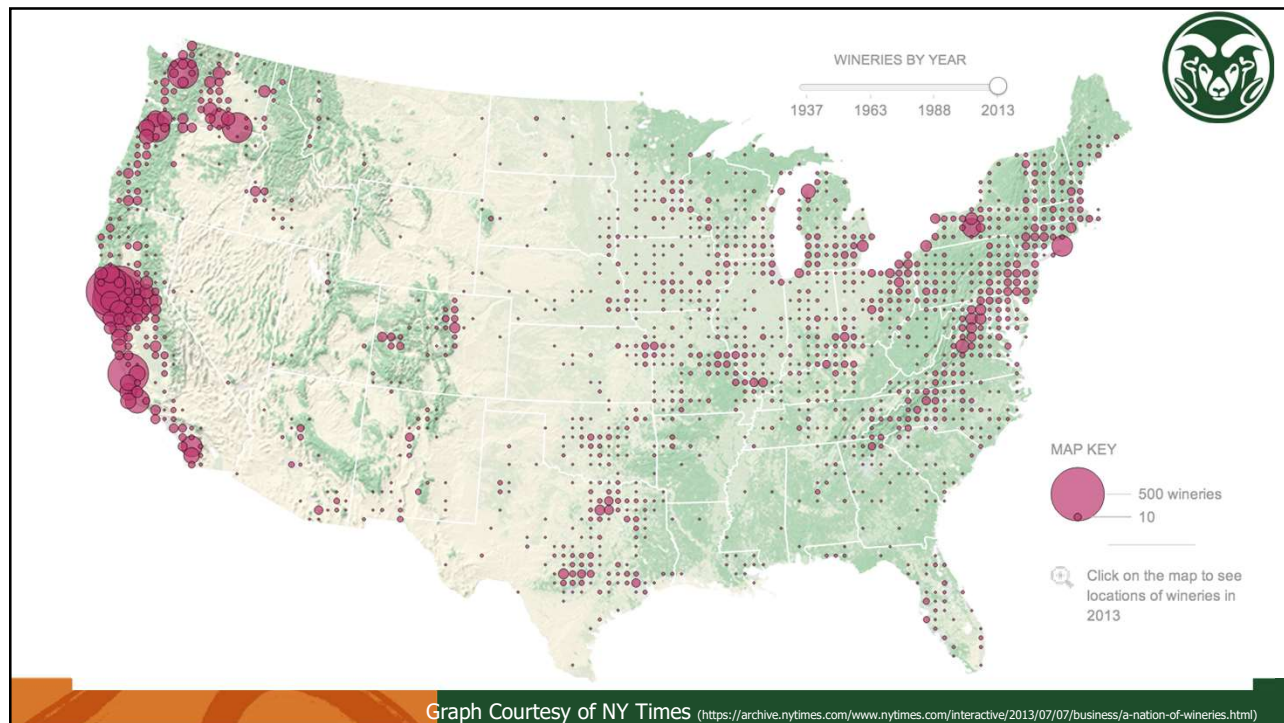


Graphs Courtesy of Stocking blue, USDA

20



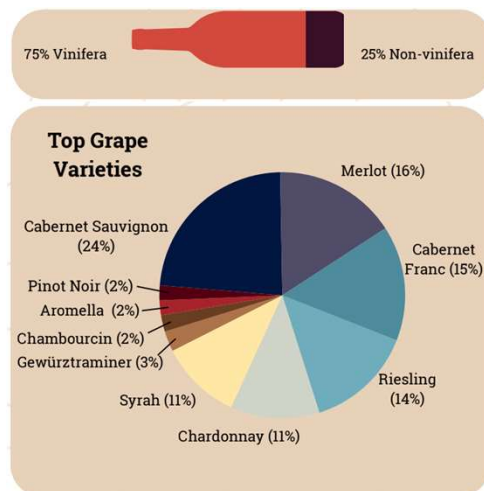
21



22

Colorado Grape Production

- Approx. 780 ac total
- Av. vineyard is 5 ac
- Median vineyard is 3 ac
- Primarily European varieties
- ~\$1900 a ton
 - More for European, less for modern varieties
- Range of 1-3 ton per ac
 - Modern varieties closer to 5-6 t/ac

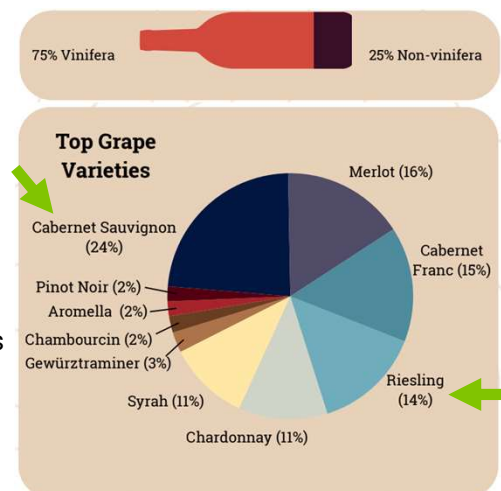


Graphics Courtesy of CWIDB

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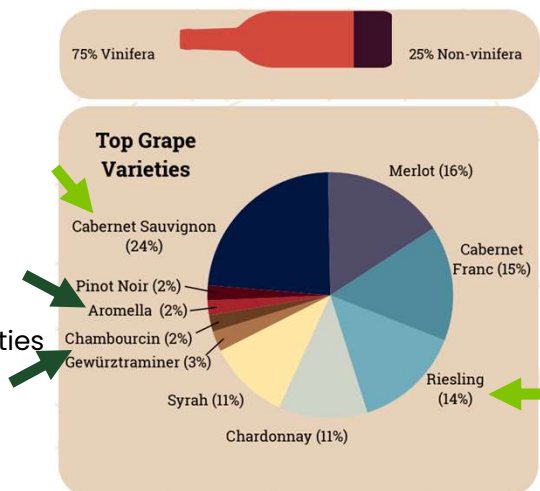


Graphics Courtesy of CWIDB

24

Colorado Grape Production

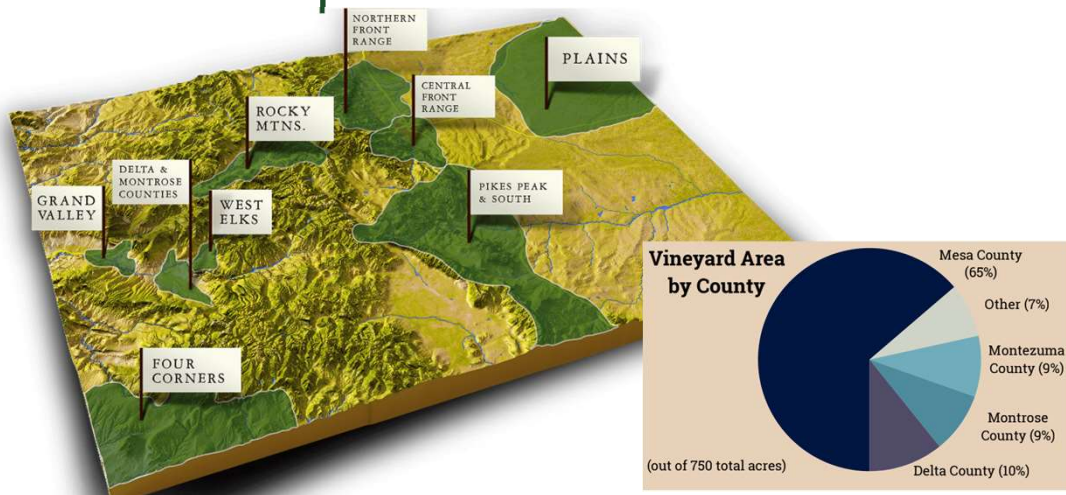
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Graphics Courtesy of CWIDB

25

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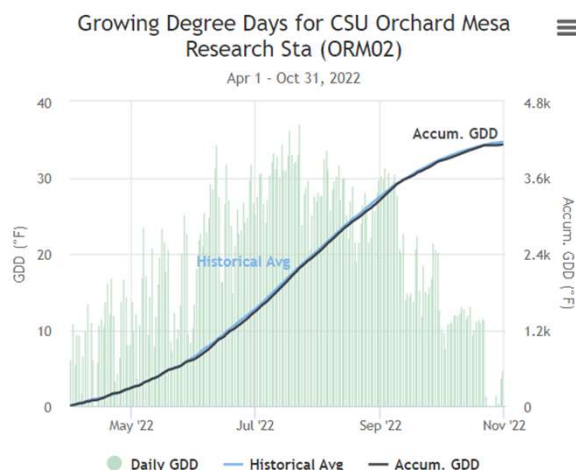


Graphics Courtesy of Colorado Wine Industry Development Board

26

Climatic Requirements

- Minimum requirements
 - GDD – cultivar dependent
 - Frost Free Days = 150-180 days
- Colorado grapes are at 4,000-7,000 ft elevation
 - Temperatures decrease as elevation increases
 - Fewer frost-free days
 - GDDs is not always too low

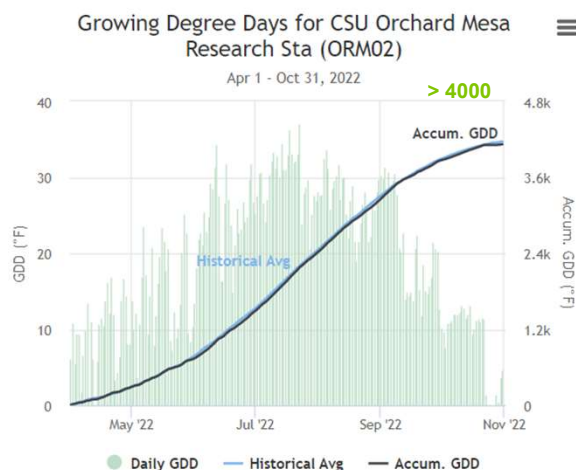


Graph courtesy of CoAgMet

27

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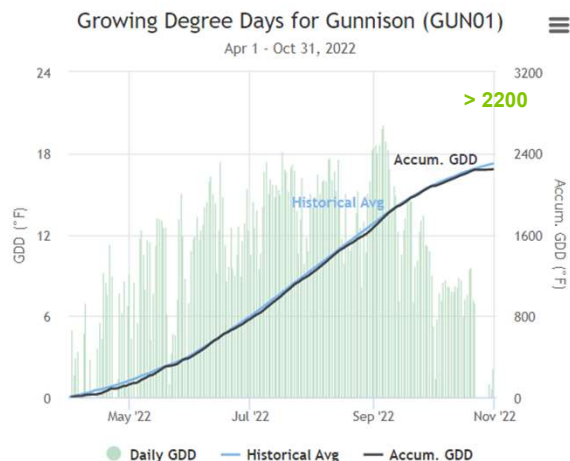


Graph courtesy of CoAgMet

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Graph courtesy of CoAgMet

29

Climatic Requirements

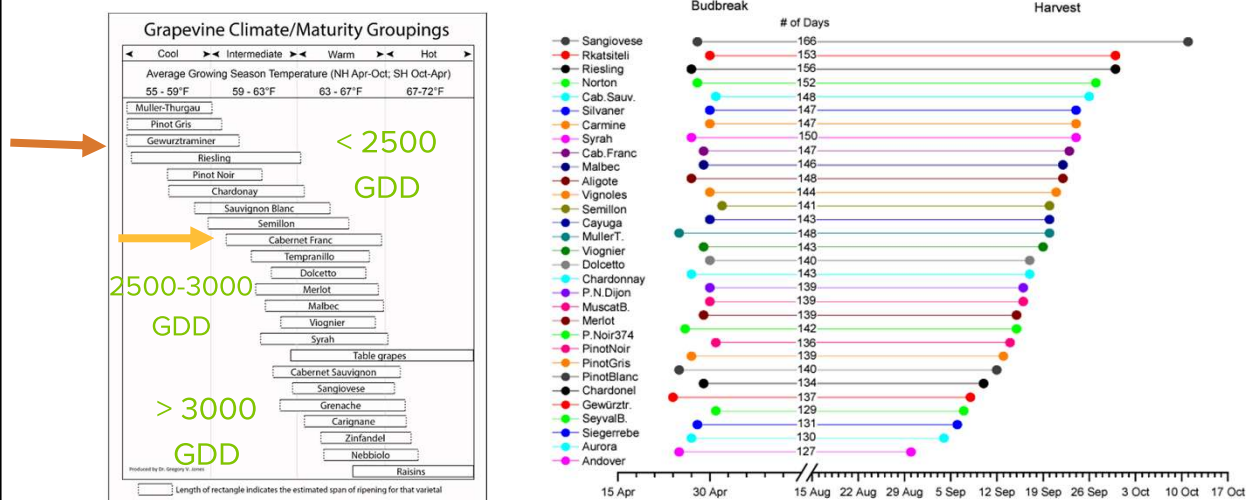
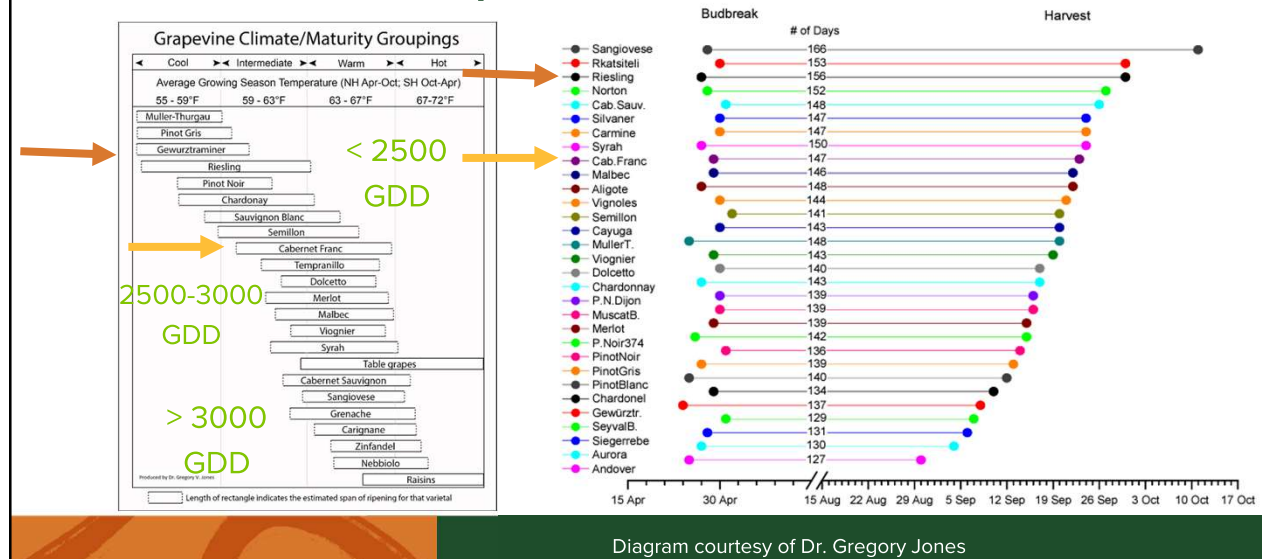


Diagram courtesy of Dr. Gregory Jones

30

Climatic Requirements



31

Unique climatic conditions

- All of the state is high elevation
 - 4,500 – 7,000 ft in absolute elevation
 - Deep cold winters
- Soils are basic, can be high in calcium sulfates and carbonates, and are highly variable



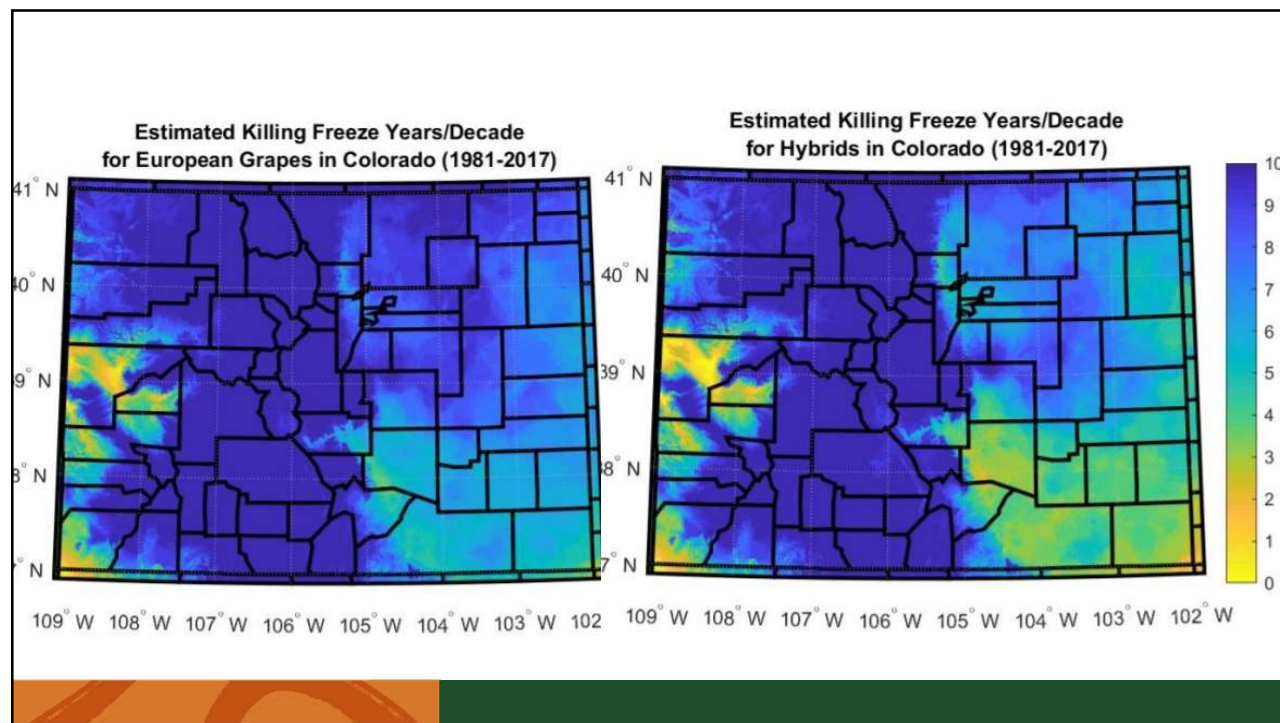
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Unique climatic conditions

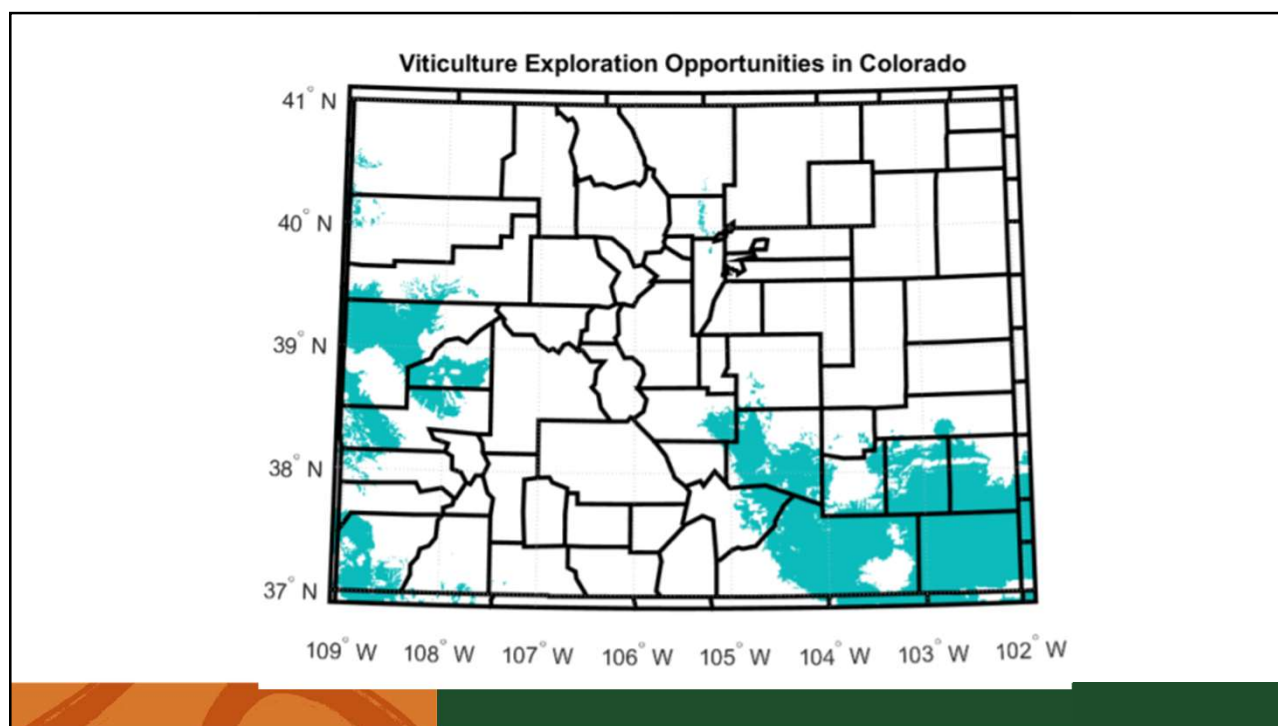
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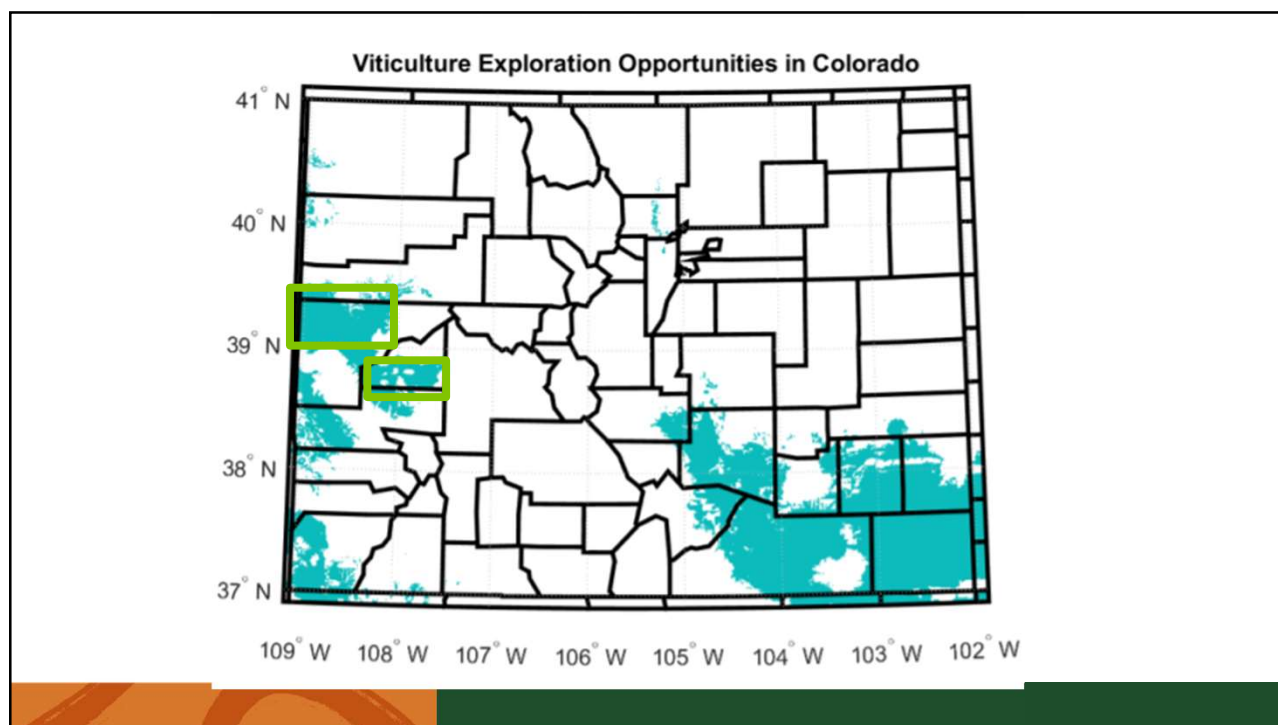
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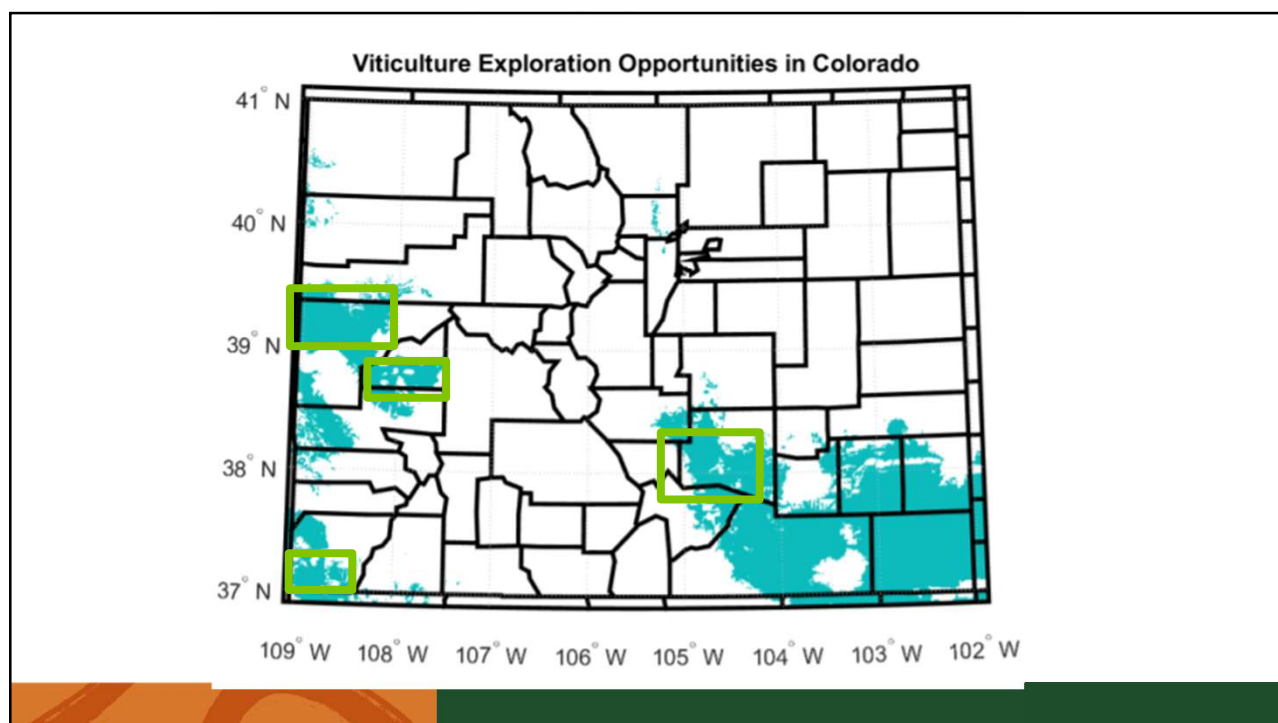
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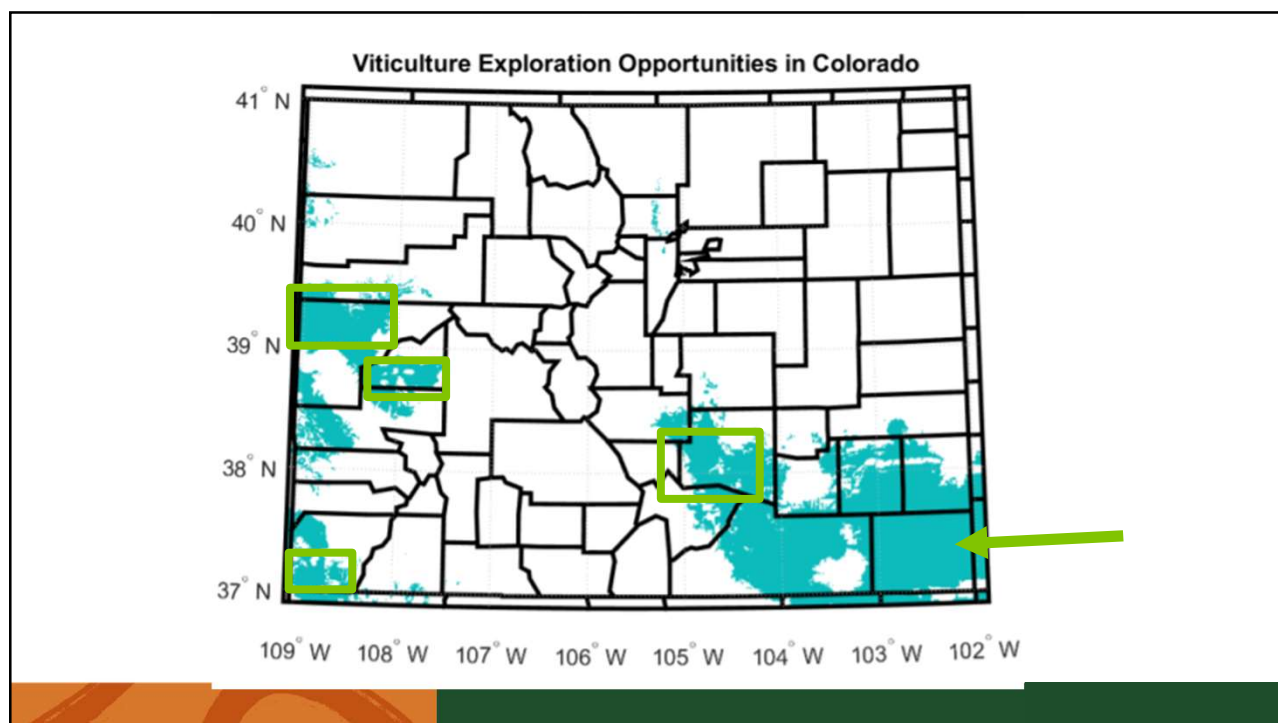
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36



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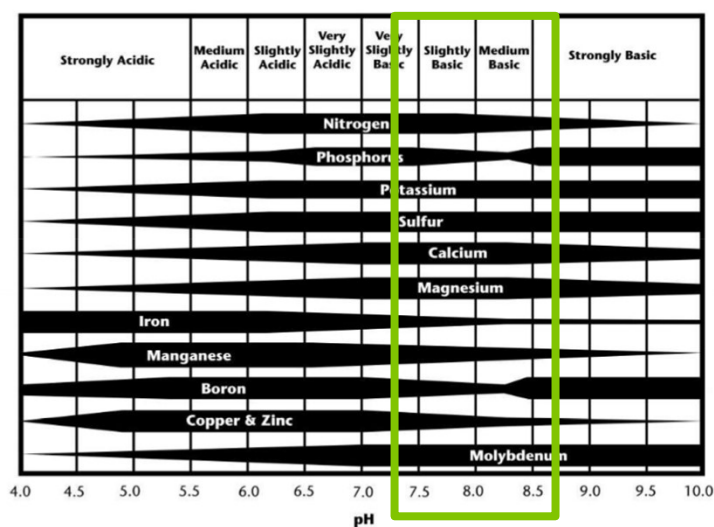
Unique climatic conditions

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39

Soil –
pH – 5.8–6.8



40

Season Snapshot



41



42

	Feb Week				Mar Week				Apr Week				May Week				Jun Week				Jul Week				Aug Week				Sept Week				Oct Week			
Phenology	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
Budswell																																				
Budbreak																																				
Shoot elongation																																				
Bloom																																				
Fruit development																																				
Veraison																																				
Harvest																																				
Vine Management Activities																																				
Pruning																																				
Shoot thinning																																				
Soil sampling																																				
shoot positioning																																				
Leafpulling																																				
Cluster thinning																																				
Suckering																																				
Skirting/hedging																																				
Petiole sampling																																				
Bird netting																																				
Harvest																																				
Hilling																																				
Irrigation																																				
Scouting Targets																																				
cutworms																																				
powdery mildew																																				
japanese beetle																																				
botrytis bunch rot																																				
sour rot																																				
leafhoppers																																				
mealybugs																																				
crown gall																																				
Vineyard Establishment																																				
Site selection																																				
soil testing																																				
Soil amendment																																				
Cover crop prep																																				
Vineyard site prep																																				
plant new vines																																				
Vineyard Infrastructure																																				
Irrigation maintenance																																				
Colorado State University																																				

43

Shoot thinning

Apr

May

Jun

Jul

Aug

Budbreak

Bloom

Shoot thin

Leaf pull

Shoot positioning

Suckering

Hedging

Bringing the shoot number down to 3-5

44

Leaf Pulling

Apr May Jun Jul Aug

Budbreak

Bloom

Shoot thin

Leaf pull

Shoot positioning

Suckering

Hedging

Removing leaves on the
eastern side



45

Suckering

Apr May Jun Jul Aug

Budbreak

Bloom

Shoot thin

Leaf pull

Shoot positioning

Suckering

Hedging

Removing shoots from
around the vine trunk



46

Let's Head Outside!



47

Integrated Pest Management

Charlotte Oliver Ph.D.
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Four Corners Grape Symposium
Apr. 8, 2026



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48

How Do you get started with Pest management?

49

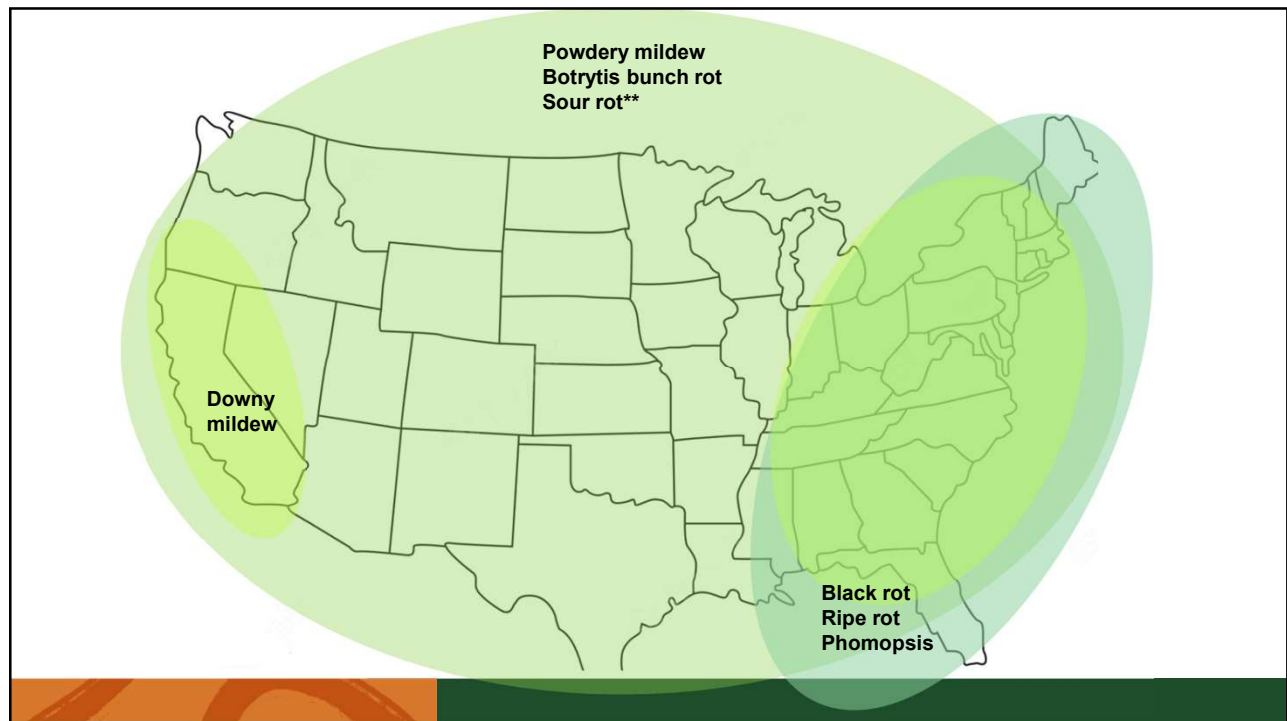
How Do you get started with Pest management?

1. Know what pests and diseases are in your vineyard
2. Evaluate what chemicals are available
3. Build programs one at a time
4. Combine your programs
5. CALIBRATE and get to work!

50

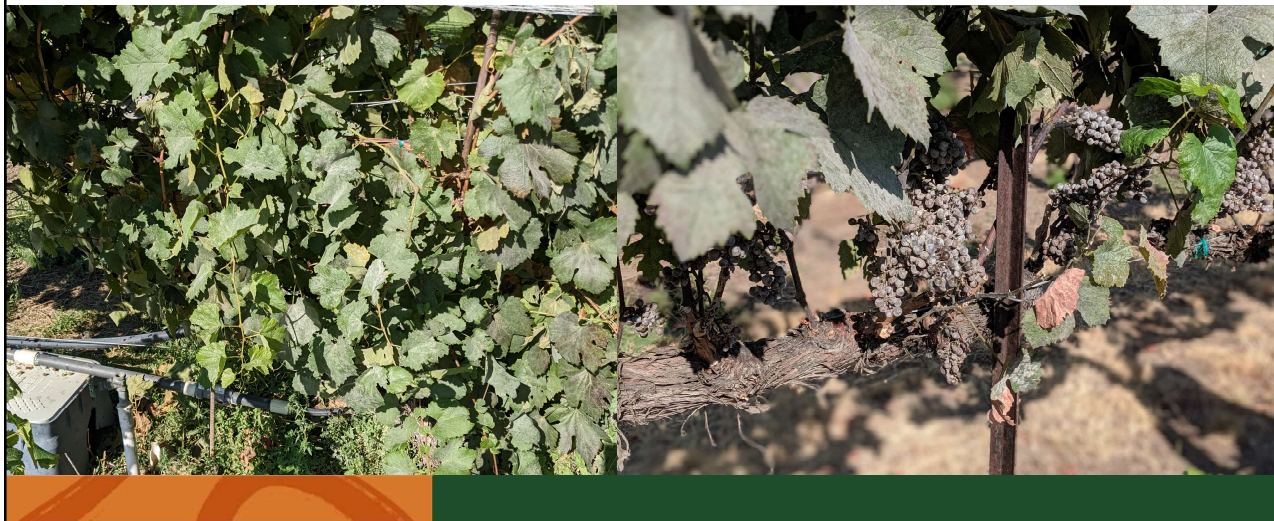
1. Know What Is In Your Vineyard

51



52

Powdery Mildew



53

Grape phylloxera



54

Grapevine Leafroll Disease



55

Crown Gall



56

1. Know What Is In Your Vineyard

- Powdery Mildew
- Leafhoppers
- Grape Berry Moth
- Grape Mealybug

57

Example - Powdery Mildew



58

Example – Powdery Mildew

- Optimum growing conditions are 65–85 °F, shady, with higher relative humidity (50–95%)
- Multiple cycles a year
- “Goldilocks Fungus”
 - Not too hot, not too cold, not too dry, not too bright
- Ontogenic resistance



59

Example – Powdery Mildew

- Optimum growing conditions are 65–85 °F, shady, with higher relative humidity (50–95%)
- Multiple cycles a year
- “Goldilocks Fungus”
 - Not too hot, not too cold, not too dry, not too bright
- **Ontogenic resistance**



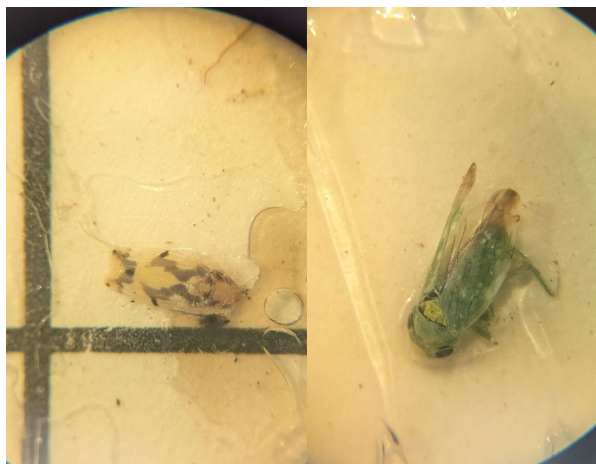
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61

Example - Leafhoppers

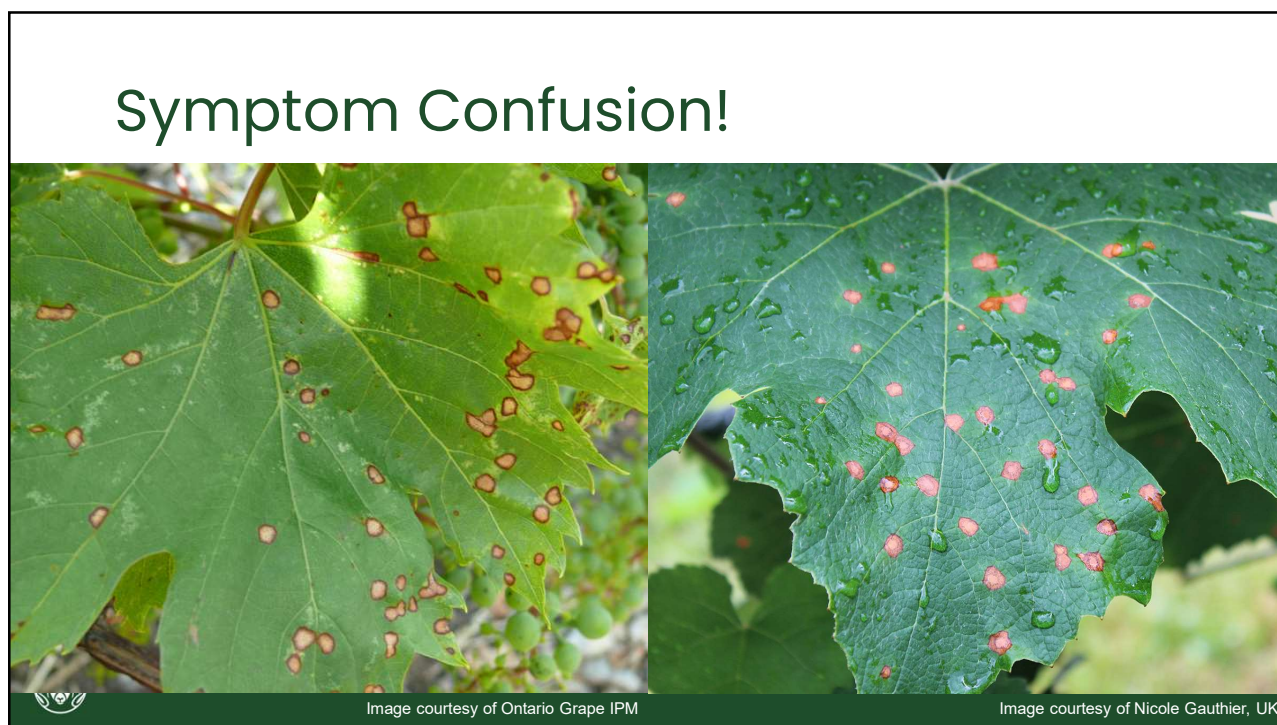
- LOTS of different insects in the same family but all managed the same
- Mostly cosmetic until it's not
- 2-3 generations a summer
- THRESHOLDS
 - Start 4 weeks after budbreak
 - ~ 10-20 nymphs per leaf



62



63



64

Symptom Confusion!



65

Symptom Confusion!



66

Symptom Confusion!



67

2. Evaluate what chemicals are available

68

	Product	Active Ingredient	FRAC	PHI	Apple			Grape			Peach			Notes
					Rate	Interval	Max	Rate	Interval	Max	Rate	Interval	Max	
1	Aprovia	Benzovindiflupyr	7	30	5.5-7 foz	7-10	4 ap or 28 foz	8.6-10.5 foz	14-21	3 ap or 31.5 foz				
2	Cevya	Mefenidriluxonazole	3	0 or 14	5 foz	7	3 ap or 15 foz	4-5 foz	10	3 ap or 15 foz	5 foz	7	3 ap or 15 foz	Table and wine have diff. rates. cause leaf injury on Vitis labrusca and V. labrusca hybrid grape varieties
4	Flint Extra	Trifloxystrobin	11	1 or 14	2.5-2.9 foz	10-14	4ap or 10.5 foz	3-3.5 foz	14-21	6 ap or 23 foz	2.5-3.8 foz	7-14	4 ap or 15.2 foz	Max. 4 FRAC 11 a year, concords are sensitive
5	Gatten	Flutianil	U13	14	6-8 foz	7-14	4 ap	6.4 foz	7-14	4 ap				20-100 gal water DOES NOT PLAY WELL WITH OTHERS, no stickers, sulfur, captan, copper, some insecticides.
7	JMS Stylet Oil	oil	.	0	1-2 gal	10-14	.	1-2 gal	10	.	1-2 gal	10-14	.	
8	Luna Experience	fluopyram & tebuconazole	7 & 3	0 or 45				6-8.6 foz	12-21	5 ap or 34 foz	6-10 foz	7-14	5 ap or 34 foz	additional REI for trying canes
12	Quadris Top	Azoxystrobin & Difenoxonazole	11 & 3	0 or 14				12-14 foz	10-21	4 ap or 56 foz	14 foz	7	4 ap or 56 foz	DO NOT SPRAY ON APPLES OR CONCORD
16	Microthiol Disperss	sulfur	M2	0	10-20 lb	7-14		3-10 lb	7-14		10-20 lb	7-14		DO NOT SPRAY ON CONCORD or APRICOT. Heat concerns
17	Torino	Cyflufenamid	U6	3 or 14	6.8 oz	14	1 ap or 6.8 foz	3.4-6.8 oz	14	2 ap or 6.8 oz				
18	Vivando	Metrafenone	U8	7 or 14				10.3-15.4 foz	14-21	46.2 foz	15.4 foz	7-14	2 ap or 30.8 foz	DO NOT mix with oil

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2	Cevya	Mefenidriluxonazole	3	0 or 14	5 foz	7	3 ap or 15 foz	4-5 foz	10	3 ap or 15 foz	5 foz	7	3 ap or 15 foz	Table and wine have diff. rates. cause leaf injury on Vitis labrusca and V. labrusca hybrid grape varieties
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17	Torino	Cyflufenamid	U6	3 or 14	6.8 oz	14	1 ap or 6.8 foz	3.4-6.8 oz	14	2 ap or 6.8 oz				
18	Vivando	Metrafenone	U8	7 or 14				10.3-15.4 foz	14-21	46.2 foz	15.4 foz	7-14	2 ap or 30.8 foz	DO NOT mix with oil

70

3. Build programs one at a time

71

3. Build programs one at a time

- Focus on:
 - Growth stage of the host and the pest
 - FRAC codes not Product names

72

What's in a name?

Drexel

Azoxystrobin SC

Fungicide

Broad spectrum fungicide for control of listed diseases in Agricultural crops, Turf and Ornamentals.

ACTIVE INGREDIENT:
 Azoxystrobin: methyl (E)-2-[2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate..... 22.9%
OTHER INGREDIENTS: 77.1%

AZOXYSTROBIN GROUP 11 FUNGICIDE

PRECAUTIONARY STATEMENTS (Cont.)
PERSONAL PROTECTIVE EQUIPMENT (PPE)
 Applicators and other handlers must wear: Long-sleeved shirt and long pants; chemical-resistant gloves made of any waterproof material such as polyvinyl chloride, nitrile rubber or butyl rubber; shoes plus socks.
Use Protective Equipment

AZOXYSTROBIN GROUP 11 FUNGICIDE PULL HERE TO

Abound[®]

Flowable Fungicide

syngenta

Broad spectrum fungicide for control of plant diseases

Active Ingredient:
 Azoxystrobin: methyl (E)-2-[2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate* 22.9%

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Flowable Fungicide

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Broad spectrum fungicide for control of plant diseases

AZOXYSTROBIN GROUP 11 FUNGICIDE PULL HERE TO OPEN

AZOXYSTROBIN: methyl (E)-2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate* 22.9%

75

Fungicide resistance action committee

- FRAC
 - www.frac.info/home
- Group materials by how they work – MODE OF ACTION (MOA)
- Rank pathogen resistance risk
- Goal – assist in MOA rotation and resistance management

GROUP 7 FUNGICIDE PULL HERE TO OPEN

Aprovia[®]
Fungicide

GROUP M2 FUNGICIDE

MICROTHIOL DISPERSS

Abound[®]
Flowable Fungicide

GROUP 11 FUNGICIDE PULL HERE TO OPEN

76

3. Build programs one at a time

- Focus on:
 - Growth stage of the host and the pest
 - FRAC codes not Product names
 - “Critical Window” – BLOOM
 - Your time commitment

77

4. Combine your programs

78

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	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

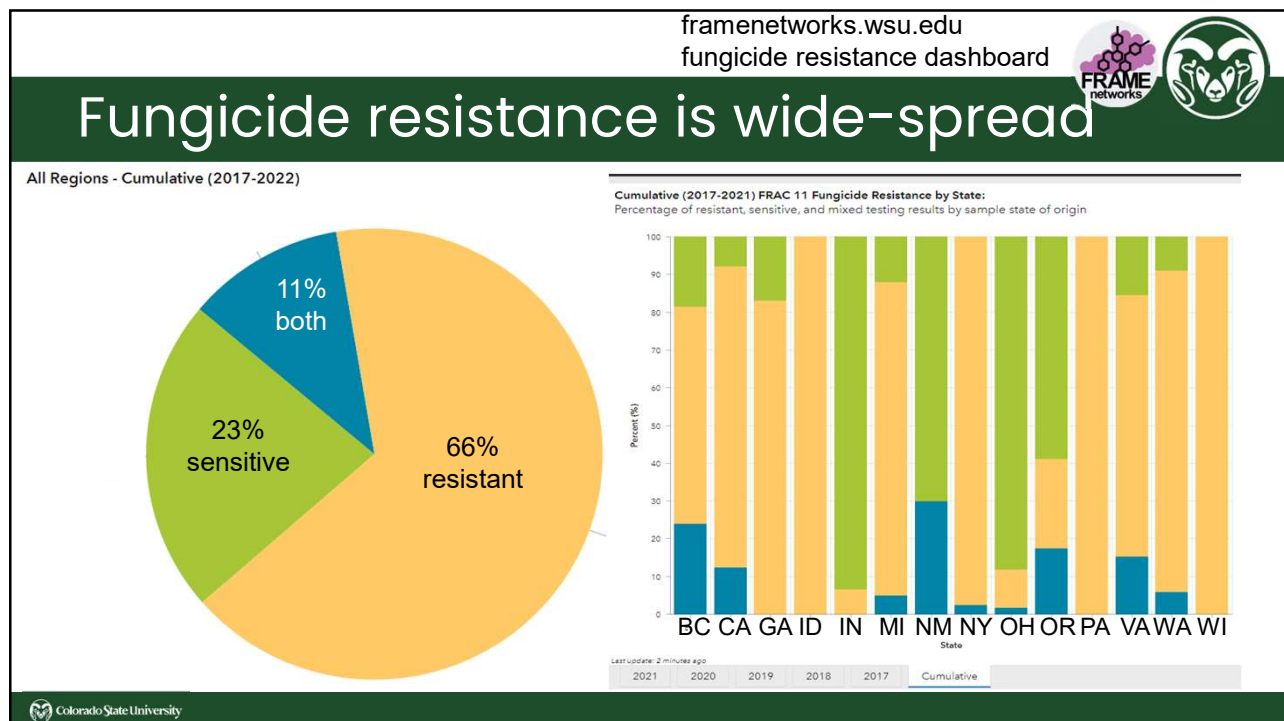
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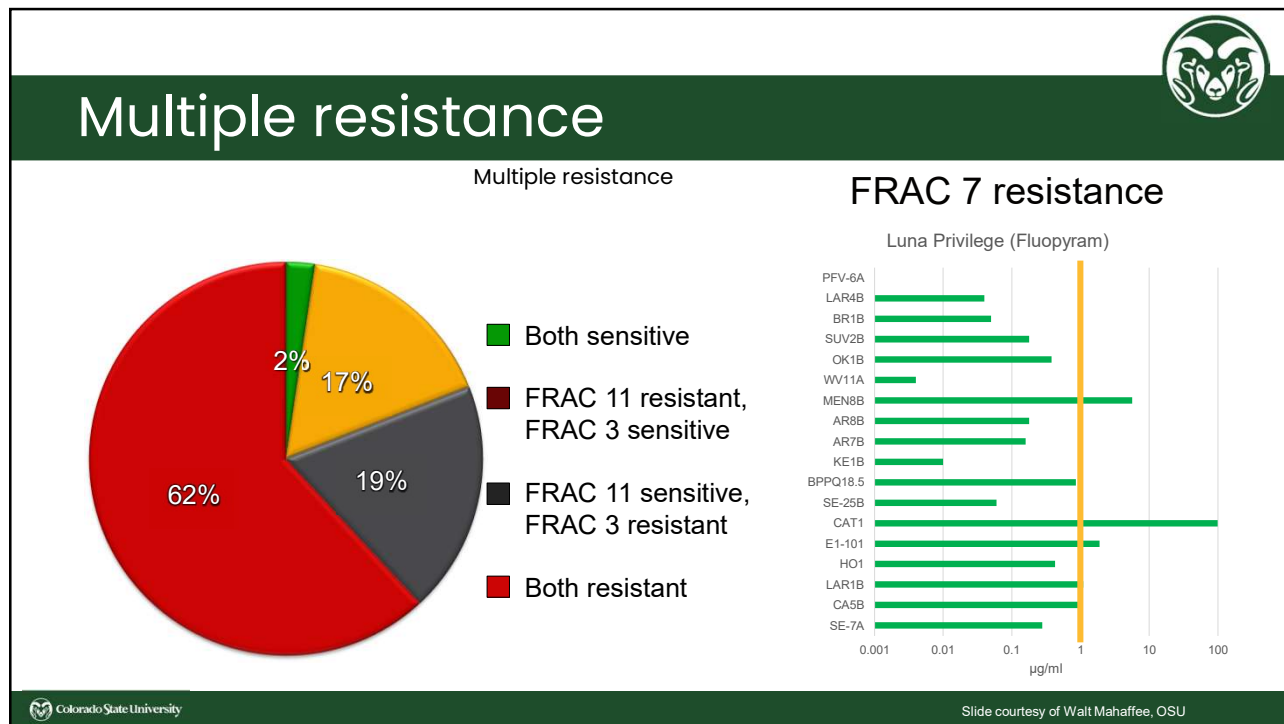
80

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81



82



83



84

LET'S CALIBRATE!

- What do you need?
 - Worksheet or paper
 - Water
 - Backpack sprayer
 - Measuring cup
 - Stopwatch or app
 - Optional:
 - A friend
 - Anemometer
- What you will need to collect
 - Walking time
 - Flow rate/Volume sprayed during walking

85

Backpack Sprayer Calibration Using the 1/128th Method

The 1/128th method is very straightforward and requires little math to perform. By creating similarities between areas and volumes the 1/128th method helps the applicator determine speed, area covered, and chemical needed. Follow the steps below for accurate calibration.

Mark off an 18.5' X 18.5' square. This 342.25 ft² box is 1/128th of an acre. Alternatively, divide 342.25 by the width, in feet, (i.e., 18" = 1.5') of your spray pattern to get the length needed to travel linearly.

Record the time required to spray the area.

Time (seconds): _____

- Fill your backpack sprayer with water.
- Spray the area at your normal walking pace while maintaining consistent pressure.

Calculate the output rate.

Volume sprayed (ounces): _____

- Maintaining consistent pressure, spray water into a bucket for the same time it took to walk the area above. Measure the water used in ounces.

Gallons per acre.

GPA: _____

- There are 128 ounces in a gallon, therefore the amount of water used to spray the 1/128th acre area is equivalent to the gallons per acre (GPA) output rate. For instance, if 50 ounces were collected, the gallons per acre (GPA) would also be 50.

Determining coverage per tank:

Area per tank: _____

Divide your sprayer tank size by GPA from above. For instance, if your tank is 5 gallons and the GPA from above was 50, a full tank would cover 0.1 acres.

86



Questions?

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learn.colostate.edu/viticulture/



Sign-up for Viticulture Extension updates!

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