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Laying the foundation for your Chateau: growing basics for grapes in Ohio

Maria Smith, PhD
Master Gardeners Horticulture Series 2021
December 3, 2021

1

About me

- Graduate from Penn State Horticulture
- Began with OSU Horticulture and Crop Science in 2018
- Based in Wooster at OARDC
- Aid in providing solutions for issues in commercial wine grape production and adoption of new management strategies

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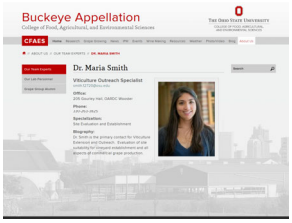


2

Our team and state partners

Ohio State University (OSU) grape team

- **Viticulture Extension:** Maria Smith, Gary Gao, Imed Dami
- **Viticulture Research:** Imed Dami
- **Kingsville, OH Station Manager:** Andy Kirk
- **Enology:** Todd Steiner
- **Pathology:** Melanie Lewis-Ivey
- **Weed Science:** Doug Doohan
- **Technicians:** Diane Kinney, Yvonne Woodworth, Ryan Slaughter

Ohio Grape Industries Committee

- Christy Eckstein

Ohio Wine Producers Association

- Donnie Winchell

3

OSU Resources

Buckeye Appellation Online

- The Grape Exchange (buy/sell)
- OSU Grape and Wine Electronic Newsletter (OGEN blog)
- Grape Maturity Updates (fall only)
- Tutorial and workshop videos
- Fact Sheets, Research publications, Grape Guide Access
- Annual disease management guide

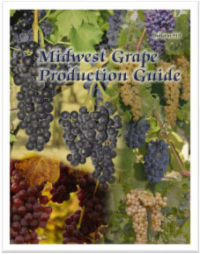
Workshops and the annual Ohio Grape and Wine Conference

https://go.osu.edu/grapes

4

OSU Resources

Midwest Grape Production Guide (Bulletin 919)
https://extensionpubs.osu.edu/midwest-grape-production-guide/



5

Visit our event page for upcoming grape team programing*

February 2022

- Feb. 21-22, 2022: Ohio Grape and Wine Conference – Dublin, OH

March 2021

- Spotted Lanternfly Management Workshops
  - March 3, 5-7pm: Geneva, OH
  - April 11, 5-7pm: Findlay, OH
- Wooster Grape Pruning Workshop
- Piketon Small Fruits Pruning Workshop

*All upcoming events are planned as in-person meetings

6

Agenda

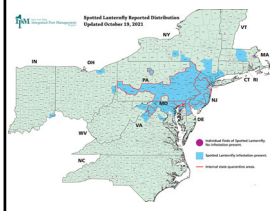
Reminder: be on the lookout for SLF egg masses over winter!

Viticulture basics

- Site selection
- Variety/Cultivar selection
- Site preparation
- Preparing for major grape issues

7

SLF quickly spreading westward



SLF confirmed in new counties during 2021

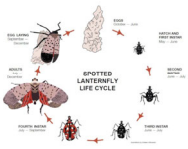


Image from NYIPM

8

Be on the lookout for **egg masses** throughout the winter months

Ex. SLF egg masses

Grey, putty-like masses

Contain up to 50 eggs per mass

Eggs can be found on any hard surface (trees, rocks, outdoor furniture, etc.)

9

How to report sightings of SLF

Do not transport any live SLF

Contact ODA:

- 614-728-6400 or email plantpest@agri.ohio.gov
- SLF Public reporting portal: https://agri.ohio.gov/wps/portal/gov/oda/divisions/plant-health/invasive-pests/slf

Submit to Great Lakes Early Detection Network App (can confirm Tree-of-Heaven here, too): https://apps.bugwood.org/apps/gledn/
*Using GLEDN: https://www.youtube.com/watch?v=PT9lik8X-Fs

10

Basics of Ohio Grape Cultivation

11

The 2 most important aspects to growing grapes:

Site (where you grow)

Cultivar (what you grow)

12

Site Selection

13

Site selection and considerations: the most important aspect of grape growing that determines what you can grow

1. Climate
   - Macro and Mesoclimate
2. Soil physical and chemical properties
3. Proximity to nearby hazards: woodland and wildlife, herbicide drift

14

Important macroclimate features

1. Winter minimum temperatures
2. Frost-free days (FFD)
3. Growing degree days (GDD)
4. Last date of spring frost/freeze and frequency of spring frost

15

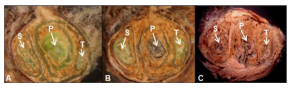
Climate

Macroclimate – prevailing climatic features of a region

1. **Oceanic/maritime climate**: cool summers, cool but not cold winters
   - NE Ohio, Lake Erie
2. **Humid Subtropical**: hot/humid summers, cold to mild winters
3. **Warm/Hot-summer humid continental climate:** warm to hot/humid summers and cold winters

16

Winter minimum temperatures are the most limiting factor to grape success



- *V. vinifera* = 0 to -10 °F
- French-American/NY *Vitis* hybrids = -15 to -25 °F
- MN cold hardy hybrids = -30 to -40 °F

Photo credit: Imed Dami

17

Macroclimate

Frost free days (season length)
- Minimum FFD = 165
- Ohio = 140-185

Growing degree days (base 50F; heat accumulation)
- Minimum GDD = 2000
- Ohio = 2000 – 3500

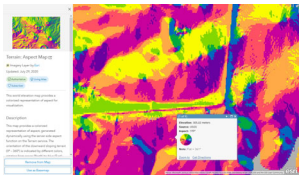
Temperature has a major affect on mature fruit quality

Data from https://mrcc.illinois.edu

18

Mesoclimate – climate of the vineyard site

- Total elevation
- Topo/Relative elevation
- Air drainage (% slope)
- Slope aspect (N, S, E, W)



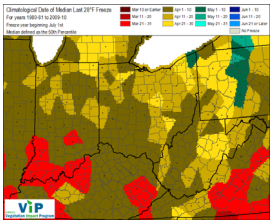
Data from https://mrcc.illinois.edu

19

Spring frost risk

- Frequency
- Intensity (minimum temperature)

2020 Spring freeze damage SW OH



Data from https://mrcc.illinois.edu

20

Soil physical and chemical properties

Grapes require:

- Well-drained soils
- pH range between 5.5 – 6.5
- Moderate soil nutrition

Photo: soil sampling 2020, Photo credit: Diane Kinney

21

Cultivar Selection

22

Cultivar selection

1. Limited by site conditions
2. Limited by local economic demands (does not apply to home growers/winemakers)

The goal is to match the variety with the site conditions and enological potential

23

The grapevine as a plant

- Botanical family: Vitaceae
- Genus: *Vitis*

Over 70 species of grapes worldwide!

Vitis riparia: Riverbank grape

Vitis labrusca: Fox grape

Vitis vinifera: European wine grape

24

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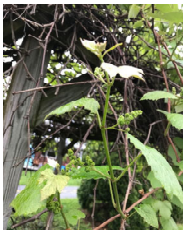
Grapes are woody perennial vines



Ornamental *V. labrusca* 'Concord'

Grapes are **climbing** vines

Require a sturdy structure to grow

- Trellises
- Fences
- Pergolas

25

25

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Back to the grape bud

Grape compound bud

- Each bud is compound with a Primary, Secondary, and Tertiary bud
- Each bud on 1-year old wood contains a fruit-bearing shoot
- Latent buds on > 1-year wood still produce shoots (usually not fruitful)
- This is the reason why grapes are pruned so aggressively compared with tree fruit

Photo: https://grapes.extension.org

26

26

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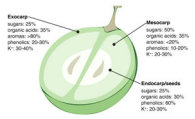
Cultivating grapes: harnessing biology

Grape shoot



Grape berry

Taking advantage of climbing traits to train and create the ideal canopy for *V. vinifera* grapes that allow sunlight and air movement

Photos from Cornell Cooperative Extension, UC Davis, and Fontes et al. 2011.

27

27

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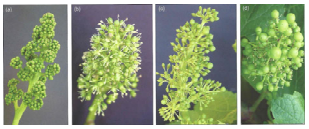
Wine grape cultivars and clones

Cultivars are vines derived from genetically distinct seeds of the same species or hybridizations across species

Clones come from mutations in genetically identical propagated vine material



Grape flowering and berry set

- Grape inflorescences (flower clusters) contain 100s of flowers
- Flowers are self-fertile and wind pollinated
- Each berry contains genetically distinct seeds

Photo from Penn State Extension

28

28

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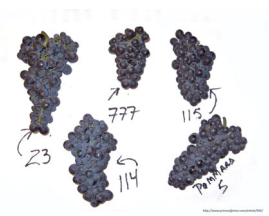
Clonal diversity

Slight mutations arising from the same variety can be advantageous for dealing with **specific factors** (climate, disease) or for **distinct qualities for wine** (color, flavors)



Example of cluster differences between 5 different clones of Pinot noir

29

29

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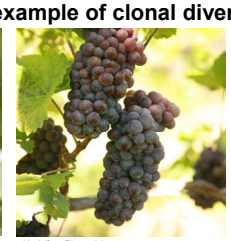
An interesting example of clonal diversity (Pinot)

V. vinifera 'Pinot noir'



V. vinifera 'Pinot gris'

V. vinifera 'Pinot blanc'

Photos from Double A Vineyards https://doubleavineyards.com/

30

30

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Over 10,000 known wine grape cultivars in the world!

31

31

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Vitis x labruscana – cultivars resulting from hybridization between *V. vinifera* and *V. labrusca*


Vitis x labruscana 'Concord'


Vitis x labruscana 'Niagara'


Vitis x labruscana 'Catawba'

Photos from Double A Vineyards https://doubleavineyards.com/

32

32

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Vitis vinifera – cultivars resulting from vine hybridization within this species


V. vinifera 'Cabernet sauvignon'


V. vinifera 'Riesling'


V. vinifera 'Sangiovese'

Photos from Double A Vineyards https://doubleavineyards.com/

33

33

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Vitis hybrids – cultivars resulting from different species hybridization


Vitis hybrid 'Chambourcin'


Vitis hybrid 'Vidal blanc'


Vitis hybrid 'Frontenac'

Photos from Double A Vineyards https://doubleavineyards.com/

34

34

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1850s changed the history of grape production: Grape phylloxera

- Aphid-like insect that girdles roots
- Introduced from North American vines to Europe in 1850s
- Discovered in California-planted vines in 1860s
- Reduced European grape production between 75-90%


Example of phylloxera damaged roots

35

35

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The phylloxera response: interspecific hybridization

1900s grape breeding effort began with hybridizing phylloxera-resistant native North American species with *V. vinifera*.

Some of these cultivars can be grown on their own roots!


Vitis hybrid 'De Chaunac'


Vitis hybrid 'Vidal blanc'

36

36

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Grafting *V. vinifera* and resistant rootstocks

Resistant rootstocks allow *V. vinifera* to be cultivated in the US and Europe

These are created using phylloxera-resistant North American grapes (*V. riparia*, *V. rupestris*, *V. aestavelis*, *V. berlandieri*)

Examples of common rootstocks in Ohio and the Eastern US:
- 101-14
- 3309 C
- Riparia gloire
- SO4
- 5BB

37

37

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Modern academic and private grape breeding efforts focus on improving disease resistance, cold hardiness while maintaining high wine quality potential


La Crescent


Aromella


Cabernet Volos


Paesante noir

38

38

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Site Preparation

Once a site has been selected and designed, site preparation can begin to provide ***the best chance at vine success.***

Failure to properly prepare a site for planting can set a vineyard back years in productivity

39

39

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Goals of site preparation

- ❑ Drainage installation
- ❑ Weed control
- ❑ Elimination of potential subsoil compaction
  - ❑ Removing trees/brush, rocks
  - ❑ Cultivation: sub-soiling, plowing, disking
- ❑ Soil pH and fertility adjustments

Hitting these goals leads to strong vine establishment and success

40

40

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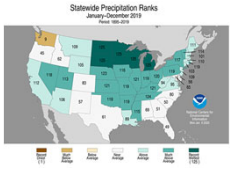
The problem: soil water availability in Ohio



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The 2010s have been the wettest decade on record for Ohio, with above average to record annual rainfall in 8 of the past 10 years https://www.ncdc.noaa.gov/temp-and-precip/us-maps/

Most Ohio soil is deep with silt-loam topsoil (5-10") and thick clay subsoils (8-35")

(photo: Madison County soil profile, Chris Coulon; https://www.nrcs.usda.gov/wps/portal/nrcs/detail/oh/newsroom/photos/?cid=nrcs144p2_022021)

41

41

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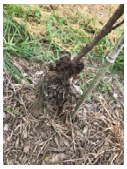
Trunk injury, Crown gall


Soil erosion, compaction


Weak vine growth, production loss

(photo: areal view of vines planted along diagonal tile drainage at Debonne vineyards from Brown et al. 2001)

42

42

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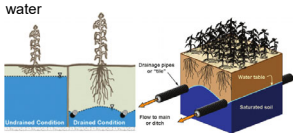
Solution: tile drainage installation

Creating subsurface drainage with **drain tile** systems on fields improves discharge of water



Subsurface drainage increases rooting depth
(photo: University of Minnesota Extension)

Tile drainage installation 2019 AARS
(photo: Andy Kirk, Yvonne Woodworth)

43

43

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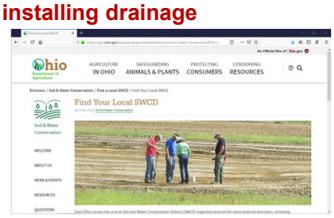
Sites vary, gather recommendations prior to installing drainage



Row orientation, topography and terrain aspects matter!

Consult your county soil and water conservation specialist and OSU Extension. ***It's a free service for you!***

https://agri.ohio.gov/wps/portal/gov/oda/divisions/soil-and-water-conservation/find-a-local-swcd

44

44

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Goals of site preparation

- ✓ Drainage installation
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- ❑ Elimination of potential subsoil compaction
- ❑ Soil pH and fertility adjustments

45

45

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Why are weeds a leading cause of poor vine establishment?

Weed: a wild plant growing where it is not wanted and in competition with cultivated plants.

Example of slow vine growth following weed establishment in a new vineyard

Weeds compete for soil resources (water and nutrients) that are necessary for good root establishment in the first year of vine growth.

46

46

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Example: Young vines planted in former pasture fields where weeds were not controlled before planting.

47

47

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Solution for weeds: Plan at least 1 year before planting for weed eradication.

Chemical control: Use systemic herbicides** about one week BEFORE plowing and tilling in **late summer** during active weed growth.

Mechanical control: Plowing and tilling aid in removing root systems of perennial weeds

Biological control: Sow groundcover (grasses) in **late summer**. Helps suppress new weed growth and prevents soil erosion.

***Avoid all use of 2,4-D and Dicamba systemic herbicide products near vines!!*

48

48

Table of herbicides for young vines

To select herbicides, consider:

- Vine age
- Weed type (perennial/annual/biennial)
- Herbicide mode of action
- Stage of vine development

Pre-emergence	Post-emergence
Treflan (1st year)	Select - grass only
Devrinol (1st year)	Poast - grass only
Surflan (1st year)	Fusilade - grass only
Prowl (1st year)	Venue (contact)
Snapshot (1st year)	Aim (contact)
Chateau (2nd year)	Gramoxone (contact)
Matrix (2nd year)	Rely (contact)
Casoron (2nd year)	Reglone (contact)
Zeus Prime XC (3rd year)	Roundup (systemic)
Princep (3rd year)	
Karmex (3rd year)	
Alion (4th year)	

Table from: Dr. Doug Doohan, OSU

49

The goal of weed control at planting

50

Goals of site preparation

- ✓ Drainage installation
- ✓ Weed control
- ❑ Elimination of subsoil compaction
- ❑ Soil pH and fertility adjustments

51

Decompacting subsoil

Compaction is common for clay soils and those soils that have been compacted over time by heavy equipment use

Decompaction improves water/nutrient infiltration and rooting depth

Photo: Case IH Agriculture

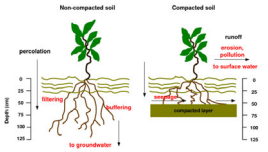

Photo: Karoline D'Haene

52

Goals of site preparation

- ✓ Drainage installation
- ✓ Weed control
- ✓ Elimination of subsoil compaction
- ❑ Soil pH and fertility adjustments

53

Managing vineyard nutrition

16 essential nutrients for vine growth and development:

Air, Water: H, O, C

Soil Macronutrients: N, P, K, Ca, Mg, S

Soil Micronutrients: Cl, B, Fe, Mn, Zn, Cu, Mo

Soil nutrients become available through mineral weathering, decomposing organic matter, or fertilizer application.

Soil organisms (bacteria, fungi, insects) have a critical role in facilitating nutrient availability.

54

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Nutrient abundance is not the same as accessibility

Root access to essential nutrients is pH dependent.

For wine grapes, the optimal pH is slightly acidic between **6.0 to 6.5**.

High pH often leads to iron, manganese, boron deficiency

Low pH often leads to phosphorus, potassium, and magnesium deficiencies

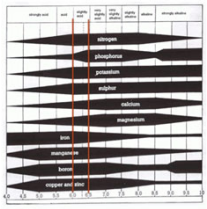

Chart from https://ifgp.cce.cornell.edu/timeline.php?id=12

55

55

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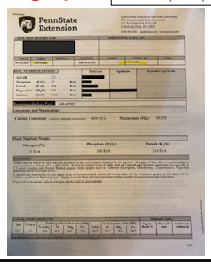
Soil nutrient requirements for grapes

ppm * 2 = pounds per acre (lbs/acre)

Nutrient	Soil
Nitrogen (N)	---
Phosphorous (P)	20-50 ppm
Potassium (K)	75-100 ppm
Calcium (Ca)	500-2,000 ppm
Magnesium (Mg)	100-250 ppm
Boron (B)	0.3-2.0 ppm
Iron (Fe)	20 ppm
Manganese (Mn)	20 ppm
Copper (Cu)	0.5 ppm
Zinc (Zn)	2 ppm
Molybdenum (Mo)	---
Aluminum (Al)	< 100ppm
Organic matter	1-2%
pH	*V. labrusca* = 5.5 Hybrids = 6.0 *V. vinifera* = 6.5

In **bold**: Nutrients fixable before planting



56

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Soil amendment steps:

1. **Assess soil nutrition** as 1st step to know what to amend
   - 2 depths: 0-8" and 8-16"
2. **Late summer before planting**
   - Deeply (> 12") incorporate P, K, lime/sulfur, gypsum
   - May also add 50lbs/A of N to help sod establishment
3. **Following vine planting in spring**
   - Spread N around vine
   - Avoid excess N, since it can burn plant tissues

57

57

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Once vines are in the ground, soil nutrients change as vines age!

Continue to **REGULARLY** monitor soil and vine nutrient status to ensure optimal nutrition each season.

58

58

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59

59

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What are the major risks for grapes?

- Diseases
- Insect pests
- Mammal and bird pests
- Nutrition management

60

60

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Let's talk about grape diseases

- The biology of each disease differs
- Cultivar susceptibility differs
- Environment and weather conditions are very important to disease development

Grape disease management is a season-long endeavor from pre-bud break through leaf fall

61

61

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Diseases – early season (budbreak through fruit-set)


Phomopsis blight


Black rot


Anthracnose

62

62

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Diseases – early through late season (post-budbreak through leaf fall)


Downy mildew


Powdery mildew

63

63

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Disease – late season fruit rots (veraison through harvest)

Botrytis mold

Sour rot complex

64

64

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A no-input vineyard is unrealistic in Ohio but using IPM approach can significantly reduce it!

- Consider planting more disease-resistant cultivars
- Understand the biology to each important disease to the grape cultivar and plan a control strategy
- Use good **canopy management** to reduce humidity and shading of fruit
- Pay attention to the vine growth stages to anticipate when to best apply fungicides
- BE PREVENTATIVE! Once you see signs of disease on fruit, it is often too late to eradicate and control

65

65

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Resources for home grower disease controls


Disease Management in Home Grape Plantings

Disease Management in Home Grape Plantings Fact Sheet

Table 1. Fungicides for Use in Home Grape Plantings

Fungicide	Trade Names	(Disease(s) Controlled	Recommended Label Rate (Per Gallon of Water)
captan	Hi-Yield Captan 50W Fungicide	Downy mildew	1-2 tablespoons
copper	Liqui-Cop Copper Fungicidal spray	Anthracnose Downy mildew Powdery mildew	1 teaspoon
copper soap	Natural Guard Copper Soap Fungicide	Downy mildew Powdery mildew Botrytis bunch rot	1-4 tablespoons
mancozeb	Bonide Mancozeb Flowable with Zinc	Black rot Downy mildew	5 teaspoons
myclobutanil	Spectracide Immunox Multi-purpose Fungicide	Anthracnose Black rot Powdery mildew	2 tablespoons
potassium salts plus sulfur	Safer 3-in-1 Garden Spray Concentrate	Powdery mildew	8 tablespoons
sulfur	Bonide Sulfur Plant Fungicide Sulfur Safer Brand Garden Fungicide II	Powdery mildew	1-4 tablespoons

***Always read labels and pay attention to grape sensitivities!**

For more info, visit: https://u.osu.edu/fruitpathology/resources/

66

66

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A few major insect pests


Leaf phylloxera


Japanese beetles


Grape berry moth

Like diseases, the biology of these insects matter to best control practices!

67

67

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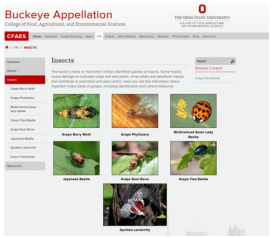
Grape insect resources



Like diseases, understanding the biology of these insects matters to best control practices!

https://ohiograpeweb.cfaes.ohio-state.edu/ipm/insects

68

68

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Birds and mammals


Deer damage to young shoots


Mechanical damage to fruit from birds and raccoons

69

69

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There are many control methods, but exclusion is the most tried and true


Over row netting


Side netting (rolled up for harvest)


Deer fencing (8-10')

70

70

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Vine nutrient imbalances and impacts on vine growth

Ex. Chambourcin vines exhibiting growth restrictions due to nutrient deficiencies

Deficiencies impact fruit maturation and quality and vine health

71

71

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Visual symptoms of nutrient deficiency


Nitrogen


Potassium (early symptoms, red grape variety)


Magnesium

72

72

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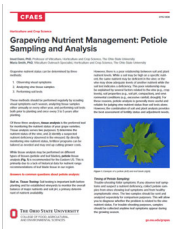
Visual symptoms of nutrient deficiency

Many leaf symptoms look similar.

If you're uncertain, the easiest diagnostic step is to test the vine nutrient status.

However, tissue analysis *only* tells vine status.


CFAES

Grapevine Nutrient Management: Petiole Sampling and Analysis

https://ohioline.osu.edu/factsheet/hyg-1438

73

73

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Couple soil analyses with tissue analysis for long-term management

- Check soil fertility once every 3-5 years once vines are in production
- Best practice is to check vine nutrient status annually
  - Weather conditions impact annual nutrient status

74

74

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Let's sum up the past of hour

- Take your time in the decision-making process!
- Adequately prepare your site, no matter how small **before** planting
- Know the problems and prevent them from happening!

75

75

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Thanks for your attention!

76