

MICHIGAN 4-H VITICULTURE

**LET'S
GROW
GRAPES**

FACILITATOR GUIDE



18 USC 707





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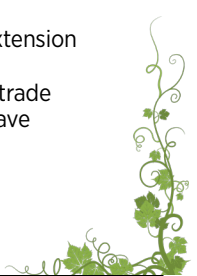
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Introduction

Why Grow Grapes?

- Grapes are grown in all 50 states.
- In Michigan, grapes provide over 46,000 jobs (WineAmerica, 2022).
- Grapes are one of the fastest growing commodities in Michigan.

The 4-H Viticulture Project *Let's Grow Grapes: Michigan 4-H Viticulture* was supported by a Michigan State University AgBioResearch Project GREEN (Generating Research and Extension to meet Economic and Environmental Needs) grant: Michigan Wine Collaborative Talent Pipeline. This curriculum introduces youth to the grape industry, focusing on growing grapes and exploring careers in *viticulture*, the science and practice of cultivating grapes. The purpose of the 4-H Viticulture Project is to create an interest and provide an opportunity for 4-H youth, ages 12 to 19, to engage with industry professionals in the grape and wine industry.

The design team made three decisions early on:

1. Build the lessons around a *phenomenon*. According to the Next Generation Science Standards (2016), "*natural phenomena* are observable events that occur in the universe and that we can use our science knowledge to explain or predict." The curriculum was built upon the question: *What are the core skill sets to run a successful vineyard?* This is the anchoring phenomenon for the whole curriculum with investigative phenomena in each lesson.
2. Embrace three-dimensional learning (<https://www.nextgenscience.org/three-dimensional-learning>) identified by the National Research Council 2011 report *A Framework for K-12 Science Education* (<https://nap.nationalacademies.org/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts>) and the foundation for the Michigan Science Standards. These three dimensions include practices, crosscutting concepts, and disciplinary core ideas. (For further information, see the section in the appendix: *Michigan 4-H Viticulture Curriculum Connection to the Next Generation Science Standards*.)
3. Include experts in viticulture throughout the development of the curriculum.

Each 4-H club will partner with a vineyard and a viticulturalist to explore grape growing, understand careers in the industry, and participate in viticulture practices.

The curriculum includes two main documents: the Facilitator Guide and the Participant Notebook:

- The Facilitator Guide includes an Introduction and 13 lessons as well as an appendix, which includes the Careers section, Grape Fast Facts, Recipes, the Next Generation Science Standards, a Parent Letter, and a list of Animated Videos.
- The Participant Notebook contains accompanying notebook pages that interrelate to the lessons and encourage engagement to increase understanding. It also contains an appendix, which includes the Careers section, Grape Fast Facts, Recipes, a Glossary, a list of Animated Videos, and an activity "Growing Grapes in Containers." You can encourage participants to do this last activity at home on their own.

Lessons include:

1. Michigan Viticulture: How Did Winemaking Evolve in Michigan?
2. Digging Deep: What Type of Soil Is in the Vineyard?
3. Canopy Exploration: What Affects Canopy Health?
4. Pruning Dormant Grapevines: When and Why Should Grapevines Be Pruned?
5. Grape Chemistry: Are the Grapes Ready for Harvest?
6. Spring in the Vineyard
7. Summer in the Vineyard
8. Fall in the Vineyard
9. Winter in the Vineyard
10. Vineyard Mapping: Where Should You Plant the Grapes? Part 1
11. Vineyard Mapping: Where Should You Plant the Grapes? Part 2
12. Vineyard Site Selection and Establishment: Will Grapes Thrive Here?
13. Integrated Pest Management: Why Is Pest Management Important?

Most lessons include an overview, the suggested age level of participants, the season the lesson should take place, whether a viticulturist is needed for that lesson, suggested lesson location, and the time it takes to give the lesson. Lessons also include objectives, materials needed, and the background that the facilitator needs to teach the lesson knowledgably. New vocabulary is introduced in each lesson that is also contained in one glossary. The lesson procedures are explained in sequential steps.



What Is 4-H?

4-H is the largest youth development organization in the United States. It is found in almost every county across the nation and enjoys a partnership between the U. S. Department of Agriculture (USDA), the state land-grant universities (such as, Michigan State University), and local county governments.

- 4-H involves youth and adults working together as partners in designing and implementing club and individual plans for activities and events.
- 4-H project areas serve as vehicles for members to learn and master project-specific skills while strengthening essential life skills.
- 4-H is growing current and future leaders – growing kids who are confident and strong, curious enough to question, and capable enough to find the answers.
- 4-H is growing youth who stick to a job until the job gets done and know how to work with others.

4-H volunteers:

At the core of 4-H are caring adult volunteers who grow current and future leaders by giving their time and expertise to empower young people with important life skills. 4-H volunteers offer young people healthy adult role models who help to grow their confidence and ignite their dreams for the future.

4-H volunteer roles and responsibilities:

- Successfully complete 4-H volunteer screening process.
- Participate in and complete 4-H volunteer leader trainings.
- Help recruit youth into the 4-H viticulture project.
- Facilitate 4-H meetings using 4-H meeting management guidelines and the experiential learning process.
- Coordinate space, manage equipment and supplies, and facilitate activities.
- Coordinate opportunities for youth to engage with a grape and wine industry mentor.
- Facilitate conversations between 4-H youth and industry professionals working with grapes and wine.

Through the 4-H club model, youth will:

- Enhance science, technology, engineering, and math (STEM) through viticulture.
- Explore careers in viticulture and the grape and wine industry.
- Engage in hands-on experiential learning activities involving viticulture and the grape and wine industry.

4-H viticulture, how to get started:

- Each 4-H viticulture club needs to establish a partnership with at least one viticulturist associated with a vineyard.
- Some activities require a vineyard and viticulturist for the outdoor learning component.
- Facilitators should print out both the Facilitator Guide for themselves as well as one Participant Notebook for each participant.
- Facilitators should read each lesson beforehand paying particular attention to reading the background information and to gathering any supplies needed.





Experiential Learning

4-H engages youth through a “learn by doing” methodology called experiential learning, which is evident in the Michigan 4-H Process of Science model.

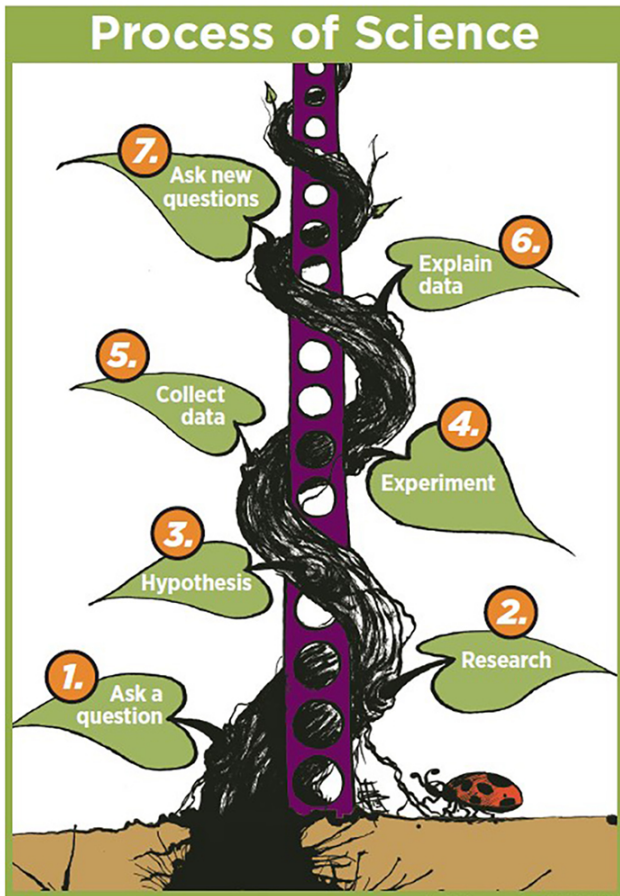


Illustration courtesy of Patrick Bird

1. **Ask a Question:** Youth ask questions based on an experience or observation.
2. **Research:** Youth explore and gather information through discussions, observations, books, or online resources to develop potential answers to their question.
3. **Hypothesis:** Youth develop a potential answer to the questions they'd like to explore.
4. **Experiment:** Youth test their hypothesis through experimentation and discussion with experts.
5. **Collect Data:** Youth analyze and evaluate the data and information they collect.
6. **Explain Data:** Youth share the results of their experiment with others, what they think it means, and how their new understanding might be used in different situations.
7. **Ask a New Question:** Youth explore new questions and ideas that came up while exploring answers to their original question.

4-H Pledge

I pledge

My HEAD to clearer thinking,

My HEART to greater loyalty,

My HANDS to larger service, and

My HEALTH to better living,

For my club, my community, my country, and my world.

Essential Elements of 4-H Youth Development

Regardless of the project area, youth need to be in environments where the following elements are present to foster youth development. 4-H clubs and programs incorporate these elements to create healthy environments for all youth.

Belonging: a positive relationship with a caring adult; an inclusive and safe environment

Mastery: engagement in learning; opportunity for mastery

Independence: opportunity to see oneself as an active participant in the future; opportunity to make choices

Generosity: opportunity to value and practice service to others (Stark, 2019)

4-H Mission Mandates

The mission of 4-H is to provide meaningful opportunities for youth and adults to work together to create sustainable community change. This is accomplished within three primary content areas, or mission mandates: citizenship, healthy living, and science. These mandates reiterate the founding purposes of Extension (for example, community leadership, quality of life, and technology transfer) in the context of 21st century challenges and opportunities (U.S. Department of Agriculture, 2011).

- **Citizenship:** connecting youth to their community, community leaders, and their role in civic affairs. This may include civic engagement, service, civic education, and leadership.
- **Healthy Living:** promoting healthy living to youth and their families. This includes nutrition, fitness, social-emotional health, injury prevention, and prevention of tobacco, alcohol, and other drug use.
- **Science:** preparing youth for science, engineering, and technology education. The core areas include animal science and agriculture, applied mathematics, consumer science, engineering, environmental science and natural resources, life science, and technology.

(U.S. Department of Agriculture, 2011).



References and Resources

Next Generation Science Standards. (2016). *Using phenomena in NGSS-designed lessons and units*. <https://www.nextgenscience.org/sites/default/files/Handout%2019%20-%20Using%20Phenomena%20in%20NGSS.pdf>

Stark, C. (2019). *Understanding and working with youth*. University of Nevada Extension 4-H Youth Development. <https://extension.unr.edu/publication.aspx?PubID=2667>

U.S. Department of Agriculture. (2011). *Mission mandates* (4-H National Headquarters Fact Sheet). <https://www.nifa.usda.gov/sites/default/files/resource/4-H%20Mission%20Mandates.pdf>

WineAmerica. (2022). *What's wine worth? 2022 Michigan economic impact study*. National Association of American Wineries. <https://bit.ly/46Zq6lZ>





Michigan Viticulture: How Did Winemaking Evolve in Michigan?

Lesson 1

Overview: Participants will learn about early settlers, the growth of the Michigan grape and wine industry, and the special designation of *American Viticultural Areas* (AVAs). AVAs are federally designated areas where wine is produced exhibiting similar characteristics that are distinct from other regions.

Age Level: 12-19 years

Season: Any

Viticulturist: Not required

Location: In classroom or online

Time: 2 hours or less, based on level of participant interest and time researching

Objectives:

Participants will be able to:

- Identify when grapes were first established in Michigan.
- Name someone who helped establish vineyards in Michigan.
- Explain a critical change in the laws of the United States that slowed the progress of wine making in Michigan.
- Locate (on a map) the current AVAs in Michigan.
- Identify one career related to winemaking or agritourism.

Materials:

- Michigan's Five AVAs*, Michigan Wine Country (<https://michiganwinecountry.com/wines-grapes/avas/>)
- Large paper or index cards
- Blank county map of the state of Michigan (two per participant) (<https://gisgeography.com/michigan-county-map/>) (These are also in the Participant Notebook.)
- Michigan road map
- Colored pencils, markers, or crayons
- Participant Notebook 1-1 "Michigan Viticulture: How Did Winemaking Evolve in Michigan? General Questions"
- Participant Notebook 1-2 "Michigan Viticulture: How Did Winemaking Evolve in Michigan? History of the Wine and Grape Industry Articles"
- Participant Notebook 1-3 "Michigan Viticulture: How Did Winemaking Evolve in Michigan? Worksheet"

Vocabulary: American Viticultural Areas (AVAs)



Figure 1-1. Delivery truck, St. Julian Winery, Paw Paw, Michigan. Photo Credit: St. Julian Winery

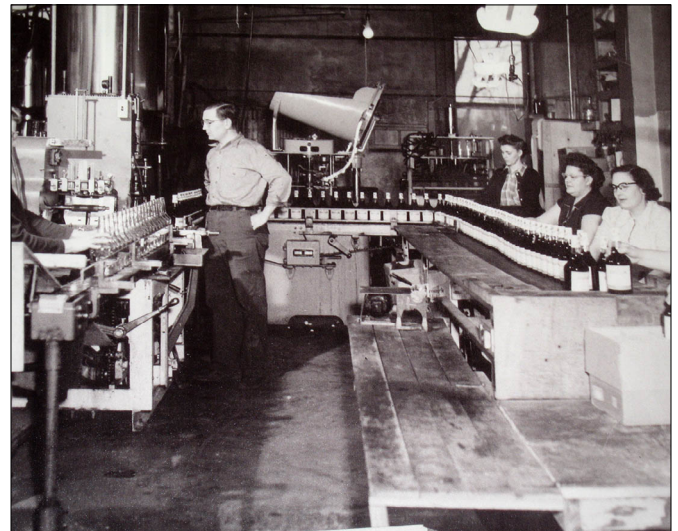


Figure 1-2. Bottling line, St. Julian Winery, Paw Paw, Michigan. Photo credit: St. Julian Winery

Background:

To get familiar with the topic, the facilitator should read the two Michigan State University Extension articles on the history of Michigan's wine and grape industry (also in Participant Notebook 1-2) as well as the article *Growing Wine Grapes in Michigan* and *The History of Michigan Wines: 150 Years of Winemaking Along the Great Lakes*. All four articles are listed under References.



Procedure:

Before the meeting:

Read the articles mentioned in the Background section.

During the meeting:

1. Brainstorm with participants by asking the following questions to encourage discussion:
 - *How do you think European grape varieties originally came to be in Michigan?*
 - *Why do you think rivers and lakes were important in the expansion of grape growing across Michigan? Refer to the Michigan road map.*
2. Read Participant Notebook 1-2, which contains two Michigan State University articles on the history of the wine and grape industry. The facilitator may choose to read aloud or have participants read on their own. Research the growth of the industry through an online search or by asking an expert. Participants may research on their own or as a group.
3. In pairs or small groups, ask the participants to use paper or index cards to create a timeline describing the establishment and growth of the industry between 1679 and 1868. Afterward, ask participants:
 - *What situations did you find that slowed the progression of wine making in Michigan? Prohibition*
 - *How did Canada and the Detroit River aid in the development of winemaking in Michigan? Rivers were the primary means of transportation. Two vineyards in Canada helped establish vineyards in Michigan after prohibition.*
 - *Who was instrumental in developing early winemaking in Michigan? Joseph M. Sterling was the first pioneer to establish the Pointe Aux Peaux wine company and produce wine for sale in 1868.*
4. Brainstorm with participants: Where in Michigan do you think grapes are grown today?
5. Read *Michigan's Five AVAs*. Using the county map of Michigan (Figure 1-3), use the AVA information (Michigan Wine Country, n.d.) to color-code the five AVA sites (Figure 1-4) and label the counties designated for growing grapes. Participants will use Participant Notebook 1-3, which contains two county maps and the map of Michigan AVAs.





Figure 1-3. Map of Michigan counties. Credit: GISGeography.

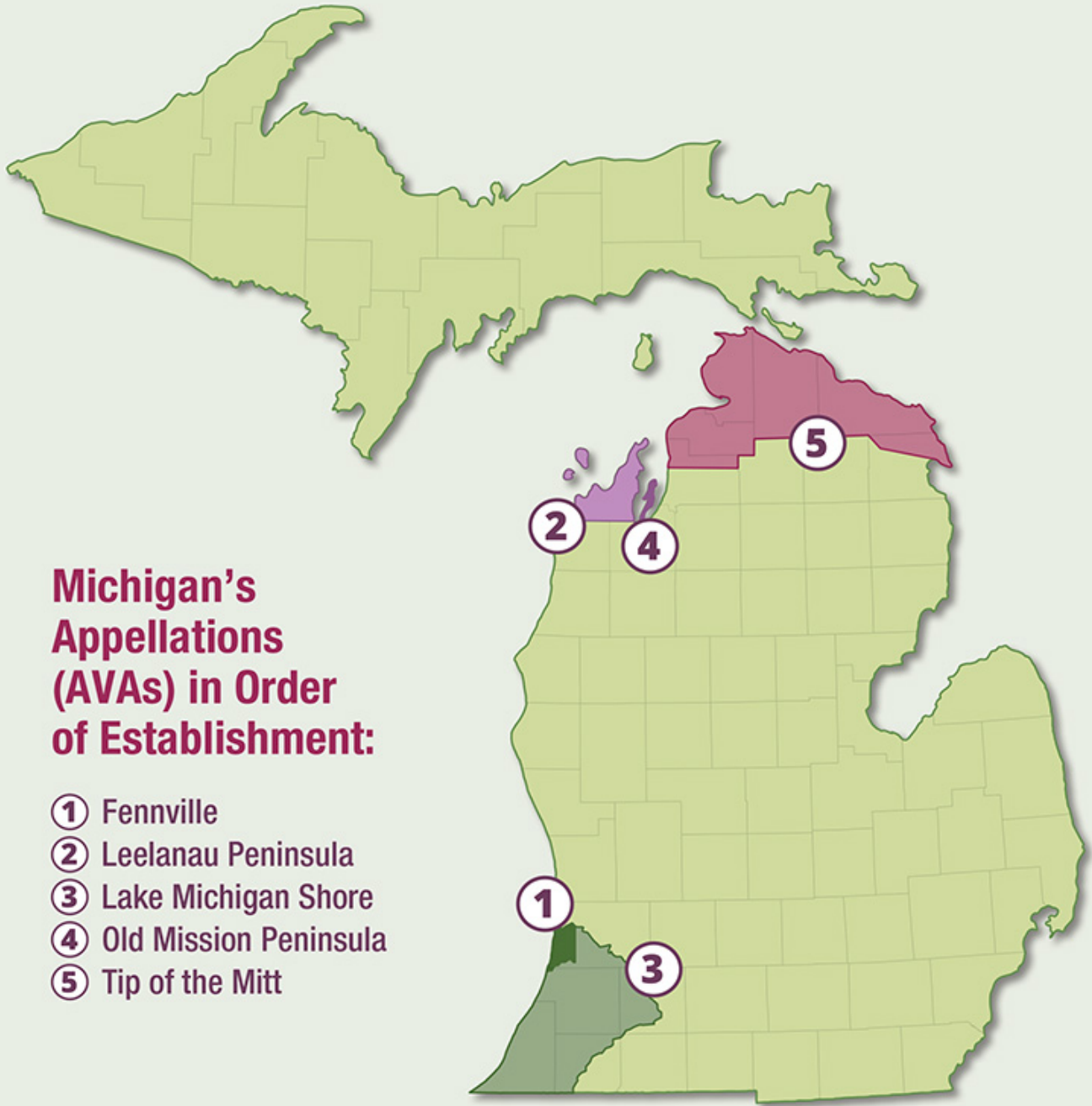


Figure 1-4. Michigan AVA map. Credit: Michigan Wine Country.



6. Using another county map of Michigan (Participants will use Participant Notebook 1-3.):
 - Color the counties where historically grapes have been grown.
 - Use another color to indicate where the majority of wine grapes currently grow.
7. Compare the maps participants completed with the latest map (2019) of Michigan AVAs: <https://michiganwinecountry.com/wines-grapes/avas/>
 - What do you think has led to the changes between the historical growing area to the 2019 growing area map?
 - *Changes in regional temperatures?*
 - *Changes in genetics through selective breeding? Cold climate grapes varieties?*
 - *Economical interest? They are more pest resistant and cold tolerant. They grow with less inputs (pesticides) and across a larger geographic region. They are hardy. (They can survive colder winter temperatures.) They have greater production.*
8. Have participants divide into pairs and answer the questions on Participant Notebook 1-1 "General Questions."

References and Resources

Hathway, L., & Kegerreis, S. (2010). *The History of Michigan Wines: 150 Years of Winemaking Along the Great Lakes*. History Press.

Michigan Wine Country. (n.d.). *Michigan's five AVAs*. <https://michiganwinecountry.com/wines-grapes/avas/>

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Digging Deep: What Type of Soil Is in the Vineyard?

Lesson 2

Overview: The rate at which water soaks into the ground helps determine soil type, which affects the amount of nutrients and organic matter available for grapevines. Participants will determine the mixture of soil types and organic matter in soil by *infiltration capacity*, the rate at which a soil can absorb water, texture tests, and a soil shake test.



Age Level: 12–19 years

Season: Any season when the ground is not frozen

Viticulturist: Required

Location: Vineyard

Time: 2–3 hours. The water infiltration test may take 2 hours after the hole is dug. The hole is filled with water, and then stands 1 hour or until the water has infiltrated the soil (whichever is first). The steps are repeated and data collected after 1 hour.

Objectives:

Participants will be able to:

- Explain how water moves through various types of soil.
- Evaluate water movement and collect data to identify soil type.
- Explain how soil-water-nutrient dynamics inform planting decisions.
- Identify at least one career important for soil assessment in a vineyard.

Materials:

- Water infiltration videos (listed in the Reference section)
- Shovel (one per group)
- Writing utensil (one per participant)
- White paper (one per group)
- Ruler (one per group)
- Timer (one per group)
- 2–3 gallons of water (per group)
- 1 clear quart-sized jar with lid for each hole you plan to dig
- 3 additional quart-sized jars with lids
- Clear plastic bags for soil samples (one for each hole you plan to dig)
- Markers (one per group)
- One 1-cup capacity measuring cup (per group)
- 1 cup of soil from the top 1–3 inches of soil from each dig site (per group)

- 1 cup each of potting soil (per group)
- 1 cup purchased topsoil (per group)
- 1 cup beach sand (per group)
- Soil Texture by Feel Key
- Soil Texture Triangle
- Participant Notebook 2-1 “Digging Deep: What Type of Soil Is in the Vineyard? Worksheet”

Vocabulary: agronomist, cover crops, humus, infiltration, infiltration capacity, percolation, viticulturist



Figure 2-1. Learning about soil in the vineyard. Photo credit: Angela Cook

Background:

The base for all agricultural production is the depth, texture, and percentage of organic matter in the soil.

Grapevines prefer deep well-drained soils that enable their tap roots to grow deep while their surface roots fan out.

The soil acts like a sponge to collect and store water, macronutrients and micronutrients that grapevines need to grow such as:

- Nitrogen (N)
- Phosphorous (P)
- Potassium (K)
- Magnesium (Mg)
- Calcium (Ca)
- Sulfur (S)
- Iron (Fe)
- Manganese (Mn)
- Copper (Cu)
- Zinc (Zn)
- Boron (B)
- Molybdenum (Mo)
- Chlorine (Cl)



Determining the rate at which water moves through soil can help identify the soil type and its suitability for supporting a vineyard.

The physical structure (arrangement of the sand, silt and clay) and texture (amount of sand, silt and clay) of the top layers of soil affect water drainage, nutrient holding capacity, and the erosion potential of the soil.

How water moves through the soil is also a factor in good agricultural land. Infiltration and percolation are two related but different processes describing the movement of water through soil.

- *Infiltration* is the downward entry of water into the soil or rock surface.
- *Percolation* is the flow of water through the soil and the porous layers of fractured rock.

The topsoil layer is a mixture of sand, silt, clay, and organic matter. Topsoil can be a few inches to several feet deep. *Humus* is rich, highly decomposed organic matter mostly made from dead plants and insects, crushed leaves, and twigs. In most agricultural soils, the topsoil is relatively thin. It usually makes up between 3% and 6% of the organic matter but contains most of the soil's nutrients.

Organic matter makes up 1-2% of a typical vineyard soil but can vary greatly throughout a single field. Ideally, at least 3% organic matter is desired, so many vineyard managers amend the soil by adding compost or cover crops. *Cover crops* are crops planted to prevent soil erosion, suppress weeds, and provide organic matter.

See Table 2-1 that follows as a reference for the optimal soil for growing grapes.





Table 2-1. Connecting Soil to Grapevines

Soil type & Size	Characteristics	Implications for grapevines
Sand 0.5-2 mm	<ul style="list-style-type: none"> • Mid-size rounded particles • Can be seen with the naked eye • Large pore spaces in between particles • Water quickly absorbs deep into the ground • Varies in color, but tend to be lighter colors 	<p>A high percentage of sand in the soil</p> <ul style="list-style-type: none"> • is needed to establish the deep tap roots. • results in less fertile soil. • allows more nutrients to leach through the soil. • may cause runoff without an established cover crop. • helps the soil to warm up quickly.
Silt 0.002-0.5mm	<ul style="list-style-type: none"> • Fine particles that aren't visible to the naked eye • Grayish • Can be powdery when dry 	<p>A high percentage of silt in the soil</p> <ul style="list-style-type: none"> • may increase runoff. • can enhance the nutrient holding capacity.
Clay <0.002 mm	<ul style="list-style-type: none"> • Very fine, small, flat particles • Particles stick together • Slows water's ability to infiltrate the soil • Can form a crust (hardpan) that water can't penetrate when it dries and hardens 	<p>A high percentage of clay in the soil</p> <ul style="list-style-type: none"> • can hold too much water and dissolved nutrients. • results in wetter and colder soils for a longer time. • can form layers and cause damage (hardpan). • can influence grape and wine flavor characteristics.

Credit: Tracy D'Augustino, Michigan State University Extension

Procedure:

Before the meeting:

1. Gather supplies.
2. Identify potential dig sites (locations to test water infiltration rates) with a *viticulturist*, who is an individual who specializes in vineyard development and grape growing.
3. Determine how many sites you will be testing and how they will be tested.
4. Review activities to determine the best order based on the number of water infiltration tests and soil shake tests you plan to do.
 - Watch *Michigan State University Extension 4-H Gardening Around Michigan Perk Testing Soil From Bay County* videos Parts 1-3. The links are in the reference section at the end of this lesson.
5. Optional: Invite an *agronomist*, an expert in soil management and crop production, to talk to the group about soil and careers.

During the meeting:

1. Ask participants to brainstorm soil characteristics they think might be important for grapevines. Have them write their answers in Participant Notebook 2-1.
2. Ask participants how they think various types of soil affect nutrients and water movement.
3. Ask participants how a vineyard owner or manager assesses soil in the vineyard.
 - Have the viticulturist talk about the careers connected to soil assessments and where to plant grapevines.
 - Talk about sending out soil for testing or contracting someone to assess the site.
4. Explore the site with participants and the viticulturist to choose water infiltration test site(s).
5. If you invited an agronomist, have them discuss soil and careers with the group.
6. Lead the participants through the tests that follow.



Water Infiltration Test: Part 1 – Unsaturated Soil

The facilitator should give these instructions to participants:

1. In your Participant Notebook 2-1, list three characteristics of soil important for grapevines.
2. Collect 2 bags of soil from each site selected, digging only 1-3 inches deep. Each bag should have one cup of soil. (These will be used for the Soil Texture by Feel and Soil Shake Tests.)
3. Next, continue to dig the holes 12-18 inches deep by 6 inches in diameter at each site. Inspect the walls of the holes, observing the soil profiles.
4. Record answers to the following questions in Participant Notebook 2-1. Include a rough drawing of the soil profile for each hole.
 - What is the soil texture?
 - Are there distinct and visible layers of soil in each hole?
 - What colors do you see?
 - Are there rocks or gravel present?
5. Fill the hole with water, start the timer and let stand for one hour or until the water has infiltrated (drained into) the soil. Repeat at other test sites in the vineyard. (Label your drawings for each soil profile in your Participant Notebook on the page provided.)

Water Infiltration Test: Part 2 – Saturated Soil

Participants complete the water infiltration test following these instructions from the facilitator:

1. After completing Water Infiltration Test Part 1, refill the holes with water. Measure and record the initial depth of water with a ruler and start the timer.
2. Let stand for one more hour or until the water is infiltrated.
3. Then measure the final water depth, and time and record in your Participant Notebook 2-1 in the "Soil Infiltration" table.
4. Determine the rate of infiltration from your data (from steps 1 to 3) for each hole.
5. Use Table 2-2, which follows, to determine the predominant soil types based on the rate at which water soaks into the soils. Record predominant soil type in your Participant Notebook in the "Soil Infiltration" table.

Table 2-2. Water Infiltration Rates by Soil Type

Soil type	Sand	Silt	Clay
Rate	2.5 inches/ hour or 4 hours total for the wa- ter to drain out of the hole	½ inches/ hour or 12 hours total for the water to drain out of the hole	1/3 inches/ hour or 18 hours total for the wa- ter to drain out of the hole

Soil Texture by Feel Test:

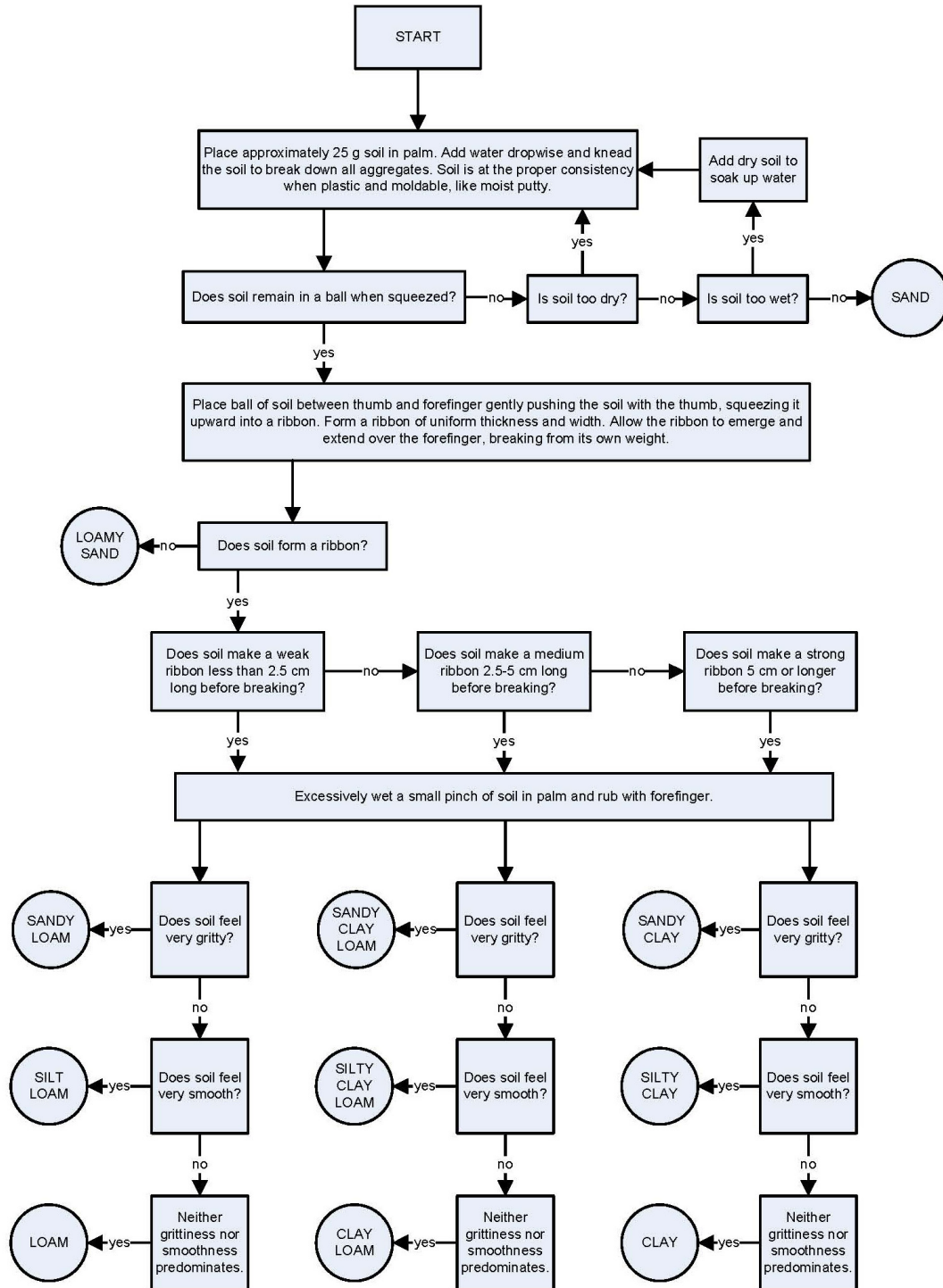
1. Use one bag of soil collected from the surface (1-3 inches) of each hole. Put a small handful of the soil on a piece of white paper for contrast. Record your observations in the "Soil Observation" table in your Participant Notebook 2-1. Answer these questions:
 - How does it feel?
 - What is the color?
 - Can you see individual particles?
2. Compare vineyard samples to purchased topsoil, potting soil, and beach sand.
3. Take a small handful of vineyard soil and squeeze the soil into a ball. Record your observations in your Participant Notebook by answering the following questions:
 - Does the soil hold together when you release your fist?
 - Does water come out like you are squeezing a sponge, or is it dry?
 - What does it smell like?
4. Use the Soil Texture by Feel Key (Figure 2-2) and Soil Texture Triangle (Figure 2-3).
 - What does this tell you about the soil structure or arrangement of the soil particles?





Guide to Texture by Feel

Modified from S.J. Thien. 1979. A flow diagram for teaching texture by feel analysis. Journal of Agronomic Education. 8:54-55.



Texture class is one of the first things determined when a soil is examined. It is related to weathering and parent material. The differences in horizons may be due to the differences in texture of their respective parent materials.

Figure 2-2. Soil Texture by Feel Key. Credit: U.S. Department of Agriculture, Natural Resources Conservation Service. <https://www.nrcs.usda.gov/sites/default/files/2022-11/texture-by-feel.pdf>

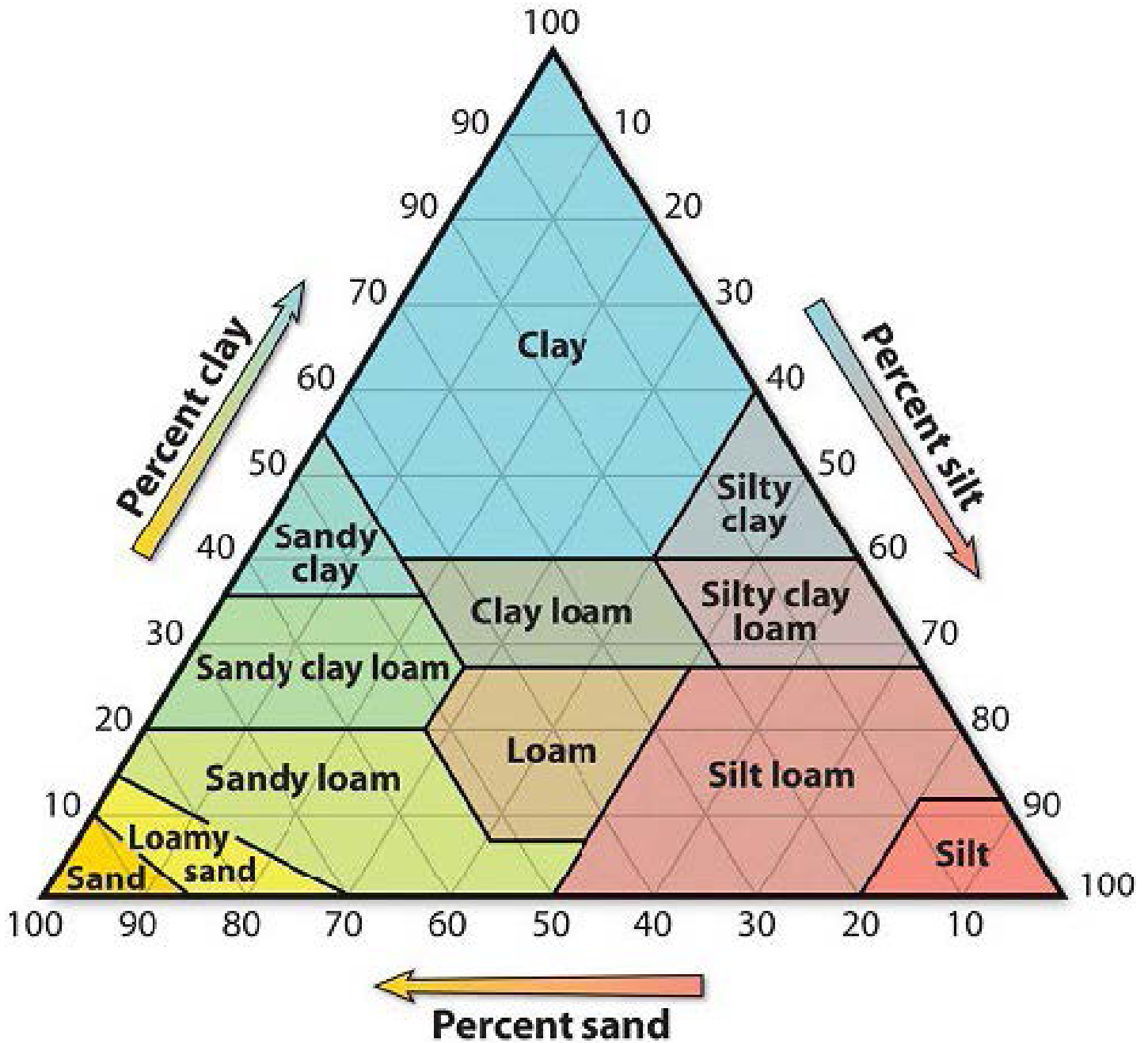


Figure 2-3. USDA textural triangle showing the percentages of clay, silt, and sand in the 12 basic texture classes.

Source: Soil Science Division Staff. 2017. Soil survey manual. C. Ditzler, K. Scheffe, and H.C. Monger (eds.). USDA Handbook 18. Government Printing Office, Washington, D.C. (page 125).

<https://www.nrcs.usda.gov/sites/default/files/2022-09/The-Soil-Survey-Manual.pdf>





Soil Shake Test:

1. Put one cup of the vineyard soil collected from the surface (1–3 inches) of a hole you dug into a clear quart jar. (Optional: Repeat for each hole.) Do the same thing with the store-bought potting soil, topsoil, and beach sand. Fill each jar with water, leaving one inch at the top. Close the lid tightly. Inspect and record your observations in your Participant Notebook.
 - What has changed?
 - Compare the different samples.
2. Shake up the jar. Inspect and record your observations in your Participant Notebook.
 - What has changed?
 - Is the water cloudy?
 - What settles to the bottom?
 - What floats to the top?

The water may look muddy because there are very fine particles of soil floating in the water.

3. Compare and contrast the different samples from your vineyard soil samples. Record observations.
4. Let stand for at least one hour or until your next meeting.
5. After the soil has settled, you should have several layers of soil in your jar.
 - The bottom layer is gravel – larger visible rock particles.
 - The next layer from the bottom is sand – coarse grains.
 - The third layer is silt – fine grains of rock.
 - The next layer is clay – very fine grains that are slimy and slippery.
 - The last layer is humus or organic matter – a dark layer of fine particles mixed with water created when plants, leaves, sticks, and insects die and decompose. You may see organic matter floating on the top of the water.
6. Calculate the percent sand, percent silt, percent clay for the vineyard soil, by measuring the total amount of each material on the bottom of the jar. A definitive line should have formed between the layers. Record the percent for each soil shake in your Participant Notebook on the “Soil Observation” table for each hole.
7. Compare these results with your Soil Texture by Feel results.

References and Resources

MSU Extension 4-H Gardening Around Michigan: Part 1 – Perk Testing Soil From Bay County video: https://mediaspace.msu.edu/media/4-HGardening-Around-Michigan-Bay-County-Soil-Perk-Test-Part-1/1_j08glqh9

MSU Extension 4-H Gardening Around Michigan: Part 2 – Perk Testing Soil From Bay County video: https://mediaspace.msu.edu/media/4-HGardening-Around-Michigan-Bay-County-Soil-Perk-Test-Part-2/1_95u338wb

MSU Extension 4-H Gardening Around Michigan: Part 3 – Perk Testing Soil From Bay County video: https://mediaspace.msu.edu/media/4-HGardening-Around-Michigan-Bay-County-Soil-Perk-Test-Part-3/1_haf3hvn7

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil profile page: <https://www.nrcs.usda.gov/resources/education-and-teaching-materials/a-soil-profile>

USDA NRCS Web Soil Survey: <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>





Canopy Exploration: What Affects Canopy Health?

Lesson 3

Overview: Participants will learn about grape leaf health, the parts of a grape leaf, the parts of a grapevine, and photosynthesis. They will use art to enhance their knowledge.

Age Level: 12–19 years

Season: Summer

Viticulturist: Required until after leaves are gathered

Location: Vineyard

Time: 1 hour or more based on the varieties of vines and leaves to compare

Objectives:

Participants will be able to:

- Explain the importance of a healthy leaf canopy in a vineyard.
- Identify parts of a leaf.
- Identify the parts of a grapevine.
- List characteristics of at least one grape pest.
- Identify one career important to grapevine care.

Materials:

- What Is Photosynthesis?* From the Smithsonian Science Education Center: <https://ssec.si.edu/stemvisions-blog/what-photosynthesis>
- Writing utensil (one per participant)
- Portable whiteboard or flipchart
- Crayons
- Fine tip markers (one per participant)
- Biodegradable marking tape (one 2- to 3-foot piece per group)
- Phone for taking pictures
- Clear Tape
- Permanent marker (one per group)
- A Pocket Guide for Grape IPM Scouting in the North Central and Eastern States by Michigan State University Extension. <https://www.canr.msu.edu/grapes/uploads/files/GrapeGuide-PDF-final2020.pdf>
- Quart-sized plastic Ziploc-type bags for collecting leaves (5 per group)
- Grape leaves from more than one *variety*, a group of plants within a species that has one or more distinguishing characteristics
- Participant Notebook 3-1 “Canopy Exploration: What Affects Canopy Health? Worksheet”

Participant Notebook 3-2 “Canopy Exploration: What Affects Canopy Health? Figures”

Participant Notebook 3-3 “Canopy Exploration: What Affects Canopy Health? Leaf Rubbings”

Vocabulary: ampelography, canopy, Integrated Pest Management (IPM), phloem, photosynthesis, variety

Background:

Photosynthesis

Photosynthesis is a process utilizing radiant energy to fix carbon dioxide gas and water into carbohydrates.

- The word *photosynthesis* comes from the Greek *photo* meaning “light” and *synthesis*, meaning “putting together.”
- Photosynthesis in grapevines is necessary to produce sugar and other elements that give grapes their color and flavor.
- The sugar is one of the foods used by the vine to grow and function including producing grapes.
- The sugar is transported through the *phloem*, a tissue in the vascular system that transports sugars and proteins to the rest of the plant and to the grapes.
- If the grapes are harvested for wine, some of the sugars are fermented into alcohol.

Learn more about photosynthesis:

What Is Photosynthesis? from the Smithsonian Science Education Center: <https://ssec.si.edu/stemvisions-blog/what-photosynthesis>



Ampelography

Ampelography is a science devoted to the identification of grape varieties and cultivars based on the vegetative characteristics of the vine.

- The word *ampelography* is from the Greek *ampelos* meaning “vine” and *graphe* meaning “description.”
- To classify grapevines, you need to pay careful attention to the distinct details of the vine’s leaves.
- Each grape variety’s leaves have unique characteristics: shape, coloring, size, texture, and other visual features.
- Ampelography is specifically concerned with the description of vine species and cultivated varieties.
- The study of ampelography covers not only identifying the leaves used for grapes but also focusing on rootstock selection and clonal variation.



Ampelography grape families and parentages have been identified, disease-resistant vines and rootstocks developed, and mysteries of many of the world's unknown or misidentified vine varieties have been solved.

- Ampelography has been used to resolve questions of vine origins for at least 2,000 years.
- Today, DNA testing is used to identify these slight nuances in varieties along with the science of ampelography.
- Today's global wine industry owes much of its success to this science as it promotes the fundamentals of ampelography.

Procedure:

Before the meeting:

1. Have participants read the article and watch the video from the Smithsonian Science Education Center's *What Is Photosynthesis?* You can send the link out via email before the lesson.
2. Arrange for the viticulturist to pre-select potential observations the participants should make about vineyard health (such as grape ripeness, insects, diseases, and weeds).
3. Arrange for the viticulturist to mark a vine for each pair of youth to label and record observations of overall health during the meeting.

Extension and Adaptation:

- Explore the culinary uses of grapes leaves in Mediterranean cuisine.
- Find a chef to cook a recipe using grape leaves with participants.
- Create a compilation of leaf rubbings that represent the varieties at the host vineyard.



During the meeting:

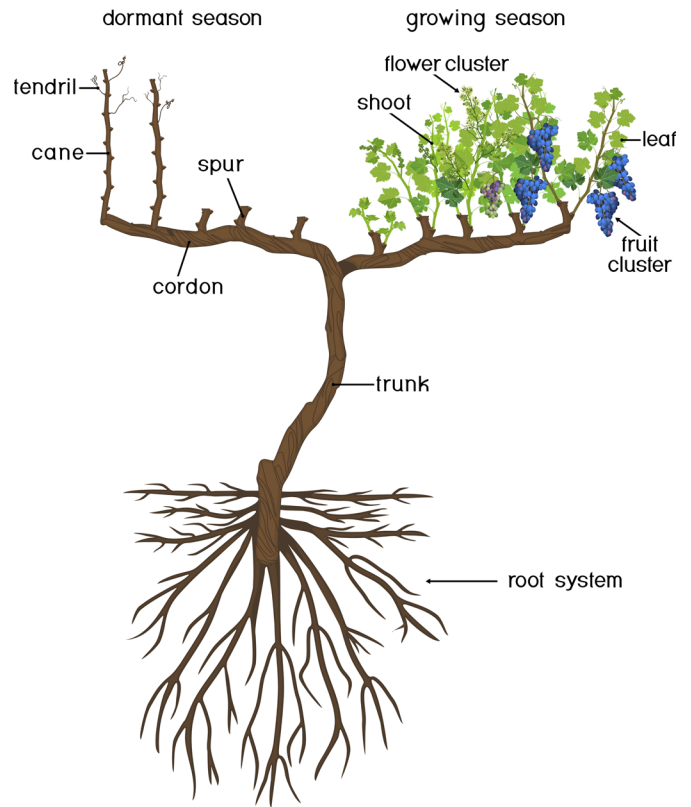


Figure 3-1. Diagram of grapevine. iStock credit: mariafaya

1. Have the viticulturist walk through a section of the grapevines modeling a quick canopy inspection. The *canopy* is the green-growing vegetative portion of the grapevine composed of shoots, leaves, tendrils, and shoot tips. The viticulturist will stop at strategic locations and ask participants, "Do you notice anything about this vine?"
 - Have the viticulturist point out features that indicate:
 - Berry ripeness.
 - Insects.
 - Disease.
 - Weeds.
 - The viticulturist could also give a brief explanation of Integrated Pest Management (IPM) and how it is incorporated into their pest management plan. IPM is a science-based decision-making process that identifies and manages pests. The United States Code, specifically 7 U.S.C. section 136r-1, Integrated Pest Management (2022) defines IPM as "a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic impacts, health, and environmental risks." Participants will learn more about IPM in Lesson 13 "Integrated Pest Management: Why Is Pest Management Important?"





2. Divide group into pairs and assign each pair a pre-selected grapevine.
3. Have participants work in pairs to:
 - Identify and label each part of the assigned grapevine using the provided diagram (Figure 3-1) with biodegradable marking tape and a permanent marker. (Facilitator, note that this figure also appears in Participant Notebook 3-2.)
 - Rip off a piece of marking tape (approximately 6 inches), label with the part of the vine, and gently tie the tape around that part of the vine.
 - Record their observations and explanations in Participant Notebook 3-1. (Encourage participants to add photos they take to their Participant Notebooks by adding extra pages.) Focus on:
 - General health.
 - Fruit ripeness.
 - Signs of insects.
 - Signs of diseases.
4. Discuss as a group their observations and ask the viticulturist to help clarify the importance of key observations.
5. Ask participants if they think the leaf canopy is important in a vineyard. Have them turn and tell their neighbor why they think it is important (*leaves are where photosynthesis occurs, where the sugar is produced*). Ask them to share their ideas.
6. Based on time and season, have the viticulturist lead a discussion on canopy management, leaf removal practices, and hedging as a part of good vineyard management practices. Include a discussion of the knowledge and potential careers needed to manage and care for a vineyard.
7. With the assistance of the viticulturist, harvest mature, undamaged, and damaged grape leaves from a variety of vines. Put the leaves in collection bags. Be sure each variety has its own bag.
 - Have participants label the variety on the collection bag, and make notes in their Participant Notebooks on leaf discoloration, disease, and other issues. Use *A Pocket Guide for Grape IPM Scouting in the North Central and Eastern States* by MSU Extension to diagnose any problems.

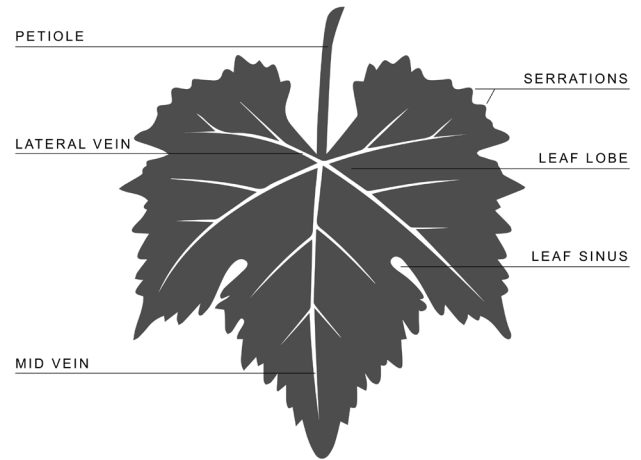


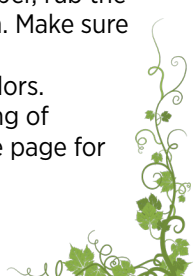
Figure 3-2. Grape leaf diagram. Created by KJMDigital

8. Ask participants to identify the parts of the grape leaf using their leaf and the provided leaf diagram (Figure 3-2). (Facilitator, note that this figure also appears in Participant Notebook 3-2.)



Figure 3-3. Grape leaf rubbing. Photo Credit: Cristin Popelier Hosmer

9. Have participants make a crayon rubbing (see Figure 3-3) of the leaves of at least three different varieties of grapes. Use Participant Notebook 3-3.
 - For best results, remove the wrap from the crayons, tape the leaf to the back side of the first page of Participant Notebook 3-3 vein side down with two small pieces of tape on the top and bottom of the leaf. Flip the paper over. Through the paper, rub the entire back side of the leaf with a crayon. Make sure to get all the veins, blade, and petiole.
 - They may want to use multiple colors.
 - They may want to do a leaf rubbing of multiple grape leaves on the same page for ease of comparison.





10. Label the parts of the leaf with a marker and add the name of the grape variety.
11. Use the leaf rubbing and leaf to discuss photosynthesis.
 - Have participants compare and record information about each of the grape leaf varieties' size, blade, serrations, color, and vein patterns.
12. Discuss the importance of ampelography.
 - Have participants research and record in their Participant Notebooks how to become an ampelographer.
13. Ask participants to brainstorm and list the careers they think are involved in the care of grapevines.
 - Have them record details of at least one of the careers identified in their Participant Notebooks.

References and Resources

A Pocket Guide for Grape IPM Scouting in North Central and Eastern United States by Michigan State University Extension, 2020. https://www.canr.msu.edu/grapes/integrated_pest_management/

Integrated Pest Management. (2022). 7 U.S.C. §136r-1. <https://www.govinfo.gov/content/pkg/USCODE-2022-title7/html/USCODE-2022-title7-chap6-subchapl-sec136r-1.htm>





Pruning Dormant Grapevines: When and Why Should Grapevines Be Pruned?

Lesson 4

Overview: Participants will discover why pruning is a necessary part of productive vineyard management. They will explore why pruning is generally done when grapevines are dormant (winter).

Age Level: 12–19 years

Season: Winter

Viticulturist: Required

Location: Vineyard

Time: 2–3 hours

Objectives:

Participants will be able to:

- Identify the dormant phase in the annual life cycle of a grapevine.
- Explain why pruning is important.
- Explain when pruning should take place.
- Identify common tools used in pruning.
- Identify one career that is important when pruning in the vineyard.

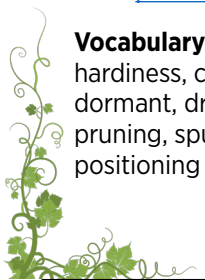
Materials:

- Writing utensils (one per participant)
- Hand pruners (one for demonstration)
- Loppers (one for demonstration)
- Pruning saw (one for demonstration)
- Biodegradable marking tape (one roll per group of participants)
- Scissors (one pair per group of participants)
- Participant Notebook 4-1 “Pruning Dormant Grape Vines: When and Why Should Grapevines Be Pruned? General Questions”
- Participant Notebook 4-2 “Pruning Dormant Grape Vines: When and Why Should Grapevines Be Pruned? Figures”
- Penn State Extension Grapevine Pruning video: https://www.youtube.com/watch?v=hsTsl_IdJxc
- MSU Extension Mechanical Pruning of Grapevines video: <https://www.canr.msu.edu/grapes/viticulture/pruning>

Vocabulary: cane, cane pruning, chilling hours, cold hardiness, cordon, crop load, cultivars, dormancy, dormant, dropping, growing degree days (GDD), pruning, spur, spur pruning, tying, véraison, vertical shoot positioning (VSP)

Background:

- Grapes have played a role in world history dating back to early civilizations.
 - Archaeological evidence shows grapes have been consumed as early as 3,500 B.C.
 - In addition, Egyptian mosaics dating back to 2,440 B.C. record people growing grapes.
 - From early civilizations to current times, humans have perfected the art of pruning plants for aesthetics and for promoting fruit production. This is true for grapevines as well.
- *Pruning* can be defined as the removal of plant parts to obtain horticultural objectives. These objectives include:
 - Controlling the size and form of the grapevine.
 - Optimizing the productive potential of the grapevine.
 - Maintaining a balance between vegetative growth and fruiting.
 - (Nonnecke, 2002)
- Pruning is one component in training grapevines. Training grapevines spatially arranges the plant parts to optimize the exposure of sunlight for fruit production. Pruning and training vines is part of good vineyard management practices. Through pruning and training:
 - Grapevines can be trained with a single or double trunk (Nonnecke, 2002).
 - Training vines to a single trunk is the most common and simplest method (Nonnecke, 2002).
 - In colder climates, training vines to a double trunk is often preferred. If one trunk is killed, the other trunk will provide some production until the dead trunk can be replaced (Nonnecke, 2002). This is also a common practice with marginally adapted cultivars of grapevines. *Cultivars*, are varieties of plants in horticulture that have been deliberately bred for desirable characteristics, such as taste, hardiness, disease resistance, and others.





Dormancy and Chilling Hours

During the winter months, grapes enter a dormant phase. *Dormancy* is the state in which a plant is alive but not actively growing. When a plant is in a state of dormancy, it is considered to be *dormant*. Dormancy allows woody plants to survive unfavorable conditions, such as extremely cold temperatures. Each grape variety has a unique required number of *chilling hours*, which is the amount of time the vine must remain dormant. Meeting the required chilling hours in colder climates such as Michigan and Minnesota are typically not a problem due to the length of the winter; however, in warmer climates like California and southern Spain, it can become a challenging issue.

- Grapevines are extremely vigorous plants, which means they can grow quickly and large when conditions are right.
 - The *canopy*, as covered in Lesson 3 “Canopy Exploration: What Affects Canopy Health?” is the green-growing vegetative part of the grapevine.
 - A vine that isn't pruned can be massive, green, and lush, but it is often devoid of fruit and more susceptible to diseases.
- Canopy management, such as pruning during dormancy, leaf pulling, and hedging, during the active growing season, are decisions made by the viticulturist or vineyard manager with the intention of decreasing disease pressure and opening up the canopy so that fruit receives sunlight.
- Berries are only produced on green shoots growing from canes. A *cane* is 1-year-old wood that is retained when pruning.
 - Vineyard managers determine which canes are likely to produce the quality and quantity of berries desired. They then prune off all other canes.
 - Pruning encourages the vine to produce berries in the coming season.
- The type of trellis system used to support a vine has an impact on pruning decisions because different types of grapevines have different growth habits.
 - Grapevines are planted and trained to different kinds of trellis systems for a multitude of reasons such as maximizing crop load and maximizing quality, ease of mechanical care, tradition, or aesthetics.
 - Some vineyards may have multiple trellis systems in place; some may only use one.
- *Tying* is the process of attaching the grapevine to the trellis using tape or twine.
 - Tying may be done at the same time as pruning or may be done on a second pass, by hand or by machine.

Trellising

Trellis systems (Figure 4-1):

- Double Cordon, vertical shoot positioning (VSP): typical for vinifera wine grape varieties, such as Pinot Grigio and Riesling
 - *Cordon* – an extension of the grapevine trunk usually horizontally oriented and trained along the trellis wires. Cordons are considered permanent (or perennial) wood.
 - *Vertical shoot positioning* – “a training system in which growth is trained upward from low cordons” (Extension.org, 2019)
- High Wire Cordon: typical for cold climate and French-American hybrid wine grape varieties, for example, Marquette and Marechal Foch
- Geneva Double Curtain: typical for juice grape varieties, such as Concord and Niagara
- Scott Henry: typical for juice grapes and wine grapes to encourage high capacity and fruit quality in cold climates.

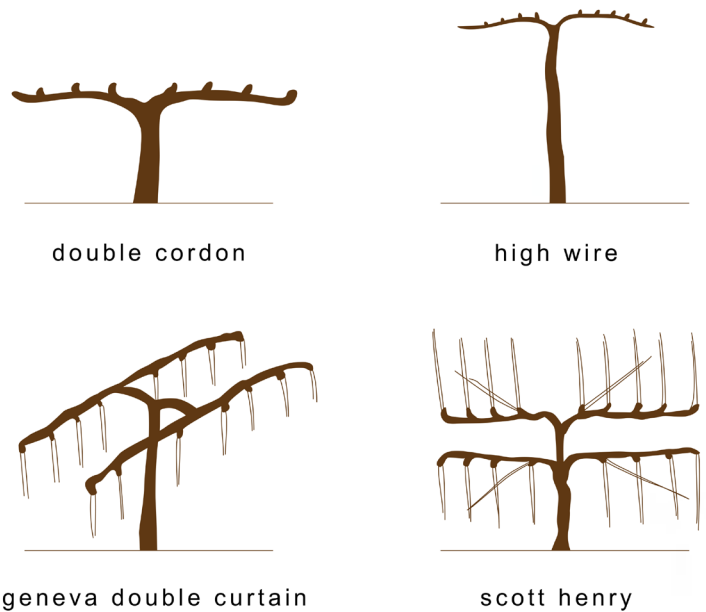


Figure 4-1. Examples of trellis systems. Created by KJMdigital

The goal of dormant grapevine pruning is to make pruning decisions so that in the coming season, and all future seasons, the vines produce high-quality grapes.

- The *crop load*, amount of fruit one vine can support, varies based on the variety, growing season length, and the *growing degree days* (GDD), which is the total accumulation of heat during the growing season.



Grape and vineyard productivity is measured in tons per acre.

- Using historical data and learning about the productivity of a vineyard overtime, growers can begin to anticipate yields.
- Good canopy management includes leaf pulling and possibly dropping fruit before *véraison*, the stage in development when berries begin to soften and change color.
- *Dropping* fruit refers to pruning fruit when the fruit load is too heavy to encourage quality over quantity.

In the timeline of vineyard activities, pruning usually happens in late winter or early spring, February to April, in colder climates before bud break.

- However, the timing of pruning activities depends on the outdoor temperatures, amount of snow in the vineyard, required chilling hours by variety, age of the vine, availability of labor, level of mechanization, and size of the operation.

Pruning may be delayed into late spring in cold climates because of the duration of low temperatures.

- Different varieties of grapevines have different levels of *cold hardiness*, the ability to tolerate cold temperatures, and have the ability to produce fruit the following season.
- Temperatures colder than -7 °F (for all vinifera grapevines) or colder than -40 °F (for all cold-hardy grapevines) can cause significant damage to the woody part of the grapevine, depending on the variety, even when it is dormant. Cold damage may result in a lower harvest to a complete crop loss.
- An assessment of winter damage is often completed prior to pruning.

Help From the Great Lakes

In winter 2014-15, when the Great Lakes froze because of the polar vortex, most of Michigan saw temperatures drop to below -20 °F causing widespread crop losses in vinifera grape varieties. Most years, the Great Lakes help to moderate the early spring and fall temperatures, which is why the vast majority of Michigan’s vinifera vineyards are located within 5 miles of Lake Michigan.

Types of Pruning

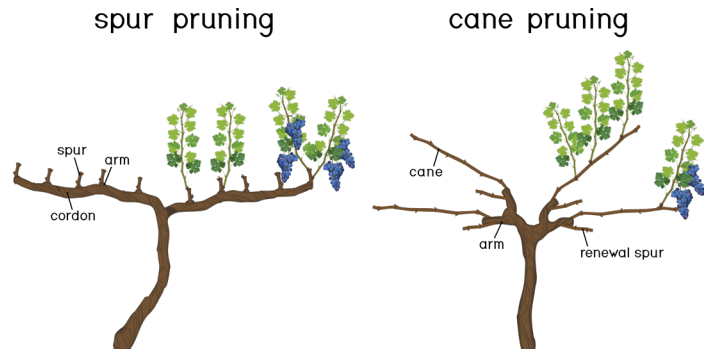


Figure 4-2. Diagram of spur pruning and cane pruning. iStock credit: mariflaya

Spur pruning (Figure 4-2) is a system of cutting grapevines typically used for canes arising on cordons.

- Spurs arising from the upper portion of cordons are selected over those on the lower portion of cordons.
- Spur pruning is used where the most fruitful buds on a cane are found near the base of the cane.
- Spur pruning involves pruning back to two to four spurs.

Cane pruning (Figure 4-2) is a system of cutting the grapevine back to one or more canes that will produce new shoots.

- The aboveground portion of a cane-pruned vine will have a trunk, one or more canes on which shoots will develop from buds on canes.
 - The vine also produces renewal spurs to be used as new canes for future fruiting sites. Spurs are short canes. The name comes from their physical appearance after cutting the cane. Each spur retains one or two buds.
 - Cane pruning is used on grape varieties where the most fruitful buds are located midway on canes.

(Lockwood, 2019)

Vineyards can be hand pruned by skilled laborers, mechanically pruned, or a combination of both. The availability of trained labor is a challenge for most agricultural producers. Some larger vineyard owners have invested in mechanical pruning equipment, which is expensive and causes more damage to the vines than hand pruning, but more efficient in completing the required pruning in the short time frame recommended for pruning.



Procedure:

Before the meeting:

1. Gather supplies.
2. Gather pruning tools.
3. Identify potential vines to demonstrate pruning with the viticulturist.
4. Review the vines for the participants to label for the pruning activity.
5. Watch Penn State Extension video *Grapevine Pruning*:
https://www.youtube.com/watch?v=hsTsl_IkJxc
6. Go to the MSU Extension Grapes website at <https://www.canr.msu.edu/grapes/viticulture/pruning>. Click on *Mechanical Pruning of Grapevines* to watch the video.

During the meeting:

1. With the viticulturist present, ask participants, "Why do you think grapevines might need to be pruned?" Potential answers include:
 - Pruning keeps the plants healthy.
 - Pruning helps vines produce better grapes.
2. Ask the viticulturists to address the ideas brought up by participants. Discussion might include:
 - General vine health of an established grapevine
 - Dead or diseased wood removal
 - Production of better grapes:
 - Buds per foot relates to tons per acre
 - Pruning decisions that will affect the quality and amount of berries the vine will produce
3. The viticulturist will demonstrate safe handling and proper care of tools.
 - Hand pruners
 - Loppers
 - Pruning saw
 - Mechanical implements (Show the MSU Extension *Mechanical Pruning of Grapevines* video.)
 - Safety
4. In the vineyard, ask the viticulturist to explain a short overview of their philosophy for pruning.
 - Machine pruning vs. hand pruning
 - One pass/multiple passes (major pruning, harder decisions, tying)
5. Explain or demonstrate pruning of a couple of the different varieties and trellis systems in the vineyard. The viticulturist should also explain the results of these practices.
 - Reduces disease pressure
 - Manages yield
 - Improves the quality of the grapes

6. Discuss how to evaluate the proper pruning methods for various grape varieties and trellis systems to encourage vine balance. Explain how this helps produce better fruit quality. (Have participants look at Figure 4-1 "Examples of Trellis Systems" in Participant Notebook 4-2.)
7. Teach participants how to visually inspect the grapevines to ensure an equal distribution of the berry producing cane over the entire vine.
 - In pairs, have participants evaluate a vine, using marking tape to mark where they think pruning cuts should be made. (Have participants look at Figure 4-2 "Diagram of Spur Pruning and Cane Pruning" in Participant Notebook 4-2.)
 - Ask the viticulturist to discuss the proposed pruning cuts for each marked vine.
8. Demonstrate how to visually inspect for the buds, which will produce the clusters of grapes. Are they equally distributed across the fruit zone?
 - In pairs, have participants evaluate the vines and identify the buds.
 - Ask the viticulturist to verify the bud locations.
9. Have participants discuss the purpose for pruning at different times of the year and the overall objectives for pruning.
10. See "Careers" section to find out about related careers. Careers related to this topic include viticulturist, office manager, laboratory technician, equipment operator, laborer, and outside services.
11. Have participants answer questions in Participant Notebook 4-1 "Pruning Dormant Grapevines General Questions."





References

Extension.org. (2019). *Grapes: Vertical shoot positioning*. <https://grapes.extension.org/vertical-shoot-positioning-vsp/>

Lockwood, D. W. (2019). *Grapes: Basic considerations for pruning grapevines*. Extension Foundation. <https://grapes.extension.org/basic-considerations-for-pruning-grapevines/>

Nonnecke, G. (2002, January 26). *Pruning, training, and grape canopy management*. [Conference session]. Iowa Grape Growers Conference. https://www.prairiefirewinery.com/Cellar/wp-content/uploads/2016/12/pruning_training_and_grape_canopy_management.pdf

Resources

Hellman, E., & O'Brien, D. (2019). *Grapes: Pruning grape vines: An overview*. Extension Foundation. <https://grapes.extension.org/basic-considerations-for-pruning-grapevines/>

MSU Extension *Grapes: Pruning Mature Grapevines: The Basic Steps* video: <https://www.canr.msu.edu/grapes/viticulture/pruning>

MSU Extension *Grapes: Pruning* video: <https://www.canr.msu.edu/grapes/viticulture/pruning>

Penn State Extension. *Grapevine Pruning* video: https://www.youtube.com/watch?v=hsTsl_lJxc





Grape Chemistry: Are the Grapes Ready for Harvest?

Lesson 5

Overview: Participants will learn to sample berries in the vineyard for chemical analysis. They will explore basic taste perceptions of unripe versus ripe berries and seed flavors.

Age Level: 12–19 years

Season: Fall

Viticulturist: Required

Location: Vineyard and winery laboratory

Time: 1.5 hours based on the varieties of grapes available, the amount of time the viticulturist has, and the availability of a laboratory tour

Objectives:

Participants will be able to:

- Explain how to test berries for ripeness.
- Identify the various taste characteristics of the berry, skin, and seed that help to determine when berries are ready to be harvested for a variety of uses.

Materials:

For laboratory analysis:

- Small 8-ounce jars (one for each grape variety collected)
- Refractometer (one to share between participants)
- Hydrometer (will have in winery laboratory)
- Hydrometer trial jar (one per variety to be tested)
- pH test paper
- Writing utensils (one per participant)
- Participant Notebook 5-1 “Grape Chemistry: Are the Grapes Ready for Harvest? Worksheet”
- Participant Notebook 5-2 “Grape Chemistry: Are the Grapes Ready for Harvest? Figures”

For collecting grape samples:

- Grapes
- Plastic bags
- Markers

Vocabulary: Brix, hydrometer, pH, refraction, refractometer, tannins, titratable acidity, varietal character, vintage

Background:

- The ripeness of the *grapes* (berries) is determined by several factors including:
 - The intended use of the grapes as defined by the grower, winemaker, or food processor.
 - What is typical for the variety being harvested.

- Grape varieties have fruiting characteristics often distinctive to each variety.
- *Varietal character* refers to the combinations of aromas and flavors, as well as the sugars and acids of wine grapes.
- The chemical composition of the berries is determined by:
 - The variety of the vine.
 - The genetic makeup of the variety.
 - Environmental factors.
 - Growing practices.
- Berry samples are taken starting about three weeks before the intended harvest.
 - The number of times the berries are sampled is dependent on the stage of ripeness and monitored closely by the grape grower, winemaker, or food processor.
- Wine bottle labels evolved to include the *vintage* (year of harvest) because the seasonal influences on the fruiting characteristics varied from year to year.
- The seeds are a vital part of the analysis for determining ripe berries.
 - Green seeds are immature.
 - Tan and tan to brown are near maturity.
 - Brown seeds are mature.
 - Ripe seeds contain *tannins*, compounds that are desirable because they give color and flavor to wine.
- Sensory evaluations are used to gauge initial ripeness of the berries and to determine when more scientific testing is needed.
 - Specific chemical tests using laboratory procedures determine when to harvest the entire crop for a specific product.
 - Accurate analysis of the ripeness is vital and dependent on the maintenance and calibration of equipment.
 - The laboratory procedures determine the soluble solids (Brix), titratable acidity, and pH.
 - *Brix* is the measure of total soluble solids, which is the approximate percentage of sugar in the grape juice by volume. Brix can vary from year to year. Ideally, ripe grape characteristics will be between 20 and 25 Brix.



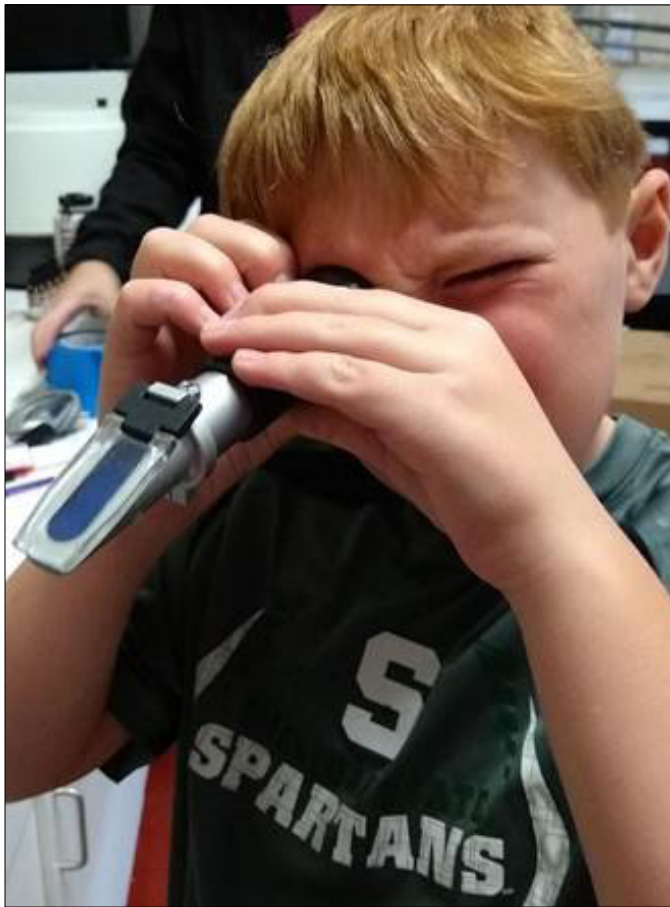


Figure 5-1. Using a refractometer to measure Brix in grapes. Photo credit: Cristin Popelier Hosmer

Refractometer:

- Temperature is one of the most important factors influencing accurate refractometer readings. A *refractometer* (see Figure 5-1) is an instrument for measuring the soluble solids in a liquid when testing a fruit's sugar content; the result is stated as Brix. Modern refractometers are temperature compensated.
 - The cooler the juice, the slower the molecules move. There will be more refraction, so the Brix reading will be higher.
 - The warmer the juice, the faster the molecules move. There will be less refraction, so the Brix reading will be lower.
 - The correct reading of Brix for the refractometer is 15.2. This is the point where the blue meets the white (See Figure 5-2). (Facilitator, note that this photo also appears in Participant Notebook 5-2.)

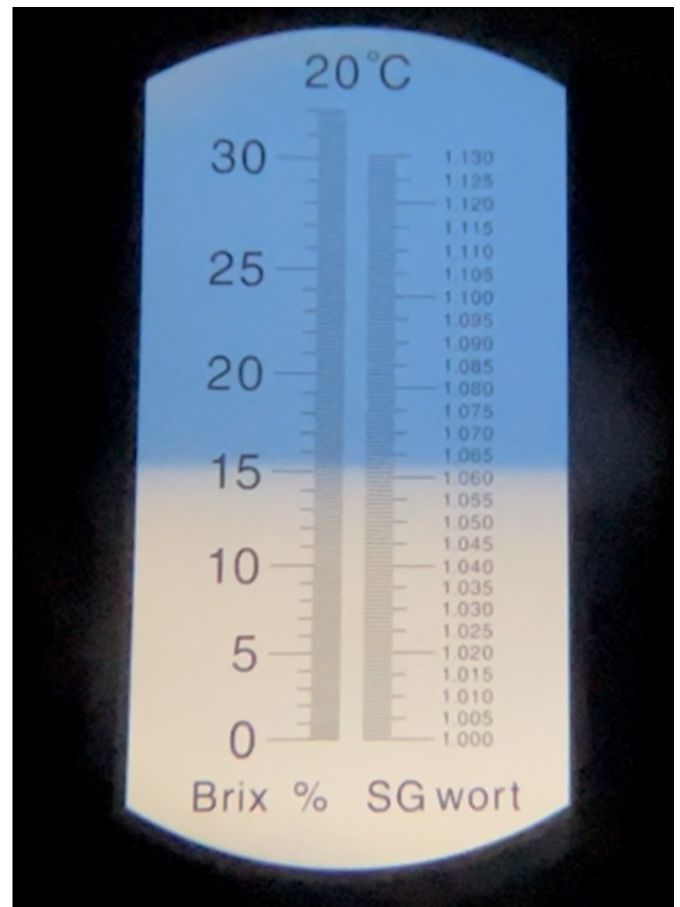


Figure 5-2. Photo of refractometer scale. Photo credit: Hayley Wineland.

Titrateable acidity and pH:

- *Titrateable acidity* refers to the total acid concentration in the fruit or the tartness of the fruit. TA (titrateable acid) varies with the type of grape or wine.
- *pH* is the measure of the strength and concentration of acids present in a medium. *The lower the pH, the higher the acidity; the higher the pH, the lower the acidity.* The pH ranges between 3.2 and 3.4 pH for white wines and between 3.4 and 3.6 pH for red wines.
- For more information about wine acidity, read "What Is Acidity in Wine?" by Noelle Hale in *Wine Enthusiast*: <https://www.wineenthusiast.com/basics/advanced-studies/what-is-acidity-in-wine/>

Hydrometer:

- A hydrometer is an important piece of equipment in a wineries' laboratory. A bonus activity would include the winemaker demonstrating and explaining the use of a hydrometer.





- A *hydrometer* measures the specific gravity of the liquid. Winemakers use hydrometers to measure the alcohol content by volume throughout the fermentation process to ensure sugar is being converted into alcohol. This is evidenced by the daily drop in the specific gravity. As sugar is converted to alcohol, the specific gravity will fall. Fermentation is complete when readings are taken 48 hours apart and the specific gravity stays consistent.

See Figure 5-3: The correct hydrometer reading for Figure 5-3 is 1.000. (Facilitator, note that this figure also appears in Participant Notebook 5-2.)

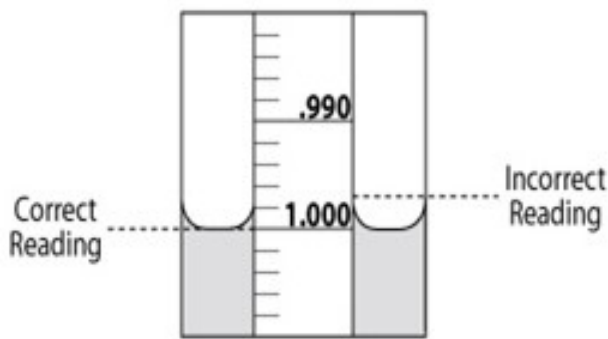


Figure 5-3. A hydrometer reading. Created by KJMdigital.

Procedure:

Before the meeting:

1. Review the background information.
2. Schedule a time with the viticulturist to sample grapes with participants.
3. Determine if participants will have the opportunity to do or observe the chemical analysis in the vineyard laboratory.
4. Collect materials needed.

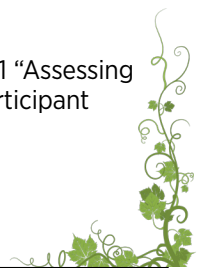
During the meeting:

1. Collect a variety of berries, clusters, or both from various parts of the vineyard. Gather enough to produce at least ½ cup of juice from each variety. (Collect five samples: five varieties of grapes or five samples of the same variety from five areas of the vineyard, or do a combination of both to equal five samples.)
 - Remove berries from the stem.
 - Do not rinse fruit.
 - Put in a plastic bag.
 - Label with the variety name.
2. Move to your indoor class space.

Assess Grapes by Taste:

Facilitator should lead the participants in the following exercise:

1. Take a sample berry and place it in your mouth. Do *not* chew it.
 - Feel the surface of the grape with your tongue.
 - Using your teeth and tongue, carefully bite into the skin of the berry and slip the pulp out of the skin.
 - Did the skins easily slip off the grape pulp?
 - Is the skin sweet or tart?
 - Did you notice anything else about the skin?
 - Is the juice sweet or tart?
 - What is the texture of the pulp?
 - Record your observations on Table 5-1 “Assessing Grapes by Taste” provided in your Participant Notebook.
 - Does the grape have seeds? Gently remove the seeds.
 - What color are the seeds?
 - How do the seeds taste?
 - Record your observations on Table 5-1 “Assessing Grapes by Taste” provided in your Participant Notebook.





2. Repeat with another variety of grape (or same variety from another area of the vineyard).
3. Compare and rank the grapes by taste, 1 to 5. Number 1 will be the least sweet. Number 5 will be the sweetest.
 - Discuss with a partner how you ranked the varieties.
 - Which variety do you think has the most sugar?
 - Did your partner rank them the same?

Assessing Grapes by Chemistry:

Facilitator should lead the participants in the following exercise:

1. Explain that a Brix refractometer uses the principle of *refraction* to measure the percent of sugars of a solution. The principle of refraction explains how light bends when it moves from one medium into another.
2. In a sealed plastic bag, lightly smash the berries that you collected earlier to release the juice. Pour 100 ml or about $\frac{1}{2}$ cup of the juice into a small glass container.
 - Place a sample of the solution (grape juice) on the prism in the refractometer.
 - Point the prism end toward a light source while looking through the eyepiece.
 - Focus the eyepiece until the scale is clear.
 - The Brix number is the reading on the scale where the light and dark sides meet.
 - Record the Brix reading in your Participant Notebook in Table 5-2 "Assessing Grapes by Chemistry."
3. Use a piece of pH test paper to determine the current pH.
 - Record the pH in your Participant Notebook in Table 5-2 "Assessing Grapes by Chemistry."
4. Are the grapes ready to harvest?
 - Use your data and explain your answer in your Participant Notebook.

References and Resources

Clark, M. (2021, August 26). *When to harvest grapes and apples at home*. University of Minnesota Extension. <https://extension.umn.edu/yard-and-garden-news/when-harvest-grapes-and-apples-home>

Fiola, J. (2021, April 30). *Evaluating grape samples for ripeness*. University of Maryland Extension. <https://extension.umd.edu/resource/evaluating-grape-samples-ripeness/>

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Spring in the Vineyard

Lesson 6

Overview: Participants will explore what happens in a vineyard in spring and the careers connected with these activities.

Age Level: 12–19 years

Season: Spring

Viticulturist: Required

Location: Vineyard

Time: 60 minutes. This lesson is designed to be used multiple times.

Objectives:

Participants will be able to:

- List at least three things that need to happen in the spring in the vineyard.
- Identify the key careers for activities required in the vineyard in the spring.
- Explain one task that can only be done in the spring.

Materials:

- Writing utensils (one for each participant)
- Portable whiteboard or flipchart
- Markers
- Spring Task Cards
- Spring Career Cards
- Spring Tool Cards
- Extra index or blank cards as needed
- Poster board, paper, or online poster tools such as Canva
- Participant Notebook 6-1 “Spring in the Vineyard General Questions”
- Participant Notebook 6-2 “Careers in the Vineyard Interview Questions”
- Participant Notebook 6-3 “Seasonal Scenarios for Spring”

Vocabulary: bud break, canes, node, shoots, suckers



After bud break. Photo credit: Esmaeil Nasrollahiazar

Background:

- Grapevines enter a period of active vegetative growth as temperatures maintain a steady 55 °F.
- Each small bud emerges from the *node*, the part of the plant that causes leaf growth. The act of buds emerging is called *bud break*.
- As the *shoots*, the primary growth structures of a grapevine, emerge, they are monitored for frost damage.
 - Frost protections, such as fans, fire, and water, may be needed during this time.
- Learn more about scouting for pests and diseases in Lesson 13 “Integrated Pest Management: Why Is Pest Management Important?”
 - Scout for insects.
 - Apply chemicals for insects as needed.
 - Scout for diseases.
 - Apply chemicals for prevention and control of diseases.
- Other vineyard management activities:
 - Although most pruning has been completed, some pruning is still performed in the spring if needed. Learn more about pruning in Lesson 4 “Pruning Dormant Grapevines: When and Why Should Grapevines Be Pruned?”
 - A *cane* is 1-year-old wood that is retained when pruning. They are trained and tied to the trellis based on a specific training system.
 - A *sucker* is a shoot that grows from the base of the trunk. They are removed.
 - Shoots contain the new green growth with leaves, tendrils, and flower clusters. They are positioned and thinned.





Procedure:

Before the meeting:

- After reading the background information, decide which careers you would like to explore with the participants by examining the "Careers" section.
- If you are planning to visit a vineyard:
 - Talk with your viticulturist contact and discuss the objective: Participants will learn about things that need to happen in the spring in the vineyard.
 - Share with your contact that another objective of this visit is for participants to interview and identify the key careers and activities required in the vineyard in the spring.
- Send the list of potential interview questions to your contact at the vineyard if you are planning to visit a vineyard and interview employees.
 - What is your job title?
 - When and how did you discover you were interested in a viticulture career?
 - What was your educational pathway to this career?
 - How did you learn this position was available, and how did you apply for it?
 - Where would you look today to find positions available in a vineyard?
 - What are the three main responsibilities of your job?
 - What is the most rewarding part of your job?
 - What are three challenges to doing your job?
 - Would you recommend a career in viticulture?
 - Why do you like coming to work every day?
- Print and cut the Spring in the Vineyard Task, Career, and Tool cards for the activities (Charades, Career Wall, What Comes First?) you plan to do during your meeting. (The cards are at the end of this lesson. Separate them into a pile for each section: tasks, careers, and tools.) The following table contains everything that appears on the cards.

Spring Vineyard Tasks, Careers, and Tools

Task (spring)	Career	Tool
Protect the vines from frost damage using fans	Laborer	Fans
Protect the vines from frost damage using fire	Laborer	Fire (like a campfire)
Protect the vines from frost damage using water	Laborer	Water, sprayer
Check vines for pests and diseases	Vineyard manager	Hands, eyes
Spray for pests and diseases	Laborer	Sprayer, gloves, and other personal protective equipment
Tie canes to the trellis	Laborer	Ties (string, zip ties, twist ties)
Thin shoots	Laborer	Hand pruners
Verify employment eligibility of laborers	Office manager	Phone, computer
Repair or install trellis systems	Equipment operator	Tractor, post digger, posts, spinning jenny, wire, hand tools
Contact a soil expert to test and report on the vineyard soil needs	Outside service	Shovel, soil probe, bucket, soil testing box, phone/mail, soil test report
Amend the soil as needed by hand	Laborer	Fertilizer spreader
Amend the soil as needed by machine	Equipment operator	Tractor and fertilizer spreader



**During the meeting:**

At the vineyard:

1. Allow participants 1 minute to move around and make observations in the predetermined area.
 - Participants should be looking for things unique to spring in the vineyard.
2. They should record their observations in Participant Notebook 6-1 "Spring in the Vineyard General Questions."
3. Ask them to share out round-robin style until all observations have been listed.
 - Record shared observations on a flipchart or portable whiteboard.
4. Using the list generated, ask participants what spring tasks they think should happen in the vineyard, and have them record them in their Participant Notebooks.
5. Ask participants to share out round-robin style until all tasks have been listed.
 - Record tasks on a flipchart or portable whiteboard.
 - Compare the tasks the participants identify with those listed in the background information and add any tasks they do not mention.
6. Ask them to brainstorm what careers they think are necessary during the spring, based on the observations and the task list they developed.
 - Have them compare their brainstorming with the career information provided.
7. If possible, interview vineyard staff who are working during the spring in the vineyard.
 - Encourage participants to use the questions from the "Before the Meeting" section and their own questions. (Use Participant Notebook 6-2 "Careers in the Vineyard Interview Questions.")

At the next meeting:

At your club meeting space:

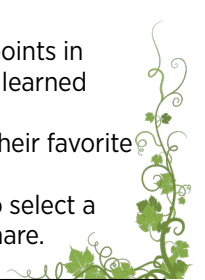
1. Play games such as charades, "What Comes First?" and Career Wall to help participants better understand what is happening in the vineyard.
 - Play charades using the Spring Task Cards.
 - Play "What Comes First?"
 - Pass out the Spring Task Cards to participants. Have them line up or arrange the cards in the order they think the tasks should occur.
 - Allow time for discussion.
 - The facilitator should ask questions to help participants to understand that some of the tasks reoccur and can happen in a variety of orders.
 - Play Career Wall. Use the "What Comes First?" timeline to connect careers and tools to the tasks.
 - Pass out Spring Career Cards to the participants and have them connect them with the appropriate tasks. You may need to make more cards.

- Pass out the Spring Tool Cards and have participants connect them with the careers and tasks.
 - Discuss the connection between tasks, careers, and tools.
2. Wrap-up
 - Have participants record three main points in their Participant Notebooks that they learned about the careers, tasks, and tools.
 - Have participants share round-robin their favorite career, task, or tool.
 - You may want each participant to select a different task or career to share.

Supplemental activities:

If participants are unable to meet in a vineyard, the following activities may be used, or as supplemental activities during your club meetings.

1. Ask participants to brainstorm together what they think is happening in the vineyard during the spring.
2. Have participants look at Participant Notebook 6-3 "Seasonal Scenarios for Spring."
 - Have participants read the scenarios or read them aloud to the group, and then answer the questions included.
3. As participants think about the seasonal scenarios story, ask them to brainstorm and make a list of the tasks they think might happen in the spring in a vineyard.
 - Compare lists with each other and with the one provided in the Spring Vineyard Tasks, Careers, and Tools table.
4. Ask participants to develop a list of careers based on the tasks identified.
 - Compare with each other and with the one provided in the Spring Vineyard Tasks, Careers, and Tools table.
5. Ask participants to work with a partner to develop a poster that includes at least three responsibilities they think a particular career would have. (Use virtual whiteboard or paper.)
 - Allow time for each pair to share their poster.
6. Have the participants select the appropriate tool and task cards to connect with each career after posters have been shared. Ensure they explain why they are placing the task or career in an appropriate sequence. The participants are correct if their explanation seems reasonable.
7. Wrap-up
 - Have participants record three main points in their Participant Notebooks that they learned about the careers, tasks, and tools.
 - Have participants share round-robin their favorite career, task, or tool.
 - You may want each participant to select a different career, task, or tool to share.





Spring in the Vineyard Scenario 1

Pruning

It is a balmy 20 °F and snow is in the forecast. The apprentice, Derrick, has just completed his online course in spring viticulture. He is going to demonstrate to his mentor his knowledge of pruning Marquette, a red grape developed by the University of Minnesota. The winery he works for makes an award-winning Rosé from these grapes, so Derrick wants to make sure that his pruning decisions take into account the desired cropping levels of 3 tons per acre. As he prepares for a day in the vineyard, he sharpens his tools, dresses in several warm layers, and fills his thermos with coffee.

Directions:

1. Have participants work in pairs to read the vineyard scenario.
2. Have them work in pairs to discuss and answer the questions.

Questions:

1. Who and what is in the vineyard (people, animals, insects, fungi)?
2. What vineyard careers are represented by the people in the vineyard?
3. What is each person doing in this vineyard scenario?
4. Are they using special equipment for what they are doing in the vineyard?
5. Why is what they are doing important for the success of the vineyard?
6. What evidence is provided that tells you about the current season in the vineyard?

Spring in the Vineyard Scenario 2

Soil Sampling and Amendments

A vineyard consultant, Dave walks a future vineyard site with the owner discussing potential plans for later this spring. A crew operating backhoes follow behind them ready to dig soil pits. Dave would like to assess the soil horizon and collect soil samples on the 35-acre site. Based on the micronutrients and macronutrients, he will make suggestions on soil amendments, cover crops, and the grape varieties including rootstock he recommends to plant. Dave is hoping that he can convince the reluctant owner to use organic agricultural practices from the onset. He believes that with proper variety selection, trellis systems, rootstock, compost applications, active scouting, good integrated pest management practices, and precisely timed sprays that he can manage this vineyard organically.

Directions:

1. Have participants work in pairs to read the vineyard scenario.
2. Have them work in pairs to discuss and answer the questions.

Questions:

1. Who and what is in the vineyard (people, animals, insects, fungi)?
2. What vineyard careers are represented by the people in the vineyard?
3. What is each person doing in this vineyard scenario?
4. Are they using special equipment for what they are doing in the vineyard?
5. Why is what they are doing important for the success of the vineyard?
6. What evidence is provided that tells you about the current season in the vineyard?





Spring in the Vineyard Scenario 3

Planting a New Vineyard

On a sunny day in the early spring, a group of friends gather to help their creative, entrepreneurial, hobby-farming friend, Dr. John, plant a new vineyard. He keeps a large garden and 2 acres of heirloom apples, pears, and apricots as well as three horses and two alpacas. He enjoys entertaining under his grape-covered pergola next to his large duck pond. Last fall, Dr. John met with a vineyard consultant, visited a local winery to talk with a winemaker, and mapped out a plan to add 1 acre of Marquette grape vines to his 10-acre farm. The 630 dormant bareroot vines were shipped from a grape breeder in upstate New York on May 12 and have been sitting in large buckets of water rehydrating in the barn. Dr. John and his friends plant the vines into the predrilled holes. It has been very wet this spring. Covered in mud, they struggle to move vehicles, even the tractor, through the waterlogged soil. It takes an exceptionally long time to plant each vine. When they are finally done, they celebrate, muddy, by a bonfire.

Directions:

1. Have participants work in pairs to read the vineyard scenario.
2. Have them work in pairs to discuss and answer the questions.

Questions:

1. Who and what is in the vineyard (people, animals, insects, fungi)?
2. What vineyard careers are represented by the people in the vineyard?
3. What is each person doing in this vineyard scenario?
4. Are they using special equipment for what they are doing in the vineyard?
5. Why is what they are doing important for the success of the vineyard?
6. What evidence is provided that tells you about the current season in the vineyard?

References and Resources

Goldammer, T. (2018). *Grape grower's handbook: A guide to viticulture for wine production* (3rd ed.) Apex Publishers. <https://wine-grape-growing.com/>

Michigan State University Extension. (2020). *A pocket guide for grape IPM scouting in north central and eastern United States*. pgs. 132-133. https://www.canr.msu.edu/grapes/integrated_pest_management/





Spring Task Cards

Protect the vines from frost damage using fans

Tie canes to the trellis

Protect the vines from frost damage using fire

Thin shoots

Protect the vines from frost damage using water

Verify employment eligibility of laborers

Check vines for pests and diseases

Repair or install trellis systems

Spray for pests and diseases

Contact a soil expert to test and report on the vineyard soil needs

Amend the soil as needed by machine

Amend the soil as needed by hand



Spring Career Cards

Laborer	Laborer
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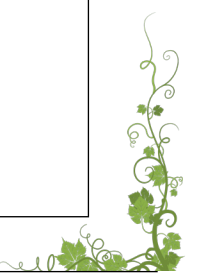
Laborer	Laborer
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Laborer	Laborer
----------------	----------------

Vineyard manager	Office manager
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Equipment operator	Laborer
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Outside service	Equipment operator
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Spring Tool Cards

Fans

Fire (similar to a campfire)

Water, sprayer

Hands, eyes

Sprayer, gloves, and other personal protective equipment

Ties (string, zip ties, twist ties)

Hand pruners

Phone, computer

Tractor, post digger, posts, spinning jenny, wire, hand tools

Shovel, soil probe, bucket, soil testing box, phone/mail, soil test report

Fertilizer spreader

Tractor and fertilizer spreader



Summer in the Vineyard

Lesson 7

Overview: Participants will explore what happens in a vineyard in summer and the careers connected with these activities.

Age Level: 12–19 years

Season: Summer

Viticulturist: Required

Location: Vineyard

Time: 60 minutes. This lesson is designed to be used multiple times.

Objectives:

Participants will be able to:

- List at least three things that need to happen in the summer in the vineyard.
- Identify the key careers for activities required in the vineyard in the summer.
- Explain one task that can only be done in the summer.

Materials:

- Writing utensils (one for each participant)
- Portable whiteboard or flipchart
- Markers
- Summer Task Cards
- Summer Career Cards
- Summer Tool Cards
- Extra index or blank cards as needed
- Poster board, paper, or online poster tools such as Canva
- Participant Notebook 7-1 “Summer in the Vineyard General Questions”
- Participant Notebook 7-2 “Careers in the Vineyard Interview Questions”
- Participant Notebook 7-3 “Seasonal Scenarios for Summer”

Vocabulary: hedging, training system, trellis, trellis system, tucked

Summer in the Vineyard



Figure 7-1. Early summer grape bloom. Photo credit: Esmaeil Nasrollahiazar

Background:

- Berries are self-pollinated when their flowers reach full bloom.
- Small berries begin to form after pollination and grow into a cluster.
- After berry clusters are fully formed, leaf removal is needed to ensure the berries are fully exposed to sunlight.
 - In the warm summer months (especially if there is a lot of rain), green shoots grow and canopy management is required.
 - As new shoots emerge, they are trained (or positioned) into a *training system*. The training system is the way the vines will be pruned and trellised for fruit growth and quality. A *trellis system* is a group of related structures (trellises) that support the vines. The design of the trellis system is determined by the outcomes desired by the grower.
 - As the shoots grow, they are *tucked*, or woven, into the trellis system by hand or machine.
 - When the canopy fills out, *hedging*, trimming the vines into the desired shape, is needed.
- Learn more about scouting for pests and diseases. For more information, see Lesson 13 “Integrated Pest Management: Why Is Pest Management Important?”
 - Scout for insects.
 - Apply chemicals for insects as needed.
 - Scout for diseases.
 - Apply chemicals for prevention and control of diseases.
- Other vineyard management activities:
 - Mow between rows of vines.
 - Control weeds at the base of the vines.



Procedure:

Before the meeting:

- After reading the background information, decide which careers you would like to explore with the participants by examining the "Careers" section.
- If you are planning to visit a vineyard:
 - Talk with your viticulturist contact and discuss the objective: Participants will learn about things that need to happen in the summer in the vineyard.
 - Share with your contact that another objective of this visit is for participants to interview and identify the key careers and activities required in the vineyard in the summer.
- Send a list of potential interview questions to your contact at the vineyard if you are planning to visit a vineyard and interview employees.
 - What is your job title?
 - When and how did you discover you were interested in a viticulture career?
 - What was your educational pathway to this career?
 - How did you learn this position was available, and how did you apply for it?
 - Where would you look today to find positions available in a vineyard?
 - What are the three main responsibilities of your job?
 - What is the most rewarding part of your job?
 - What are three challenges to doing your job?
 - Would you recommend a career in viticulture?
 - Why do you like coming to work every day?
- Print and cut the Summer in the Vineyard Task, Career, and Tool cards for the activities (Charades, Career Wall, What Comes First?) you plan to do during your meeting. (The cards are at the end of this lesson. Separate them into a pile for each section: tasks, careers, and tools.) The following table contains everything that appears on the cards.

Summer Vineyard Tasks, Careers, and Tools

Task (summer)	Career	Tool
Leaf removal by hand	Laborer	Hand pruners, gloves
Leaf removal by machine	Equipment operator	Tractor, mechanical leaf remover
Weave/tie new shoots to trellis system by hand	Laborer	Plastic vineyard ties
Weave/tie new shoots to trellis system by machine	Equipment operator	Tying machine
Trim canopy to desired shape	Laborer	Hand pruners, machete
Check for pests and diseases	Vineyard manager	Eyes, hands
Spray for pests and diseases	Laborer	Sprayer, gloves, and other personal protective equipment
Mow between rows	Laborer	Tractor, mower
Weed around the base of vines	Laborer	Hands, bucket, gloves, gardening hand tools
Mulch to prevent weed around vines	Laborer	Hands, mulching fork, tractor, wagon
Check employment eligibility and schedule additional help for harvesting in fall	Office manager	Phone, computer





During the meeting:

At the vineyard:

1. Allow participants 1 minute to move around and make observations in the predetermined area.
 - Participants should be looking for things unique to summer in the vineyard.
2. They should record their observations in Participant Notebook 7-1 "Summer in the Vineyard."
3. Ask them to share out round-robin style until all observations have been listed.
 - Record shared observations on a flipchart or portable whiteboard.
4. Using the list generated, ask participants what summer tasks they think should happen in the vineyard, and have them record them in their Participant Notebooks.
5. Ask participants to share out round-robin style until all tasks have been listed.
 - Record tasks on a flipchart or portable whiteboard.
 - Compare the tasks the participants identify with those listed in the background information and add any task they do not mention.
6. Ask them to brainstorm what careers they think are necessary during the summer, based on the observations and the task list they developed.
 - Have them compare their brainstorming with the career information provided.
7. If possible, interview vineyard staff who are working during the summer in the vineyard.
 - Encourage participants to use the questions from the "Before the Meeting" section and their own questions. (Use Participant Notebook 7-2 "Careers in the Vineyard Interview Questions.")

At the next meeting:

At your club meeting space:

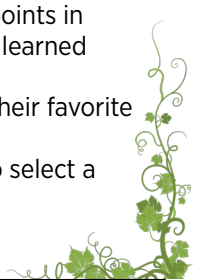
1. Play games such as charades, "What Comes First?" and Career Wall to help participants better understand what is happening in the vineyard.
 - Play charades using the Summer Task Cards.
 - Play "What Comes First?"
 - Pass out the Summer Task Cards to participants and have them line up or arrange the cards in the order they think the tasks should occur.
 - Allow time for discussion.
 - The facilitator should ask questions to help participants to understand that some of the tasks reoccur and can happen in a variety of orders.
 - Play Career Wall. Use the "What Comes First?" timeline to connect careers and tools to the tasks.
 - Pass out Summer Career Cards to the participants and have them connect them with the appropriate tasks. You may need to make more cards.

- Pass out the Summer Tool Cards and have participants connect them with the careers and tasks.
 - Discuss the connections between tasks, careers, and tools.
2. Wrap-up:
 - Have participants record three main points in their Participant Notebooks that they learned about the careers, tasks, and tools.
 - Have participants share round-robin their favorite career, task or tool.
 - You may want each participant to select a different task or career to share.

Supplemental activities:

If participants are unable to meet in a vineyard, the following activities may be used, or as supplemental activities during your club meetings.

1. Ask participants to brainstorm together what they think is happening in the vineyard during the summer.
2. Have participants look at Participant Notebook 7-3 "Seasonal Scenarios for Summer."
 - Have participants read the scenarios or read them aloud to the group, and then answer the questions included.
3. As participants think about the seasonal scenarios story, ask them to brainstorm and make a list of the tasks they think might happen in the summer in a vineyard.
 - Compare lists with each other and with the one provided in the Summer Vineyard, Tasks, Careers, and Tools table.
4. Ask participants to develop a list of careers based on the tasks identified.
 - Compare lists with each other and with the one provided in the Summer Vineyard, Tasks, Careers, and Tools table.
5. Ask participants to work with a partner to develop a poster that includes at least three responsibilities they think a particular career would have. (Use virtual whiteboard or paper.)
 - Allow time for each pair to share their poster.
6. Have the participants select the appropriate tool and task cards to connect with each career after posters have been shared. Ensure they explain why they are placing the task or career in an appropriate sequence. The participants are correct if their explanation seems reasonable.
7. Wrap-up:
 - Have participants record three main points in their Participant Notebooks that they learned about the careers, tasks, and tools.
 - Have participants share round-robin their favorite career, task, or tool.
 - You may want each participant to select a different task or career to share.





Summer in the Vineyard Scenario 1

Weather and Pests

Brian, a vineyard owner and winemaker, is in the vineyard with his dog Waves. He is using a spinning jenny to assist in stringing the third and top trellis wire to the steel vineyard posts in a 3-year-old planting. Brian will use this third wire to continue to train the vines. It is important to train young vines at this time of year.

It has been a hot and humid summer, so he is spending the afternoon lifting and tucking young vines in an upright position so that he can spray for powdery and downy mildew. The Old Mission AVA (American Viticultural Area) is suitable for growing Pinot Grigio; however, the high humidity of the summer has intensified the need to spray.

Directions:

1. Have participants work in pairs to read the vineyard scenario.
2. Have them work in pairs to discuss and answer the questions.

Questions:

1. Who and what is in the vineyard (people, animals, insects, fungi)?
2. What vineyard careers are represented by the people in the vineyard?
3. What is each person doing in this vineyard scenario?
4. Are they using special equipment for what they are doing in the vineyard?
5. Why is what they are doing important for the success of the vineyard?
6. What evidence is provided that tells you about the current season in the vineyard?

Summer in the Vineyard Scenario 2

Hedging and Canopy Management After Hail

Piper is the vineyard manager for a large fruit farming company. On August 2, several of the farms she manages were hit by a rare damaging hailstorm. After the storm, she inspects the damage to the canopy, canes, and berries in one of the vineyards caused by 1-inch to 2-inch diameter ice balls. After surveying the extensive damage in the Riesling block, she has instructed the vineyard crew how to use hand pruners to remove the severely damaged leaves and any clusters that have visible signs of hail damage. She will come through with a follow-up spray to eliminate any fungal pathogens that may take advantage of the bruised and battered fruit. Damage will be reassessed weekly until harvest because even a small bruise can turn into a full-scale rot in a short period of time when certain conditions are met. Piper estimates that at least half of the crop was damaged during this one event. It may impact the vines' ability to fully ripen the remaining grapes and negatively impact next year's crop. Her next call will be to her crop insurance provider.

Directions:

1. Have participants work in pairs to read the vineyard scenario.
2. Have them work in pairs to discuss and answer the questions.

Questions:

1. Who and what is in the vineyard (people, animals, insects, fungi)?
2. What vineyard careers are represented by the people in the vineyard?
3. What is each person doing in this vineyard scenario?
4. Are they using special equipment for what they are doing in the vineyard?
5. Why is what they are doing important for the success of the vineyard?
6. What evidence is provided that tells you about the current season in the Vineyard?





References and Resources

Goldammer, T. (2018). *Grape grower's handbook: A guide to viticulture for wine production* (3rd ed.) Apex Publishers. <https://wine-grape-growing.com/>

Michigan State University Extension. (2020). *A pocket guide for grape IPM scouting in north central and eastern United States*. pgs. 132-133. https://www.canr.msu.edu/grapes/integrated_pest_management/





Summer Tasks Cards

Leaf removal by hand

Leaf removal by machine

Weave/tie new shoots to trellis system by hand

Weave/tie new shoots to trellis system by machine

Trim canopy to desired shape

Check for pests and diseases

Spray for pests and diseases

Mow between rows

Weed around the base of vines

Mulch to prevent weed around vines

Check employment eligibility and schedule additional help for harvesting in fall



Summer Careers Cards

Laborer	Laborer
Laborer	Laborer
Laborer	Laborer
Vineyard manager	Office manager
Equipment operator	Laborer
Outside service	Equipment operator





Summer Tools Cards

Hand pruners, gloves	Tractor, mechanical leaf remover
Plastic vineyard ties	Tying machine
Hand pruners, machete	Eyes, hands
Sprayer, gloves, and other personal protective equipment	Tractor, mower
Hands, bucket, gloves, gardening hand tools	Hands, mulching fork, tractor, wagon
Phone, computer	





Fall in the Vineyard

Lesson 8

Overview: Participants will explore what happens in a vineyard in fall and the careers connected with these activities.

Age Level: 12–19 Years

Season: Fall

Viticulturist: Required

Location: Vineyard

Time: 60 minutes. This lesson is designed to be used multiple times.

Objectives:

Participants will be able to:

- List at least three things that need to happen in the fall in the vineyard.
- Identify the key careers for activities required in the vineyard in the fall.
- Explain one task that can only be done in the fall.

Materials:

- Writing utensils (one for each participant)
- Portable whiteboard or flipchart
- Markers
- Fall Task Cards
- Fall Career Cards
- Fall Tool Cards
- Extra index or blank cards as needed
- Poster board, paper, or online poster tools such as Canva
- Participant Notebook 8-1 “Fall in the Vineyard General Questions”
- Participant Notebook 8-2 “ Careers in the Vineyard Interview Questions”
- Participant Notebook 8-3 “ Seasonal Scenarios for Fall”

Vocabulary: lug, rachis

Fall in the Vineyard



Figure 8-1. Véraison of a grape cluster. Photo credit: Esmaeil Nasrollahiazar

Background:

A potential list of activities that occur in the fall follows:

- Winemakers and vineyard managers begin to sample berries for ripeness.
 - Ripeness is determined by color, Brix, and titratable acid (TA). For more information, refer to Lesson 5 “Grape Chemistry: Are the Grapes Ready for Harvest?”
 - Grape clusters tighten and berries fill with water.
 - Green vegetative growth slows down and energy is sent to the berries.
 - *Véraison* begins as berries fill with water. *Véraison* is defined in Lesson 4 “Pruning Dormant Grapevines: When and Why Should Grapevines Be Pruned?” as the stage when the berries soften and change color.
- Vineyard managers may need to remove damaged berries or clusters.
 - The damage is generally caused by natural weather events such as hail, early frost, or excessive moisture.
- Vineyard managers regularly scout (check) for diseases on the vines and fruit. Learn more about scouting in Lesson 13 “Integrated Pest Management: Why Is Pest Management Important?”
 - Chemical applications may be used to manage diseases if there is enough time before harvest.
- Birds, insects, and mammals may come into the vineyard to eat ripening berries.
 - Bird netting or lasers may be installed.
 - Electric fences may be installed.
 - Noisemakers may be deployed.
- When the berries are ripe, the entire cluster is harvested.



- Hand harvesting is done with hand pruners, removing the entire cluster by cutting the rachis, the central stem of the grape cluster (See Figure 8-2.).

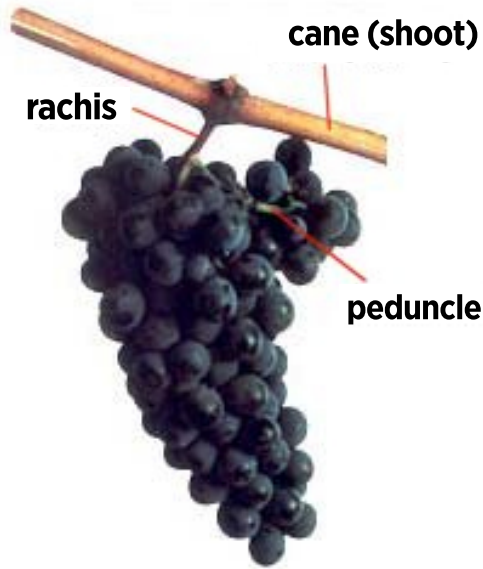


Figure 8-2. Grape cluster identification. Created by KJMDigital

- The fruit is loaded into 25-pound lugs. A lug is a shallow container used for harvesting. The grapes are then combined into large picking bins and transported for processing.
- Machine harvesting is an option growers may use. As technology has improved, so has the quality and reliability of mechanical harvesters.
- In the Midwest and eastern United States, harvest typically begins in September and can last until November – or even later for ice wine.
 - Berries for ice wine need to be on the vine during a hard freeze.
- Snow, rain, and colder temperatures cause the leaves to fall off the vine.
 - When the leaves fall off the vines, berries will no longer ripen.

Procedure:

Before the meeting:

1. After reading the background information, decide which careers you would like to explore with participants by examining the “Careers” section.
2. If you are planning to visit a vineyard:
 - Talk with your viticulturist contact and discuss the objective: Participants will learn about things that need to happen in the fall in the vineyard.
 - Share with your contact that another objective of this visit is for participants to interview and identify the key careers and activities required in the vineyard in the fall.
3. Send a list of potential interview questions to your contact at the vineyard if you are planning to visit a vineyard and interview employees.
 - What is your job title?
 - When and how did you discover you were interested in a viticulture career?
 - What was your educational pathway to this career?
 - How did you learn this position was available, and how did you apply for it?
 - Where would you look today to find positions available in a vineyard?
 - What are the three main responsibilities of your job?
 - What is the most rewarding part of your job?
 - What are three challenges to doing your job?
 - Would you recommend a career in viticulture?
 - Why do you like coming to work every day?
4. Print and cut the Fall in the Vineyard Task, Career, and Tool cards for the activities (Charades, Career Wall, “What Comes First?”) you plan to do during your meeting. (The cards are at the end of this lesson. Separate them into a pile for each section: tasks, careers, and tools.) The following table contains everything that appears on the cards.





Fall Vineyard Tasks, Careers, and Tools

Task (Fall)	Career	Tools
Removed damaged berries or clusters	Laborer	Hand pruners
Check berries/vines for insect pests and diseases	Vineyard manager	Eyes, hands
Spray vines for insect pests and diseases	Laborer	Sprayer, gloves, and other personal protective equipment
Check berries on the vines for ripeness	Vineyard manager	Hands, eyes, mouth
Check Brix of the berries with a refractometer	Winemaker/lab technician	Refractometer
Verify employment eligibility of laborers	Office manager	Computer, phone
Install nets to keep out birds	Laborer	Nets, rope, poles
Install electric fences	Laborer	Electrical fence, post hole digger, pliers
Deploy noise makers to chase birds away	Laborer	Noise makers
Harvest ripe berry clusters from the vines by hand	Laborer	Hand pruners
Harvest ripe berry clusters from the vines by machine	Equipment operator	Grape harvester
Carry lugs of berries to the wagon	Laborer	Lugs, tractor, wagon

During the meeting:

At the Vineyard

1. Allow participants 1 minute to move around and make observations in the predetermined area.
 - Participants should be looking for things unique to fall in the vineyard.
2. They should record their observations in Participant Notebook 8-1 "Fall in the Vineyard General Questions."
3. Ask them to share out round-robin style until all observations have been listed.
 - Record shared observations on a flipchart or portable whiteboard.
4. Using the list generated, ask participants what fall tasks they think should happen in the vineyard, and have them record them in their Participant Notebooks.
5. Ask participants to share out round-robin style until all tasks have been listed.
 - Record tasks on a flipchart or portable whiteboard.
 - Compare the tasks the participants identify with those listed in the background information and add any task they do not mention.
6. Ask them to brainstorm what careers they think are necessary during the fall, based on the observations and the task list they developed.
 - Have them compare their brainstorming with the career information provided.
7. If possible, interview vineyard staff who are working during the fall in the vineyard.
 - Encourage participants to use the questions from the "Before the Meeting" section and their own questions. (Use Participant Notebook 8-2 "Careers in the Vineyard Interview Questions.")



**At the next meeting:**

At your club meeting space:

1. Play games such as charades, "What Comes First?" and Career Wall to help participants better understand what is happening in the vineyard.
 - Play charades using the Fall Task Cards.
 - Play "What Comes First?"
 - Pass out the Fall Task Cards to participants and have them line up or arrange the cards in the order they think the tasks should occur.
 - Allow time for discussion.
 - The facilitator needs to ask questions to help participants to understand that some of the tasks reoccur and can happen in a variety of orders.
 - Play Career Wall. Use the "What Comes First?" timeline to connect careers and tools to the tasks.
 - Pass out Fall Career Cards to the participants and have them connect them with the appropriate tasks. You may need to make more cards.
 - Pass out the Fall Tool Cards and have participants connect them with the careers and tasks.
 - Discuss the connections between tasks, careers, and tools.
2. Wrap-up:
 - Have participants record three main points in their Participant Notebooks that they learned about the careers, tasks, and tools.
 - Have participants share round-robin their favorite career, task, or tool.
 - You may want each participant to select a different task or career to share.

Supplemental activities:

If participants are unable to meet in a vineyard, the following activities may be used, or as supplemental activities during your club meetings.

1. Ask participants to brainstorm together what they think is happening in the vineyard during the fall.
2. Have participants look at Participant Notebook 8-3 "Seasonal Scenarios for Fall."
 - Have participants read the scenarios or read them aloud to the group, and then answer the questions included.
3. As participants think about the seasonal scenarios story, ask them to brainstorm and make a list of the tasks they think might happen in the fall in a vineyard.
 - Compare lists with each other and with the one provided in the Fall Vineyard Tasks, Careers, and Tools table.
4. Ask participants to develop a list of careers based on the tasks identified.
 - Compare lists with each other and with the one provided in the Fall Vineyard Tasks, Careers, and Tools table.
5. Ask participants to work with a partner to develop a poster that includes at least three responsibilities they think a particular career would have. (Use a virtual whiteboard or paper.)
 - Allow time for each pair to share their poster.
6. Have participants select the appropriate tool and task cards to connect with each career after posters have been shared. Ensure they explain why they are placing the task or career in an appropriate sequence. The participants are correct if their explanation seems reasonable.
7. Wrap-up:
 - Have participants record three main points in their Participant Notebooks that they learned about the careers, tasks, and tools.
 - Have participants share round-robin their favorite career, task, or tool.
 - You may want each participant to select a different task or career to share.





Fall in the Vineyard Scenario 1

Late Season Leaf Removal

Peter is the farm and vineyard manager for a 100-acre Centennial farm. On the farm, they grow grapes, apples, cherries, and other fruits. Peter manages a large crew of temporary, seasonal, nonimmigrant skilled farm workers from Honduras, referred to as H2A workers. Section 218 of the Immigration and Nationality Act authorizes the lawful admission into the United States of temporary, nonimmigrant workers (H-2A workers) to perform agricultural labor or services of a temporary or seasonal nature. Today, he will be directing the workers in late season leaf removal around the fruiting zone of the high value Cabernet Franc that has just gone through véraison. Véraison is the stage of development when berries begin to soften and change color. Peter and the workers will be removing leaves that block sunlight from reaching the clusters of grapes. Both light exposure and temperature influence the amount of sugar and acid produced in the grapes.

Directions:

1. Have participants work in pairs to read the vineyard scenario.
2. Have them work in pairs to discuss and answer the questions.

Questions:

1. Who and what is in the vineyard (people, animals, insects, fungi)?
2. What vineyard careers are represented by the people in the vineyard?
3. What is each person doing in this vineyard scenario?
4. Are they using special equipment for what they are doing in the vineyard?
5. Why is what they are doing important for the success of the vineyard?
6. What evidence is provided that tells you about the current season in the vineyard?

Fall in the Vineyard Scenario 2

Netting and Other Pest Protection

Janelle smiles as she drives the tractor down the narrow vineyard row on a hazy late fall afternoon. She chats with Dylan, the harvest intern behind her. Dylan feeds the end of the second bag of bird netting through the eye of the net machine. Marco and Jimi pull the nets over and down the sides of each vine as the tractor slowly moves forward. It is a team effort to cover each 250-foot row with nets. The nets protect the vines from the local wildlife: birds, deer, and raccoons. Birds, particularly the non-native invasive starling, can destroy an entire crop in an extraordinarily short period of time. Janelle explains to Dylan that when you are in the migratory path of the starling, you must use nets to protect the grapes. The nets will remain over the vines until the grapes are harvested. Janelle explains that when all the other picking is done on the farm, hopefully before the snow, Dylan will need to return and help bag and store the nets until next year.

Directions:

1. Have participants work in pairs to read the vineyard scenario.
2. Have them work in pairs to discuss and answer the questions.

Questions:

1. Who and what is in the vineyard (people, animals, insects, fungi)?
2. What vineyard careers are represented by the people in the vineyard?
3. What is each person doing in this vineyard scenario?
4. Are they using special equipment for what they are doing in the vineyard?
5. Why is what they are doing important for the success of the vineyard?
6. What evidence is provided that tells you about the current season in the vineyard?





Resources

Goldammer, T. (2018). *Grape grower's handbook: A guide to viticulture for wine production* (3rd ed.) Apex Publishers. <https://wine-grape-growing.com/>

Michigan State University Extension. (2020). *A pocket guide for grape IPM scouting in north central and eastern United States*. pgs. 132-133. https://www.canr.msu.edu/grapes/integrated_pest_management/





Fall Task Cards

Removed damaged berries or clusters

Check berries/vines for insect pests and diseases

Spray vines for insect pests and diseases

Check berries on the vines for ripeness

Check Brix of the berries with a refractometer

Verify employment eligibility of laborers

Install nets to keep out birds

Install electric fences

Deploy noise makers to chase birds away

Harvest ripe berry clusters from the vines by hand

Harvest ripe berry clusters from the vines by machine

Carry lugs of berries to the wagon



Fall Career Cards

Laborer	Laborer
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Vineyard manager	Office manager
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Laborer	Vineyard manager
----------------	-------------------------

Laborer	Laborer
----------------	----------------

Laborer	Laborer
----------------	----------------

Equipment operator	Winemaker/ lab technician
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Fall Tool Cards

Hand pruners	Eyes, hands
Sprayer, gloves, and other personal protective equipment	Hands, eyes, mouth
Refractometer	Computer, phone
Nets, rope, poles	Electrical fence, post hole digger, pliers
Noise makers	Hand pruners
Grape harvester	Lugs, tractor, wagon





Winter in the Vineyard

Lesson 9

Overview: Participants will explore what happens in a vineyard in the winter and the careers connected with these activities.

Age Level: 12–19 years

Season: Winter

Viticulturist: Required

Location: Vineyard

Time: 60 minutes. This lesson is designed to be used multiple times.

Objectives:

Participants will be able to:

- List at least three things that need to happen in the winter in the vineyard.
- Identify the key careers for activities required in the vineyard in the winter.
- Explain one task that can only be done in the winter.

Materials:

- Writing utensils (one for each participant)
- Portable whiteboard or flipchart
- Markers
- Winter Task Cards
- Winter Career Cards
- Winter Tool Cards
- Extra index or blank cards as needed
- Poster board, paper, or online poster tools such as Canva
- Participant Notebook 9-1 “Winter in the Vineyard General Questions”
- Participant Notebook 9-2 “Careers in the Vineyard Interview Questions”
- Participant Notebook 9-3 “Seasonal Scenarios for Winter”

Vocabulary: cambium, dormancy, graft union, hardy, herbicide, pre-emergent herbicide, rootstock, scion

Winter in the Vineyard



Figure 9-1. Winter in the vineyard. Photo credit: Esmael Nasrollahiazar

Background:

- Grapevines enter a required period of *dormancy*. *Dormancy* is the state in which a plant is alive but not actively growing, as defined in Lesson 4 “Pruning Dormant Grapevines: When and Why Should Grapevines Be Pruned?” In the winter, there is no photosynthesis occurring and little metabolic activity. Dormancy occurs after the fruit has been harvested as temperatures approach 45 °F.
 - Vinifera grapes are hardy to -7 °F. When a plant is *hardy*, it means that the grapevine will withstand temperatures to a certain degree.
 - Cold climate grapes, or cold hardy grapes, are hardy to -40 °F. Vinifera grapes are not as hardy as cold climate grapes. Cold climate grapes were specifically bred to withstand very cold temperatures.
- Grapevines can be susceptible to winter damage and the freeze-thaw cycle. Deep snow in winter can help insulate the *graft union*, the precise spot where the *scion*, a shoot system, and the *rootstock*, root of a different grape species, join to make a grafted vine.
 - Some growers are experimenting with burying grapevines under the snow.
 - Hilling up soil around a grafted vine protects it during the winter.
 - Mulching vines can also be protective during winter.
- Required pruning occurs throughout the winter. For more information, see Lesson 4 “Pruning Dormant Grapevines: When and Why Should Grapevines Be Pruned?”





- As snow melts, growers inspect vines for winter damage from cold or animals.
- Growers must complete many management tasks in the winter. They should:
 - Order new vines for new plantings, or replace vines where needed in existing crop blocks.
 - Keep vineyard records.
 - Prepare and file annual business taxes.
 - Plan for the coming year.
 - Clean and repair all vineyard tools and equipment.
- Vines begin to break dormancy in the winter when the temperature reaches 55 °F as sap begins to flow.
- An *herbicide* is a substance used to destroy or limit unwanted plants such as weeds. A *pre-emergent herbicide* is an herbicide used before the weed emerges from the ground. It is used as an under-row chemical treatment is applied just before buds emerge to decrease weed competition.

Note: Under-row cultivators are being developed as an alternative to herbicides. They can be used year-round when the ground is not frozen, but they are typically used during the growing season.

Procedure:

Before the meeting:

1. After reading the background information, decide which careers you would like to explore with participants by examining the “Careers” section.
2. If you are planning to visit a vineyard:
 - Talk with your viticulturist contact and discuss the objective: Participants will learn about things that need to happen in the winter in the vineyard.
 - Share with your contact that another objective of this visit is for participants to interview and identify the key careers and activities required in the vineyard in the winter.
3. Send the list of potential interview questions to your contact at the vineyard if you are planning to visit a vineyard and interview employees.
 - What is your job title?
 - When and how did you discover you were interested in a viticulture career?
 - What was your educational pathway to this career?
 - How did you learn this position was available, and how did you apply for it?
 - Where would you look today to find positions available in a vineyard?
 - What are the three main responsibilities of your job?
 - What is the most rewarding part of your job?
 - What are three challenges to doing your job?
 - Would you recommend a career in viticulture?
 - Why do you like coming to work every day?

4. Print and cut the Winter in the Vineyard Task, Career, and Tool cards for the activities (Charades, Career Wall, What Comes First?) you plan to do during your meeting. (The cards are at the end of the lesson. Separate them into a pile for each section: tasks, careers, and tools). The Following table contains everything that appears on the cards.

Winter Vineyard Tasks, Careers, and Tools

Task (winter)	Career	Tool
Mulch vines for cold protection	Laborer	Shovel, tractor
Prune as needed by hand	Laborer	Hand pruners
Prune as need by machine	Equipment operator	Mechanical pruner
Inspect vines for winter damage	Vineyard manager	Eyes, hands
Clean all vineyard tools	Equipment manager	Tools, rags, oil
Place order for new or replacement vines	Office manager	Phone, computer
Complete year end bookkeeping and file taxes	Office manager	Computer, phone
Preventative weed spraying, applied before grapevines bud	Laborer	Sprayer, gloves, and other personal protective equipment
Annual oil changes and maintenance on machinery	Equipment manager	Machines, oil, hydraulic fluid, spark plugs, air filters

During the meeting:

At the vineyard

1. Allow participants 1 minute to move around and make observations in the predetermined area.
 - Participants should be looking for things unique to winter in the vineyard.
2. They should record their observations in their Participant Notebook 9-1 “Winter in the Vineyard General Questions.”
3. Ask them to share out round-robin style until all observations have been listed.
 - Record shared observations on a flipchart or portable whiteboard.
4. Using the list generated, ask participants what winter tasks they think should happen in the vineyard, and have them record them in their Participant Notebooks.



5. Ask participants to share out round-robin style until all tasks have been listed.
 - Record tasks on a flipchart or portable whiteboard.
 - Compare the tasks the participants identify with those listed in the background information and add any tasks they do not mention.
6. Ask them to brainstorm what careers they think are necessary during the winter, based on the observations and the task list they developed.
 - Have them compare their brainstorming with the career information provided.
7. If possible, interview vineyard staff who are working during the winter in the vineyard.
 - Encourage participants to use the questions from the “Before the Meeting” section and their own questions. (Use Participant Notebook 9-2 “Careers in the Vineyard Interview Questions.”)

At the next meeting:

At your club meeting space:

1. Play games such as charades, “What Comes First?” and Career Wall to help participants better understand what is happening in the vineyard.
 - Play charades using the Winter Task Cards.
 - Play “What Comes First?”
 - Pass out the Winter Task Cards to participants. Have them line up or arrange the cards in the order they think the tasks should occur.
 - Allow time for discussion.
 - The facilitator should ask questions to help participants to understand that some of the tasks reoccur and can happen in a variety of orders.
 - Play Career Wall. Use the “What Comes First?” timeline to connect careers and tools to the tasks.
 - Pass out Winter Career Cards to the participants and have them connect them with the appropriate tasks. You may need to make more cards.
 - Pass out the Winter Tool Cards and have participants connect them with the careers and tasks.
 - Discuss the connections between tasks, careers, and tools.
2. Wrap-up:
 - Have participants record three main points in their Participant Notebooks that they learned about the careers, tasks, and tools.
 - Have participants share round-robin their favorite career, task, or tool.
 - You may want each participant to select a different task or career to share.

Supplemental activities:

If participants are unable to meet in a vineyard, the following activities may be used, or as supplemental activities during your club meetings.

1. Ask participants to brainstorm together what they think is happening in the vineyard during the winter.
2. Have participants look at Participant Notebook 9-3 “Seasonal Scenarios for Winter.”
 - Have participants read the scenarios or read them aloud to the group and then answer the questions included.
3. As participants think about the seasonal scenarios story, ask them to brainstorm and make a list of the tasks they think might happen in the winter in a vineyard.
 - Compare lists with each other and with the one provided in the Winter Vineyard Tasks, Careers, and Tools table.
4. Ask participants to develop a list of careers based on the tasks identified.
 - Compare lists with each other and with the Winter Vineyard Tasks, Careers, and Tools table.
5. Ask participants to work with a partner to develop a poster that includes at least three responsibilities they think a particular career would have. (Use a virtual whiteboard or paper.)
 - Allow time for each pair to share their poster.
6. Have participants select the appropriate tool and task cards to connect with each career after posters have been shared. Ensure they explain why they are placing the task or an appropriate sequence. The participants are correct if their explanation seems reasonable.
7. Wrap-up:
 - Have participants record three main points in their Participant Notebooks that they learned about the careers, tasks, and tools.
 - Have participants share round-robin their favorite career, task, or tool.
 - You may want each participant to select a different task or career to share.





Winter in the Vineyard Scenario 1

Harvesting Grapes for Ice Wine

A Lake Michigan Shore American Viticultural Area grape grower has been patiently waiting for the really cold weather to arrive. He gambled and left 2 acres of Seyval Blanc hanging on the vine for ice wine. He has been waiting for the air temperature to drop way below freezing to 14 °F or below for at least 24 hours or until the berries freeze. According to the U.S. Alcohol and Tobacco Tax and Trade Bureau, natural freezing is the required standard for ice wines. Finally, at 4 a.m., he and his team head out to the snow-covered frozen vineyard to hand-harvest the frozen berries. The heavy lugs are loaded onto a large ice-fishing sled and pulled out of the vineyard by snowmobile. It is a windy and cold December morning to be trudging back and forth in the heavy snow. After the grapes have been moved up to the cellar and loaded into the press, it takes hours for the juice to start flowing with the sweetest juice of this year's harvest. After testing the juice with a refractometer, the grower proudly determines that the juice is 36 °Brix, twice as much sugar as the Seyval Blanc grapes picked in the row over 3 months ago. He is pleased with the delicious flavors of the juice and with his decision to leave 2 acres for ice wine.

Directions:

1. Have participants work in pairs to read the vineyard scenario.
2. Have them work in pairs to discuss and answer the questions.

Questions:

1. Who and what is in the vineyard (people, animals, insects, fungi)?
2. What vineyard careers are represented by the people in the vineyard?
3. What is each person doing in this vineyard scenario?
4. Are they using special equipment for what they are doing in the vineyard?
5. Why is what they are doing important for the success of the vineyard?
6. What evidence is provided that tells you the current season in the vineyard?

Winter in the Vineyard Scenario 2

Dormancy and Assessing Winter Injury

After an exceedingly long week of cold weather caused by a polar vortex reaching down from Canada, vineyard manager Stanley is worried about the vines. He cross-country skis through deep drifts of snow, stopping every so often to inspect a vine. He removes a long shoot and inspects the *cambium*, or woody tissues nearest to the trunk, as well as the dormant buds. Stanley determines that there has been some damage to the vine from the sustained -20 °F temperatures, but it is too early to tell how much damage has been done. He digs the snow out from around the base of a vine. He wants to determine if the graft union of the 5-year-old Pinot Blanc has been damaged by voles. This has been a problem in the past. Seeing none, he skis on to inspect the lower block of Traminette that was planted this year.

Directions:

1. Have participants work in pairs to read the vineyard scenario.
2. Have them work in pairs to discuss and answer the questions.

Questions:

1. Who and what is in the vineyard (people, animals, insects, fungi)?
2. What vineyard careers are represented by the people in the vineyard?
3. What is each person doing in this vineyard scenario?
4. Are they using special equipment for what they are doing in the vineyard?
5. Why is what they are doing important for the success of the vineyard?
6. What evidence is provided that tells you about the current season in the vineyard?





Resources

Goldammer, T. (2018). *Grape grower's handbook: A guide to viticulture for wine production* (3rd ed.) Apex Publishers. <https://wine-grape-growing.com/>

Michigan State University Extension. (2020). *A pocket guide for grape IPM scouting in north central and eastern United States*. pgs. 132-133. https://www.canr.msu.edu/grapes/integrated_pest_management/





Winter Task Cards

Mulch vines for cold protection

Prune as needed by hand

Prune as needed by machine

Inspect vines for winter damage

Clean all vineyard tools

Place order for new or replacement vines

Complete year end bookkeeping and file taxes

Preventative weed spraying, applied before grapevines bud

Annual oil changes and maintenance on machinery



Winter Career Cards

Laborer	Laborer
----------------	----------------

Equipment operator	Vineyard manager
---------------------------	-------------------------

Equipment manager	Office manager
--------------------------	-----------------------

Office manager	Laborer
-----------------------	----------------

Equipment manager	
--------------------------	--





Winter Tool Cards

Shovel, tractor

Hand pruners

Mechanical pruner

Eyes, hands

Tools, rags, oil

Phone, computer

Computer, phone

**Sprayer, gloves, and
other personal
protective equipment**

**Machines, oil, hydraulic
fluid, spark plugs, air
filters...**



Vineyard Mapping: Where Should You Plant the Grapes? Part 1

Lesson 10

Overview: Participants will understand why site maps are important for grape-growing businesses. Using various web-based geospatial technologies, they will explore and analyze site characteristics for their suitability for grapevines. Follow up this activity with Lesson 11 “Vineyard Mapping: Where Should You Plant the Grapes? Part 2.”

Age Level: 12–19

Season: Any

Viticulturist: Not required

Location: Indoor meeting space with computer access

Time: 2 hours

Objectives:

Participants will be able to:

- Identify existing landscape or farm features.
- Identify information needed on a vineyard site map.
- Draw a vineyard site map.
- Identify one career that would be important when mapping a vineyard.

Materials:

- Proposed vineyard site (Google Earth)
- Writing utensils (one for each participant)
- Portable whiteboard or flipchart
- Markers
- Local map
- Paper for maps (large)
- Computer(s)
- Internet access
- Projector
- Google Earth

- U.S. Department of Agriculture (USDA) Web Soil Survey: <https://websoilsurvey.nrcs.usda.gov/app/>
- USDA Plant Hardiness Zone Map: <https://planthardiness.ars.usda.gov/>
- Growing Degree Days: https://www.canr.msu.edu/grapes/weather_climate/growing-degree-days
- Assessing Growing Degree Days With Enviro-Weather: https://www.canr.msu.edu/news/accessing_growing_degree_days_with_enviro_weather
- Participant Notebook 10-1 “Vineyard Mapping: Where Should You Plant the Grapes? Part 1 General Questions”
- Participant Notebook 10-2 “Vineyard Mapping: Where Should You Plant the Grapes? Part 1 Figures”

Vocabulary: cold air drainage, geographic information system (GIS), headlands, isolines, scale, topography, wet feet, wetlands



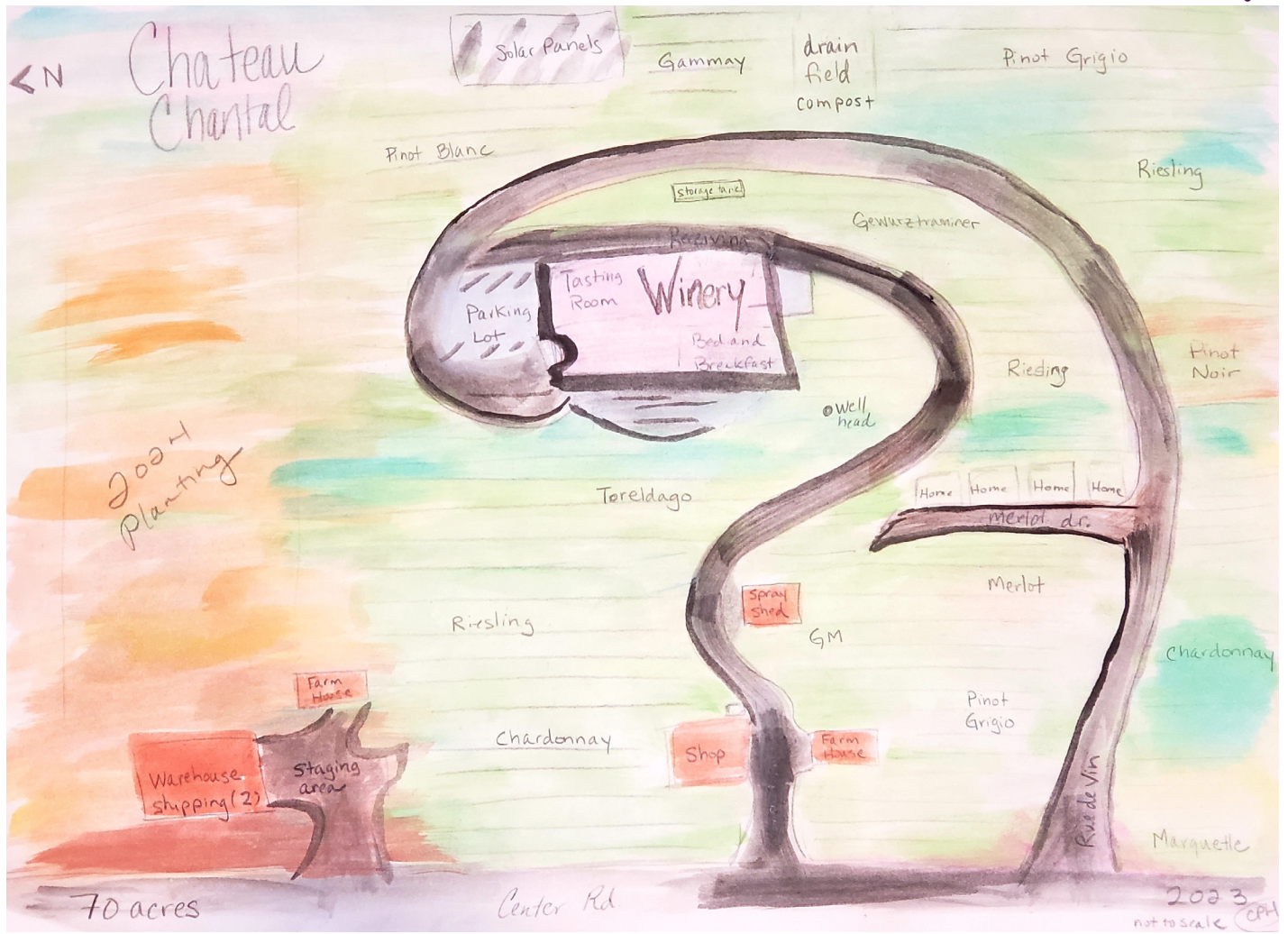


Figure 10-1. Chateau Chantal vineyard site map, Traverse City, Michigan. Drawing credit: Cristin Popelier Hosmer

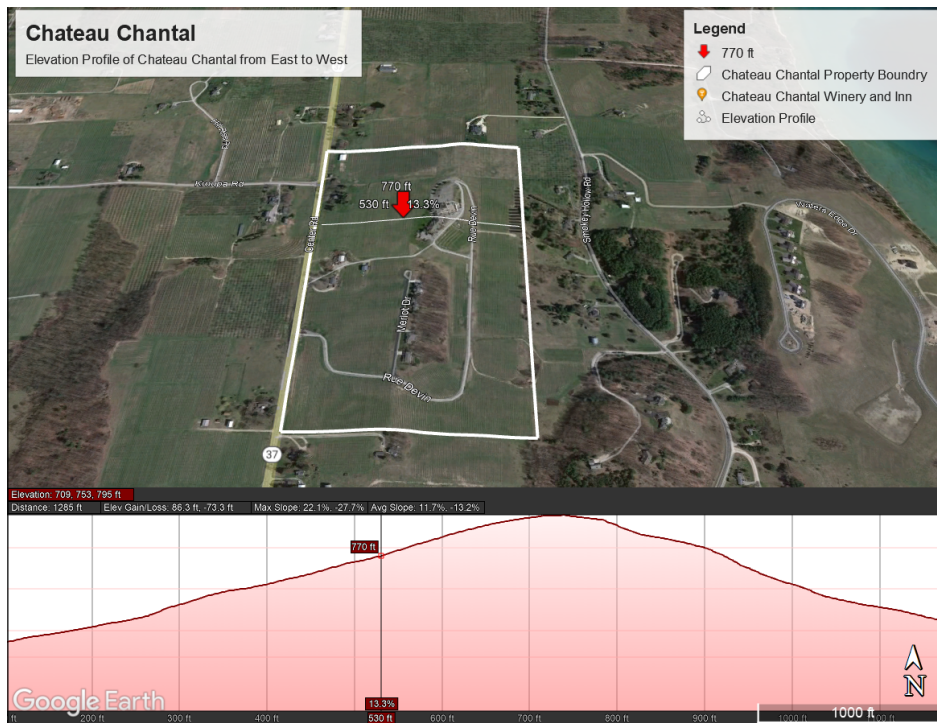


Figure 10-2. Chateau Chantal elevation profile. Credit: Google Earth.



Background:

Selecting the ideal location to establish a vineyard in Michigan requires careful consideration. Potential growers should understand the climate and the land including the *topography*, slope, orientation, and types of soil. (See Figure 10-2.) *Topography* is the configuration of the surface of an area including natural and constructed features. Grapes thrive on sandy, loamy, well-drained soils, which lessens the possibility of *wet feet*. *Wet feet* is a term used in farming when a species does not tolerate wet growing conditions. Wet growing conditions consist of saturated soil, resulting in the lack of oxygen available to the plant roots.



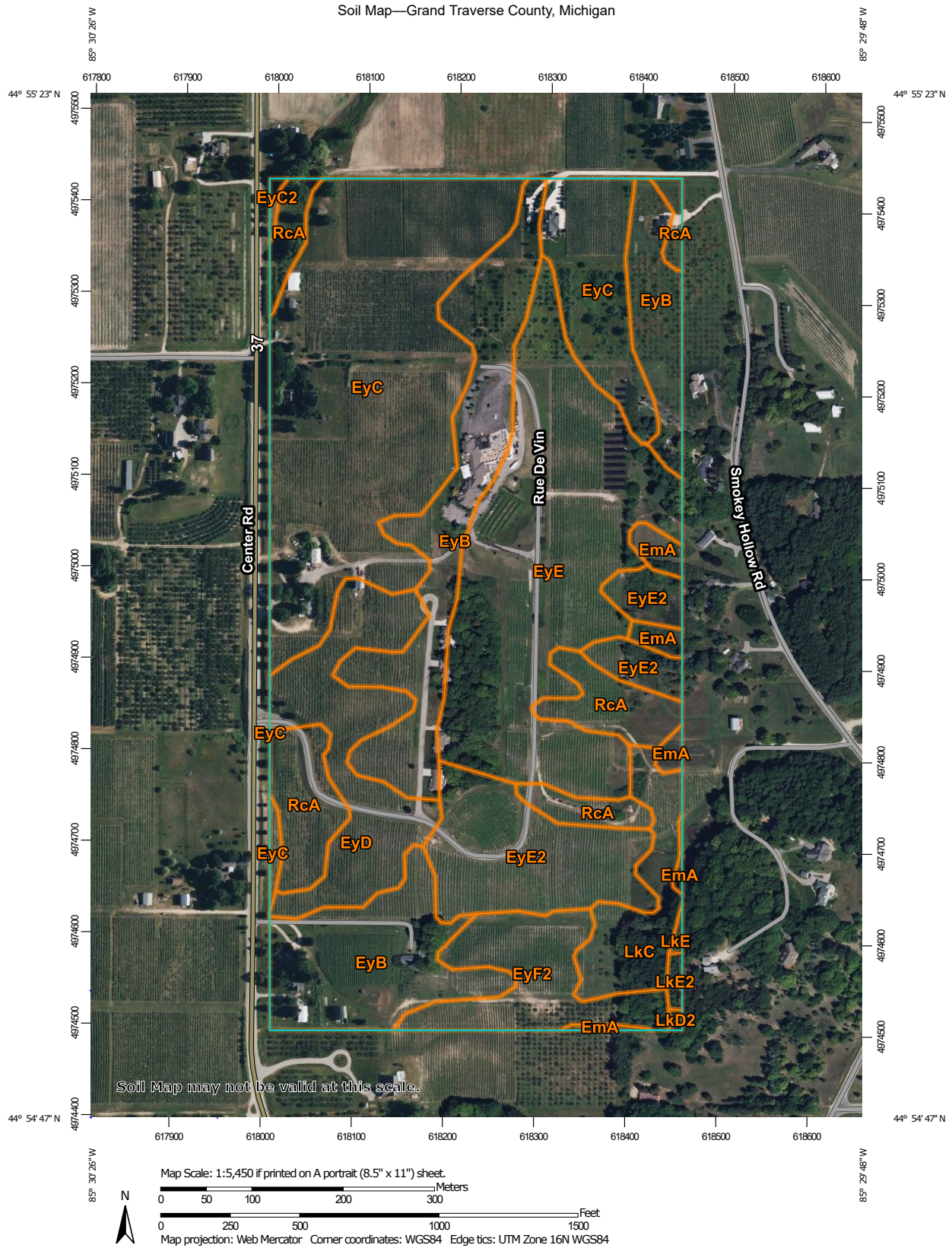


Figure 10-3a. USDA soil survey map of Chateau Chantal vineyards, Traverse City, Michigan. Credit: USDA Natural Resources Conservation Service.



MAP LEGEND		MAP INFORMATION	
Area of Interest (AOI)	Area of Interest (AOI)	Spoil Area	The soil surveys that comprise your AOI were mapped at 1:15,800.
Soils	Soil Map Unit Polygons	Stony Spot	
	Soil Map Unit Lines	Very Stony Spot	Warning: Soil Map may not be valid at this scale. Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.
	Soil Map Unit Points	Wet Spot	
Special Point Features	Blowout	Other	
	Borrow Pit	Special Line Features	
	Clay Spot	Water Features	
	Closed Depression	Streams and Canals	
	Gravel Pit	Transportation	
	Gravelly Spot	Rails	
	Landfill	Interstate Highways	
	Lava Flow	US Routes	
	Marsh or swamp	Major Roads	
	Mine or Quarry	Local Roads	
	Miscellaneous Water	Background	
	Perennial Water	Aerial Photography	
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

Figure 10-3b. Map legend and information to accompany USDA soil sample map Figure 10-3a. Credit: USDA Natural Resources Conservation Service.





Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
EmA	East Lake-Mancelona loamy sands, 0 to 2 percent slopes	1.4	1.4%
EyB	Emmet sandy loam, 2 to 6 percent slopes	20.7	19.8%
EyC	Emmet sandy loam, 6 to 12 percent slopes	28.4	27.2%
EyC2	Emmet sandy loam, 6 to 12 percent slopes, moderately eroded	0.1	0.1%
EyD	Emmet sandy loam, 12 to 18 percent slopes	7.8	7.5%
EyE	Emmet sandy loam, 18 to 25 percent slopes	19.9	19.0%
EyE2	Emmet sandy loam, 18 to 25 percent slopes, moderately eroded	9.1	8.7%
EyF2	Emmet sandy loam, 25 to 45 percent slopes, moderately eroded	5.2	5.0%
LkC	Leelanau-Kalkaska loamy sands, 6 to 12 percent slopes	3.9	3.7%
LkD2	Leelanau-Kalkaska loamy sands, 12 to 18 percent slopes, moderately eroded	0.1	0.1%
LkE	Leelanau-Kalkaska loamy sands, 18 to 25 percent slopes	0.1	0.1%
LkE2	Leelanau-Kalkaska loamy sands, 18 to 25 percent slopes, moderately eroded	0.2	0.2%
RcA	Richter loams, 0 to 2 percent slopes, overwash	7.5	7.2%
Totals for Area of Interest		104.5	100.0%

Figure 10-3c. Map unit legend to accompany USDA soil sample map Figure 10-3a. Credit: USDA Natural Resources Conservation Service.



Finding a place with the right soils with good drainage and not too much standing water (lakes, streams, wetlands) is crucial. (*Wetlands* are low points in the land with saturated soil, sometimes consisting of swamps or marches.) Grapes prefer south-facing or southeast-facing slopes for optimal sun exposure and *cold air drainage*, the movement of cold air from a higher elevation to a lower elevation.

Examine figures 10-3a, b, and c. The map (Figure 10-3a) and the accompanying legend and information (Figure 10-3b) as well as the map unit legend (Figure 10-3c) were created by Cristin Popelier Hosmer, proprietor of Alchemae Craft Beverage and adjunct professor at Michigan State University, using the USDA Web Soil Survey: <https://websoilsurvey.nrcs.usda.gov/app/>.

These types of maps are used by farmers including viticulturists when planning new crop blocks. They give farmers important information about the soil types that exist on a property. The map (Figure 10-3a) shows that there are 13 individual soil types and shows the elevations specific to this particular vineyard.

A *geographic information system* (GIS) is a computer tool, such as Google Earth, that captures and stores data related to the Earth's surface. It can be used in vineyard planning. Easily accessible Google Earth high-resolution satellite imagery can aid in site assessment by helping viticulturalists visualize topographical features and measure distances and elevations. Soil surveys, available from the USDA, offer essential data on soil types, texture, drainage, and nutrient content. It can help farmers see what the land looks like, how hilly or flat it is, and what other features are nearby. Farmers also look at maps showing the soil in different areas. The best soil for grapes is sandy loam because it drains well.

Sitemaps are essential for grape growing because they help farmers choose the best place to plant grapevines. By using GIS tools, such as Google Earth, and soil surveys, vineyard planners can make informed decisions about site selection and optimize vineyard management practices, ultimately leading to more successful grape cultivation. Exploring and analyzing the land before planting helps growers choose the perfect home for grapevines, where they can thrive and be happy.

Procedure:

Before the meeting:

1. Using Google Earth, identify the site to be mapped, ideally a host vineyard.
2. Ensure the meeting space has technology (computers, internet, projector) to deliver the web-based content.
3. Familiarize yourself with the concept of growing degree days by reading the MSU Extension article "Accessing Growing Degree Days With Enviro-Weather" by Beth Bishop: https://www.canr.msu.edu/news/accessing_growing_degree_days_with_enviro_weather

During the meeting:

1. Show county-level soils map and explain soil water-holding capacity <https://websoilsurvey.nrcs.usda.gov/app/>.
2. Ask the participants if they know what USDA hardiness zone they live in.
3. Show the USDA Plant Hardiness Interactive Map and discuss why this is important for grapevines and how varieties of grapes have been selected to be more cold hardy (<https://planthardiness.ars.usda.gov/>).
3. Introduce and discuss *growing degree days*. *Growing degree days* (GDD) as defined in Lesson 4 "Pruning Dormant Grapes: When and Why Should Grapevines Be Pruned?" is the total accumulation of heat during a growing season. GDD is a way to measure the accumulated temperature to predict the growth and development of plants. In a vineyard, growing degree days are also important to determine the growth and development of insect pests.

Vineyard Mapping

1. Ask the participants:
 - Where have you seen a map? *seating, theaters, airplanes, school, emergency routes, road maps*
 - What is the purpose of a map? *to show the layout of an area*
 - Have you ever drawn a map?
2. Provide participants with a local map.
 - Ask participants to look over the map and share what information they see. *direction (compass rose), topography, terrain, road types and locations, rivers*
3. Introduce Geospatial Satellite Imagery (GSI) available on Google Earth.
4. Participants could use some of the Google Earth tools to mark features (homes and barns), or create property or vineyard block boundaries.





5. Show an example site map: <https://pasowine.com/wp-content/uploads/Dark-STAR-Vineyard-plan-with-Vine-information.jpg>
6. Have the participants explore the selected site. (Remember grapevines don't like wet feet.)
7. Calculate the distance to surface water (lakes, rivers) if necessary.
8. Show the USDA Plant Hardiness Zone Map: <https://planthardiness.ars.usda.gov/>
9. Have participants look at the soil survey map legend and information, and map unit legend for Chateau Chantal (figures 10-3a, b, and c in Participant Notebook 10-2).
10. Ask the participants to discuss the soil survey map, legend and information for Chateau Chantal.
 - Why is it important to know the different soil types within a vineyard?
 - What do you find interesting about the map and information?
11. Use the soil survey map to help identify soil type: <https://websoilsurvey.nrcs.usda.gov/app/>
12. Identify existing wetlands.
13. Allow participants time to explore the selected site with Google Earth tools.
14. Have participants generate a list of information that could be put on their viticulture site map. This list might include:

Property owner and address

 - Number of acres
 - Property legal description (from tax assessment records) or coordinate location
 - Compass rose
 - Title
 - Legend
 - Scale and units
 - Existing roads, driveways and other access points
 - Buildings
 - *Isolines* (lines on a map that show elevation of the land)
 - Crops by block and orientation
 - Adequate access for equipment (*headlands*) – *Headlands* are part of the vineyard (field) that is used as a staging area, access to the vineyard, and a place where equipment has room to maneuver in the field, such as making turns and loading and unloading equipment and supplies.
 - Well(s)
 - Drain field
 - Fallow and wooded areas
 - Predominant soil type(s)
 - Land use and zoning classification
15. Decide as a group: What will be included on their vineyard site map(s)?
16. Discuss the concept of *scale* and drawing a map to scale. *Scale* on a map refers to the size and proportions of objects within a given space on a map or the relationship of features to its actual size in the real world.
17. Using Figure 10-1 as an example, have participants draw a map of the vineyard, or proposed vineyard site on large paper.
18. Label:
 - Infrastructure and other nonplantable areas
 - Roads, driveways
 - Shipping and receiving
 - Fruit staging area during harvest
 - Parking
 - Emergency access
 - Buildings
 - Wellhead(s)
 - Drain field (if applicable)
19. Answer the questions in Participant Notebook 10-1.

References and Resources

Bishop, B. (2013). *Assessing growing degree days with Enviro-weather*. Michigan State University Extension. https://www.canr.msu.edu/news/accessing_growing_degree_days_with_enviro_weather

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U.S. Department of Agriculture. (2023). *2023 USDA plant hardiness zone map*. <https://planthardiness.ars.usda.gov/>

U.S. Department of Agriculture. (2023). *Web soil survey*. <https://websoilsurvey.nrcs.usda.gov/app/>





Vineyard Mapping: Where Should You Plant the Grapes? Part 2

Lesson 11

Overview: Participants will understand why site maps are important for grape-growing businesses. They will explore and analyze site characteristics for their suitability for grapevines and ground truth their maps by assessing the vineyard.

For this lesson, you will use information gathered from Lesson 10 “Vineyard Mapping: Where Should You Plant the Grapes? Part 1.”

Age Level: 12–19

Season: Spring through fall

Viticulturist: Required

Location: Vineyard or proposed vineyard site

Time: 2 hours

Objectives:

Participants will be able to:

- Explain what makes a good site for a vineyard.
- Use a map to determine locations of crop blocks.
- Identify one career that would be important when mapping a vineyard.

Materials:

- Writing utensils (one for each participant)
- Portable whiteboard or flipchart
- Markers
- Maps participants generated from Lesson 10 “Vineyard Mapping: Where Should You Plant the Grapes? Part 1”
- Participant Notebook 11-1 “Vineyard Mapping: Where Should You Plant the Grapes? Part 2 General Questions”

Vocabulary: crop block, ground truth

Background:

Review the “Background” section from Lesson 10 “Vineyard Mapping: Where Should You Plant the Grapes? Part 1.”



Figure 11-1. Mid-season crop blocks, Traverse City, Michigan. Photo Credit: Esmail Nasrollahiazar



Figure 11-2. Post-harvest crop blocks, Traverse City, Michigan. Photo Credit: Esmail Nasrollahiazar



Procedure:

Before the meeting:

1. Review Lesson 10 "Vineyard Mapping: Where Should You Plant the Grapes? Part 1."
2. Coordinate meeting time with the host vineyard, and determine the viticulturalist's availability. Ask if it would be possible to see a demonstration of farm equipment moving through the rows to help participants understand the space needed for turning and other farming operations.
 - Discuss with the viticulturist that this activity is helping participants make a connection between mapping and vineyard layout. Ask if they would be willing to share how a viticulturist uses or used a map in laying out this specific vineyard.
 - What are important features on the farm that influence planning and planting vines?

During the meeting:

1. Have participants bring the large maps they drew in Lesson 10 "Vineyard Mapping: Where Should You Plant the Grapes? Part 1" to the vineyard.
2. Have the viticulturist discuss the use of maps and vineyard planning and planting with the participants.
 - Review specific points related to the placement of the crop blocks. A crop block is a particular area of the vineyard represented by a single variety or a soil type, a topography feature such as a slope or fence lines, or a natural feature such as a stream (figures 11-1 and 11-2).
3. Have participants view a farm equipment demonstration if possible.
4. Explain to participants that *ground truth* is information that is known to be true. To *ground truth* would be to gather data on site to test the truth of something. Have participants ground truth the maps they created in Lesson 10 by walking the property, checking for accuracy, and adding elements to the site map.

5. Have participants record observations and additions to their map. Use the list from Part 1 as needed:
 - Property owner and address
 - Number of acres
 - Property legal description (from tax assessment records) or coordinate location
 - Compass rose
 - Title
 - Legend
 - Scale and units
 - Existing roads, driveways, and other access points
 - Buildings
 - Isolines (lines on a map that shows elevation of the land)
 - Crops by block and orientation
 - Adequate access for equipment (*headlands*, staging area)
 - Well(s)
 - Drain field
 - Fallow and wooded areas
 - Predominant soil type(s)
 - Land use and zoning classification
 - Sketch of planted areas: Crops by blocks
6. Add any features that you observe that are not already on the vineyard map you created. These may include infrastructure and other nonplantable areas such as roads, driveways, shipping and receiving, fruit staging area during harvest, parking, and emergency access. Mark the location of buildings, barns, pesticide storage, fuel storage, wellhead(s), and drain field (if applicable).
 - Have participants add items to their maps or make notes in their Participant Notebooks so they can add items later. Consider having them take photos to help them remember why they are making changes to their maps.
 - Record observations and ideas about mapping the vineyard in their Participant Notebooks.
7. Direct participants to answer the questions on Participant Notebook 11-1.





Vineyard Site Selection and Establishment: Will Grapes Thrive Here?

Lesson 12

Overview: Participants will learn about elements that influence vineyard location and variety selection as they design a crop block for a vineyard. This activity could be presented for the development of a project proposal when seeking financing (loan) to purchase a farm or establish a vineyard.

Age Level: 12-19

Season: Spring through fall

Viticulturist: Required

Location: Proposed vineyard location

Time: 2 hours

Objectives:

Participants will be able to:

- List three things to consider when preparing to establish a vineyard.
- Determine the best variety of grapes for the proposed site.
- Determine the number of vines that can be planted.
- Identify at least one career that would be important for vineyard site selection and establishment.

Materials:

- Writing utensils (one for each participant)
- Portable whiteboard or flipchart
- Markers
- U.S. Geological Survey county soils maps: <https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>
- USDA Plant Hardiness Zone Map*: <https://planthardiness.ars.usda.gov/>
- Growing Degree Days*: https://www.canr.msu.edu/grapes/weather_climate/growing-degree-days
- Michigan Wine Grape Varieties*: <https://michiganwinecountry.com/wines-grapes/wine-grape-varieties/>
- Participant Notebook 12-1 "Vineyard Site Selection and Establishment: Will Grapes Thrive Here? General Questions"
- Participant Notebook 12-2 "Vineyard Site Selection and Establishment: Will Grapes Thrive Here? Crop Blocks"
- Participant Notebook 12-3 "Vineyard Site Selection and Establishment: Will Grapes Thrive Here? Financial Institution Proposal and Career Question"

Vocabulary: crop block, microclimates, viniferous varieties



Figure 12.1. A beautiful northern Michigan vineyard. Photo credit: Esmaeil Nasrollahiazar

Background:

When selecting a vineyard site, keep these few basic things in mind:

- Desired varieties (See *Michigan Wine Grape Varieties*: <https://michiganwinecountry.com/wines-grapes/wine-grape-varieties/>) (Note that this is used with permission, copyright Michigan Wine Country.)
- Soil type
- *Cold air drainage*: the movement of cold air from a higher elevation to a lower elevation as defined in Lesson 10 "Vineyard Mapping: Where Should You Plant the Grapes? Part 1"
- Slope for *viniferous varieties*, which are grape varieties suitable for making wine
- North-south orientation
- *Microclimates*: climate conditions of a relatively small area that differs from the surrounding area
- Irrigation during vine establishment
- The source of irrigation needed during vine establishment



Procedure:

Before the meeting:

1. Determine the location of the proposed vineyard or *crop block* to be established. A crop block is a particular area of the vineyard. The block might represent a single variety or a soil type, a topography feature such as a slope or fence lines, or a natural feature such as a stream. You may have identified existing unplanted crop blocks during your vineyard mapping activity. These would be ideal to use in this activity. If not, you will need to determine a location for your new vineyard (school yard, empty lot, or vacant field).
2. Watch the Michigan State University Extension video *Everything You Need to Know Before Planning a Vineyard*. Send this link to the participants before the meeting: <https://youtube.com/watch?v=etw5JCxtLQ>
3. Coordinate access of the property with land or vineyard owner as needed.
4. Determine the information you will need to share with participants about varieties of grapes they may choose to plant.
5. Participants will use the references and mapping information in lessons 10 and 11 "Vineyard Mapping: Where Should You Plant the Grapes?" parts 1 and 2.

During the meeting:

1. Discuss with the participants the information in the video *Everything You Need to Know Before Planning a Vineyard*. Using your whiteboard, list the participants' responses.
2. Have participants either use their existing vineyard maps with an unplanted crop block or create a map of a new vineyard location for one crop block.
3. Have participants consider the following when determining the layout of the vineyard and varieties of grapes suited for the site:
 - Microclimate(s) that may affect the vineyard site
 - USDA hardiness zones (<https://planthardiness.ars.usda.gov/>) and growing degree days (https://www.canr.msu.edu/grapes/weather_climate/growing-degree-days) of site
 - Topography for cold air drainage
 - Soil type
 - Use the U.S. Geological Survey county soil map to determine the soil type. <https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>
 - Is the soil well drained?
 - Water source for first-year irrigation

4. Have participants use the information they've collected and determine the variety of vines they will plant.
5. At the site, participants draft a rough layout of the crop block in their Participant Notebook 12-2. They should include:
 - Appropriate headlands
 - Row orientation
 - Trellis system needed for the selected variety
 - Row spacing – number of rows
 - Vine spacing – number of plants per row
6. Participants map a final version of the crop block in their Participant Notebook 12-2.
7. As a group, they should determine the elements from the mapping activity they will include.
8. In their Participant Notebook 12-3, participants should include an explanation for their financial institution. When seeking approval for a loan, a grower might include this information:
 - Varieties
 - Trellis system
 - Spacing (row and vine)
 - Total number of vines to be planted
 - Microclimate(s)
 - USDA hardiness zone
 - Growing degree days
 - Topography for cold air drainage
 - Soil type
 - Water source for first-year irrigation
9. Participants should answer the career question on Participant Notebook 12-3.





References and Resources

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Integrated Pest Management: Why Is Pest Management Important?

Lesson 13

Overview: Participants will identify pests in the vineyard, particularly insect pest and disease damage, and explore various control measures. Vineyards will never be pest free but determining the economic threshold of pest tolerance is critical in pest management.

Age Level: 12-19

Season: Spring through fall

Viticulturist: Required

Location: Vineyard

Time: 2 hours

Objectives:

Participants will be able to:

- Identify three common insect pests of a vineyard.
- Identify three common diseases in a vineyard.
- Explain common controls for insect pests.
- Explain common controls for diseases.
- Explain the importance of pesticide safety.
- Determine alternatives to chemical pesticides.
- Describe the difference between harmful and beneficial insects.
- Identify one career important to pest management of a vineyard.

Materials:

- Writing utensil (one per participant)
- Portable whiteboard or flipchart
- Markers
- Phone for taking pictures (one per group)
- A Pocket Guide for Grape IPM Scouting in the North Central and Eastern United States* (Michigan State University Extension, 2020) <https://www.canr.msu.edu/grapes/uploads/files/GrapeGuide-PDF-final2020.pdf> (one per group)
- Monitoring traps, often referred to as sticky traps (five to six per block of fruit being monitored)
- 20x magnifying hand lens (one per group)
- Clipboards (one per group)
- MSU Vineyard IPM Scouting Forms (Michigan State University, n.d.): <https://www.canr.msu.edu/grapes/uploads/files/scoutingForm.pdf> (five per group)
- Vineyard maps (create using Google Earth or use the map created in Lesson 10 "Vineyard Mapping: Where Should You Plant the Grapes? Part 1"(one per group)
- Colored tape or tags (one roll of tape or several tags per group)
- Waterproof markers (one per group)

- Participant Notebook 13-1 "Integrated Pest Management: Why is Pest Management Important? General Questions"
- Participant Notebook 13-2 "What Is IPM?"

Vocabulary: economic injury level, economic threshold, Integrated Pest Management (IPM), scouting



Figure 13-1. Powdery mildew, a common fungal disease in vineyards. Photo credit: Esmaeil Nasrollahiazar



Figure 13-2. An example of insect damage in a vineyard - bee and wasp damage just before harvest. Photo credit: Esmaeil Nasrollahiazar



For the purpose of this curriculum, this lesson focuses on insect pests and fungal diseases.

Background:

Good Science and Good Sense = *Integrated Pest Management* (IPM)

IPM is a science-based decision-making process that identifies and manages pests. The United States Code, specifically 7 U.S.C. section 136r-1, Integrated Pest Management (2022) defines IPM as “a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic impacts, health, and environmental risks.”

- The best *IPM program provides economic, health, and environmental benefits. Growers need to be knowledgeable of insect pests and diseases, as well as the host's biology.* They should be aware of methods of biological and environmental monitoring. Their response to insect pest and disease problems should:
 - Prevent unacceptable levels of insect and disease damage.
 - Minimize the risk to people, property, natural resources, and the environment.
 - Reduce the evolution of insect and disease resistance to pesticides.
- The best *preventatives* involve:
 - Healthy plants.
 - Healthy soil.
 - Plant selection for disease and insect resistance.

Regular *scouting*, looking for visual clues of pests or pest damage, is the foundation of effective vineyard pest management. Scouting for insect pests and diseases means looking for them in the vineyard at critical times in their development and recording their incidence and abundance. Growers should know the pest's life cycle and environmental factors regarding the pest such as heat, rain, and other factors.

For more detailed information, refer to the Michigan State University (MSU) Extension Grapes Pest Management (n.d.) website at https://www.canr.msu.edu/grapes/integrated_pest_management/.

Topics covered in detail on the MSU Extension Grapes Pest Management website include:

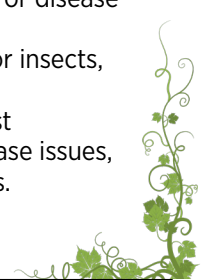
- The biology of a grapevine and its annual growth habits.
- The biology and life cycle of insects, diseases, nematodes, and weeds found in vineyards.
- The environmental conditions favoring pests that injure the crop.
- The susceptibility of various varieties of grapes to pests and pesticides.
- The cultural, biological, and chemical control strategies that can be used for optimal production of commercial grapes.

(MSU Extension, n.d.)

Procedure:

Before the meeting:

1. Arrange with the viticulturalist to place monitoring (sticky) traps in the vineyard at least three to four days before the participants visit. The optimal placements would be five to six traps per block of fruit being monitored. If possible, place traps in the fruit blocks at intervals of seven days, three days, and one day before the participants visit, allowing participants to understand the insect pressure over time.
2. Arrange with the viticulturalist to mark insect pests, diseases, or other injuries such as bird pressure, weather damage, or other issues with colored tape or tags and waterproof markers. This will help identify areas for discussion.
3. Arrange with the viticulturist for the vineyard you are visiting to discuss:
 - Insect pests and diseases currently in the vineyard.
 - Insect pest and disease damage.
 - Common insect pests and diseases in most vineyards.
 - Methods of monitoring insect pest and disease populations.
 - Methods of controlling insect pests and diseases.
 - The difference between harmful and beneficial insects.
 - Common weeds in most vineyards.
 - Methods for controlling weeds.
 - Resources they currently use.
 - How they determine when the insect or disease pressure needs to be taken care of.
 - Alternatives to chemical pesticides for insects, diseases, and weeds.
 - How they educate themselves on pest management, arising insect and disease issues, and current laws regarding pesticides.
 - The importance of pesticide safety.





- How economic injury level and economic threshold is determined for their vineyard, crop block, or particular varieties.
 - *Economic injury level* is the lowest level of injury that will cause economic damage.
 - *Economic threshold* occurs when the density of the pest requires management practices from reaching the economic injury level.
4. Review the background information.
 5. Review information on the MSU Grapes websites regarding grape pests and grape scouting reports as well as the MSU Extension pocket guide.
 - MSU Extension Grapes: Grapes Scouting Reports: https://www.canr.msu.edu/grapes/integrated_pest_management/grape-ipm-scouting-reports
 - MSU Extension Grapes: Pest Management (Michigan State University Extension, n.d.): https://www.canr.msu.edu/grapes/integrated_pest_management/
 - *A Pocket Guide for Grape IPM Scouting in the North Central and Eastern United States* MSU Extension, (2020): <https://www.canr.msu.edu/grapes/uploads/files/GrapeGuide-PDF-final2020.pdf>

During the meeting:

1. Have the viticulturist discuss with the participants the information he or she prepared for the meeting using the previous outline in the "Before the Meeting" section. Discussion will include helping participants:
 - Explain the difference between harmful and beneficial insects.
 - Identify three common insect pests of a vineyard.
 - Identify three common diseases in a vineyard.
 - Explain common controls for insect pests.
 - Explain common controls for diseases.
 - Discuss common weeds and weed controls.
 - Discuss the difference between harmful and beneficial insects.
 - Explain the importance of pesticide safety.
 - Determine alternatives to chemical pesticides.
2. Scout for pests. Participants may use hand lenses if needed to identify pests.
3. Have participants:
 - Record insect pests and diseases on MSU Vineyard IPM Scouting Forms: <https://www.canr.msu.edu/grapes/uploads/files/scoutingForm.pdf>
 - Compare their scouting reports with other participants.
 - Use the vineyard map to identify crop blocks.
 - Use colored tape or tags and waterproof markers to mark and identify insect pests, diseases, or other injuries such as bird pressure, weather damage, and other issues.
 - Write any additional notes in Participant

Notebook 13-1 "Integrated Pest Management: Why Is Pest Management Important? General Questions," including any newly identified pests or diseases.

- Take pictures of insect pests, diseases, and other injuries. Add the pictures to your notebook by adding extra pages. Label the pictures with name of pest, date, vineyard, and vineyard block or row number.
 - Identify one career important to pest management of a vineyard.
4. Review the information page from the Entomological Society of America "What Is IPM?" (Participant Notebook 13-2). Using this page and the discussion from the viticulturalist, have participants explain how they would use IPM if they owned or managed a vineyard.

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Careers

As participants explore the 4-H Let's Grow Grapes lessons, they will learn that a variety of careers exist in the grape-growing industry. This Careers section touches on eight careers and lists the responsibilities and expectations of each. Make sure you make them aware that many opportunities await those interested in this exciting field.

Research current wages for jobs related to the grape and wine industry in the U.S. Bureau of Labor Statistics *Occupational Outlook Handbook* at <https://www.bls.gov/ooh/> and also at the U.S. Department of Labor, Employment and Training Administration *CareerOneStop* website at <https://www.careeronestop.org/ExploreCareers/Plan/salaries.aspx>

Viticulturist: Vineyard Manager

- Full-time, year-round position, extended hours during harvest
- 5 years of experience and/or degree in a relevant field
- Maintain a high-quality grape crop, scout vineyards frequently, implement pest management strategies, work with outside scouting and chemical companies to explore the most successful strategies
- Work directly with the winemaker to determine harvest quality objectives by variety and sample fruit for analysis
- Maintain farm and worker safety and lead safety compliance training
- Maintain agricultural certifications and compliance standards
- Train, oversee, and manage daily, weekly, and seasonal schedules for labor crews for multiple vineyards
- Oversee maintenance and use of all farm equipment, supervise equipment operators, laborers, and outside service providers such as agronomists
- Bilingual preferred Spanish/English, ability to translate instruction to workers in multiple languages

Office Manager: Operations and Compliance

- Full-time or part-time, office support, may use outside services
- Maintain employee records, verify employment eligibility
- Prepare and process employee payroll and taxes
- Maintain adequate insurance coverage: farm, auto, liability, health, workers' compensation
- Work with regulatory agencies to maintain relevant business permits and licenses
- Prepare and file annual tax returns for business

Laboratory Technician:

- Full-time or part-time, extended hours during harvest
- Experience working in a lab for more than one harvest, with a background in chemistry, attention to detail is necessary
- Collect samples from the vineyard for analysis and run laboratory tests such as pH, TA, Brix, and other tests as needed
- Maintain and calibrate laboratory equipment such as:
 - *pH meter*, an instrument used to measure the hydrogen-ion activity in water-based solutions, including acidity and alkalinity that is expressed as the pH
 - *refractometer*, an instrument used to measure the soluble solids in a liquid when testing a fruit's sugar content; the result is stated as Brix.
 - *hydrometer*, an instrument that measures the specific gravity of a liquid. Winemakers use hydrometers to measure the alcohol content by volume throughout the fermentation process to ensure sugar is being converted into alcohol.
 - *densitometer*, an instrument for determining optical, photographic, or mass density
 - *spectrometer*, an analytical instrument in which an emission (as of particles or radiation) is dispersed according to some property (such as mass or energy) of the emission and the amount of dispersion is measured.
- Perform *enzymatic analysis* for wine making and for determining soil amendments
- Work directly with the winemaker or food processor to determine the time to harvest and product quality
- Work independently in a laboratory, and assist the wine cellar staff as needed with yeast inoculations and fermentation management

Equipment Operator:

- Full-time, seasonal
- 2 years of experience and certifications
- Comfortable with long hours of working on a tractor, using leaf-pulling implements, mowing, operating the harvester, using the forklift, and other duties
- Able to maintain the farm equipment and troubleshoot issues as they arise in the field
- Plan, install, and maintain trellis systems, irrigation, fencing, frost protection, and roadways
- Drive large vehicles and safely transport equipment among farms
- Maintain pesticide sprayer certification and attend annual continuing education courses
- Calibrate spray equipment and properly apply pesticides according to the label
- Maintain cleanliness of equipment, barns, and the pesticide storage area



Laborer:

- Full-time, seasonal
- Proficiently perform all grapevine management tasks, including pruning, vine tying, leaf pulling, crop thinning, and harvesting
- Weeding and in-row cultivating
- Fruit sorting and processing
- Bottling and other cellar activities
- Planting vines and installing trellis systems
- Harvesting grapes, lifting up to 50 pounds
- Spanish or English language proficient

Outside Services:

- Vineyard consultant, scouting, and chemical recommendations
- Agronomist for soil biology testing and recommendations
- Mechanic
- Engineering, services for managing water use
- Legal services

Marketing Director at a regional tourism organization

- Full-time, year-round
- Degree in marketing, communications, or public relations
- 5+ years of experience in marketing, branding, or communication
- Oversee the marketing budget for agritourism in the region and implement new partnerships for funding cooperative tourism in the area
- Coordinate creative development, production, and distribution of content across multiple media including social media

Sommelier:

- A certified wine specialist
 - Court of Master Sommelier (CMS), service-related pathway
 - Wine & Spirits Education Trust (WSET), communication and educational pathway
 - Sommelier certification levels (introductory, certified, advanced, and master) are based on the number of years spent studying and examinations passed
- 5+ years of experience in hospitality field
- Work in various hospitality and wine industry-related jobs
 - Wine director for a restaurant group or grocery chain in charge of purchasing wine for the menu or retail shelf



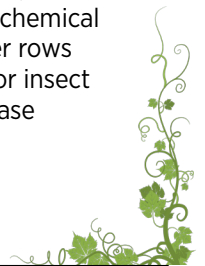


Grape Fast Facts: Growing Grapes in Michigan

The facilitator should note that this fact sheet is also in the Let's Grow Grapes Participant Notebook. You may choose to read it aloud together and discuss or direct participants to read it on their own time or with a partner.

- Grapevines (genus *Vitis*) are a genetically diverse species of perennial, flower-bearing and fruit-bearing, woody vines with long tendrils.
 - The species *Vitis vinifera* is the common grapevine native to Europe and the Middle East.
 - These grapes are most commonly fermented into wine. Examples are Cabernet Sauvignon and Pinot Grigio.
 - The list of species classified as *Vitis vinifera* is extremely diverse.
 - *Vitis labrusca* are native to North America.
 - Familiar varieties include Concord and Niagara.
 - Grapes may be consumed as a fruit or as a juice, or the juice can be fermented.
 - Many crosses or hybrids between European and American varieties have been developed and commercialized by grape geneticists. Examples include:
 - Itasca, Marquette, and Frontenac (University of Minnesota)
 - Noiret, Corot noir, Valvin, and Muscat (Cornell University)
 - *Vitis riparia* is a native wild grape you see growing abundantly in Michigan. It is often used as rootstock because of its resistance to *phylloxera*, a grape pest.
 - Most table grape varieties have been bred to be seedless, although some varieties still have seeds.
 - For thousands of years, civilizations have cultivated grapevines and moved them around the globe. The first known species was found in the country of Georgia, near the Black Sea (Batiuk et al., 2016). There are now over 10,000 species of grapes worldwide.
 - *Viticulture* is the science and practice of cultivating grapes.
 - Today, many varieties of grapes grow in Michigan. A grape grower may choose a particular variety to plant for any or all of the following reasons:
 - It can be grown successfully in Michigan.
 - It can be eaten or sold for a profit to a consumer or a processor.

- It can be harvested and made into a value-added product.
 - It has name recognition.
 - It is disease resistant.
 - It is cold hardy.
- Grapes have been typically grown in the southwestern and northwestern regions of the state near Lake Michigan because of the suitability of the climate and soils. However, newly developed cold-hardy varieties are now being grown across lower Michigan and in the southern Upper Peninsula.
 - Grapes are grown in vineyards that may include 500 to 1,700 plants per acre, depending on the variety, trellis (support system) used, and the row spacing. Typically, the vineyard rows run from north to south to maximize the sun exposure on the canopy and fruit. But drainage, slope, and the level of mechanization may factor into decisions on the layout.
 - Good growers should walk in their vineyard daily, scouting for anything out of the ordinary. They must understand the annual growth cycle of a grapevine and be able to quickly identify its parts. They must understand the difference between a healthy vineyard (lush, green, free of disease) and an unhealthy vineyard (yellow, full of pests, not producing fruit).
 - Managing a vineyard during the growing season requires tremendous work. Key times of the year when additional labor or mechanization might be needed include:
 - Pruning in late winter and early spring.
 - Hedging and leaf pulling in mid-summer.
 - Harvest in fall.
 - Growing any crop requires the use of tools and inputs. Important vineyard tools include hand pruners, a tractor, a sprayer, a mower, and any implements specific to grape growing such as an over-the-row pruning or hedging implement, a leaf remover, or a harvester. Important inputs depend on the type of farming system employed: conventional, organic, biodynamic, Michigan Agriculture Environmental Assurance Program (MAEAP), Great Lakes Sustainable Wine Alliance, or other systems.
 - Conventional growers grow high-quality fruit with assistance from mechanical and chemical inputs. They may use herbicides under rows for weed management, insecticides for insect management, and fungicides for disease management.





- Organic growers have the same goal, but they would follow organic protocols and procedures, and they would limit the use of some chemicals not approved for organic growing.
- The Great Lakes Sustainable Wine Alliance system is based on the MAEAP, which is a verification program for farms and cropping systems with the goal of protecting ground water and all surface water within the Great Lakes region.
- According to statistics from the U.S. Department of Agriculture, National Agricultural Statistics Service (2020, p. 2–3):
 - 10,900 acres of grapes are under cultivation in Michigan that include:
 - 5,450 acres of Concord.
 - 2,325 acres of Vinifera.
 - 2,075 acres of other native (Catawba, Delaware, Fredonia, Niagara, and Norton).
 - 1,050 acres of hybrids.
- Michigan grapes are sold for direct consumption and made into products such as jelly, juice, and wine. Some products include:
 - Table grapes sold for direct consumption (for example, Cotton Candy).
 - Jelly grapes (for example, Concord).
 - Juice grapes (for example, Concord and Niagara). In Michigan, there are 157 growers, growing Concord and Niagara grapes on over 7,000 acres.
 - Wine grapes: approximately 120 varieties are grown in Michigan.
- The economic impact of the wine and cider industry is tremendous.
 - According to the *Michigan Economic Impact Study 2022* (WineAmerica, 2022):
 - The Michigan wine industry generated \$6.33 billion in total economic activity in the state.
 - The Michigan wine industry employs as many as 25,611 people and generates an additional 9,351 jobs in ancillary industries.
 - The average annual wage in the Michigan wine industry is \$44,800.
 - The total wages generated by direct, indirect, and induced economic activity by the wine industry were \$2.10 billion in 2022.
 - Michigan's wine country had 615,700 tourist visits and \$208.94 billion in annual tourism expenditures added to local economies.
 - Tax revenue for Michigan in 2022 from the wine industry was \$25.71 million in federal consumption taxes and \$190.58 million in state consumption taxes, which include excise and sales taxes.

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Recipes

Introduction

The 4-H Viticulture Project *Let's Grow Grapes: Michigan 4-H Viticulture* focuses on growing grapes and exploring careers in the grape industry. The recipes included in this section encourage participants to explore the rich history, culture, and traditions of grapes.

Many middle school- and high school-aged kids have never cooked, baked, or even explored their own kitchens. Using the recipes will show them the many things they can do with grapes. Making grape products from your own vines or from purchased grapes is a great way to teach them about cooking.

Research

Many researchers have studied the benefits of kids and cooking. Many studies are related to kids eating more fruits and vegetables and making healthier snack choices. Some research goes further, suggesting cooking with kids makes kids smarter, boosts self-confidence, and teaches about other cultures.

According to Farmer, Touchton-Leonard, and Ross (2018):

Because cooking requires integration of cognitive, physical, and socioemotional processes, and learning to cook involves modeling and mastery of skills, social cognitive theory might explain why a successful food system that relies on cooking would benefit from activity that promotes positive mood, self-confidence, and self-esteem in order to promote exchange of food and ideas. Indeed, some research exists to support the idea that cooking may improve socialization and other physical and mental health outcomes. (p.168)

Stephanie Gallagher who writes about food and has authored several cookbooks states:

... time invested in teaching your children how to cook is time well-spent. It not only provides you with quiet moments to bond with your youngster but also offers a myriad of other benefits, including boosting confidence, teaching math and science ... (Gallagher, 2023)

Cooking also introduces young people to other cultures.

Benefits of Cooking

Math: Following recipes teaches measuring, sequencing, and fractions.

Reading: The cooking terms in recipes build vocabulary. Reading the recipe builds skills in following directions.

Science: Cooking provides opportunities to learn about food groups and observe how ingredients change while cooking and using the five senses.

Creative Arts: Creating and decorating foods is a creative process.

Cultures/History: Cooking provides opportunities to experience other cultures by preparing foods from other countries.

Nutrition/Health: Proper food handling teaches food safety and hand washing. Cooking can be used to introduce nutrition concepts, healthy cooking methods and healthy ingredient use.

Social Skills: Cooking together uncovers the importance of being responsible, working together, sharing, completing a task, and feeling confident.

Physical development: Preparing foods develops fine motor skills through cracking eggs, chopping, stirring, pouring, and cutting.

Adapted with permission from *Cooking With Young Children* by Yaebin Kim in the section "What Children Can Learn From Cooking," 2015, University of Nevada Cooperative Extension, Fact Sheet-15-03. <https://extension.unr.edu/publication.aspx?PubID=2468>





Grape Jam From Concord Grapes

Prep time: 15 minutes

Cook Time: 35 minutes total

Total Time: 50 minutes

Servings: about six 8-ounce jars

Ingredients:

2 quarts destemmed Concord grapes

6 cups sugar

Instructions:

1. Sterilize canning jars.
2. Separate pulp from the skin of the grapes.
3. If desired, chop skins in food blender or chopper.
4. Cook skins gently 15–20 minutes, adding only enough water to prevent sticking (about ¼ cup).
5. Cook pulp, skins, and sugar. Bring to jelling point, about 10 minutes. As mixture thickens, stir frequently to prevent sticking.
6. Pour into hot jars, leaving ¼-inch headspace.
7. Wipe jar rims and adjust lids.
8. Process for 5 minutes in a boiling water bath.

The “Grape Jam from Concord Grapes” recipe is adapted from the National Center for Home Food Preservation.

So Easy to Preserve Bulletin No. 989. Athens, GA: Cooperative Extension, University of Georgia. It was adapted and used with permission.

Uncooked Grape Jelly

Prep time: 5 minutes

Cook time: none

Total time: 15 minutes

Servings: About five 8-ounce containers

Ingredients:

2 cups lukewarm water

1 box powdered pectin

One 6-ounce can frozen grape juice concentrate

¾ cups sugar

Instructions:

1. In a 2-quart mixing bowl, mix the pectin slowly into the lukewarm water. Stir constantly until completely dissolved. Let stand 45 minutes. Stir occasionally but do not beat.
2. Thaw juice by placing can in cold water. When the juice is thawed, pour into a 1-quart mixing bowl.
3. Add ¾ cups sugar. Mix thoroughly. All the sugar will not be dissolved.
4. Add the remaining ½ cups sugar to the dissolved pectin mixture. Stir constantly until all sugar is dissolved.
5. Pour into freezer containers or canning jars, leaving ¼-inch headspace.
6. Cover with a tight lid.
7. Let stand at room temperature until set (up to 12 hours).
8. Freeze or refrigerate. This will last 6 months in the freezer and 4 weeks in the refrigerator.

The “Uncooked Grape Jelly” recipe is retrieved from the National Center for Home Food Preservation.

So Easy to Preserve Bulletin No. 989. Athens, GA: Cooperative Extension, University of Georgia. It was adapted and used with permission.





Grape Syrup

Prep time: 30 minutes

Cook time: 25 minutes

Total Time: 55 minutes

Servings: About two 8-ounce jars

Ingredients:

1¼ grape puree

1½ cups sugar

¼ cup corn syrup

1 tablespoon lemon juice

Instructions:

To prepare puree:

1. Wash and destem ripe grapes.
2. In a large saucepan, heat grapes at a low temperature setting for 8 to 10 minutes to loosen skins. *Do not boil.*
3. Put through a food mill with wire mesh strainer.
4. Discard skins and seeds.

To make syrup:

1. Sterilize canning jars.
2. Combine ingredients in a saucepan.
3. Bring to boil and boil for 1 minute.
4. Remove from heat and skim off foam.
5. Pour into hot half-pint (8-ounce) jars, leaving ¼-inch headspace.
6. Wipe jar rims and adjust lids.
7. Process 5 minutes in a boiling water bath.

The "Grape Syrup" recipe is adapted from the National Center for Home Food Preservation.

So Easy to Preserve Bulletin No. 989. Athens, GA: Cooperative Extension, University of Georgia. It was adapted and used with permission.

Stuffed Grape Leaves

Background

Many countries have a long history of eating stuffed grape leaves. Many Greek people claim that stuffed grape leaves go all the way back to Alexander the Great when he besieged Thebes, a city in Greece. Food was so scarce that the Thebans cut what meat they had into little bits and rolled it in grape leaves to make it more filling (Ferretti, 1983).

The word *dolmas*, *dolmeh*, or *dolmades* in Middle Eastern and Greek cooking, refers to various stuffed foods usually young leaves of the grapevine stuffed with rice, onion and many times, ground lamb. Dolmas can also include stuffed zucchini, bell peppers, cabbage, and onions (Britannica, 2024).

Most countries and even regions within a country have their own unique spin on the recipe. Some recipes call for meat; others only call for vegetables. Some are cooked in tomato sauce; others are cooked in lemon broth or grape syrup. Stuffed grape leaves are often seasoned with allspice and cumin and loaded with fresh herbs such as parsley, dill, and mint.

Esmail Nasrollahiazar, Michigan State University Extension viticulture specialist and technical contributor to the 4-H Viticulture Project *Let's Grow Grapes*, loves growing grapes, making wine, and teaching about viticulture. He enjoys many foods from his native country Iran and especially enjoys dolmeh.

Esmail said, "Wrapping grape leaves is not easy and when my mom was in a good mood, she would make dolmeh for us in early summer when the leaves are in great shape and fresh. We also canned the leaves to make dolmeh in wintertime. When I was young, we made our own grape syrup."

Esmail's family grape syrup recipe:

Leave the grapes on the vine until the sugar level increases and the acid level decreases in the grape juice. Then harvest, destem, and extract the juice. Boil it until the juice becomes concentrated. If your grape juice is too acidic, you can adjust the acid level by adding some baking soda to reduce the acidity. You can also purchase grape syrup from a variety of stores.





Esmail states, "In the south of Iran, people add date syrup instead of grape syrup. This makes their dolmeh sweeter than the northern region. Some people prefer to make a mixture of sugar and lemon juice and add it to the pot."

According to Esmail the sultana (Thompson Seedless) grape leaves are the leaves his family uses to make stuffed grape leaves. They prefer them because they are large, flexible and have shallow lobes, making wrapping and rolling easier. The leaves are also smooth and tender when cooked.

Esmail's recipe for dolmeh follows:

Dolmeh – Persian Stuffed Grape Leaves

Prep time: 1 hour

Cook time: 20 minutes

Total time: 1 hour 20 minutes

Ingredients:

- 2 tablespoons and 3 tablespoons olive oil
- 1 yellow onion, finely chopped
- 1/2 cup chopped sabzi (herbs such as parsley or any combination of parsley, cilantro, green onions, mint, and dill)
- 1/2 teaspoon allspice
- 1/2 teaspoon cumin
- 1.5 pounds cooked ground beef or ground lamb
- 1 cup cooked white basmati rice
- 1/2 cup cooked yellow split peas
- salt and pepper to taste
- 30–40 grape leaves (fresh or jarred) (include a few extra to place on the bottom of the pot)
- grape syrup (make your own or purchase; see the previous recipe given)

Instructions:

1. In a skillet, heat 2 tablespoons of olive oil over medium high heat and sauté the chopped onion until translucent, about 2 minutes. Add the spices and let them sweat for a couple more minutes.
2. In a large bowl, combine the meat, rice, split peas, the onion and herbs, spices, salt and pepper. Mix everything together with your hands until everything is well mixed.
3. Take the stems off every grape leaf and blanch them (if using fresh leaves) in boiling water for 10 minutes. If using jarred leaves rinse well in water. Drain.
4. To roll the grape leaves, place a leaf with the vein side up on your work surface. Place 1 to 2 tablespoons of the filling mixture in the center of the leaf. Fold the edges in and up, and roll the grape leaf until it looks like a sausage. Repeat with the other leaves until you've run out of filling or leaves.
5. Line a pot that has a heavy base with (unrolled) grape leaves. Add 3 tablespoons of oil and coat the bottom of the pan.
6. Place the stuffed grape leaves in rows. Alternate the direction of each layer of rows.
7. Add equal amount of syrup and water to cover the bottom of the pot at least 2 inches.
8. Cover the pot and bring to a boil.
9. When it boils, lower the heat to low and steam for 20 minutes.

Recipe from Esmail Nasrollahiazar, Michigan State University Extension Viticulture Specialist





Lemony Frozen Grapes

Prep time: 10 minutes

Total time: varies

Ingredients:

- Grapes (green, red, or a combination)
- Lemonade (frozen concentrate prepared as directed on package)
- Sweetened lemon-flavored powdered drink mix

Instructions:

1. Wash and destem grapes.
2. Using a shallow baking dish, cover the bottom with grapes.
3. Cover the grapes with lemonade.
4. Refrigerate for 4 to 12 hours.
5. Drain grapes.
6. Roll the grapes in the powdered drink mix.
7. Freeze the grapes for 30 to 45 minutes. They should be firm but not frozen solid.
8. Enjoy.

Recipe from Dixie Sandborn, Michigan State University Extension 4-H Horticulture Specialist

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Animated Videos

The animated videos *Viticulture Time* were created for the Michigan Wine Collaborative Talent Pipeline in collaboration with Michigan State University Extension and Michigan 4-H Youth Development. The following table lists the available titles and links as well as the lesson(s) in the 4-H Viticulture Project *Let's Grow Grapes: Michigan 4-H Viticulture* that correspond(s) best with the animated video. Incorporate the videos into your lessons by showing them to participants and leading a discussion afterward. They are intended to supplement the lessons.

Title	Lesson	Link
Lesson: Digging Deep (Soil)	2	Lesson: Digging Deep (Soil) (youtube.com) https://bit.ly/49yCYai
Activity: Soil Analysis	2	Activity: Soil Analysis (youtube.com) https://bit.ly/49HZ2zu
Lesson: Grape Leaves	3	Lesson: Grape Leaves (youtube.com) https://bit.ly/3VXQn8O
Viticulture Time: Photosynthesis	3	Viticulture Time: Photosynthesis (youtube.com) https://bit.ly/3UgvDb9
Activity: Grape Leaf Rubbings	3	Activity: Grape Leaf Rubbings (youtube.com) https://bit.ly/3xAUiYb
Viticulture Time: Pruning	4	Viticulture Time: Pruning (youtube.com) https://bit.ly/440cNs2
Lesson and Activity: Grape Harvest and Berry Sampling	5	Lesson & Activity: Grape Harvest and Berry Sampling (youtube.com) https://bit.ly/49ycR3d
Spring in the Vineyard	6	Spring in the Vineyard (youtube.com) https://bit.ly/4bawyj1
Summer in the Vineyard	7	Summer in the Vineyard (youtube.com) https://bit.ly/3VTh9Pp
Fall in the Vineyard	8	Fall in the Vineyard (youtube.com) https://bit.ly/4ayhTxX
Winter in the Vineyard	9	Winter in the Vineyard (youtube.com) https://bit.ly/3Jisgdc



Connection to the Next Generation Science Standards

This overview contains *Let's Grow Grapes'* connection to the Disciplinary Core Ideas, Science and Engineering Practices (SEP) and Cross-Cutting Concepts as outlined in the *Framework for K-12 Science Education* (NRC 2011). The 4-H Let's Grow Grapes curriculum aligns with the following dimensions of the Next Generation Science Standards but does not fully address them.

Summary of Disciplinary Core Idea (DCI) connections

Primary connections

LS1.C Organization for matter and energy flow in organisms

LS2.A Interdependent relationships in ecosystems

ESS2.C The roles of water in Earth's surface processes

ESS3.C Human Impacts on Earth Systems

PS3.D Energy in chemical processes and Everyday Life

Secondary connections

LS4.B Natural Selection

ESS2.D Weather and climate

LS4.D Biodiversity and humans

ESS2.E Biogeology

ESS3.A Natural Resources

LS2.C Ecosystem dynamics, functioning, and resilience





DCI Grade Progression across the grades from the *Framework for K-12 Science Education (NRC 2011)*

Primary and secondary DCI	Grades 6–8	Grades 9–12
LS1.C Organization for matter and energy flow in organisms	Plants use the energy from light to make sugars through photosynthesis. Within individual organisms, food is broken down through a series of chemical reactions that rearrange molecules and release energy.	The hydrocarbon backbones of sugars produced through photosynthesis are used to make amino acids and other molecules that can be assembled into proteins or DNA. Through cellular respiration, matter and energy flow through different organizational levels of an organism as elements are recombined to form different products and transfer energy.
LS2.A Interdependent relationships in ecosystems	Organisms and populations are dependent on their environmental interactions both with other living things and with nonliving factors, any of which can limit their growth	Ecosystems have carrying capacities resulting from biotic and abiotic factors. The fundamental tension between resource availability and organism populations affects the abundance of species in any given ecosystem.
ESS2.C The Roles of water in Earth's surface processes	Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.	The planet's dynamics are greatly influenced by water's unique chemical and physical properties.
ESS3.C Human Impacts on Earth Systems	Human activities have altered the biosphere, sometimes damaging it, although changes to environments can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth.	Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources, including the development of technologies.
PS3.D Energy in chemical processes and everyday life	Sunlight is captured by plants and used in a reaction to produce sugar molecules, which can be reversed by burning those molecules to release energy.	Photosynthesis is the primary biological means of capturing radiation from the sun; energy cannot be destroyed, it can be converted to less useful forms.
ESS2.D Weather and climate	Complex interactions determine local weather patterns and influence climate, including the role of the ocean.	The role of radiation from the sun and its interactions with the atmosphere, ocean, and land are the foundation for the global climate system. Global climate models are used to predict future changes, including changes influenced by human behavior and natural factors.
ESS2.E Biogeology	Changes in biodiversity can influence humans' resources and ecosystem services they rely on. LS4.D	The biosphere and Earth's other systems have many interconnections that cause a continual coevolution of Earth's surface and life on it
ESS3.D Global Climate Change	Human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics	Global climate models used to predict changes continue to be improved, although discoveries about the global climate system are ongoing and continually needed.



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Primary and secondary DCI	Grades 6–8	Grades 9–12
LS2.C Ecosystem dynamics, functioning, and resilience	The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.	If a biological or physical disturbance to an ecosystem occurs, including one induced by human activity, the ecosystem may return to its more or less original state or become a very different ecosystem, depending on the complex set of interactions within the ecosystem
LS4.B Natural Selection	Both natural and artificial selection result from certain traits giving some individuals an advantage in surviving and reproducing, leading to predominance of certain traits in a population.	Natural selection occurs only if there is variation in the genes and traits between organisms in a population. Traits that positively affect survival can become more common in a population.
LS4.D Biodiversity and humans	Changes in biodiversity can influence humans' resources and ecosystem services they rely on.	Biodiversity is increased by formation of new species and reduced by extinction. Humans depend on biodiversity but also have adverse impacts on it. Sustaining biodiversity is essential to supporting life on Earth.





Cross-Cutting Concepts

Cross-cutting concepts	Grades 6–8	Grades 9–12
Patterns	They identify patterns in rates of change and other numerical relationships that provide information about natural and human designed systems. They use patterns to identify cause and effect relationships, and use graphs and charts to identify patterns in data.	Students observe patterns in systems at different scales and cite patterns as empirical evidence for causality in supporting their explanations of phenomena.
Cause and Effect	They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.	They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects.
Systems and System models	Students can understand that systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.	Students can investigate or analyze a system by defining its boundaries and initial conditions, as well as its inputs and outputs. They can use models to simulate the flow of energy, matter, and interactions within and between systems at different scales.
Energy and matter	Students learn within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system.	They can describe changes of energy and matter in a system in terms of energy and matter flows into, out of, and within that system. Energy drives the cycling of matter within and between systems.
Structure and Function	Students model complex and microscopic structures and systems and visualize how their function depends on the shapes, composition, and relationships among its parts. They analyze many complex natural and designed structures and systems to determine how they function.	Students investigate systems by examining the properties of different materials, the structures of different components, and their interconnections to reveal the system's function and/or solve a problem. They infer the functions and properties of natural and designed objects and systems from their overall structure, the way their components are shaped and used, and the molecular substructures of their various materials.

Science and Engineering Practices (SEP) – The SEP are all about youth doing science. Throughout this curriculum, participants will engage in all of the SEP. A description of the progression of the SEP practices across K-12 is available on the Next Generation Science Standards website (<https://www.nextgenscience.org/>). Go to <https://www.nextgenscience.org/resources/ngss-appendices> and click on “Appendix F: Science and Engineering Practices.”



MICHIGAN STATE | Extension UNIVERSITY

<Place date here>

Dear Parent or Guardian,

We are excited your child has chosen to learn about growing grapes in the 4-H Viticulture Club. This new and exciting project is created by experts in the grape industry, university faculty, and youth development educators. Together they have partnered to develop a vibrant program to introduce 4-H youth to hands-on activities, the latest technologies, and exciting careers in this growing industry.

Native to Michigan, grapes have played a significant part in the state's history. As early as 1679, French Canadians and Americans started vineyards in what is now Michigan. The French explorers discovered distinctive wild grape vines on the banks of what is now the Detroit River. Commander Antoine de la Moth Cadillac first planted grapevines at Fort Pontchartrain in Detroit in 1702. This was just the beginning of what today is a multi-million-dollar industry.

The 4-H Viticulture Club will explore growing, harvesting, and marketing grapes as well as the many careers that are sustained by the grape industry. By participating in the 4-H Viticulture Club, your youth will be introduced to a variety of opportunities we call a career pipeline leading to apprenticeships and educational opportunities available in this industry. Along with technical skills, your youth will participate in activities based on the life skills needed to be successful in a changing workforce.



MSU EXTENSION

Children and Youth Institute

160 Agriculture Hall
Michigan State University
East Lansing, MI 48824-1039

517.432.7575
Fax: 517.355.6748
msue.msu.edu

Although this club and the activities will focus on the production of the fruit, there will be lessons in chemistry, biochemistry, and other aspects of the grape industry linked to enology (wine making).

4-H is not promoting the consumption of wine, but the production of wine grapes is a viable and growing enterprise not only in Michigan but also throughout the United States and around the world. Grapes are produced for many products including table grapes, juice, jam, jelly, and wine.

This curriculum will introduce youth to a broad range of career opportunities directly or indirectly linked to growing grapes.

Some of the jobs in the direct grape industry are in the areas of:

- Vineyard management
- Wine making
- Marketing
- Accounting/Business Management
- Hospitality

Jobs indirectly supported by grape growers are in the areas of:

- Engineering
- Sales from equipment to glassware
- Supply chain management for all grape products

Some of the activities will take place at vineyards that may have a winery on site, and there may be opportunities in the future for youth to do some hands-on chemistry activities in a winery or take an educational winery tour.

Youth will be supervised by a 4-H volunteer who has been approved through Michigan State University's 4-H Volunteer Selection Process. Your signature on this document acknowledges that your child has permission to take part in activities that will take place where wine is being produced, distributed, or both.

Sincerely,

Dixie Sandborn

Dixie Sandborn
4-H Horticulture Specialist
Michigan State University

Please sign and return to your club leader. Thank you.

Name of youth

Name of parent or guardian

Signature of parent or guardian

Date signed



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