

# Unit E: Fruit and Nut Production

## Lesson 1: Grape Production

**Student Learning Objectives:** Instruction in this lesson should result in students achieving the following objectives:

1. Discuss the history and background of grapes.
2. Discuss grape growth.
3. Prepare a vineyard site.
4. Determine the best design for a vineyard.
5. Discuss vine preparation and planting.
6. Discuss trellis construction.

**Recommended Teaching Time:** 4 hours

**Recommended Resources:** The following resources may be useful in teaching this lesson:

- A PowerPoint has been developed for use with this lesson plan
- [http://en.wikipedia.org/wiki/Annual\\_growth\\_cycle\\_of\\_grapevines](http://en.wikipedia.org/wiki/Annual_growth_cycle_of_grapevines)
- <http://en.wikipedia.org/wiki/Veraison>

## List of Equipment, Tools, Supplies, and Facilities

Writing surface  
PowerPoint Projector  
PowerPoint Slides  
Copies of Transparency Masters  
Copies of Student Lab sheets  
Rulers  
Stakes  
Rope  
Measuring tape  
Samples of grapes and grape products  
Empty plot of land to analyze for vineyard development

**Terms:** The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide #2):

**Berry**  
**Bud break**  
**Fruit set**  
**Veraison**

**Interest Approach:** Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

**Hold a bunch of grapes up in front of the class and ask them, “What do we need in order to produce a bunch of grapes like this?” Have them raise their hand and once they have given an item record it on the chalkboard or computer and shown on the PowerPoint projector. Don’t give answers to the students, rather just record the responses they give and at the end of the lesson they will go over the list again and see if they need to add or remove any items they listed.**

Use this approach to move into Objective 1.

## Summary of Content and Teaching Strategies

### **Objective 1: Discuss the history and background of grapes.**

#### **(PowerPoint Slide #3)**

- I. Grapes have been cultivated for thousands of years and served as an important crop in the development of humans.
  - A. Grapes originated in Southern Turkey and have been cultivated for over 8,000 years.
    - 1. Ancient Egyptians and Greeks grew grapes for consumption both as fresh fruit and wine.
    - 2. Grape production and domestication later spread to Northern Africa, Europe and North America.

#### **(PowerPoint Slide #4)**

- B. Grapes are botanically a **berry** and grow on perennial vines.
  - 1. A **berry** is any juicy fruit with a fleshy covering around the seeds.
  - 2. Grapes grow in clusters of 6 to 300.
  - 3. They can range in colors from crimson, black, dark blue, yellow, green and pink.

#### **(PowerPoint Slide #5)**

- C. The uses of grapes are many and include: juice, wine, raisins, vinegar, grape seed oil and jams.
  - a. Approximately 71% of world grape production is used for wine, 27% as fresh fruit, and 2% as dried fruit.

**Provide the students with an overview of grape production in Afghanistan. Ask the students if any of them produce grapes at home. Discuss with the students why they like grapes and also why grapes are important to the economy of Afghanistan.**

## **Objective 2: Discuss grape growth.**

### **(PowerPoint Slide #6)**

II. Grapes grow on a perennial vine and begin their growing cycle in early spring.

A. The first stage is **bud break**.

1. Tiny buds on the vine start to swell and eventually shoots begin to grow from the buds in early spring, depending upon the variety and climate.
2. The energy the buds need to break comes from the stored energy held in the vines and wood from the previous year's growth.
3. Soon, tiny leaves begin to form which facilitates the process of photosynthesis.

### **(PowerPoint Slide #7)**

B. Once leaves are fully formed and developed, flowering occurs.

1. Depending upon the temperature and variety, flowering will occur two to two and a half months after bud break.
2. Flowering occurs when daily average temperatures reach 15 to 20 degrees Celsius.
3. A few weeks after the clusters form, flowers enlarge and become more visible.

### **(PowerPoint Slide #8)**

4. During this stage, pollination and fertilization take place producing 1 to 4 seeds per berry.
5. Grape flowers are perfect, meaning they have both male and female parts and can pollinate themselves.
  - a. Cross pollination is possible between grape varieties and this is why there is such a wide array of grapes throughout the world.

### **(PowerPoint Slide #9)**

C. **Fruit set** occurs once fertilization has taken place the berry begins to enlarge.

1. Fruit set depends upon the variety and climate but will generally occur in May.
2. This point in the grapes' life will determine the yield.
3. The final amount of grape production is determined by the climate and the health of the vine.
  - a. Factors such as low humidity, high temperatures and water stress can have the potential of severely reducing the number of flowers that get fertilized.

### **(PowerPoint Slide #10)**

D. The final stage of growth in the life of a grape is called **veraison**.

1. Veraison is a French word that describes the change of color of the grape berries.
2. At this point, the grapes have very little sugar and are high in organic acids.
3. When veraison is reached, the grapes are half their mature size and begin the ripening process.
  - a. This will take place 40 to 50 days after fruit set.

**(PowerPoint Slide #11) This shows a picture of grapes entering veraison.**

### **(PowerPoint Slide #12)**

4. The berries will start to soften after sugars develop.

- a. Within six days of the start of veraison, the berries begin to grow quickly.
- 5. Veraison does not occur simultaneously across the cluster of grapes.
  - a. Berries on the outside of the vines with more exposure to the sun enter veraison first.
  - b. Factors controlling the onset of veraison include limited water stress and canopy management that creates a high "leaf to fruit" ratio.

**(PowerPoint Slide #13)**

- E. After these stages are complete, harvest can take place and the fruit is ready to be processed into any number of grape products or eaten as fresh table grapes.

**Split the students up into small groups and assign each group one of the growth stages of grapes (bud break, flowering, fruit set, and veraison). Have each group research their growth stage in more depth. Once they have researched their stage, they should create a poster or handout to present to the class.**

**Objective 3: Prepare a vineyard site.**

**(PowerPoint Slide #14)**

III. Preparation of the proposed vineyard site is important and should begin the year before planting. A soil test should be conducted the season before planting to provide information on soil pH status, liming, and fertilizer requirements.

**(PowerPoint Slide #15)**

- A. If soil pH is below 5.5, apply agricultural ground limestone to raise the pH to a more desirable level (5.5 to 6.8).
  - 1. The application should be made well before planting time and the limestone incorporated into the soil.
  - 2. For highly acidic subsoils, deep-plowing with limestone is recommended.

**(PowerPoint Slide #16)**

- 3. Soil testing also will provide information on soil fertility and fertilizer needs for the first-year vineyard.
- 4. Animal manures, when available, may be applied in the fall before spring planting of the vines.
  - a. A suitable application is 9 to 11 metric tons of horse or cow manure per 0.5 hectares or 22 to 34 kilograms per 9 square meters.

**(PowerPoint Slide #17)**

- B. Site preparation in the year prior to planting should include land leveling, drainage tile installation (when needed), and fertility adjustments based on a soil test.
- C. At this time, growers also must pay special attention to controlling persistent weed pests
  - 1. Several safe and effective herbicides are available to control troublesome weeds in the preparation period, but they cannot be used after the vines are planted.
  - 2. If possible, avoid sites that are severely infested with such weeds until the weeds have been eradicated.

**(PowerPoint Slide #18)**

- D. If the available site has internal drainage problems or areas where water will pond, install drainage tile and waterways before planting.
  - 1. If the area to be planted is in sod and free of weeds, at least two options are open to the grower, depending on the topography of the site.

- a. If the proposed vineyard is on a hillside or sloping ground and erosion is a consideration, an approved systemic herbicide can be applied in the fall while the vegetation is actively growing.

**(PowerPoint Slide #19)**

- i. Herbicide is applied to the row area where the vines are to be established.
- ii. The row middles will remain in sod.
- iii. In fall or early spring, these row areas are tilled so the sod mat or ground cover is destroyed and a friable planting soil is established.

**(PowerPoint Slide #20)**

- b. If the proposed vineyard site is located on relatively level or gently sloping ground so that erosion is not a serious consideration, or if it is necessary to apply lime, the site should be plowed in the fall to incorporate the lime and seeded to a suitable winter cover crop.

**(PowerPoint Slide #21)**

- i. One week before plowing, apply a systemic herbicide to kill spreading roots and rhizomes of perennial weeds.
- ii. Most grasses establish better if sown between mid-August and mid-September, rather than during the spring.
- iii. An application of 15 kilograms of actual nitrogen per 0.4 hectares at the time grass is sown will stimulate growth.

**(PowerPoint Slide #22)**

- E. Final site preparation should be made as early in the spring as the soil can be worked, preferably in late March or early April.
  1. After plowing or tilling, apply and disk (or till) the required fertilizer into the soil before setting the vines.
  2. Even though early spring preparation is advisable, it should not be done until the soil is dry enough to work properly.
    - a. If soil is worked too wet, the advantages of early preparation will be lost because soil structure may be damaged.

**Have the students visit a potential vineyard site. As a class, discuss what needs to be done to this site to make it suitable for the establishment of a vineyard. If possible, conduct a soil test on this site. Also, identify any weeds that are currently growing that might be a problem in the vineyard.**

## **Objective 4: Determine the best design for a vineyard.**

**(PowerPoint Slide #23)**

IV. The vineyard should be designed to achieve the following goals: to prevent soil erosion (the most important), use land area efficiently, optimize vine performance, facilitate management and equipment operation.

**(PowerPoint Slide #24)**

- A. Vineyard rows need to be straight for trellis strength.
  1. On sloping land, rows should be across or perpendicular to the slope.
  2. It may be necessary to divide the vineyard into blocks to accommodate depressions or other characteristics.

3. If erosion control can be accommodated, it is preferable to orient rows north-south.

**(PowerPoint Slide #25) This is an aerial view of a vineyard in Afghanistan. Point out the straight rows.**

**(PowerPoint Slide #26#)**

4. This orientation provides the most even distribution of light in the canopy and has been associated with improved yields and **berry** quality.
5. Row spacing depends in part on the proposed training and trellising system and the equipment to be used in the vineyard, such as a mechanical harvester.

**(PowerPoint Slide #27)**

- a. 2.7 to 3 meter spacing between rows are common and generally ample, but 3.3 or even 3.7 meters between rows may be needed to accommodate divided training systems (e.g., Geneva Double Curtain), large equipment, or steep slopes.
- b. A 2.4 meter spacing between rows is satisfactory for small plantings, but this is considered too restrictive for most commercial operations.

**(PowerPoint Slide #28)**

6. In general, as distance between rows increases, yield per hectare decreases.
7. Spacing vines in the row at 2.4 meter intervals has proved satisfactory for average conditions.
  - a. However, closer spacing have produced higher yields under certain conditions.
  - b. Cultivars that produce less vigorous growth, such as Delaware, some French hybrids (Seyval and Chambourcin), and some vinifera, may be set closer together than Concord or others of similar vigor.
  - c. Highest yields generally have been obtained from vineyards containing 1200 or more vines per hectare.

**(PowerPoint Slide #29)**

8. To create conventional, straight rows, establish a baseline along the edge of the field.
  - a. Drive a stake at each end of the proposed line.
  - b. Generally, these stakes are located by measuring a desired distance in from the edge of the field to allow turning space for equipment.
  - c. By sighting from one stake to the other, additional stakes are placed on the baseline to mark it.
  - d. A careful tractor operator can plow a furrow along the baseline, which also serves as the first row of grapes.

**(PowerPoint Slide #30)**

9. There are several ways to establish rows parallel to the baseline or first row.
  - a. A simple way is to establish a perpendicular line at each end of the row.
  - b. First, set a stake on the baseline 9 meters from the end.
  - c. Then, place a stake 12 meters from the end of the baseline on the assumed perpendicular line.
  - d. Measure the angular distance between the 9- and 12-meter stakes.

**(PowerPoint Slide #31)**

- e. If the distance is 15 meters, the assumed line is correct and can be extended by sighting.
- f. If it is not, move the 12 meter marker not the 9 meter marker until there is 15 meters between the two stakes.
- g. Stakes can be driven on this second base at the proper intervals to indicate the row ends.
- h. The procedure used to mark the baseline is repeated until the required number of rows has been marked.

**Pass out TM: E1-1 “Establishing Parallel Rows”. It will help the students further understand the principles of setting up parallel and straight rows. Drawing the picture on the chalkboard and explaining the concept can also be used.**

**(PowerPoint Slide #32)**

10. A pole the length of the desired interval between vines can be used to space vines in the row as they are planted.
  - a. However, a planting chain with lead markers at designated intervals is much more accurate.
  - b. It is important to leave enough space at the end of rows for machinery to turn.
  - c. A 7.6 to 9 meter headland at each end of the vineyard should be adequate.
  - d. It is also important to leave sufficient space on the sides of the vineyard to allow easy movement of equipment.
  - e. If rows are long, 6 to 7.6 meter wide crossing alleys at about 0.15 kilometer intervals will ease vineyard management.

**Have the students practice setting up straight and parallel rows. Wood stakes, rope and a measuring tape will be needed. Demonstrate the procedure to the students and then have them practice creating straight and parallel rows of differing widths.**

**Objective 5: Discuss vine preparation and planting.**

**(PowerPoint Slide #33)**

- V. Handle young vines carefully to prevent drying out or other damage after they have been dug or received from the nursery.
  - A. If dormant vines are not planted immediately, place them in cold storage (0°C with high relative humidity) until planting time.

**(PowerPoint Slide #34)**

- B. If proper facilities are not available, carefully heel-in vines in a sheltered location.
  1. To heel-in plants, dig a shallow trench and place vines in the trench so the tops are exposed.
  2. Cover the roots with soil and firm the soil.
  3. If the soil is not moist enough, water newly set vines to prevent the roots from drying out.
  4. Vines should be transplanted to their permanent location as soon as possible.

**(PowerPoint Slide #35)**

- C. Soaking dormant vine roots in water two to three hours before planting also will increase their chance of survival.
- D. Early spring is the most suitable time for planting grapevines.
- E. Fall planting generally is not recommended because fall-set plants are likely to be lost to heaving during the first winter.
  - 1. If plants must be set in the fall, plow a 10 to 15 centimeter mound of soil around the base of the young vines, or mulch them with straw to protect against heaving and severe cold.

**(PowerPoint Slide #36)**

- F. Do not prune roots except to remove broken or dead portions.
  - 1. Plant as much of the root as possible, ensuring good distribution in the trench or hole.
  - 2. Most of the reserves of the vine are stored in the roots and to ensure maximum growth, plant as much of the root system as possible.
  - 3. Normally vines purchased from a commercial nursery have been pruned, but if not, they should be pruned to a single cane.
  - 4. It is critical to keep vine roots moist during planting and transporting to the field.

**(PowerPoint Slide #37)**

- G. Grafted grapevines should be set in the hole with the graft union several centimeters above the soil line and soil firmed around the roots.
  - 1. After soil settling, the graft union should be 5 to 7 centimeters above the soil line.
  - 2. Setting too deep will result in scion rooting and loss of phylloxera resistance of the rootstock.
  - 3. Non-grafted vines should be set with the junction of the older wood and new canes at the soil line.

**(PowerPoint Slide #38)**

- H. To plant, plow a straight furrow 25 to 30 centimeters deep for the row.
  - 1. This depth will accommodate a large root system without packing a mass of roots into a small hole.
  - 2. Spread roots well, cover with about 6 centimeters of topsoil, and tamp firmly.
  - 3. A plow or disk may be used to finish filling the furrow.
  - 4. In small plantings, the entire operation can be done by hand.
  - 5. In large operations, a commercial vine-planting machine often is used.

**(PowerPoint Slide #39)**

- I. When planting is completed, the node from which the lowest cane will arise should be at or just above the soil level.
  - 1. Prune the single cane remaining after planting so that only two or three live buds remain.
  - 2. Some growers prefer to leave five or six buds.
  - 3. As these shoots develop, all but two of the most vigorous are removed when about 2.5 centimeters long.
  - 4. This pruning provides two shoots to develop into vigorous new canes.

**(PowerPoint Slide #40)**

- J. Apply nitrogen two weeks after planting at a rate of 4.5 kg of 10-6-4/30.5 meters of row.
  - 1. Reapply the same rate annually in early spring, right before growth starts.



2. Fertilizer can be applied to a single plant at a rate of .45 kg/plant.

**(PowerPoint Slide #41)**

3. Have the soil tested every three to five years.
4. Do not apply fertilizers containing herbicides (such as some lawn fertilizers) in or near the grapes.
5. 10 to 15 centimeters of mulch may be applied to help control weeds and conserve soil moistures.

**(PowerPoint Slide #42)**

6. Afghanistan has over 100 varieties of grapes but not all are named. Common grape varieties include:

***The next slides show pictures and/or information about common grape varieties of Afghanistan. Some varieties have pictures and some do not. You may provide the students with additional pictures and information if available.***

**(PowerPoint Slide #43)**

- a. Kiashmishi Shamili (*no picture*)
  - i. Mature in September.
  - ii. Used as table grapes and export.
  - iii. These grapes are light yellow in color.

**(PowerPoint Slide #44)**

- b. Hosinee Arosi (*no picture*)
  - i. Mature in September
  - ii. Commonly eaten as table grapes
  - iii. These grapes are yellowish white

**(PowerPoint Slide #45)**

- c. Askari
  - i. Mature in October.
  - ii. Usually exported.
  - iii. These grapes are light green in color

**(PowerPoint Slide #46)**

- d. Ghola dan (*no picture*)
  - i. These grapes mature in September.
  - ii. Commonly used as table grapes or exported.
  - iii. They are green in color

**(PowerPoint Slide #47)**

- e. Spen manga (*no picture*)
  - i. Mature in October.
  - ii. Commonly used as table grapes.
  - iii. These grapes are dark green.

**(PowerPoint Slide #48)**

- f. Naderi (*no picture*)
  - i. Mature in late September.
  - ii. Mostly used as table grapes.
  - iii. These grapes are light red.

**(PowerPoint Slide #49)** This slide provides a picture of Keshmishi Siah Bedana. Provide any additional information about this grape, if available.

**(PowerPoint Slide #50)** This slide provides a picture of Hussaini grapes. Provide any additional information about this grape if available.

**Obtain a variety of grapes and grape products (raisins, etc) commonly grown in Afghanistan. Allow the students to taste these and determine the differences in taste, texture and color. Discuss the uses for grapes other than fresh and raisins.**

## **Objective 6: Discuss trellis construction.**

### **(PowerPoint Slide #51)**

VI. Constructing the trellis can be the greatest cash expense in vineyard establishment, and it must be strong enough to carry heavy fruit loads and withstand strong winds.

### **(PowerPoint Slide #52)**

- A. The trellis must be durable, and its real cost is determined by years of service, rather than initial cost.
- B. The physiological function of the trellis is to expose foliage and fruit to sunlight, and generally, the higher the trellis, the more foliage will be exposed and the more productive the vineyard.
- C. The best time to construct a trellis is during the first growing season or the following spring before growth begins.
  - 1. Waiting beyond this time will result in delayed harvest of profitable crops.

### **(PowerPoint Slide #53)**

- D. End posts should be large (11 to 15 centimeters diameter) and longer than line posts (2.7 to 3 meters instead of 2.4 meters) because they must serve as anchor points as well as wire supports.
  - 1. Posts should be either metal or wood that has been treated to prevent rotting.
  - 2. Some tree species produce wood posts which are naturally rot resistant for many years.
  - 3. The posts used are determined by the vineyard grower and also cost and materials available.

### **(PowerPoint Slide #54)**

- E. Set end posts about 91 centimeters in the ground and at a slight angle with the top leaning away from the direction of the row.
  - 1. The top should extend at least 1.8 meters above ground level after setting to support the top trellis wire at the desired height.
    - a. End posts can be braced in several ways.
    - b. A common method is to set a screw anchor about a meter outside the end post.
    - c. The angle of the wire attaching the anchor to the post should be about 34 degrees.

### **(PowerPoint Slide #55)**

- d. Another bracing method uses a brace wire from the top of the end post to an anchor in place of the screw anchor.
- e. The anchor is buried 0.9 to 1.2 meters from the post.
- f. A double-wire brace extends around the post near the top and to the anchor.
- g. The brace is tightened against the anchor by twisting the wires together.
- h. Other types of braces with the guy wire are available.

**(PowerPoint Slide #56)**

- i. Line posts generally are cut 2.4 to 2.7 meters long with a minimum of 7.6 centimeters diameter at the top.
- i. They are set 0.6 to 0.75 meters deep and spaced 6 to 7 meters apart in the row.
- ii. The exact spacing depends on vine spacing.

**(PowerPoint Slide #57)**

- F. High-tensile-strength steel wire is becoming popular in newly set vineyards.
1. Its strength and durability are in several ways superior to conventional wire.
  2. Because this wire has much greater tensile strength (14065 kg/cm), it must be handled differently than regular iron or galvanized wire.
  3. Galvanized 9-gauge wire was the standard for many years.

**(PowerPoint Slide #58)**

4. While high-tensile steel wire is initially more expensive than galvanized wire, it is more durable and may be the most economical over a long period.
  - a. Rusted wire can seriously chafe vines.
5. High-tensile-strength steel wire should have Class III galvanizing, and a wire gauge of 11 to 12.5 is acceptable, with 12.5 gauge most commonly used.
6. The number of wires and their location depend on the training system.

**(PowerPoint Slide #59)**

- G. The length of wire needed for a hectare of grapes depends on row spacing, the gauge of wire used, and the training system.
1. Wires may be secured to end posts in various ways.
  2. A common method for galvanized or iron wire is to wind the wire around the post once or twice and then twist the end several times around the wire as it is stretched to the next post.
  3. Special devices also are available to attach the wires to the posts.

**(PowerPoint Slide #60)**

4. These devices simplify adjustment of the wires by using a crank or a cinch that eliminates removal of wires from end posts when tightening or loosening.
5. If high-tensile-strength steel wire is used, a special wire-crimping tool is required.

**(PowerPoint Slide #61)**

- H. There are also several types of wire anchors and connectors specifically designed for high-tensile wire.
1. Wires are fastened to line posts with ordinary staples or inserted in holes drilled in wooden line posts.
  2. The staples must be driven deep enough to hold the wires close to the post, but with enough play that the wire will slip through when tightening is needed.
  3. Staples are less likely to pull out if wires are hung on the windward side or the uphill side of posts.
  4. With steel posts, regular fence wire fasteners are used.

**Show the students a grape trellis which has been constructed, or take them to an established vineyard to view the trellising systems. If possible, have the students construct a grape trellis or arbor. Use Unit C Lesson 4 “Pruning Small Fruits” Objective**

**2 as guidance when discussing pruning and training grapes on the trellis. TM: C4-1 and TM: C4-2 will be helpful in providing illustrations of trellises and training.**

**Review/Summary:** Use the student learning objectives to summarize the lesson. Have the students explain the response to the anticipated problem of each objective. Student responses can be used to determine which objectives need to be reviewed. Questions on **PowerPoint Slide #62** can be used as review.

**Application:** Split the class into small groups. Pass out LS: E1-1 "Vineyard Plan". Point out that the top of the map is North so they should plan their vineyard accordingly. They should add the rows in and indicate the spacings between rows and space at the ends of the rows. Somewhere on the sheet they should include what varieties they want to grow. Provide the students with rulers.

**Evaluation:** Evaluation should focus on student achievement of this lesson's objectives. A sample written test is attached.

## **Answers to Sample Test:**

### Matching

1. C
2. B
3. A
4. D

### Short Answer

1. Bud break      Flowering      Fruit set      Veraison      Harvest
2. Decrease
3. Land leveling, drainage tile installation (when needed), and fertility adjustments based on a soil test.

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# Test

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## Unit E Lesson 1: Grape Production

**Part One: Matching**

*Instructions.* Match the term with the correct response. Write the letter of the term by the definition.

- a. Berry      b. Bud break      c. Fruit set      d. Veraison

- \_\_\_\_\_ 1. Occurs once fertilization has taken place the berry begins to enlarge.  
\_\_\_\_\_ 2. This growth stage occurs when tiny buds on the vine start to swell and eventually shoots begin to grow from the buds in early spring  
\_\_\_\_\_ 3. any juicy fruit with a fleshy covering around the seeds  
\_\_\_\_\_ 4. The change of color of the grape berries.

**Part Two: Short Answer**

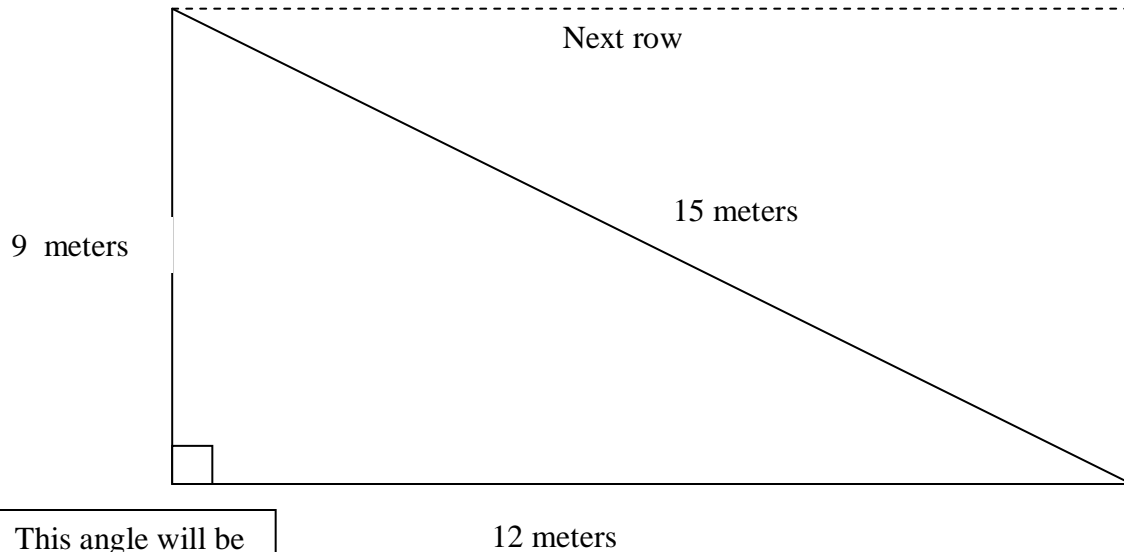
*Instructions.* Provide information to answer the following questions.

1. Place the following growth stages of grapes in the correct order from first to last.

Fruit set      Bud break      Harvest      Veraison      Flowering

2. Does grape yield increase or decrease per hectare as row spacing increases?
3. List four actions that should be completed when establishing a new vineyard.

## Establishing Parallel Rows



This angle will be exactly 90°

This works for a 3-4-5 triangle, meaning when each side is divided by 3 you get  $9/3=3$ ,  $12/3=4$ , and  $15/3=5$ . Use this by taking the distance you want between your rows (in this example, 9 meters) and dividing by 0.75. In this example you get 12 meters. Go to the end of the 12 meter line and walk back to the end of the 9 meter line. The distance between the ends should be 15 meters. This will give you an exact 90° angle and make your rows perfectly straight and parallel.

# Vineyard Plan

