

Unit D: Fruit and Vegetable Crop Production

Lesson 3: Growing and Maintaining Small Fruits

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

1. Understand site and fruit selection when planning a garden.
2. Explain how to prepare and plant small fruits.
3. Discuss the maintenance of small fruit planting.
4. Understand harvesting and marketing systems for small fruits.

Recommended Teaching Time: 3 hours

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

- A PowerPoint has also been developed with use of this lesson plan
- <http://www.hort.purdue.edu/ext/ho-46.pdf>
- <http://en.wikipedia.org/wiki/Grape>

List of Equipment, Tools, Supplies, and Facilities

Writing surface

PowerPoint Projector

PowerPoint slides

Transparency Masters

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

- Arbors
- Banded fertilizer
- Bleeding
- Broadcast fertilizer
- Crown
- Everbearing strawberries
- Four-arm kniffen system
- Frost protection
- Hill system
- K soil test
- Matted-row system
- P₁ soil test
- Refractometer
- Small fruits
- Spaced-row system
- Spring-bearing (June bearing) strawberries
- Trellises

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.

Have samples of strawberries and grapes on hand. Ask students what these items have in common (they are all small fruits.). Find out which students have had experience in growing, harvesting, and consuming these products. Ask students what we need to know in order to raise these crops. Identify a site where the garden can be planted.

**** Use this activity to lead into what you need to think about when starting to plant small fruits for the first time.**

Summary of Content and Teaching Strategies

Objective 1: Understand site and fruit selection when planning a garden.

(PowerPoint Slide #3 and #4)

I. **Small fruits** are the edible fruit that is produced on a small perennial plant. They may be grown when space is limited. A well-planned garden will supply fresh fruit from early spring to the first killing frost in the fall. The fruits produced have a pleasing taste and dietary value as sources of vitamins, minerals, and acids.

(PowerPoint Slide #5)

A. The size of your family, personal taste preferences, the space available, and planned usage of the fruit are factors in determining what to plant. Fruit can be eaten fresh, canned, frozen, or preserved as jellies or jams for use during the rest of the year. Do not plant more than you can care for properly.

(PowerPoint Slide #6)

B. The ideal small fruit site would be near the house with fertile well-drained soil. Full sunlight is preferred. A moderately elevated or sloping site, which provides good drainage, will reduce losses from late spring frosts if applicable.

(PowerPoint Slide #7)

C. Varieties for home small fruit planting should be selected for high quality; either for eating fresh, preserving, or both. Resistance to diseases and winter hardiness should be considered. Selection of early, mid-season, and late-season varieties will provide a harvest of fresh fruit during a longer period. The use of several varieties helps ensure a successful harvest.

****Ask the students for a definition of “small fruits”. Find out which fruits class members like and which ones they have raised.**

Objective 2: Explain how to prepare and plant small fruits.

(PowerPoint Slide #8)

II. Most small fruit plants occupy the same location for several years. Therefore, it is desirable to build up the soil fertility of the proposed location. Planning one or two years ahead can

also help to reduce weed problems. Plant small fruits where row crops have been cultivated for one or two years.

(PowerPoint Slide #9)

- A. Application of 4 bushels of well-rotted manure per 9.3 square meters in the summer or fall before planting will add organic matter and nutrients to the planting bed. Add 11 kilograms of 20 percent superphosphate for each 0.4 metric tons of manure. Compost, decomposed leaves, or lawn clippings may also be used. In the fall, sow rye as a cover crop at the rate of 1.3 kilograms per 93 square meters. Plow it under in early spring to improve the soil.

(PowerPoint Slide #10)

- B. All of the small fruits grow satisfactorily in a soil pH range of 5.5 to 7.5. The pH refers to the acidity or alkalinity of the soil with 7.0 as neutral and 6.0 to 7.0 slightly acid. Before planting, use a spade in small areas or a rototiller in larger areas to prepare the seedbed. The soil should be loose and the organic matter and fertilizer thoroughly incorporated.

(PowerPoint Slide #11)

- C. If you happen to get your plants before you are ready to plant, you have a couple options. Plants that arrive early should be placed in cold storage if available (0 to 4°C) or "heeled-in". Heeling-in is placing plants in a trench deep enough to permit covering the roots and long enough to spread the plants side-by-side one layer deep. The soil is firmed over the roots. The plants are watered and kept shaded until the weather and the seedbed are ready for planting.

(PowerPoint Slide #12)

- D. Planting and spacing requirements vary with the type of small fruit you plant.
 1. Strawberries can be planted as soon in the spring as the ground can be prepared. Plant them so that the top of roots is just covered with soil and add one pint of water. The **crown** is where the shoot and roots come together. It should be exposed at ground level. **Spring-bearing strawberries** produce berries mainly in the month of June while **everbearing strawberries** produce berries throughout the summer. The type of strawberry you plant could have an effect on which planting method you choose.

(PowerPoint Slide #13)

- a. The **matted-row system** requires setting plants 60 centimeters apart in rows 1.1 to 1.2 meters apart. This popular method allows the plant to form runners (horizontal shoots) to fill in the row to about 0.6 meters wide.

(PowerPoint Slide #14)

- b. The spaced-row system is a modification of the matted-row system. The **spaced-row system** includes setting plants 60 centimeters apart in rows 1.1 to 1.2 meters apart but the runner plants are spaced to make roots not closer than ten centimeters apart. After the spaced-row about 0.6 meters wide is obtained, all new runners are removed. This will give optimum growing conditions since strawberry rows can often be too dense for good production. Spaced-row culture requires more care than matted-row culture but higher yields, larger berries, and fewer disease problems are the rewards.

(PowerPoint Slide #15)

- c. The **hill system** requires the removal of all runners. The plants are set 0.3 to 0.4 meters apart in rows that are 0.3 to 0.4 meters apart. Often the rows are arranged in groups of three or four, with a 0.6 meter walkway between each group of rows.

(PowerPoint Slide #16 shows the correct depth to plant strawberries and PowerPoint Slide # 17 shows strawberry planting systems)

(PowerPoint Slide #18)

- 2. Grapes are popular for home gardens. Some grape varieties ripen from early August until mid-October, thereby providing a long season of fresh fruit. Set the plants slightly deeper than they grew in the nursery. Space the plants 2.4 meters apart and space rows 2.5 meters apart. As the plants develop they need supports. **Trellises** are two or three wire supports stretched between wood or metal posts. **Arbors** are curved wooden supports that may also provide shade and interest to your garden.

(PowerPoint Slide #19 shows a grape arbor and grape trellis.)

****Discuss seedbed preparation and planting procedures for each of the commonly grown small fruits. Ask the students if they grow any of these fruits. Have them explain their operation to the class. TM: D3-1 TM: D3-2 and TM: D3-3 to help explain planting procedures.**

Objective 3: Discuss the maintenance of small fruit plantings.

(PowerPoint Slide #20 and #21)

III. Small fruit maintenance includes weed control, mulching, fertilizing, irrigation, frost control, pruning, and pest control.

- A. Weed control, especially with the low growth habit of strawberries, is important. Hoeing or tilling should be shallow to prevent damage to plant roots. As plants become established, mulch with black plastic and/or organic mulches such as straw, sawdust, ground corncobs, or wood chips. Mulching not only reduces weed growth but conserves moisture, prevents soil erosion, and helps keep fruit clean.
- B. Soil tests taken before planting should guide fertilizer application during seedbed preparation. The **P₁ soil test** is a soil test for available phosphorus. The **K soil test** measures potash (K₂O) levels in the soil. Soils showing a high P₁ test (50 and up) and a high K test (300 and up) need only nitrogen fertilizer. Apply fertilizer in the early spring. **Banded fertilizer** is placed only on the row while **broadcast fertilizer** is placed over the entire area. Broadcast fertilizer can stimulate unwanted weed growth between the rows. Consult the text for specific fertilizer recommendations for each type of small fruit.

(PowerPoint Slide #22)

- C. Irrigation/watering depends on the amount of natural rainfall. Water is a key to successful small fruit production especially with strawberries. Insufficient moisture results in undersized berries, delayed maturity, less flavor, and dull fruit color. Like most other plants, 2.5 centimeters of water once a week is ideal. Use of overhead sprinklers allows the adaptability for spring frost control. Because strawberries grow close to the

ground where cold air (which is heavier than warm air) accumulates, they are particularly susceptible to frost damage.

(PowerPoint Slide #24)

Frost protection is the practice of using water sprinklers in the patch when temperatures drop to 1° C at plant level in the field or garden to prevent frost damage. The sprinklers are run continuously until the ice that forms on the plants has melted. As water freezes, it releases heat (heat of fusion), which warms objects in contact with the water and ice. If some free water is maintained on a bud covered with ice, the temperature of the bud will remain approximately 0°C. At 0°, there will ordinarily be no injury since flower tissue damage generally begins at -2°C. Winter freeze protection can be accomplished by covering plants with straw.

(PowerPoint Slide #25)

D. Pruning is the removal of plant parts to regulate crop size and quality and to direct growth. Pruning of small fruits requires an understanding of their growth habits.

Whether strawberry runners are to be pruned/pinched off depends on the planting system you selected. Renovation of a strawberry patch is the renewing the plants by mowing off the tops within 10 days of the final harvest. Rows can be narrowed and fertilizer added at that time. This process will result in higher yields.

(PowerPoint Slide #26)

With grapes, pruning usually refers to the removal of canes during the dormant season and is based on the number of buds needed to produce the next year's growth. Avoid late spring pruning that results in **bleeding**, the oozing of plant sap. Prune after the coldest part of winter is past and before the buds begin to swell. When vines were planted they should have been pruned to a single stem with two buds. A shoot grows from each bud. In the second year all but the strongest cane are pruned. During the third year strong lateral canes develop and can be trained to supports.

(PowerPoint Slide #27)

Leave two buds (renewal spurs) on each shoot near the lower and upper trellis wires. Fruiting canes for next season grow from these buds. After the third year, most vines can be treated as mature vines.

(PowerPoint Slide #28)

The **fourarm kniffen system** is the use of a two-wire trellis to support vines that have a main trunk and four major lateral canes or "arms". For this system in early spring prune the vine to four lateral canes, each with 6 to 12 buds arising from the main trunk. Each of these buds is capable of producing two or three clusters of grapes. Leave two renewal spurs near the main trunk for future fruiting canes at each trellis wire. Remove all other growth. Over-pruned vines become too vegetative and under-pruned vines are weak and produce small cluster of fruit. Healthy canes have a darker color and shorter internodes.

(PowerPoint Slide #29)

The thinning of vines should result in good exposure to sunlight of pencil diameter (6 to 8 millimeters) canes, consistent yield, and high quality fruit. Proper pruning necessitates removal of 80 to 90% of the wood. A vigorous growing vine can support 45 to 60 buds. After pruning, loop or spiral the canes over the support wires and tie with twine or other durable material.

(PowerPoint Slide #30)

Pest control begins with the selection of a suitable planting site, the use of disease resistant varieties, purchase of healthy plants, and the use of good cultural and sanitation practices. The home gardener may use individual chemicals or multipurpose mix containing insecticide and fungicide.

**** Plant and care for a small fruit garden in your land lab or at a home garden if possible. If this isn't possible, try to take the students to see a strawberry patch or a trellis of grapes. Have the owner talk about what they do to care for these small fruits.**

Objective 4: Understand harvesting and marketing systems for small fruits.

(PowerPoint Slide #31 and #32)

IV. Most small fruits are harvested by hand. Picked fruit may be eaten fresh, used in cooking (pies, jellies, jams, preserves, juices) or frozen. Small fruits vary greatly in their keeping ability at harvest.

(PowerPoint Slide #33)

A. Strawberries are perishable products so harvest time, handling, and storing are key to quality. Color change is a good indication of ripeness. Flavor is the best indication of harvest ripeness. Berries picked too early will continue to ripen but sweetness, quality and size will be sacrificed. Overripe berries will be soft, poor quality, and rapidly deteriorate.

(PowerPoint Slide #34)

B. With grapes, color, sugar content, taste, aroma, and ease of berry separation from the stem are indications of ripeness. For wine grapes, extensive testing is done to determine harvest readiness. The **refractometer** is a hand-held instrument used in the field to estimate the sugars present in grapes. Laboratory tests are made to determine the acid level of the grapes. It is important to note that grape clusters do not continue to ripen after being cut from the vine, so they should not be harvested before they are fully ripe.

****Compare the keeping ability of the various small fruits and discuss the implications that this characteristic has on harvesting. Discuss the uses of the small fruits in your area.**

Review/Summary: Review weed control, fertilizing, irrigation, and frost control. Review questions on PowerPoint Slide #35 can be used.

Application: Plant and care for a small fruit garden, or visit a place that grows strawberries or grapes.

Evaluation: Observe student work in the planting and care of a small fruit garden. Complete the written test.

Answers to Sample Test:

Part One: Matching

1. e
2. b
3. c
4. f.
5. g
6. d
7. a

Part Two: Completion

1. Matted row
2. Space row
3. Hill
4. P₁
5. K
9. crown
10. Banded, broadcast

Part Three: Short Answer

1. Mow off strawberry patch 10 days after the last harvest. Mow off the leaves but do not damage the crowns. Narrow the rows to 22 cm and add fertilizer.
2. Sprinkle water on strawberries to form a protective layer of ice. Keep sprinkling until warmer temperatures result in melting ice.
3. Factors used to determine if grapes are ready for harvest are: color, sugar content, taste, aroma, and ease of berry separation from the stem.

Sample Test

Name _____

Test

Unit D Lesson 3: Growing and Maintaining Small Fruits

Part One: Matching

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

- | | |
|----------------------------|-------------------|
| a. four-arm kniffen system | e. spring-bearing |
| b. arbor | f. perennials |
| c. trellises | g. refractometer |
| d. everbearing | |

- _____ 1. Strawberries that ripen mainly in the month of June.
- _____ 2. Curved support used for grapes.
- _____ 3. Support with two wires stretched between wooden or metal posts.
- _____ 4. Plants that come back each year from the roots.
- _____ 5. Instrument used to measure sugar content of grapes.
- _____ 6. Strawberries than ripen throughout the summer.
- _____ 7. Training system of grapes with one stem and two lateral canes to the left and right.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. The _____ system allows strawberry runners to root freely.
2. The _____ system requires hand placement of strawberry runners ten or more centimeters apart.
3. The _____ system requires the removal of all strawberry runners.
4. Available phosphorus is measured with the _____ soil test.
5. Potassium is measured with the _____ soil test.
6. The _____ is where the roots and shoots of a strawberry plant are joined.
7. _____ fertilizer is applied only over the row while _____ fertilizer applied over the entire patch.

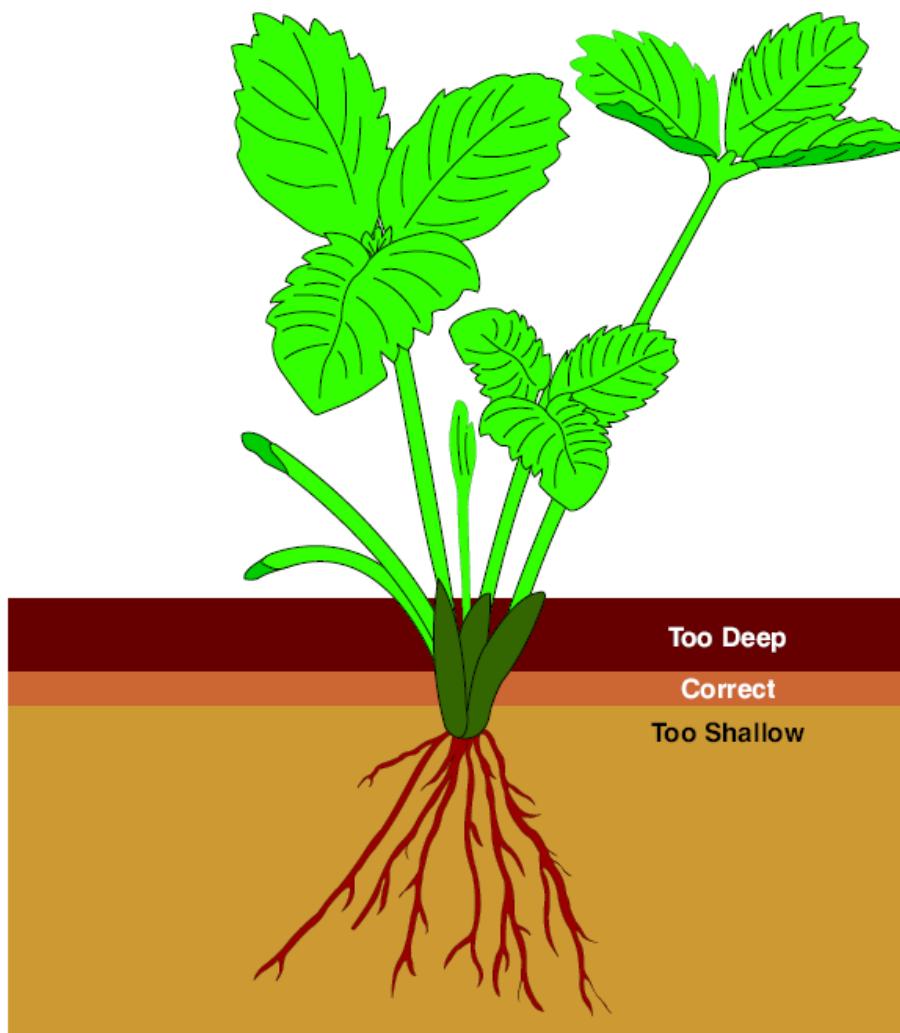
Part Three: Short Answer

Instructions. Provide information to answer the following questions.

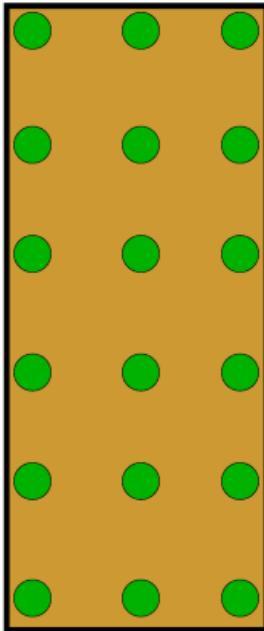
1. Explain how to renovate a strawberry patch:
 2. Explain how sprinklers are used to prevent frost damage to strawberries:
 3. What factors are important in determining that grapes are ready for harvest?

TM: D3-1

STRAWBERRY PLANTING DEPTH

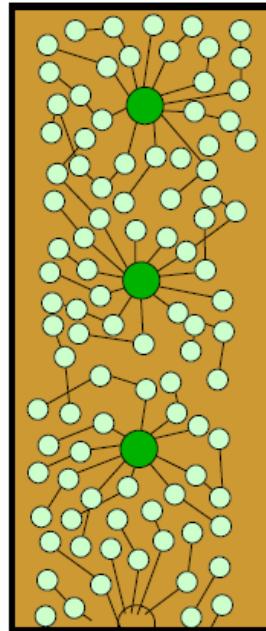


STRAWBERRY ROW SYSTEMS



HILL

- plants spaced 30 cm apart
- multiple rows (3 or 4)
- no runners allowed
- .6 meter aisles



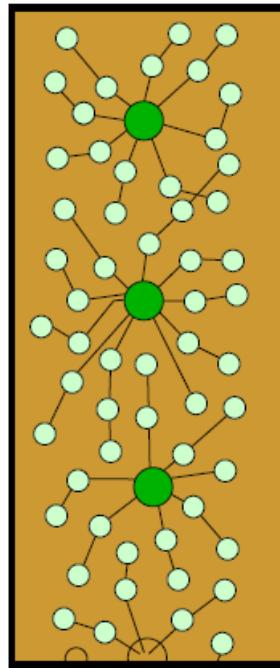
MATTED ROW*

- plants spaced 45 to 76 cm apart
- single rows
- runners fill in row to width of .6 meters
- .9 to 1.2 meter aisles

● Parent plant

○ Runner plant

*Matted row is actually a modification of the broadcast system:
BROADCAST: plants spaced 45 to 76 cm apart, single rows, runner freely, no aisles maintained.

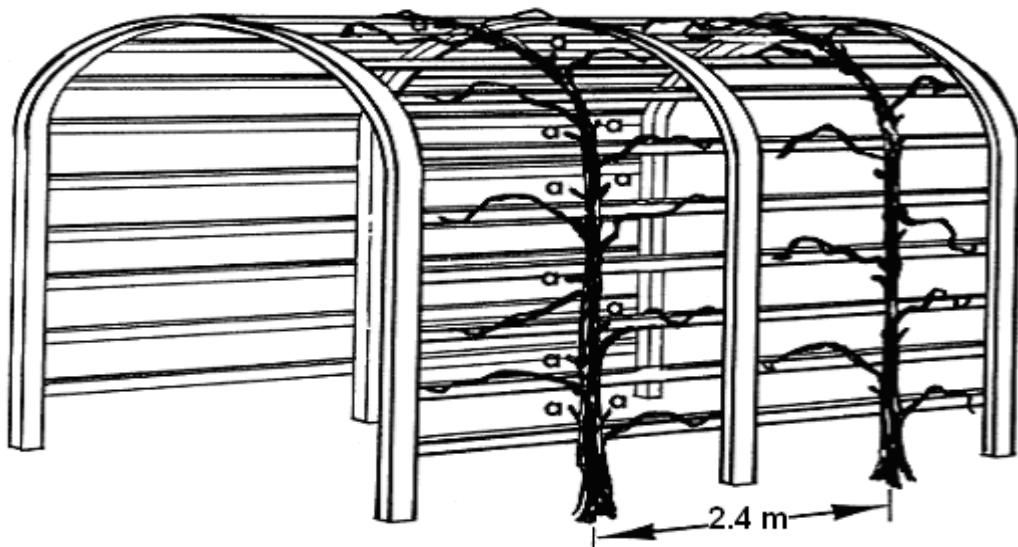


SPACED PLANTING

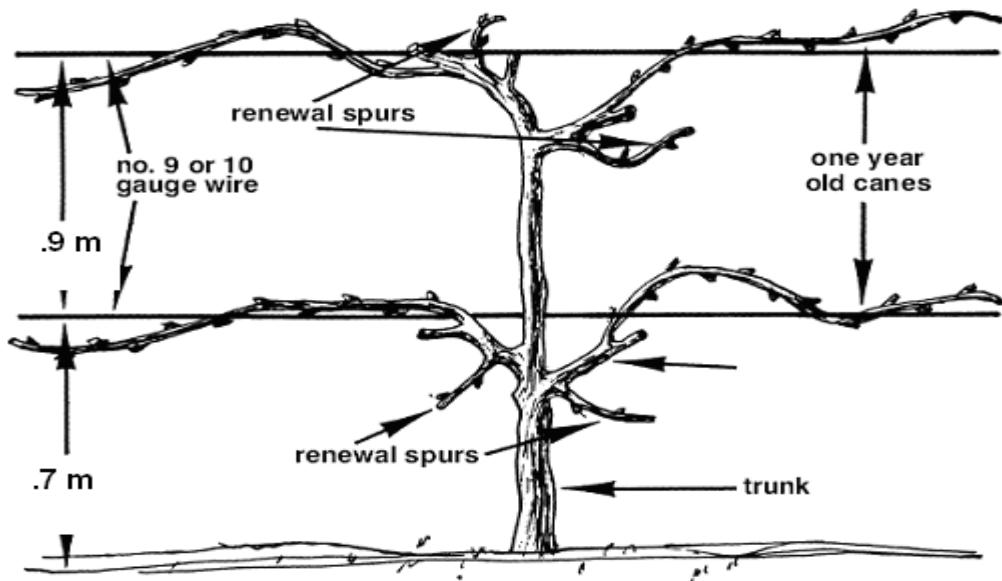
- plants spaced 45 to 60 cm apart
- single rows
- runner plants at 15 cm intervals
- .9 to 1.0 meter aisles

TM: D3-3

GRAPE ARBOR AND TRELLIS



Mature grapevines trained and pruned on an arbor.



A grapevine after three growing seasons.
A maximum of 12 to 15 buds may be left on each lateral cane.