Lesson C5–3

Growing and Maintaining Small Fruits

Unit C. Nursery, Landscaping, and Gardening

Problem Area 5. Fruit and Vegetable Crop Production

Lesson 3. Growing and Maintaining Small Fruits

New Mexico Content Standard:

Pathway Strand: Plant Systems

Standard: **III:** Apply fundamentals of production and harvesting to produce plants.

Benchmark: **III-A:** Apply fundamentals of plant management to develop a production plan.

Performance Standard: **2.** Manipulate and evaluate environmental conditions (e.g., irrigation, mulch, shading) to foster plant germination, growth and development. **3.** Evaluate and demonstrate planting practices (e.g., population rate, germination/seed vigor, inoculation, seed and plant treatments). **6.** Control plant growth (e.g., pruning, pinching, disbudding, topping, detasseling, staking, cabling, shearing, shaping). **7.** Prepare plants and plant products for distribution.

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.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Courter, J.W., Zych, C.C., and Shurtleff, M.C. *Growing Small Fruits in the Home Garden (Circ. 935)*, Cooperative Extension Service, University of Illinois.

Reiley, H. Edward and Carroll L. Shry, Jr. *Introductory Horticulture,* Sixth Edition. Albany, New York: Delmar Publishers, 2002.

Other Resources. The following resources will be useful to students and teachers:

Schroeder, Charles B., et al. *Introduction to Horticulture*, Third Edition. Danville, Illinois: Interstate Publishers, Inc., 2000.

McPheeters, Ken. *Growing Strawberries*, ITCS (U5027 and U5027 supp).

McPheeters, Ken. *Growing Raspberries and Blackberries in the Midwest*, ITCS (U5026).

McPheeters, Ken. *Growing Blueberries*, ITCS. (U5028).

McPheeters, Ken. *Growing Grapes*, ITCS. (U5029).

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of student lab sheet
Seed Catalogs

Terms. The following terms are presented in this lesson (shown in bold italics):

Arbors
Banded fertilizer
Biennial
Bleeding
Broadcast fertilizer
Crown
Everbearing strawberries
Floricances
Four-arm kniffen system
Frost protection
Hill system
K soil test
Matted-row system

P_1 soil test
Perennial
Primocanes
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, raspberries, blackberries, blueberries, 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 to raise these crops. Identify a site where the garden can be planted.

Summary of Content And Teaching Strategies

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

Anticipated Problem: How can I select small fruits to grow?

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.

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.

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.

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. Use TM: C5–3A to show a guide to plant spacing, approximate yields, and a suggested number of plants for a family of five. Use LS: C5–3A to draw out this fruit garden for a family of 5. Advise the students to place the taller-growing fruits such as trellised grapes, north of the low-growing fruits, such as strawberries. Use the text for additional information about available varieties recommended for your area. Characteristics of the varieties need to be studied so that the home gardener can make the correct variety choices to fit their needs.

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

Anticipated Problem: How is a small fruit site prepared and planting done?

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.

A. Application of 4 bushels of well-rotted manure per 100 square feet in the summer or fall before planting will add organic matter and nutrients to the planting bed. Add 25 pounds of 20 percent superphosphate for each 1,000 pounds of manure. Compost, decomposed leaves, or lawn clippings may also be used. In September, sow rye as a cover crop at the rate of 3 pounds per 1,000 square feet. Plow it under in early spring to improve the soil.

B. All of the small fruits, except blueberries, grow satisfactorily in a soil pH range of 5.5 to 7.5. Blueberries require a pH of 4.2 to 5.2 for best growth. 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.

C. Plants that arrive early should be placed in cold storage (32 to 40°F) 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.

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 (June 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.

a. The ***matted-row system*** requires setting plants 24 inches apart in rows 3' 6" to 4' apart. This popular method allows the plant to form runners (horizontal shoots) to fill in the row to about two feet wide.

b. The spaced-row system is a modification of the matted-row system. The ***spaced-row system*** includes setting plants 24 inches apart in rows 3½ to 4 feet apart but the runner plants are spaced to make roots not closer than four inches apart. After the spaced-row about two feet 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.

c. The ***hill system*** requires the removal of all runners. The plants are set 1 to 1½ feet apart in rows that are 1 to 1½ feet apart. Often the rows are arranged in groups of three or four, with a 2-foot walkway between each group of rows.

2. Raspberries ripen shortly after strawberries. Red, black, purple, and yellow fruit types are available. Because of virus disease, black and purple raspberries should be planted about 600 feet from red varieties. Virus-free one-year-old No. 1 grade plants are suggested for planting. Plant in early spring. Avoid allowing the roots to dry out. Spread the roots out in the planting hole and firm soil over them.

   a. Set red raspberries two or three inches deeper than they were in the nursery and set black and purple raspberries about one inch deeper. Apply one or two quarts of water around each plant.

   b. Cut red raspberry plants back to 8 to 12 inches after planting. The stems of canes of black and purple raspberries should be cut off at ground level, removed from the planting, and burned.

3. Blackberries are best planted in early spring. Spacing will depend on the trellis and training system to be used. Most erect blackberry varieties can be grown without supports, spaced four to five feet apart in rows 8 to 10 feet apart. Set the plants at the same depth as they were planted in the nursery. Cut the tops back to six inches.

4. Blueberries are eaten fresh and easily frozen. Blueberries require an acid soil (4.2 to 5.2) and a high organic matter. Buy two year old plants of medium to large size. Set plants at the same depth that they were in the nursery. Space plants six to eight feet apart in rows 8 to 10 feet apart and water thoroughly.

5. 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 eight feet apart and space rows eight feet 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.

Discuss seedbed preparation and planting procedures for each of the commonly grown small fruits. If possible have the students prepare a seedbed and plant plants. Use TM: C3–3B, TM: C3–3C, and TM: C3–3D to help explain planting procedures. Use the recommended textbooks to provide additional information.

Objective 3: Discuss the maintenance of small fruit plantings.

Anticipated Problem: How are small fruit plantings maintained?

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. Consult the Cooperative Extension office annually to get current herbicide recommendations. 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 ***P_1 soil test*** is a soil test for available phosphorus. The ***K soil test*** measures potash (K_20) levels in the soil. Soils showing a high P_1 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.

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, one inch 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. ***Frost protection*** is the practice of using water sprinklers in the patch when temperatures drop to 34° F 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 32°F. At 32°, there will ordinarily be no injury since flower tissue damage generally begins at 28°F. Winter freeze protection can be accomplished by covering plants with straw.

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.

1. Whether strawberry runners are to be pruned/pinched off depends on the planting system you selected (see Objective 1). 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.
2. Brambles (raspberries and blackberries) send up new shoots or canes each year from the roots and crown. ***Primocanes*** are the first year vegetative canes. They grow vigorously during the summer, initiate flower buds in the fall, and over winter.

Floricances are the second year canes that form flowers and bear fruit. Roots and crowns are ***perennial*** meaning that they live for an indefinite number of years going dormant for the winter. The canes are ***biennial*** meaning they have a two year life. Fruit is borne on leafy shoots from one-year-old wood during the second year, then gradually dry up and die shortly after harvest. Prune out these canes at ground level. Pruning brambles also involves training them to the support or trellis system you have selected.

3. The objective of pruning blueberries is to remove old or unthrifty wood and to stimulate production of new vigorous growth. The first 2 years pruning is removing blossoms. When danger of frost is past in the early spring of the 3rd year before new growth begins, remove dead or injured branches, short branches near the ground, and any spindly stems. On mature bushes, remove some old wood annually and prune to keep the bush at a manageable height. Older branches are distinguished by their grayish-black bark while newer branches have a reddish color. Keep in mind that blueberries bear on the one-year-old growth. Thinning plants can result in larger berries.
4. 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. February and early March are usually best. 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. 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. The ***four-arm 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. The thinning of vines should result in good exposure to sunlight of pencil diameter (1/4 to 1/3 inch) 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.
5. 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. Refer to Cooperative Extension pesticide recommendations and spray schedules. The home gardener may use individual chemicals or multipurpose mix containing insecticide and fungicide.

This objective includes much information. It can be taught at an introductory level or in great detail. Weed control, mulching, fertilizer use, watering, and pest control may have been taught in other lessons such as Maintaining the Vegetable Garden (Lesson C5–2). Reviewing these areas and comparing them to vegetable gardening may be helpful. Use TM: C5–3E and TM: C5–3F to help illustrate the topics. Use LS: C5–3A to draw a small fruit garden layout for a family of five. Plant and care for a small fruit garden in your land lab or at a home garden if possible. Pruning of small fruits is a large topic in and of itself. Much more information is available in the recommended texts.

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

Anticipated Problem: What harvesting and marketing systems can be used with small fruits?

IV. Most small fruits are harvested by hand. The owner harvests small gardens while larger areas requires hired labor. Pickers are either paid wages or the fruit is harvested and marketed through a pick-your-own patch (PYO). With PYO patches the customers pick and pay a per pound price for what they harvest. 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.

A. Strawberries, raspberries, and blackberries 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.

B. Blueberries in large patches are sometimes harvested with vibrating devices and catch frames or mechanical harvesters. Mature blueberries will keep several days on the bushes. The blue or black color of the particular variety is the key to knowing that berries are ready for harvest.

C. With grapes, color, sugar content, taste, aroma, and ease of berry separation from the stem are indications of ripeness. For wine grapes, extensive testing in 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. Visit a pick-your-own patch, harvest berries, and use the owner as a guest speaker with the class.

Review/Summary. Use seed catalogs to review varieties and culture of small fruits. Review weed control, fertilizing, irrigation, and frost control. Have students develop a comparison chart on paper or on the computer of the planting procedures, pruning, and harvesting of strawberries, brambles, blueberries, and grapes.

Application. Draw the small fruit garden layout (LS: C5–3A), plant and care for a small fruit garden, and harvest fruit at a pick-your-own patch.

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=i, 2=b, 3=g, 4=f, 5=c, 6=d, 7=a, 8=h, 9=j, 10=e

Part Two: Completion

1. Matted row
2. Space row
3. Hill
4. P_1
5. K
6. 1st, 2nd
7. perennial
8. raspberries, blackberries
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 9 inches 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

Lesson C5–3: 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
b. arbor
c. biennial
d. everbearing
e. floricances
f. perennials
g. primocanes
h. refractometer
i. spring-bearing
j. trellises

_____ 1. Strawberries that ripen mainly in the month of June.
_____ 2. Curved support used for grapes.
_____ 3. First year vegetative bramble canes.
_____ 4. Plants that come back each year from the roots.
_____ 5. Plants or plant parts that live two years.
_____ 6. Strawberries than ripen throughout the summer.
_____ 7. Training system of grapes with one stem and two lateral canes to the left and right.
_____ 8. Instrument used to measure sugar content of grapes.
_____ 9. Support with two wires stretched between wooden or metal posts.
_____ 10. Second year flowering and fruiting bramble canes.

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 four or more inches 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. Blueberries bear fruit on _____ (1st or 2nd) year wood while blackberries bear fruit on ____ (1st or 2nd) year wood.
7. Small fruits are produced on a small _____(biennial or perennial) plant where space is limited.
8. Brambles include _____ and _____.
9. The _____ is where the roots and shoots of a strawberry plant are joined.
10. _____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?

RECOMMENDED FRUIT GARDEN FOR A FAMILY OF FIVE

SPACING, BEARING AGE, AND PRODUCTION OF SMALL FRUITS							
Fruit[a]	Planting distance[b]		Interval from planting to fruiting	Life of plants	Height of mature plant	Estimated annual yield per plant[c]	Suggested number of plants for family of 5
	Between Rows	Between Plants					
	feet	*feet*	*years*	*years*	*feet*		
Strawberries (matted row)	4	2	1	3–4	1	½–1 qt. per foot of row	100
Raspberries							
Red	6–8	3–4	1	8–10	4–5	1½ quarts	20–25
Black	6–8	3–4	1	8–10	4–5	1 quart	20–25
Purple	6–8	3–4	1	8–10	4–5	1 quart	20–25
Blackberries							
Erect	6–8	4–5	1	10–12	3–5	1 quart	15–20
Trailing or semi-trailing	6–8	6–10	1	8–10	6–8 (staked or trellis)	4–10 quarts	8–10
Blueberries	8–10	6–8	2	20+	6–10	3–4 quarts	8–10
Grapes	8–10	8–10	3	20+	6 trellised	¼–½ bushel	5–10
Everbearing strawberries (hills)	1—1½	1—1½	½	2–3	1	½ quart	100
Everbearing Raspberries	8	3	½	8–10	4–5	1 quart—spring ½ quart—fall	15–20 15–20

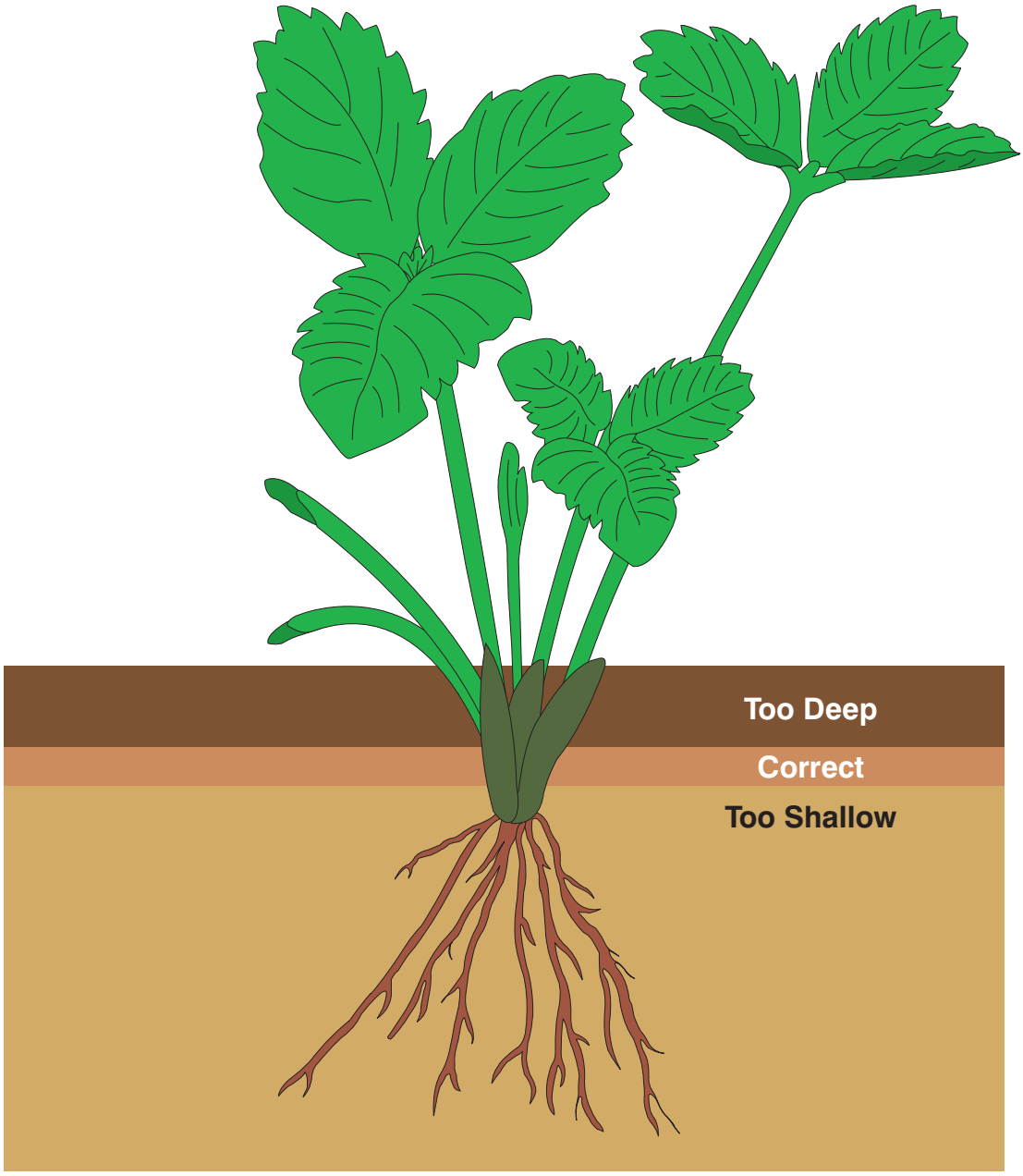
[a]Listed in approximate order of ripening from early spring to fall.

[b]Minimum suggested spacings. See discussion of plant spacings in text.

[c]At full bearing age, with good care.

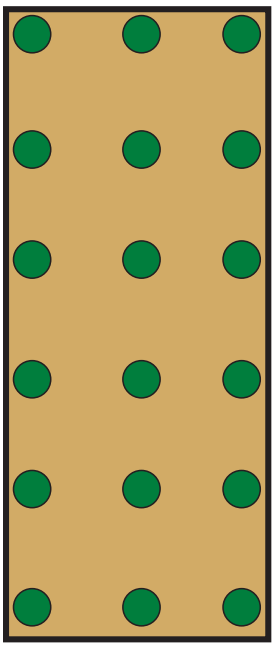
TM: C5–3B

STRAWBERRY PLANTING DEPTH



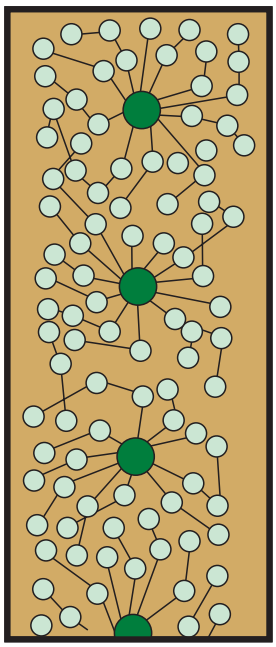
(Courtesy, Interstate Publishers, Inc.)

STRAWBERRY ROW SYSTEMS



HILL

- plants spaced 12" apart
- multiple rows (3 or 4)
- no runners allowed
- 2' aisles



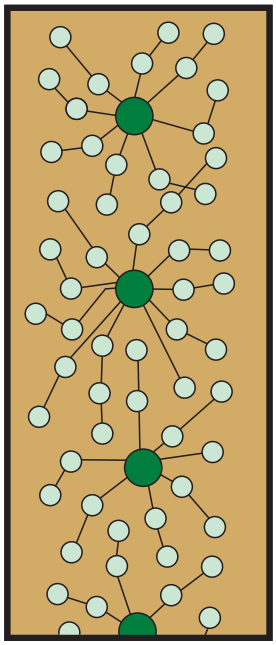
MATTED ROW*

- plants spaced 18–30" apart
- single rows
- runners fill in row to width of 2'
- 3–4' aisles

Parent plant

Runner plant

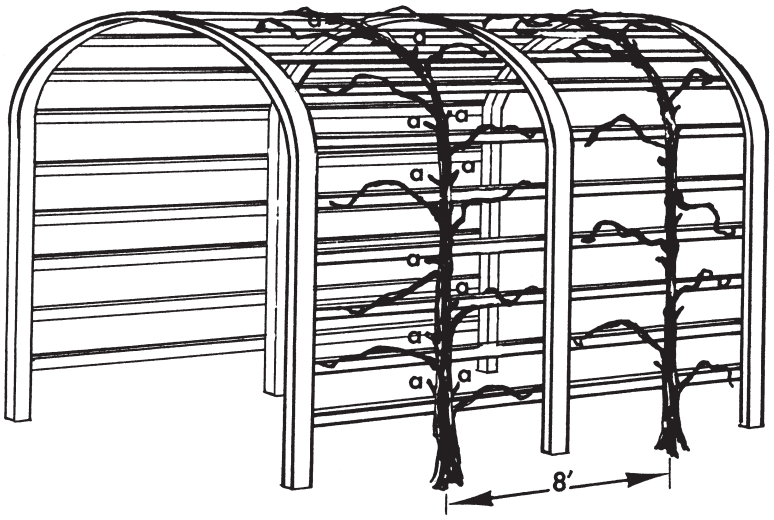
*Matted row is actually a modification of the broadcast system: **BROADCAST:** plants spaced 18–30" apart, single rows, runner freely, no aisles maintained.



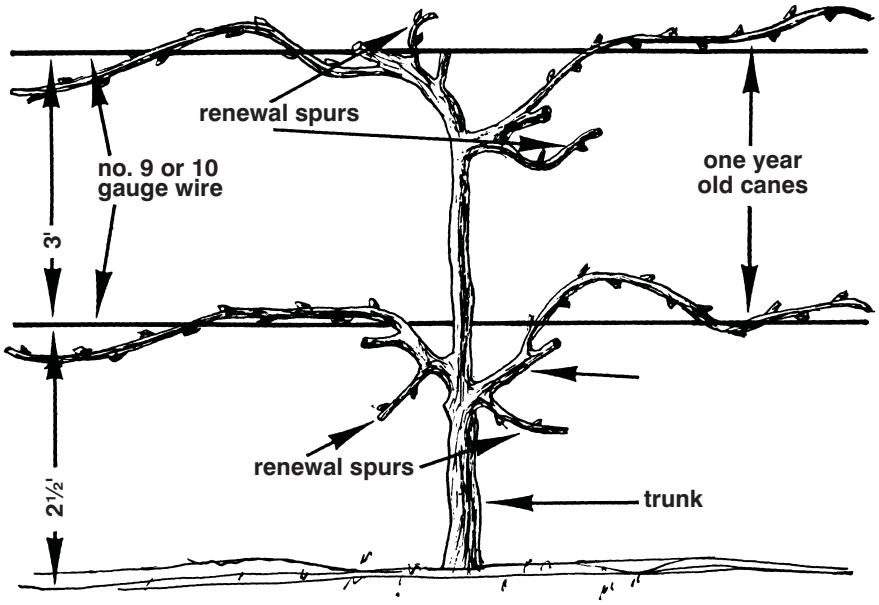
SPACED PLANTING

- plants spaced 18–24" apart
- single rows
- runner plants at 6" intervals
- 3–3½' aisles

GRAPE ARBOR AND GRAPE TRELLIS



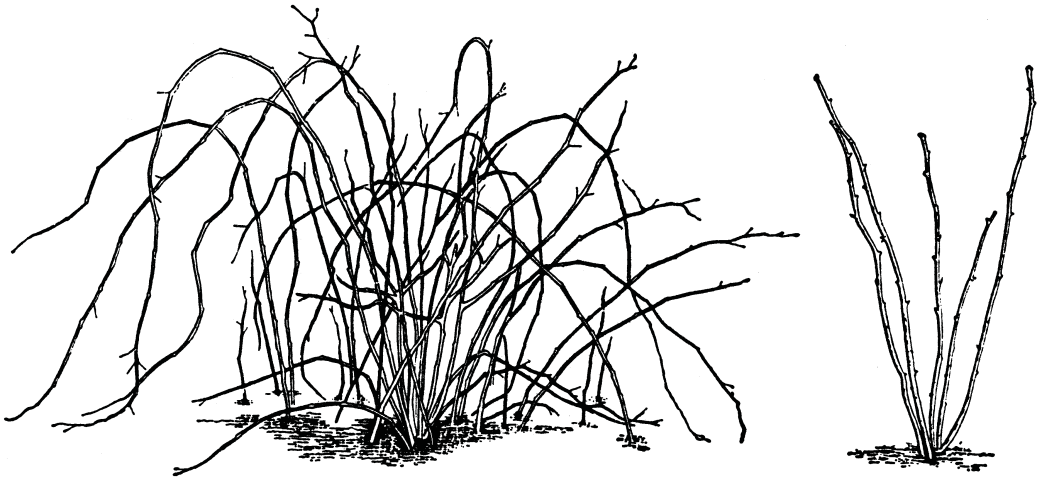
Mature grapevines trained and pruned on an arbor.



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

TM: C5–3E

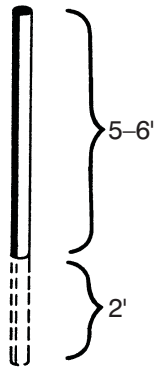
DORMANT BRAMBLE PRUNING

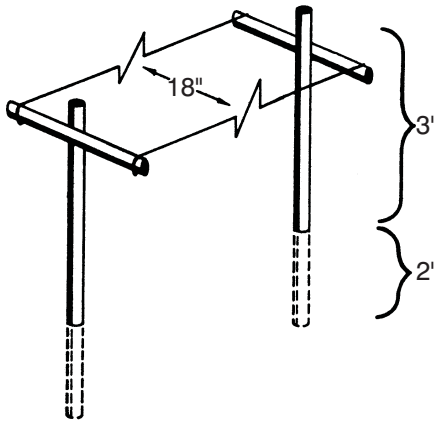


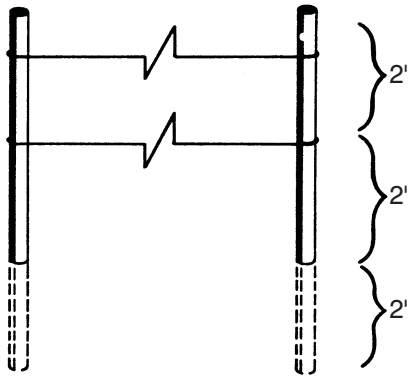
Red raspberry plant before (left) and after (right) dormant pruning.

Black raspberry plant before (left) and after (right) pruning. Purple raspberries and erect blackberries are pruned in a similar manner.

BRAMBLE SUPPORT SYSTEMS







STAKED HILL SYSTEM

- 2–4" diameter posts
- treat underground portions of posts
- canes are tied to posts
- may be used for any bramble fruit

HORIZONTAL TRELLIS

- 2 × 4" cross bars
- No. 12 galvanized wire
- 3–4" diameter posts, 25–30' apart
- wire clips
- treat underground portions of posts
- no tying required
- most common system of training
- used with hedgerows

VERTICAL TRELLIS

- No. 12 galvanized wire
- 3–4" diameter posts, 25–30' apart
- treat underground portions of posts
- canes tied to wires
- used for linear system (narrow rows)
- most useful with semi-erect blackberries

Name _____

Lab Sheet

Family of Five Small Fruit Garden Layout

Using TM: C5–3A and a piece of graph paper lay out a fruit garden for a family of five. Plant taller small fruit plants on the north and west. The transparency gives the spacing between rows, spacing between plants, and the number of plants needed. Select a minimum of four different types of small fruits.