



# **Fruit & Vegetable Production Unit for Plant Science Core Curriculum**

## **Instructor Guide**



**Instructional Materials Laboratory  
College of Education • University of Missouri-Columbia**

**Agricultural Education Section Division of Career Education  
Department of Elementary and Secondary Education, Jefferson City, Missouri**

# **Fruit and Vegetable Production Unit for Plant Science Core Curriculum**

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## Foreword

Missouri offers a variety of opportunities for fruit and vegetable producers. *Fruit and Vegetable Production Unit for Plant Science Core Curriculum* was developed to provide students with an overview of fundamental production concerns as well as useful information about specific crops.

*Fruit and Vegetable Production Unit for Plant Science Core Curriculum* is designed as a four-week course for tenth grade students. Lessons focus on planting and growing considerations as well as financial and marketing concerns. Lesson-level activities and a unit-level activity have been included to provide opportunities for students to apply skills and concepts covered in the curriculum and for instructors to assess student performance. Crosswalk tables are included to show where *Fruit and Vegetable Production Unit for Plant Science Core Curriculum* competencies relate to Missouri's Show-Me Standards, Frameworks for Curriculum Development, and Grade-Level Expectations for science. A suggested teaching calendar is included at the end of the table of contents.

This instructor guide and the corresponding student reference contain six lessons: Managing Financial Resources, Developing a Marketing Plan, Site Evaluation, Integrated Pest Management, Vegetable Production, and Fruit Production. In addition, the instructor guide includes completed production charts for over 30 fruit and vegetable crops as well as blank charts to copy and distribute to students to fill out during class discussion or as part of their assigned work. The instructor can also use the blank charts to develop additional charts for other crops he or she wishes to discuss.

Terry Heiman, Director  
Agricultural Education  
Division of Career Education  
Department of Elementary and  
Secondary Education

## Introduction

*Fruit and Vegetable Production Unit for Plant Science Core Curriculum* is a four-week course designed to introduce students to fundamental concepts and information related to the production of fruit and vegetable crops. Because of the broad scope of the material and the limited time available, the course has been arranged so that main topics related to fruit and vegetable production are discussed in the study questions and information regarding specific fruits and vegetables is included in supplemental charts, which will be chosen by the instructor to accompany the appropriate lessons. There are a number of advantages to arranging the curriculum this way.

- By putting crop-specific information in the charts, study questions can be used to focus on key concepts. Because an entire lesson is not needed to address each crop, the number of crops available to the instructor has nearly tripled compared to the previous edition of this curriculum guide.
- Having a wide variety of completed charts allows the instructor to tailor the material to his or her specific needs. Crops can be chosen based on regional production; the crops discussed can be changed from year to year; and new or specialty crops can be added or removed to reflect changes in the market. The instructor can also update and modify existing charts as needed.
- Because students will fill out their own charts, the instructor can use the charts as an additional tool for assessment, if desired.
- Having students fill out the charts for themselves is an interactive strategy that should aid in content retention and promote higher-level learning.
- The informational headings on the charts are based on points that will be addressed by lesson topics and study questions. This allows the instructor to reinforce these concepts by presenting them in a new context and by connecting them to real-world situations.
- As an additional feature, the resources used to compile the charts have been placed at the bottom of each chart as footnotes. In the case of links to Web resources, this allows the instructor to quickly and easily access additional information about a specific crop while online without searching through the complete list of references.

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# Fruit and Vegetable Production Unit for Plant Science Core Curriculum

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## COMPETENCIES/OBJECTIVES

1. Explain the importance of financial planning in fruit and vegetable production.
2. Describe approaches for the marketing of fresh fruits and vegetables.
3. Classify characteristics of selecting and planning for fruit and vegetable production.
4. Explain management practices for pest control.
5. Identify characteristics of cool season, long season, and warm season vegetable crops.
6. Identify characteristics of small fruits and tree fruits.

## UNIT OBJECTIVE

Students will demonstrate their knowledge of production requirements for fruits and vegetables by developing a calendar for cultivating and harvesting 10 fruits and vegetables.

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## Fruit and Vegetable Production Unit for Plant Science Core Curriculum - Competency Crosswalk

Duty Band & Task Statement	SHOW-ME STANDARDS		CURRICULUM FRAMEWORKS FOR GRADES 9-12					
	Knowledge (Content)	Performance (Goals)	Communication Arts	Fine Arts	Health/Physical Education	Math	Science	Social Studies
1	CA 4; MA 1, 3; SS 4	1.4, 1.7, 2.3, 2.7, 3.8, 4.1, 4.5	I.2.a, III.1.a, III.1.i			I.2.b, II.4.h, V.1.a, VII.4.a		IV.D.1.h, IV.D.1.k
2	CA 3, 4; MA 3;	1.1, 1.8, 2.1, 3.8, 4.1	I.2.a, I.2.c, I.2.d, I.3.a, IV.3.a, IV.2.b					
3	CA 1, 4; SC 4, 8; SS 5	1.10	IV.1.e				I.A.3.a, II.A.2.a, VI.A.1.a, VI.B.4.a	III.E.6.n, IV.E.4.g
4	SC 3, 5, 8; PE 5	1.3, 1.10, 2.1, 3.6, 3.8, 4.7	I.3.f, I.6.c		II.B.4.a, II.D.1.b, III.D.1.a, III.D.2.a		I.A.3.a, II.A.2.a, VIII.A.1.a, VIII.B.1.a	
5	CA 1, 4, 6; SC 5	1.5, 1.8, 2.1	I.2.a, I.2.c, I.2.d, I.3.a, III.1.c				VII.A.4.a	
6	CA 1, 4, 6; SC 5	1.5, 1.8, 2.1	I.2.a, I.2.c, I.2.d, I.3.a, III.1.c				VII.A.4.a	

<b>Duty Band &amp; Task Statement</b>	<b>SHOW-ME STANDARDS</b>		<b>CURRICULUM FRAMEWORKS FOR GRADES 9-12</b>					
	<b>Knowledge (Content)</b>	<b>Performance (Goals)</b>	<b>Communication Arts</b>	<b>Fine Arts</b>	<b>Health/Physical Education</b>	<b>Math</b>	<b>Science</b>	<b>Social Studies</b>
Unit Activity	CA 3	1.2	I.2.a, I.2.c, I.2.d, I.3.b, II.2.c, III.1.d,IV.3.b				VI.A.1a, VI.B.4.a, VIII.A.1.a	III.E.6.n, IV.E.4.g

## Fruit and Vegetable Production Unit for Plant Science Core Curriculum - Competency Crosswalk

Duty Band & Task Statement	Science 9-12 Grade Level Expectations							
	Strand 1 Matter & Energy	Strand 2 Force & Motion	Strand 3 Living Organisms	Strand 4 Ecology	Strand 5 Earth Systems	Strand 6 Universe	Strand 7 Scientific Inquiry	Strand 8 Science, Technology, & Human Activity
1							1.E.a	
2							1.B.a, 1.C.a, 1.E.a	1.B.a
3				1.C.b, 1.D.a, 3.C.a, 3C.c	1.D.b, 2.A.a, 2.A.b, 3.A.e		1.C.a	1.C.a
4				1.A.a, 1.A.b, 1.D.a, 3.C.a, 3.C.c			1.A.f, 1.C.a, 1.E.a	1.C.a
5							1.A.f, 1.C.a, 1.E.a	
6							1.A.f, 1.C.a, 1.E.a	
Unit Activity				1.A.a, 1.A.b, 3.C.a, 3.C.c	1.D.b, 3.A.e		1.C.a, 1.E.a	1.C.a

Name: \_\_\_\_\_

## Fruit and Vegetable Production Competency Profile

Directions: **Evaluate the student by checking the appropriate number to indicate the degree of competency. The rating for each task should reflect employability readiness rather than the grades given in class.**

### Student Rating Scale:

- 3 – Mastered** – can work independently with no supervision
- 2 – Requires Supervision** – can perform the job completely with limited supervision
- 1 – Not Mastered** – requires instruction and close supervision
- N – No Exposure** – no experience or knowledge in this area

**NOTE:** All competencies involving safety require a Number 3 rating.

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3	2	1	N

## Fruit and Vegetable Production

1. Explain the importance of financial planning in fruit and vegetable production.
  2. Describe approaches for the marketing of fresh fruits and vegetables.
  3. Classify characteristics of selecting and planning for fruit and vegetable production.
  4. Explain management practices for pest control.
  5. Identify characteristics of cool season, long season, and warm season vegetable crops.
  6. Identify characteristics of small fruits and tree fruits.
- Other: \_\_\_\_\_
- Unit Activity Demonstrate knowledge of production requirements for fruits and vegetables by developing a calendar for cultivating and harvesting 10 fruits and vegetables.





## Fruit and Vegetable Production Unit for Plant Science Core Curriculum

[illegible]

## Fruit and Vegetable Production

1. Explain the importance of financial planning in fruit and vegetable production.
2. Describe approaches for the marketing of fresh fruits and vegetables.
3. Classify characteristics of selecting and planning for fruit and vegetable production.
4. Explain management practices for pest control.
5. Identify characteristics of cool season, long season, and warm season vegetable crops.
6. Identify characteristics of small fruits and tree fruits.

## Unit Activity

Demonstrate knowledge of production requirements for fruits and vegetables by developing a calendar for cultivating and harvesting 10 fruits and vegetables.





## Fruit and Vegetable Production Unit for Plant Science Core Curriculum

### Teaching Calendar

	Length for Classroom Instruction/Activities (Hours)	Length for Activity Sheets (AS) (Minutes)
Lesson 1	1	AS 1.1 40
Lesson 2	2	AS 2.1 80
Lesson 3	2	AS 3.1 120
Lesson 4	2	AS 4.1 60
Lesson 5	2	AS 5.1 90
Lesson 6	2	AS 6.1 90
Unit Activity		60



# Fruit and Vegetable Production

## Lesson 1: Managing Financial Resources

### Competency/Objective

Explain the importance of financial planning in fruit and vegetable production.

### Study Questions

1. Why is financial planning important in fruit and vegetable production?
2. What is the importance of setting goals for financial planning?
3. What are the three steps in financial planning?

### References and Materials

1. *Fruit and Vegetable Production Unit for Plant Science Core Curriculum* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2006.
2. Figures/Transparency Masters
3. Activity Sheet  
  
AS 1.1 Distinguishing Between Receipts and Expenditures
4. Supplies

Record book receipt and expenditure pages to accompany activity sheet

## Teaching Procedures

### A. Introduction

Growing fruits and vegetables can be a very rewarding experience. However, risks are involved. As with any new business, it is important to have a plan before investing time, money, and energy.

### B. Motivation

Ask students if they have ever been to a farmers' market. Have them list items that are sold at farmers' markets. Ask the students if they have ever tried to start a business of their own. What are the rewards of having your own business? What are the drawbacks? When the students have compiled a list, ask what level of finances needs to be available and what they need to know to become a vendor at a farmers' market.

### C. Assignment

The instructor should assign the unit-level performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.

### D. Supervised Study

Lead students in collecting the information needed to answer and discuss the study questions. The instructor may choose to work on one study question at a time or have students consider all the study questions before the discussion. Another option is to have students work in a cooperative learning environment by forming groups and assigning different study questions to each group.

### E. Discussion

Lead students in a discussion of the study questions. Supplement students' responses and information with additional materials when needed.

#### **1. Why is financial planning important in fruit and vegetable production?**

Financial planning should be done ahead of time to ensure adequate funds or secure additional finances, if needed.

- a. Financial planning is the process of defining goals and developing and implementing a plan to finance the goals.
- b. Financial planning is essential in fruit and vegetable production.
  - i. There is a limited period of income because of the limited growing season.
  - ii. Planning will help ensure finances will last throughout the year.
  - iii. Planning promotes critical thinking regarding planting times and varieties of crops.

### **2. What is the importance of setting goals for financial planning?**

Setting goals is an important step in determining where the grower wants to be at the end of the season or year.

- a. A goal is a statement of what an individual wants to accomplish both personally and financially.
- b. Goal setting is important in fruit and vegetable production.
  - i. Because products are highly perishable, careful planning is needed to ensure that they are saleable.
  - ii. Labor is a major expense, and labor requirements vary depending on the type of operation. Determining labor needs and costs is an important part of setting goals and making a financial plan.

### **3. What are the three steps in financial planning?**

Each step in financial planning allows the grower to accurately assess the current situation and plan for the future.

- a. Step one: Record a projection of income and expenses.
  - i. Income is money the business will receive.
    - 1. Income (receipts) may be received weekly, every two weeks, monthly, or even once or twice a year.
    - 2. Use the receipts pages in a record book to show the income that is received, where it came from, and the date it was received.
    - 3. Gross income is the total amount of money the business takes in before any deductions are made.
    - 4. Net income is the money the business has after expenses and deductions, such as taxes and Social Security, have been taken out.
  - ii. An expense is money that is spent to obtain a goal or purpose.
    - 1. Use the expenditures pages in a record book to keep track of how much money is spent and where it is going.
    - 2. Fixed (ownership) costs are paid regularly, regardless of the amount of sales the business makes.

## Fruit and Vegetable Production

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3. The major areas of fixed costs are rent, insurance, depreciation, taxes, interest, and repair.
  4. Examples of fixed costs in fruit and vegetable production are rent, land insurance, repair of structures, and interest on principal.
  5. Variable (operating) costs change according to the production level and amount of use.
  6. The major categories of variable costs include labor (salaries), fertilizer, chemicals, seeds/plants, gasoline and oil, inventory, supplies, advertising, utilities, telephone bills, and principal payment.
  7. Examples of variable costs in fruit and vegetable production are labor (both seasonal and full-time), fertilizer, growing media and chemicals, water, electricity, and advertising.
- b. Step two: Make a list of wants and needs.
- i. Needs are items and expenses that are necessary for the survival of the business.
  - ii. Wants are items and expenses that are desired but not essential.
  - iii. Making a list of wants and needs helps set short-, intermediate-, and long-term goals.
- c. Step three: Implement the financial plan.
- i. Keep current and accurate records of all income and expenses.
  - ii. Monitor progress toward reaching the business goals.
  - iii. Adjust plans as needed to manage problems and reach goals.
  - iv. Adapting to changes builds understanding and confidence.

### F. Other Activities

1. Set goals for a fruit and/or vegetable production SAE.
2. Contact the local extension agent to find out about the average income generated from fruit and/or vegetable production.

### G. Conclusion

Financial planning is an integral part of a business and should be done to help establish goals and reach objectives. Receipts and expenditures should be recorded to keep accurate records of how much money is received and how much money is being spent. Always be sure to factor fixed and variable costs into the financial plan. As the financial plan is put into action, monitor business activity and adjust the plan as necessary to attain the established goals and objectives.

### H. Answers to Activity Sheet

#### AS 1.1 Distinguishing Between Receipts and Expenditures

- |             |             |
|-------------|-------------|
| 1. \$37.50  | Expenditure |
| 2. \$52.50  | Receipt     |
| 3. \$300.00 | Expenditure |
| 4. \$600.00 | Expenditure |
| 5. \$360.00 | Receipt     |
| 6. \$225.00 | Receipt     |
| 7. \$25.00  | Expenditure |

Answers will vary on record book pages.

### I. Answers to Assessment

1. Financial planning is the process of defining goals and developing and implementing a plan to finance the goals.
2. Financial planning is very important in fruit and vegetable production because the products are highly perishable, which means marketing and selling time are limited. Students may also note that labor is a major expense that must be planned for, and planning promotes critical thinking about what crops to plant.
3. Gross income is the total amount of money the business takes in before any deductions are made.
4. Net income is the money the business has after expenses have been met and deductions, such as taxes and Social Security, have been taken out.
5. Students could list two of the following major areas of fixed expense.
  - A. Rent
  - B. Insurance
  - C. Depreciation
  - D. Taxes
  - E. Interest
  - F. RepairStudents could also list two of the examples related to fruit and vegetable production.
  - A. Rent
  - B. Land insurance
  - C. Repair of structures
  - D. Interest on principal

## Fruit and Vegetable Production

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6. Students could list two of the major categories of variable costs.

- A. Labor (salaries)
- B. Fertilizer
- C. Chemicals
- D. Seeds/plants
- E. Gasoline and oil
- F. Inventory
- G. Supplies
- H. Advertising
- I. Utilities
- J. Telephone bills
- K. Principal payment

Students could also list two of the examples related to fruit and vegetable production.

- A. Labor (both seasonal and full-time)
- B. Fertilizer
- C. Growing media and chemicals
- D. Water
- E. Electricity
- F. Advertising

7. Wants are items and expenses that are desirable but not essential, and needs are items and expenses that are necessary for the survival of the business.

8. Implement the financial plan.



## Lesson 1: Managing Financial Resources

**Short-Answer Questions: Write the answers in the space provided.**

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## Fruit and Vegetable Production

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6. List two variable (operating) expenses.
  - A.
  - B.
7. What is the difference between wants and needs?
8. What is the final step in the financial planning process?

# Fruit and Vegetable Production

## Unit I: Fruit and Vegetable Production

AS 1.1

### Lesson 1: Managing Financial Resources

Name: \_\_\_\_\_

#### Distinguishing Between Receipts and Expenditures

**Objective:** Distinguish between receipts and expenditures in fruit and vegetable production.

**Directions:** Work in small groups. Figure the total amount for each item. Then separate the list below into receipts and expenditures. With the receipts and expenditures record book pages provided, place each item on the appropriate page and complete the receipts and expenditures pages.

Item	Description	Amount	Total Amount
1. Seeds	25 packets	\$1.50 a packet	
2. Blueberries	15 lbs	\$3.50/lb	
3. Labor	2 students @ 30 hrs/each	\$5.00/hr	
4. Rent	3 months	\$200/month	
5. Corn	15 dozen ears	\$2.00/ear	
6. Cucumbers	450	\$0.50 each	
7. Pruners	2 pair	\$12.50	

Receipts	Expenditures



# Fruit and Vegetable Production

## Lesson 2: Developing a Marketing Plan

### Competency/Objective

Describe approaches for the marketing of fresh fruits and vegetables.

### Study Questions

1. How does a business identify a customer base?
2. What are the different venues to sell products?
3. What are the different ways to advertise?

### References and Materials

1. *Fruit and Vegetable Production Unit for Plant Science Core Curriculum* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2006.
  - Fig. 2.1 Identifying a Market
  - Fig. 2.2 Characteristics of Many Successful Retail Produce Businesses
2. Figures/Transparency Masters
3. Activity Sheet
  - AS 2.1 Advertising a Product

## Teaching Procedures

### A. Review

The first lesson discussed the importance of managing financial resources and the steps in financial planning. This lesson covers key factors in developing a marketing plan: identifying customers, considering venues for selling products, and choosing methods of advertising.

### B. Motivation

Ask the students if they have ever seen a commercial or ad that made them want whatever was being advertised. Have them discuss the way the ad made them feel and the way it made them react.

### C. Assignment

### D. Supervised Study

Lead students in collecting the information needed to answer and discuss the study questions. The instructor may choose to work on one study question at a time or have students consider all the study questions before the discussion. Another option is to have students work in a cooperative learning environment by forming groups and assigning different study questions to each group.

### E. Discussion

Lead students in a discussion of the study questions. Supplement students' responses and information with additional materials when needed.

## 1. How does a business identify a customer base?

Refer to Figure 2.1 Identifying a Market. The first step in creating a marketing plan is identifying the market. It is essential that growers have their marketing plan in place before their produce is ready to sell.

- a. A market is all the potential customers for a particular product or service.
  - i. There are six steps in defining a business's market that move from the total population, in which no market is identified, to the penetrated market of customers who buy the product.

1. Total population: no market identified.
2. Potential market: all customers who might have interest in the product.
3. Available market: customers with the necessary interest, income, and access to the product.
4. Qualified available market: customers who can buy a product based on age or other criteria.
5. Target market: customers the company will serve.
6. Penetrated market: customers already buying the product.
- b. The first factor in identifying a customer base is deciding whether to sell to wholesale or retail customers.
  - i. Selling wholesale means selling goods to a buyer who sells the goods again. Considerations include the following:
    1. Wholesalers sell in bulk.
    2. A few customers purchase the whole crop.
    3. Producers do not deal directly with the general public.
    4. Customers aren't interested in product displays and ads.
    5. Producers provide less customer assistance.
    6. Producers make less on each item sold.
  - ii. Retailers sell relatively small amounts of products directly to the people who will use them. Considerations include the following:
    1. Producers can charge more per item.
    2. Displays and ads are important.
    3. Customers expect more service.
- c. Producers should determine what customers exist in their market.
- d. Characteristics such as age, income level, population of surrounding areas, location of residential areas, and influx of travelers to the area should all be considered to help determine the target market.
- e. The local Chamber of Commerce, census bureau, university extensions, and trade associations are among the resources that may be used to obtain these statistics.

## **2. What are the different venues to sell products?**

Fresh produce may be sold through a variety of outlets. Each has its own characteristics that should be considered when developing a marketing plan. Refer to Figure 2.2 Characteristics of Many Successful Retail Produce Businesses as a summary or for further discussion after covering retail venues.

## Fruit and Vegetable Production

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- a. Roadside stands
  - i. Stands are a relatively easy way to sell directly to customers.
  - ii. The grower sets the hours, prices, and products.
  - iii. Sales provide immediate income.
  - iv. Minimal setup cost is required for a small operation.
  - v. Safe, adequate parking is needed.
  - vi. Stands must comply with all zoning, licensing, and insurance requirements.
- b. Farmers' markets
  - i. Farmers' markets are a low-cost way to sell fresh produce to a large number of customers within a short period of time.
  - ii. Producers have the opportunity to network with other growers, widen their customer base, and develop their marketing skills.
  - iii. Producers also share the costs of advertising and promotion.
  - iv. There is some loss of flexibility. Growers must adhere to rules and regulations regarding hours and days of operation, space availability, and products sold.
- c. Community-supported agriculture (CSA)
  - i. A CSA operation is a partnership between a grower and individuals who become members by purchasing shares of the season's harvest.
  - ii. Members help pay for seeds, fertilizer, water, equipment maintenance, and labor in return for fresh produce throughout the season.
  - iii. Growers benefit by receiving income as soon as work begins.
  - iv. A financial plan is essential for determining share price.
  - v. Since members are also the customers, growers should consider crops members want.
  - vi. Growers can work together to provide a greater variety of crops.
- d. Pick-your-own businesses
  - i. Pick-your-owns need less harvesting labor than traditional operations.
  - ii. However, pick-your-owns do require long work hours and additional liability insurance for the growers.
  - iii. There must be room for customer parking and traffic.
  - iv. The business must be accessible and close to a population that can support it.
  - v. Growers and operators must be willing to work weekends.
  - vi. Image is important.
  - vii. Weather is a key factor; farmers rarely sell by pick-your-own alone.
- e. Business and institutional markets
  - i. Examples include restaurants, grocery stores, wholesale cooperatives, schools, hospitals, and nursing homes.
  - ii. Sales are usually made by contract.
  - iii. Produce is normally purchased on a weekly basis.
  - iv. Buyers require prompt, regular delivery and consistent quality.



### 3. What are the different ways to advertise?

Advertising is essential to building a business. As with other parts of the marketing strategy, advertising needs to be planned in advance and used effectively to reach as many customers as possible.

- a. Newspapers
  - i. Advantages
    - 1. Local newspapers are available in most communities.
    - 2. Businesses can reach many potential customers for relatively little cost.
    - 3. Papers do research that can help businesses appeal to readers.
    - 4. Businesses can create or change ads quickly.
    - 5. Newspaper ads can generate sales in a relatively short period of time.
  - ii. Disadvantages
    - 1. Circulation may be wider than the target market, meaning the business pays to reach people who aren't interested.
    - 2. Many ads compete for the reader's attention.
    - 3. The production quality and appearance of ads are frequently low.
- b. Billboards
  - i. Advantages
    - 1. Billboards are a relatively inexpensive way to advertise.
    - 2. Billboards can be seen by potential customers 24 hours a day.
  - ii. Disadvantages
    - 1. Customers only have a short period of time to read the ads.
    - 2. Billboards are regulated in some areas.
- c. Direct mailing
  - i. Advantages
    - 1. Ads can be sent out selectively to the target audience.
    - 2. There are many options for how ads can appear.
    - 3. Ads are not competing with other ads on the page.
  - ii. Disadvantages
    - 1. Mailing lists must be current. Ads can annoy people who aren't interested in the product and waste the business's ad budget.
- d. Radio
  - i. Advantages
    - 1. Radio ads are typically inexpensive.
    - 2. Stations can help businesses gear ads toward listeners.
    - 3. Ads can reach listeners at home, work, or on the go.
  - ii. Disadvantages
    - 1. It is easy for listeners to become distracted or ignore the ad.
    - 2. There is no visual image to appeal to customers.

### e. Internet

#### i. Advantages

1. Advertisers can reach millions of potential customer at relatively low cost.
2. Ads can have creative audio and visual appeal.
3. Customers have access 24 hours a day, 7 days a week.

#### ii. Disadvantages

1. The site must be maintained.
2. It can be difficult for customers to find the site among all of the Web sites available.

### F. Other Activities

Call local radio stations and have students compare and contrast prices for radio ads.

### G. Conclusion

A business must find a market for the goods it sells in order to survive. The producer narrows the field from the total population of all individuals to the target market that will be pursued. Establishing a target market allows the producer to tailor advertising and products to the customers' needs and wants. Producers may choose to sell wholesale or retail. In general, the producer makes less per item selling wholesale but spends less on customer relations. When selling to retail customers, the producer can charge more per item, but in turn is expected to provide more customer service. Advertising is the way businesses communicate with customers about their products or services and encourage customers to make a purchase. Advertising is essential to building a business. As with other parts of the marketing strategy, advertising needs to be planned in advance and used effectively to reach as many customers as possible. Businesses should focus their efforts on an advertising plan that directly addresses their target market.

### H. Answers to Activity Sheet

#### AS 2.1 Advertising a Product

Answers will vary.

### I. Answers to Assessment

1. The potential market is all of the customers who might have interest in a particular product.
2. The target market is the customer base the company will serve.
3. Students should list three of the following answers.
  - A. Age
  - B. Income level
  - C. Population of surrounding areas
  - D. Location of residential areas
  - E. Influx of travelers
4. Students should list one of the following answers.
  - A. It is a low-cost way to sell fresh produce to a large number of customers within a short period of time.
  - B. Farmers' markets provide an opportunity to network with other growers, widen the business's customer base, and develop marketing skills.
  - C. Producers share the cost of advertising and promotion.
5. Community-supported agriculture is a partnership between a grower and individuals who become members by purchasing shares of the season's harvest.
6. Students should list three of the following answers.
  - A. Pick-your-owns need less harvesting labor than traditional operations
  - B. Growers must work long hours.
  - C. Growers need additional liability insurance.
  - D. There must be room for customer parking and traffic.
  - E. The business must be accessible and close to a population that can support it.
  - F. Growers and operators must be willing to work weekends.
  - G. Image is important.
  - H. Weather is a key factor; farmers rarely sell by pick-your-own alone.
7. Students should list three of the following answers.
  - A. Local newspapers are available in most communities.
  - B. Businesses can reach many potential customers for relatively little cost.
  - C. Papers do research that can help businesses appeal to readers.
  - D. Businesses can create or change ads quickly.
  - E. Newspaper ads can generate sales in a relatively short period of time.
8. Students should list the following answers.
  - A. It is easy for listeners to become distracted or ignore the ad.
  - B. There is no visual image to appeal to customers.



**Unit I: Fruit and Vegetable Production**

Name: \_\_\_\_\_

**Lesson 2: Developing a Marketing Plan**

Date: \_\_\_\_\_

**ASSESSMENT****Short-Answer Questions: Write the answers in the space provided.**

1. What is a potential market?
  
  
  
  
  
  
  
  
  
  
2. What is a target market?
  
  
  
  
  
  
  
  
  
  
3. List three characteristics that should be considered when conducting market research to determine a target market.
  - A.
  
  
  
  
  
  
  
  - B.
  
  
  
  
  
  
  
  - C.
  
  
  
  
  
  
  
4. What is an advantage of selling produce at farmers' markets?
  
  
  
  
  
  
  
  
  
  
5. What is community-supported agriculture (CSA)?

## Fruit and Vegetable Production

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6. What are three characteristics to consider before starting a pick-your-own business?
  - A.
  - B.
  - C.
  
7. What are three advantages of using newspapers as a method of advertising?
  - A.
  - B.
  - C.
  
8. What are two disadvantages of using radio as a method of advertising?
  - A.
  - B.

Figure 2.1

## Identifying a Market

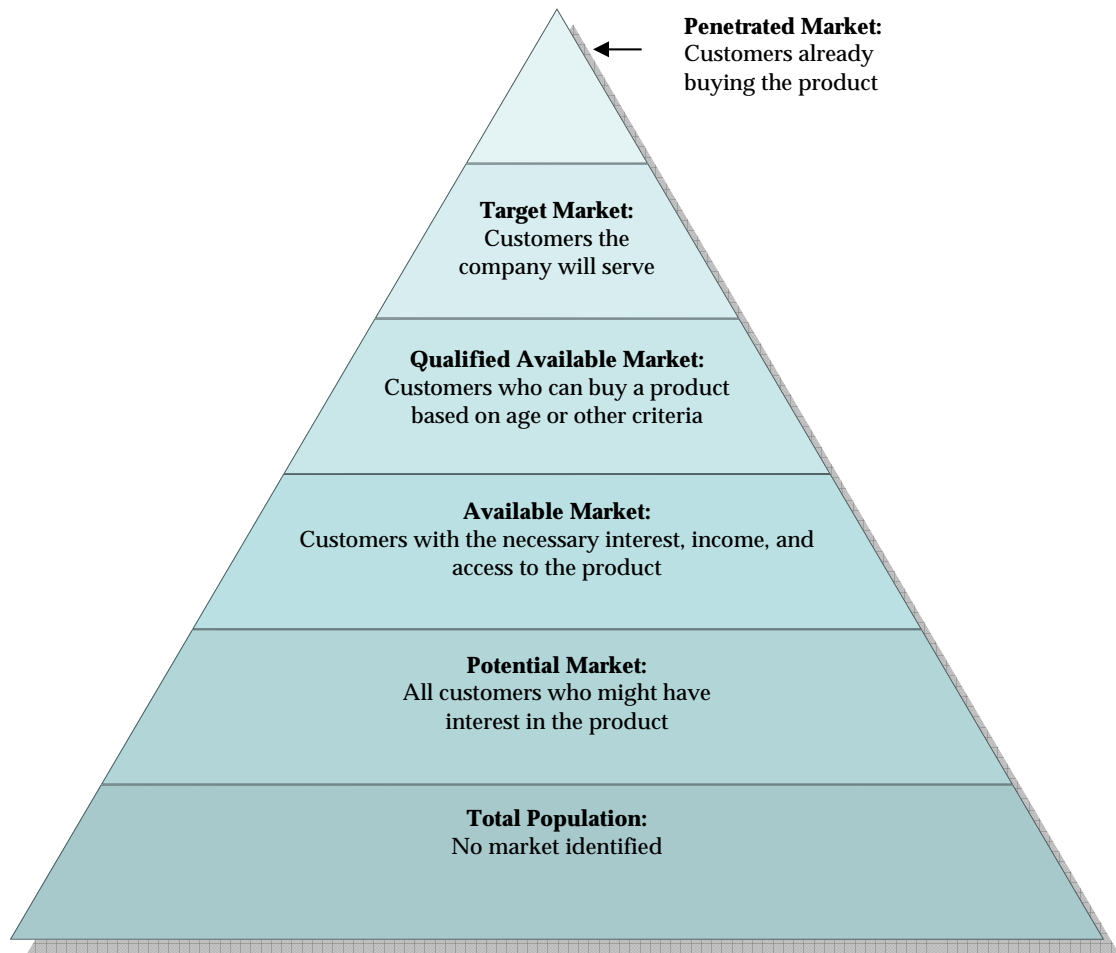






Figure 2.2

## **Characteristics of Many Successful Retail Produce Businesses**

- Phone with an answering machine that provides essential information, such as prices and hours of operation
- Weekend, summer, and holiday hours
- Accommodations for children and a family friendly environment
- Barrier-free access to all services and facilities
- Sufficient parking and clear roads and trails at pick-your-owns
- Large, readable signs with vital information for customers
- Well-mannered, knowledgeable employees
- Free drinking water (Selling cold sodas, candy, and juices is also a good idea.)
- Containers supplied for customers who forget to bring one
- Plenty of shade
- Clean restrooms
- Attractive, well-stocked displays (Pick-your-owns should also have some produce on display, ready to purchase, for customers who prefer this option.)







# Fruit and Vegetable Production

## Lesson 3: Site Evaluation

### Competency/Objective

Classify characteristics of selecting and planning for fruit and vegetable production.

### Study Questions

1. What are soil considerations when evaluating a site?
2. What are topography considerations when evaluating a site?
3. What are accessibility considerations when evaluating a site?
4. What are climatic considerations when evaluating a site?
5. How do utilities affect evaluation of a site?
6. How does zoning affect evaluation of a site?
7. How does labor affect evaluation of a site?

### References and Materials

1. *Fruit and Vegetable Production Unit for Plant Science Core Curriculum* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2006.
2. Figures/Transparency Masters
  - Fig. 3.1 Soil Texture Triangle
  - Fig. 3.2 pH Scale
  - Fig. 3.3 Essential Plant Nutrients
  - Fig. 3.4 Spring Frost Dates
  - Fig. 3.5 Fall Frost Dates
3. Activity Sheet
  - AS 3.1 Evaluating a Possible Production Site



## Teaching Procedures

### A. Review

Lessons one and two outlined the importance of financial and market planning to fruit and vegetable operations. Lesson three looks at how to evaluate a site to determine if it is suitable for production. There are environmental and nonenvironmental factors to consider. Environmental factors include soil, topography, accessibility, and climate. Nonenvironmental factors include utilities, zoning, and labor.

### B. Motivation

Ask students to think about building a house. What things should be considered before construction begins? Some examples would be land, location, zoning, electricity, water, and workers to build it. Then discuss how some of these concerns must also be evaluated before selecting a site for fruit and vegetable production.

### C. Assignment

### D. Supervised Study

Lead students in collecting the information needed to answer and discuss the study questions. The instructor may choose to work on one study question at a time or have students consider all the study questions before the discussion. Another option is to have students work in a cooperative learning environment by forming groups and assigning different study questions to each group.

### E. Discussion

Lead students in a discussion of the study questions. Supplement students' responses and information with additional materials when needed.

#### **1. What are soil considerations when evaluating a site?**

Ask students what they know about soil. During the discussion, help students relate what they know about soil to how it affects fruit and vegetable production. Refer to Figure 3.1 Soil Texture Triangle, Figure 3.2 pH Scale, and Figure 3.3 Essential Plant Nutrients.

## Fruit and Vegetable Production

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- a. Soil is a living, naturally occurring, dynamic system at the interface of air and rock.
  - i. Soil forms when climate and organisms act on organic and geologic material in a specific landscape over time.
- b. Soil texture refers to the percentage by weight of sand, silt, and clay in a soil.
  - i. Ease of tilling and root development are influenced by soil texture.
  - ii. Soil texture affects the amount of air and water the soil will hold and the rate of water movement through the soil.
  - iii. Nutrient supplies are also affected by soil texture.
- c. Soil pH measures the acidity and alkalinity of the soil.
  - i. The pH scale ranges from 0 to 14, with 0 being the most acidic and 14 being the most alkaline or basic.
  - ii. The pH value gives an estimate of the balance between the plant nutrient elements in the soil and other non-nutrient elements.
  - iii. Soil pH affects available nutrient levels and should be monitored to reduce the likelihood of nutrient deficiencies.
- d. There are nine essential macronutrients and eight essential micronutrients needed for plant growth.
  - i. Macronutrients:
    - 1. Calcium (Ca)
    - 2. Magnesium (Mg)
    - 3. Potassium (K)
    - 4. Phosphorus (P)
    - 5. Sulfur (S)
    - 6. Nitrogen (N)
    - 7. Carbon (C)
    - 8. Hydrogen (H)
    - 9. Oxygen (O)
  - ii. Micronutrients:
    - 1. Boron (B)
    - 2. Chlorine (Cl)
    - 3. Cobalt (Co)
    - 4. Iron (Fe)
    - 5. Manganese (Mn)
    - 6. Molybdenum (Mo)
    - 7. Zinc (Zn)
    - 8. Copper (Cu)



- e. Fertile soil produces high-yielding, healthy crops. Soil fertility depends on the following:
  - i. Nutrient balance and quantity
  - ii. Soil texture
  - iii. Soil structure
  - iv. Rooting depth
  - v. Organic matter content
  - vi. Available water capacity
  - vii. Aeration (porosity)
  - viii. Length of growing season
  - ix. Physical support
    - 1. Erosion control
    - 2. Good plant residue management
- f. Soil testing is one of the best ways to evaluate soil.
  - i. Soil testing can reveal the percentage of organic matter, pH, and available nutrients in soil.
  - ii. Test results can be used to guide the application of fertilizer and soil amendments.
  - iii. Soil testing can be used to monitor conditions and diagnose problems, which helps save time and money in the long run.

### **2. What are topography considerations when evaluating a site?**

Ask students to explain what topography is. Why is topography an element considered in fruit and vegetable production?

- a. Topography refers to the relative positions and elevations of the natural and fabricated features that describe the surface of an area. Topography affects the following:
  - i. Soil condition
  - ii. Types of plants that can grow well in the area
  - iii. How accessible the area is for machinery
- b. Topography determines how wind and water move toward, over, and away from the area. The interaction between topography, wind, and water influences the following:
  - i. Soil erosion
  - ii. Soil drainage
  - iii. Water-holding capacity

### 3. What are accessibility considerations when evaluating a site?

Ask students what it means for an area to be accessible. Why would a production site need to be accessible? What are the different types of elements that might need to be present for a planting site?

- a. Accessibility refers to how readily a site can be reached and used. Considerations include the following:
  - i. Ease of getting into and out of the area with equipment and supplies to plant, maintain, and harvest the crop
  - ii. Utilities, such as water and electricity
  - iii. Existing roads
  - iv. Roads that will need to be built
- b. Pick-your-own and CSA farms must also be accessible to the public. Producers evaluating a site for these operations must plan on additional factors.
  - i. Sufficient parking
  - ii. Clear roads and trails
  - iii. Barrier-free access to all services and facilities

### 4. What are climatic considerations when evaluating a site?

Ask students what type of climate zone they live in. Why is it important to know about the climate of an area? Can there be more than one climate in the same area? Refer to Figure 3.4 Spring Frost Dates and Figure 3.5 Fall Frost Dates.

- a. Climate is all the atmospheric influences, usually considered over a number of years, that combine to influence the land forms, soils, vegetation, and land use of a region. Principal atmospheric influences include the following:
  - i. Temperature
  - ii. Moisture
  - iii. Wind
  - iv. Pressure
  - v. Evaporation
- b. The climate helps determine what plants will thrive during the growing season.

- c. Climate and region determine an area's frost dates.
  - i. Frost dates are the estimated dates of the last frost in spring and the first frost in fall.
  - ii. The time between frost dates is the growing season in which plants can reach maturity and produce fruits and vegetables that are ready to harvest.
  - iii. Frost dates are based on historical data compiled by the USDA.
  - iv. Frost dates are estimates only—earlier and later frosts can occur.
- d. A microclimate is an area in which the climate is different from the area around it.
  - i. Microclimates may be large or small.
  - ii. They may be natural or caused by human construction or activity.
  - iii. Producers can take advantage of microclimatic differences by the varieties of plants they choose and how they position their crops.

### **5. How do utilities affect evaluation of a site?**

Ask students what utilities are. How are they used in everyday life? What possible uses would they have in fruit and vegetable production?

- a. Utilities and services should be easily accessible.
  - i. The distance from utilities will affect the cost of bringing them to the site.
  - ii. Water should be available and plentiful, and water quality should also be considered.
  - iii. Electricity may be needed, depending on the equipment used.

### **6. How does zoning affect evaluation of a site?**

Ask students what they know about zoning issues. Does zoning change between communities? How do you find out about zoning regulations in your area?

- a. Zoning controls the physical development of land and dictates the kinds of uses allowed on individual properties.
  - i. Zoning laws determine where residential, industrial, recreational, and commercial activities can occur.
  - ii. Local governments usually control zoning.
- b. Check with the local zoning board about the regulations concerning the specific site before starting production.

### 7. How does labor affect evaluation of a site?

Ask students if they were going to start a fruit or vegetable production site how they would do it. How would they set out the plants? How would they gather the products? How would they maintain the production site? Will they need help?

- a. Labor needs depend on the type, size, and scale of production.
  - i. The producer should determine the availability of a labor force in the area.
  - ii. Labor may be automated or done by hand.
    - 1. Hand labor is done by people working manually with crops.
    - 2. Automated labor is done by people operating machines.

### F. Other Activities

- 1. Have students contact the local zoning board and find out about regulations in the area.
- 2. Ask a local producer to explain to the students what factors he or she considered before selecting a fruit or vegetable production site.

### G. Conclusion

When considering a site for fruit and vegetable production, a number of environmental and nonenvironmental factors should be considered. Environmental factors include soil, topography, accessibility, and climate. Nonenvironmental factors include utilities, zoning, and labor. Carefully considering these factors before selecting a site can help avoid problems in the future.

### H. Answers to Activity Sheet

#### AS 3.1 Evaluating a Possible Production Site

Answers will vary.

### I. Answers to Assessment

1. Students should list the following answers.
  - A. Silt
  - B. Clay
  - C. Sand
2. The pH scale measures the acidity and alkalinity of the soil.
3. Students should list three of the following answers.
  - A. Temperature
  - B. Moisture
  - C. Wind
  - D. Pressure
  - E. Evaporation
4. Producers can take advantage of microclimatic differences by the varieties of plants they choose and how they position their crops.
5. Zoning controls the physical development of land and dictates the kinds of uses allowed on individual properties. Zoning determines where residential, industrial, recreational, and commercial activities can occur.
6. Topography refers to the relative positions and elevations of the natural and fabricated features that describe the surface of an area.
7. Students should list three of the following answers.
  - A. Soil condition
  - B. Types of plants that can grow well in the area
  - C. How accessible the area is for machinery
  - D. Soil erosion
  - E. Soil drainage
  - F. Water-holding capacity

# Fruit and Vegetable Production

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## Unit I: Fruit and Vegetable Production

Name: \_\_\_\_\_

### Lesson 3: Site Evaluation

Date: \_\_\_\_\_

## ASSESSMENT

**Short-Answer Questions: Write the answers in the space provided.**

1. Soil texture refers to a soil's percentage by weight of what three components?

A.

B.

C.

2. What does the pH scale measure?

3. What are three atmospheric influences that help determine climate?

A.

B.

C.

4. How can producers use microclimates to their advantage?

5. Why is zoning a consideration in selecting a production site?
  
  
  
  
  
  
  
  
  
  
6. What is the definition of topography?
  
  
  
  
  
  
  
  
  
  
7. What are three things that topography can affect in a production site?
  - A.
  
  
  
  
  
  
  
  
  
  
  - B.
  
  
  
  
  
  
  
  
  
  
  - C.

Figure 3.1

## Soil Texture Triangle

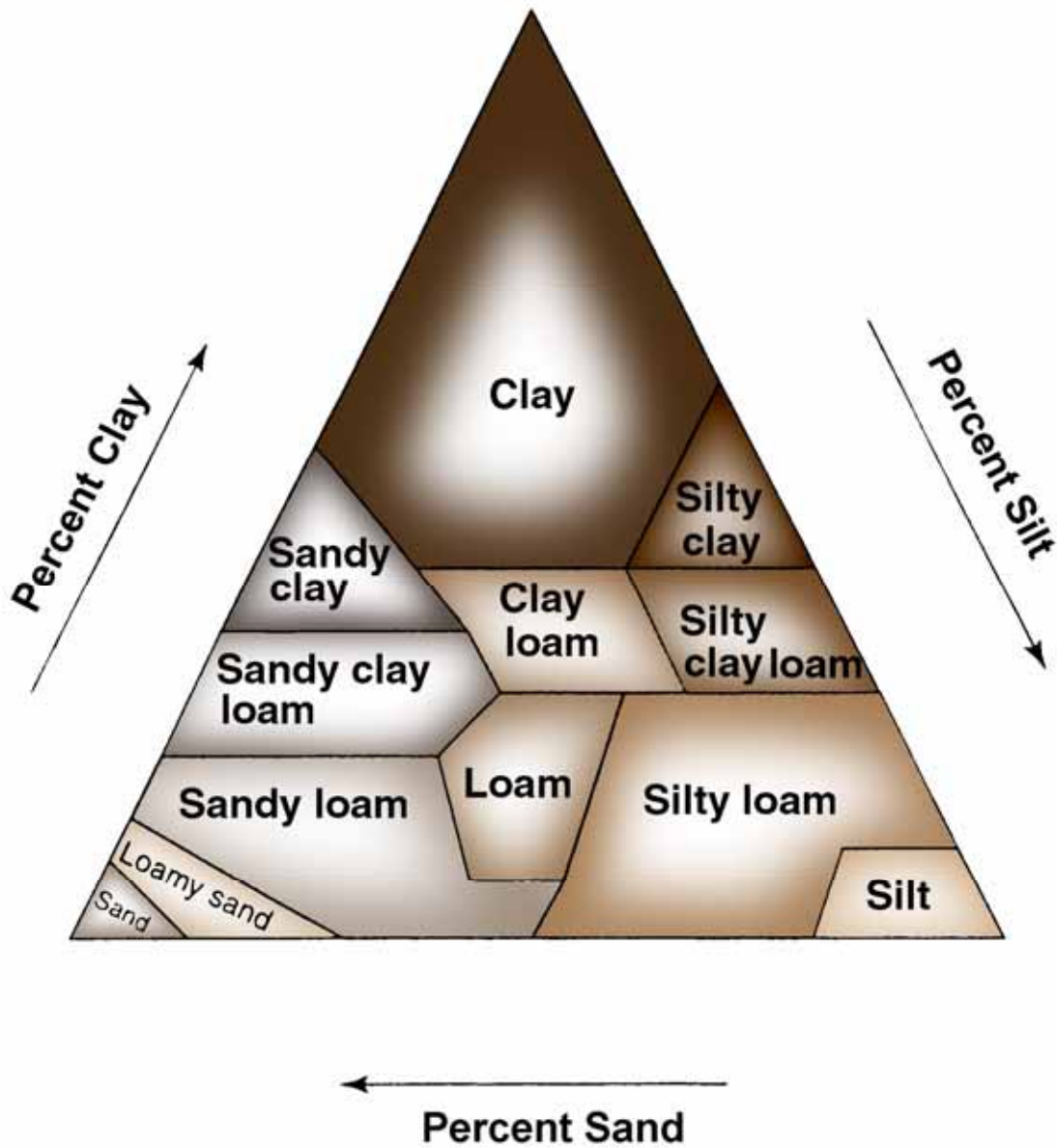






Figure 3.2

## pH Scale

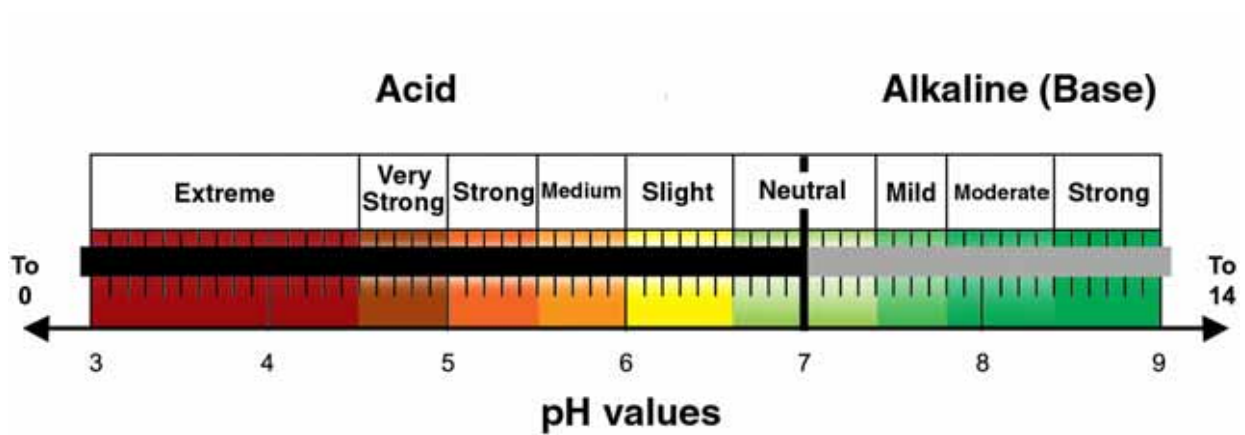




Figure 3.3

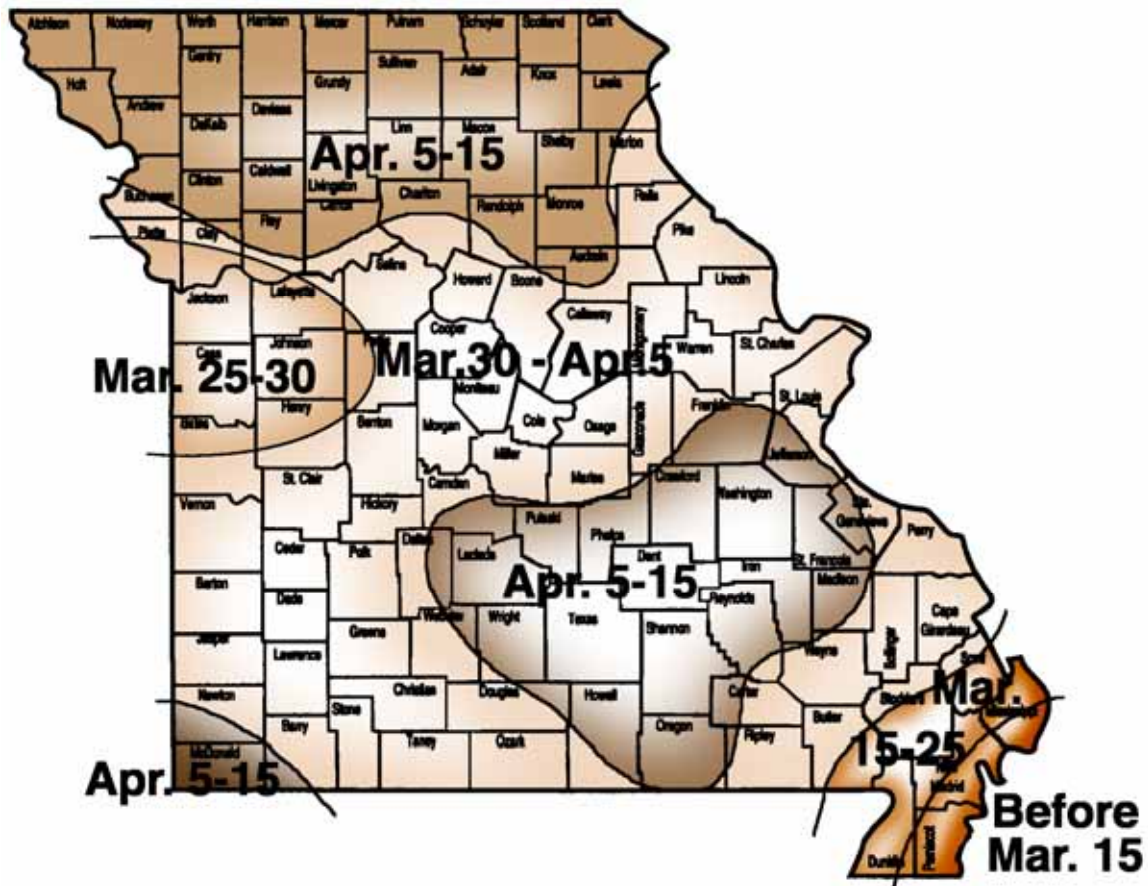
## Essential Plant Nutrients

	Nutrients	Source
<b>Macronutrients</b>	Ca    Calcium Mg    Magnesium K      Potassium	Mineral solids
	P      Phosphorus S      Sulfur	Mineral solids; organic matter
	N      Nitrogen	Organic matter (primarily)
	C      Carbon H      Hydrogen O      Oxygen	Water and air
<b>Micronutrients</b>	B      Boron Cl      Chlorine Co      Cobalt Fe      Iron Mn      Manganese Mo      Molybdenum Zn      Zinc Cu      Copper	Naturally in soil; can be added with fertilizers



Figure 3.4

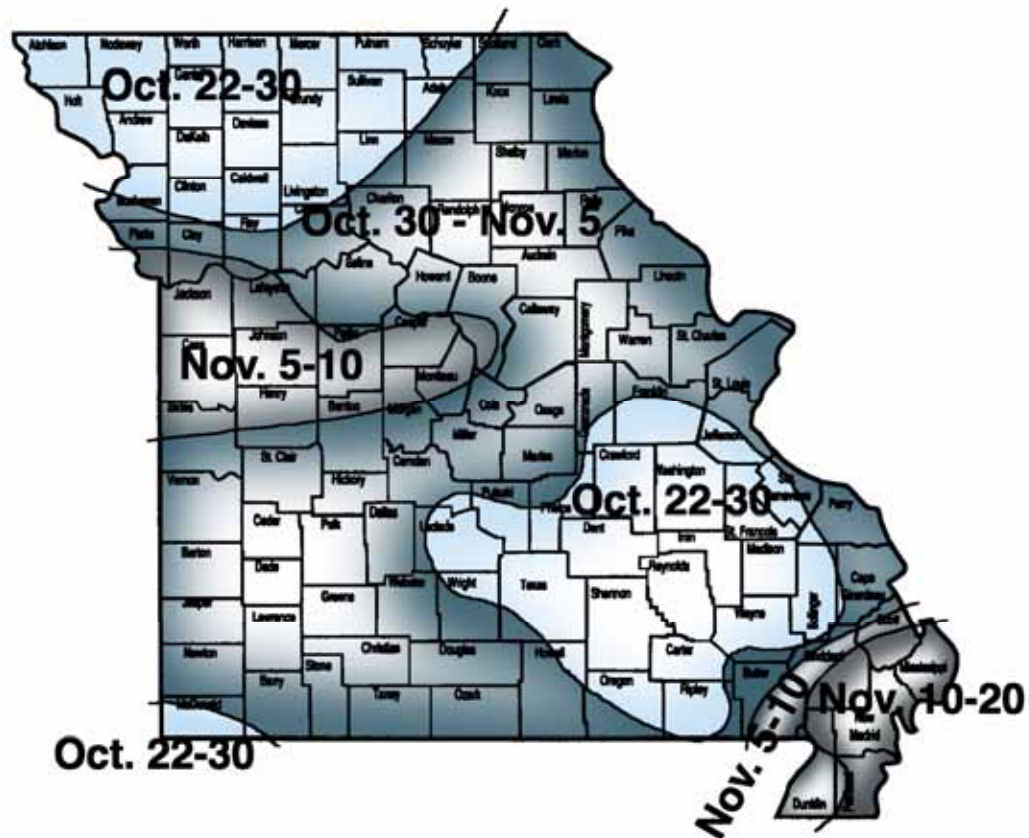
## Spring Frost Dates





### Figure 3.5

## Fall Frost Dates







## Unit I: Fruit and Vegetable Production

AS 3.1

### Lesson 3: Site Evaluation

Name: \_\_\_\_\_

#### Evaluating a Possible Production Site

**Objective:** Identify a possible production site and evaluate it.

**Directions:** Work in small groups. Select a site for a possible fruit or vegetable production area. Evaluate the site based on the information discussed in the lesson. Answer the following questions about the site.

1. Where is the site located?
2. What are the dimensions of the site?
3. What crops would be best suited for the site?
4. Describe the appearance and texture of the soil.
5. Describe the topography of the area.

6. Is the area easily accessible? If so, how can the area be accessed? If not, what changes would be needed to provide better access to the site?
7. What is the climate of the area? Are there any microclimates in the site?
8. What utilities are available at the site? What additional utilities are needed?
9. Would this area be a good production site? Why or why not?

# Fruit and Vegetable Production

## Lesson 4: Integrated Pest Management

### Competency/Objective

Explain management practices for pest control.

### Study Questions

1. What are the basic considerations of pest control?
2. What are biological pest management methods?
3. What are chemical pest management methods?
4. What are cultural pest management methods?
5. What are physical and mechanical pest management methods?
6. What is integrated pest management?

### References and Materials

1. *Fruit and Vegetable Production Unit for Plant Science Core Curriculum* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2006.
2. Figures/Transparency Masters
  - Fig. 4.1 Pesticides for Specific Pests
  - Fig. 4.2 Steps of Integrated Pest Management
3. Activity Sheet
  - AS 4.1 Designing an IPM Strategy

## Teaching Procedures

### A. Review

Lesson three discussed evaluating a site. The same factors that make a site desirable for planting a crop—fertile soil, adequate moisture, and a hospitable climate—also make it susceptible to many pests and diseases. To have a profitable yield and a healthy crop, producers must have a system of preventing pest infestation and protecting crops. This lesson covers systems of pest management.

### B. Motivation

Show students a plant that has been damaged by pests. Have students discuss possible pest problems the plant might have and ways to prevent and treat the problems. Keep the plant for section F. Other Activity and discuss it again after students have completed the lesson.

### C. Assignment

### D. Supervised Study

Lead students in collecting the information needed to answer and discuss the study questions. The instructor may choose to work on one study question at a time or have students consider all the study questions before the discussion. Another option is to have students work in a cooperative learning environment by forming groups and assigning different study questions to each group.

### E. Discussion

Lead students in a discussion of the study questions. Supplement students' responses and information with additional materials when needed.

## 1. What are the basic considerations of pest control?

Introduce the topic of pest control and ask students to give examples of pest control strategies. Could a plant or insect be a pest in one situation and not in another?

- a. Pests are plants, animals, or other organisms that occur where they are not wanted or where they can cause damage.

- b. A pest control program should do the following:
  - i. Protect crops from pests
  - ii. Increase plant resistance to pests
  - iii. Reduce or eliminate pest populations
- c. There are four basic methods of pest control:
  - i. Biological
  - ii. Chemical
  - iii. Cultural
  - iv. Physical and mechanical

### **2. What are biological pest management methods?**

- a. Biological pest management is the use of living organisms to control pests. Examples include the following:
  - i. Trap plants used to lure pests from crops
  - ii. Natural predators and parasites used to reduce pests
- b. Biological pest management is usually done in one or more of three ways:
  - i. Conserving or encouraging species in the area that control the pests
  - ii. Supplementing existing predator populations with additional members of the same species
  - iii. Introducing new species to the environment specifically to control pests
- c. Biological methods tend to take longer than other management methods and do not completely eliminate pests.

### **3. What are chemical pest management methods?**

Refer to Figure 4.1 Pesticides for Specific Pests.

- a. Chemical pest management is the use of chemicals to protect and treat plants and to repel or destroy pests.
- b. Pesticides are the most common form of chemical pest management.
- c. Pesticides can be a very useful tool in managing pest populations, but they do pose potential risks.
  - i. Can present health risks to humans
  - ii. Can cause damage to the environment
- d. Pesticide use is monitored and regulated by various agencies, including the U. S. Environmental Protection Agency, which evaluates new pesticides and reviews old ones to determine that they can be used safely.
- e. Growers should follow all directions and regulations regarding the proper use, handling, and storage of any pesticides they use.
- f. Pests can develop resistance to chemicals over time, so using pesticides alone should not be the only method for treating pests.

- g. Pesticides should be used only when necessary and at the lowest rate of application that will effectively control the pests. This is done for the following reasons:
  - i. Reduce expense
  - ii. Help prevent pests from becoming resistant
  - iii. Lower health and environmental risks

#### **4. What are cultural pest management methods?**

- a. Cultural pest management is controlling pests through the use of proper planting and growing techniques.
- b. Cultural pest management works by optimizing conditions for crops while minimizing opportunities for pests.
- c. Cultural management strategies have the advantage that many of them can be implemented before pests appear.
- d. Examples of cultural pest management practices include the following:
  - i. Choosing crop varieties suited to the area
  - ii. Planting crops to optimize growing conditions and reduce plant stress
  - iii. Providing adequate water and nutrients so plants resist disease and pests and outgrow weeds
  - iv. Rotating crops
  - v. Disposing of plant residue
  - vi. Planting and harvesting to avoid coinciding with pests

#### **5. What are physical and mechanical pest management methods?**

- a. Physical and mechanical pest management strategies use physical barriers and labor to prevent or limit pest damage. Examples of barriers and techniques include the following:
  - i. Fencing
  - ii. Traps
  - iii. Row covers
  - iv. Trenches
  - v. Mowing
  - vi. Plowing
  - vii. Hand-picking insects off plants
  - viii. Holding produce in cold storage to kill pests or slow or stop their development
- b. Some physical and mechanical strategies, such as removing insects by hand, can require too much time and labor to be practical for larger operations.
- c. The size of the operation and the availability of a labor force should be considered before using physical and mechanical management strategies.

### 6. What is integrated pest management?

Refer to Figure 4.2 Steps of Integrated Pest Management.

- a. Integrated pest management (IPM) combines biological, chemical, cultural, and physical and mechanical strategies into a comprehensive system of pest control.
- b. Integrated pest management programs have the following goals:
  - i. Limit pests to acceptable levels
  - ii. Promote healthy crops and good land management
  - iii. Reduce reliance on pesticides
  - iv. Promote long-term management strategies
  - v. Improve health and safety for farm workers and consumers
  - vi. Limit damage to the environment
- c. Integrated pest management plans don't try to eliminate all pests—small pest populations are left to support predators and parasites utilized for biological control.
- d. The key to IPM is knowing the action threshold (also called the economic threshold)—the point at which the cost of damage is greater than the cost of controlling the pests.
- e. There are a number of factors that should be considered when determining the action threshold:
  - i. Level of damage and infestation
  - ii. Market price
  - iii. Stage of crop growth
  - iv. Cost of pesticides
- f. A successful IPM strategy requires a thorough understanding of the following factors:
  - i. Crops to be grown
  - ii. Potential pests and their enemies
  - iii. Surrounding environment
  - iv. How these elements interact
- g. Monitoring the site for pest activity is critical for the IPM strategy to succeed.
- h. By utilizing a variety of control methods, IPM reduces the likelihood that pests will adapt to one particular strategy.

### F. Other Activities

Revisit the motivation activity in which students examined a plant damaged by pests. Have students separate into small groups and discuss ways to prevent or treat the problem using an integrated pest management strategy. Have the groups present their strategies to the class.



### G. Conclusion

Protecting crops from pest damage is an essential part of raising a healthy, productive crop. The four types of pest management are biological, chemical, cultural, and physical and mechanical. Integrated pest management incorporates techniques from all four strategies into a comprehensive system of pest control.

### H. Answers to Activity Sheet

#### AS 4.1 Designing an IPM Strategy

Answers will vary.

### I. Answers to Assessment

1. Biological pest management is the use of living organisms to control pests.
2. Students should list four of the following answers.
  - A. Fencing
  - B. Traps
  - C. Row covers
  - D. Trenches
  - E. Mowing
  - F. Plowing
  - G. Hand-picking insects off plants
  - H. Holding produce in cold storage to kill pests or slow or stop their development
3. Integrated pest management (IPM) combines biological, chemical, cultural, and physical and mechanical strategies into a comprehensive system of pest control.
4. Students should list three of the following answers.
  - A. Limit pests to acceptable levels
  - B. Promote healthy crops and good land management
  - C. Reduce reliance on pesticides
  - D. Promote long-term management strategies
  - E. Improve health and safety for farm workers and consumers
  - F. Limit damage to the environment
5. Students should list three of the following answers.
  - A. Level of damage and infestation
  - B. Market price
  - C. Stage of crop growth
  - D. Cost of pesticides

**Unit I: Fruit and Vegetable Production**

Name: \_\_\_\_\_

**Lesson 4: Integrated Pest Management**

Date: \_\_\_\_\_

**ASSESSMENT****Short-Answer Questions: Write the answers in the space provided.**

1. What is biological pest management?
  
  
  
  
  
  
  
  
  
  
2. List four examples of physical or mechanical pest management strategies.
  - A.
  
  
  
  
  - B.
  
  
  
  
  - C.
  
  
  
  
  - D.
  
3. What is integrated pest management (IPM)?
  
  
  
  
  
  
  
  
  
  
4. Identify three goals of integrated pest management.
  - A.
  
  
  
  
  - B.
  
  
  
  
  - C.

## Fruit and Vegetable Production

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5. Identify three factors to consider when determining the action threshold in an integrated pest management strategy.

A.

B.

C.

Figure 4.1

## Pesticides for Specific Pests

Type of Pesticide	Pests Treated
Bactericide	Bacteria
Fungicide	Fungi
Herbicide	Plants
Insecticide	Insects
Miticide	Mites, ticks
Molluscide	Snails, slugs
Nematicide	Nematodes



Figure 4.2

## Steps of Integrated Pest Management

Six Steps of IPM
1. Implement preventive strategies.
2. Scout plants for symptoms or presence of pests.
3. Identify pests and scope of damage.
4. Determine when action must be taken.
5. Implement management strategies.
6. Evaluate results.



## Unit I: Fruit and Vegetable Production

AS 4.1

### Lesson 4: Integrated Pest Management

Name: \_\_\_\_\_

#### Designing an IPM Strategy

**Objective:** Design an IPM strategy for a garden.

**Directions:** Work in small groups to create an integrated pest management strategy for a 10 ft x 10 ft tomato garden using all four methods of pest control: biological, chemical, cultural, and physical and mechanical. Use Table 4.2 Steps of Integrated Pest Management in lesson four to guide your plan. Choose one of the 10 pests below to help focus your plan.

- Birds
- Cutworms
- Flea beetles
- Hornworms
- Leaf miners
- Spider mites
- Stalk borers
- Stink bugs
- Tomato fruit worms
- Turtles





# Fruit and Vegetable Production

## Lesson 5: Vegetable Production

### Competency/Objective

Identify characteristics of cool season, long season, and warm season vegetable crops.

### Study Questions

1. What are plant considerations in vegetable production?
2. What are cool season crops?
3. What are warm season crops?
4. What are long season crops?
5. What are the components of the vegetable charts and what do they mean?
6. What are the important production characteristics of individual vegetable crops?

### References and Materials

1. *Fruit and Vegetable Production Unit for Plant Science Core Curriculum* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2006.
2. Figures/Transparency Masters  
  
Fig. 5.1 Sample Vegetable Chart
3. Activity Sheet  
  
AS 5.1 Exploring a Vegetable Crop

## Teaching Procedures

### A. Review

Lesson four discussed the basic methods of pest management and the general steps and benefits of an integrated pest management strategy. This lesson covers cool, warm, and long season crops and important aspects of vegetable production.

### B. Motivation

Ask students to picture a grocery store produce aisle. What do they see? How are the various crops produced? How do the plants grow?

### C. Assignment

### D. Supervised Study

Lead students in collecting the information needed to answer and discuss the study questions. The instructor may choose to work on one study question at a time or have students consider all the study questions before the discussion. Another option is to have students work in a cooperative learning environment by forming groups and assigning different study questions to each group.

### E. Discussion

Lead students in a discussion of the study questions. Supplement students' responses and information with additional materials when needed.

## 1. What are plant considerations in vegetable production?

Ask students what they know about vegetable production. What are some things that need to be considered? Why are these things important?

- a. The term vegetable is generally used to refer to the edible portion of herbaceous (nonwoody) plants—the roots, stems, leaves, flowers, or fruit.
- b. Different varieties and hybrids of vegetables offer certain desirable characteristics, such as good size, flavor, and appearance and resistance to certain pests and diseases.

- i. Variety: plant that occurs naturally or through cultivation and differs from other members of its species by one or more characteristics
- ii. Hybrid: plant that results from interbreeding two distinct cultivars, varieties, or species

### **2. What are cool season crops?**

Ask students to explain what cool season crops are. Why is it important to know about cool season crops?

- a. A cool season crop is a crop that grows best during the cool temperatures of fall and spring.
  - i. Cool season crops prefer temperature between 50°F and 70°F.
  - ii. They are very tolerant of cold weather and can usually stand a light frost.
  - iii. Examples: beets, carrots, potatoes, cabbage, and cauliflower
  - iv. Two primary types of cool season crops are root crops and surface crops.
    - 1. Root crops: vegetables that are primarily cultivated for their edible roots, tubers, or modified stems, which grow below ground
    - 2. Surface crops: vegetables that are grown for edible parts—leaves, flowers, and “fruits”—that grow above ground

### **3. What are warm season crops?**

Ask students what vegetables are considered warm season crops. Why are these crops considered warm season crops?

- a. Warm season crops are crops that are severely harmed by frost and do not grow well until the temperature is at or above 70°F.
  - i. Warm season crops should only be planted when soil temperature is warm enough to induce sprouting.
  - ii. Examples: tomatoes, eggplants, and corn

### **4. What are long season crops?**

Ask students what vegetables are considered long season crops. Why are these crops considered long season crops?

- a. Long season crops are vegetables that require a relatively long growing season to mature compared to other plants.
  - i. Examples: pumpkins, gourds, and watermelons

### 5. What are the components of the vegetable charts and what do they mean?

Ask students what they would need to know about a specific crop if they were going to grow it. How could knowing this information help them with production? Refer to Figure 5.1 Sample Vegetable Chart.

- a. Different types of vegetables will be discussed in this lesson using a chart format. Vegetable chart components are discussed below.
  - i. **Days to Germination:** The days to germination is an estimated number of days before a plant will begin to grow and sprout.
  - ii. **Days to Maturity:** The days to maturity is the estimated number of days from planting until a usable or salable product can be harvested.
  - iii. **Soil:** This section of the chart explains what soil conditions are desirable for the plant to grow, such as the recommended soil pH, texture, and drainage.
  - iv. **Spacing:** Spacing requirements provide a guideline for how much space to leave between plants and rows to allow adequate room for growth, cultivation, and harvesting.
  - v. **Harvest:** The harvest section provides general guidelines to help determine when the crop is ready to be harvested and how to harvest the crop.
  - vi. **Postharvest:** Proper storage and handling procedures are listed in the postharvest portion of the chart.
  - vii. **Production Concerns:** Crop-specific information to facilitate proper growth and production is supplied in the production concerns section.
  - viii. **Pests and Diseases:** This section lists common pests and diseases that affect the specific crop.
  - ix. **Other Considerations:** This heading provides a place to include crop-specific concerns that are not associated with other areas of the chart.

### 6. What are the important production characteristics of individual vegetable crops?

Ask students what vegetable crops grow in the area. What types of vegetable crops have students grown?

- a. The instructor should choose vegetable charts to discuss in class from those provided or use blank charts to develop charts for other crops as needed.
- b. The instructor should distribute blank charts to students to fill out during class discussion or as part of their assigned work.
- c. Charts for the following vegetables are included with this unit. A blank chart for student charts and other vegetables is included with each group.

- i. Cool season root crops
  - 1. Beets
  - 2. Carrots
  - 3. Potatoes
  - 4. Radishes
  - 5. Turnips
  - 6. Others
- ii. Cool season surface crops
  - 1. Asparagus
  - 2. Cabbage
  - 3. Cauliflower
  - 4. Lettuce
  - 5. Spinach
  - 6. Others
- iii. Warm season crops
  - 1. Cucumbers
  - 2. Eggplants
  - 3. Green beans
  - 4. Okra
  - 5. Peppers
  - 6. Summer squash
  - 7. Sweet corn
  - 8. Tomatoes
  - 9. Others
- iv. Long season crops
  - 1. Cantaloupes
  - 2. Gourds
  - 3. Pumpkins
  - 4. Watermelons
  - 5. Winter squash
  - 6. Others

### F. Other Activities

- 1. Have students plant 10 vegetable seeds each and monitor them. Have students record the days the seeds germinate and the germination rate.
- 2. Start a production site where students can watch and identify the different types of vegetables as they mature.
- 3. Have samples of each of the different crops studied in class for the students to see and taste.

### G. Conclusion

Vegetables are the edible portions of herbaceous plants. They can be divided into three general categories based on their growing season: cool season, warm season, and long season crops.

The charts that accompany this lesson summarize a number of key elements needed to produce a successful vegetable crop. Recommendations will vary depending on specific crops and growing conditions.

### H. Answers to Activity Sheet

#### AS 5.1 Exploring a Vegetable Crop

Answers will vary.

### I. Answers to Assessment

1. Students should provide the following answers.
  - A. Days to Germination: The days to germination is an estimated number of days before a plant will begin to grow and sprout.
  - B. Days to Maturity: The days to maturity is the estimated number of days from planting until a usable or salable product can be harvested.
  - C. Soil: This section of the chart explains what soil conditions are desirable for the plant to grow, such as the recommended soil pH, texture, and drainage.
  - D. Spacing: Spacing requirements provide a guideline for how much space to leave between plants and rows to allow adequate room for growth, cultivation, and harvesting.
  - E. Harvest: The harvest section provides general guidelines to help determine when the crop is ready to be harvested and how to harvest the crop.
  - F. Postharvest: Proper storage and handling procedures are listed in the postharvest portion of the chart.
  - G. Production Concerns: Crop-specific information to facilitate proper growth and production is supplied in the production concerns section.
  - H. Pests and Diseases: This section lists common pests and diseases that affect the specific crop.
  - I. Other Considerations: This heading provides a place to include crop-specific concerns that are not associated with other areas of the chart.

2. Students should provide two of the following answers.
  - A. Good size
  - B. Good flavor
  - C. Good appearance
  - D. Resistance to certain pests
  - E. Resistance to certain diseases
3. A cool season crop is a crop that grows best during the cool temperatures of fall and spring.
4. Students should provide two of the following answers.
  - A. Beets
  - B. Carrots
  - C. Potatoes
  - D. Radishes
  - E. Turnips
  - F. Asparagus
  - G. Cabbage
  - H. Cauliflower
  - I. Lettuce
  - J. Spinach
5. Long season crops are vegetables that require a relatively long growing season to mature compared to other plants.
6. Students should provide two of the following answers.
  - A. Cantaloupes
  - B. Gourds
  - C. Pumpkins
  - D. Watermelons
  - E. Winter squash
7. Warm season crops are crops that are severely harmed by frost and do not grow well until the temperature is at or above 70°F.
8. Students should provide two of the following answers.
  - A. Cucumbers
  - B. Eggplants
  - C. Green beans
  - D. Okra
  - E. Peppers
  - F. Summer squash
  - G. Sweet corn
  - H. Tomatoes





**Unit I: Fruit and Vegetable Production**

Name: \_\_\_\_\_

**Lesson 5: Vegetable Production**

Date: \_\_\_\_\_

**ASSESSMENT****Short-Answer Questions: Write the answers in the space provided.**

1. Explain what information would be found under each heading of the vegetable chart.

A. Days to Germination:

B. Days to Maturity:

C. Soil:

D. Spacing:

E. Harvest:

F. Postharvest:

## Fruit and Vegetable Production

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G. Production Concerns:

H. Pests and Diseases:

I. Other Considerations:

2. What are two advantages that a variety or hybrid can offer?

A.

B.

3. What is a cool season crop?

4. What are two examples of cool season crops?

A.

B.

5. What is a long season crop?
  
  
  
  
  
  
  
  
  
  
6. What are two examples of long season crops?
  - A.
  
  
  
  
  
  - B.
  
  
  
  
  
  
  
  
  
  
7. What is a warm season crop?
  
  
  
  
  
  
  
  
  
  
8. What are two examples of warm season crops?
  - A.
  
  
  
  
  
  - B.



Figure 5.1

## Sample Vegetable Chart

### Cool Season Root Crop

<b>Days to Germination</b>	
<b>Days to Maturity</b>	
<b>Soil</b>	
<b>Spacing</b>	
<b>Harvest</b>	
<b>Postharvest</b>	
<b>Production Concerns</b>	
<b>Pests and Diseases</b>	
<b>Other Considerations</b>	



## Unit I: Fruit and Vegetable Production

AS 5.1

### Lesson 5: Vegetable Production

Name: \_\_\_\_\_

#### Exploring a Vegetable Crop

**Objective:** Identify key growing elements for a vegetable crop.

**Directions:** Each student will receive a blank vegetable chart. The instructor will assign each student a vegetable to research. Students will complete the chart for their assigned vegetable. Textbooks, seed catalogs, magazines, the Internet, and other sources may be used as references. After the chart is completed, students will present their findings to the class. Students will turn in their completed chart and a bibliography of their sources following their presentations.





# Fruit and Vegetable Production

## Lesson 6: Fruit Production

### Competency/Objective

Identify characteristics of small fruits and tree fruits.

### Study Questions

1. What are plant considerations in fruit production?
2. What are small fruits?
3. What are tree fruits?
4. How are fruit trees produced?
5. What are the types of fruit trees?
6. What are the components of the fruit charts and what do they mean?
7. What are the important production characteristics of individual fruit crops?

### References and Materials

1. *Fruit and Vegetable Production Unit for Plant Science Core Curriculum* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2006.
2. Figures/Transparency Masters
  - Fig. 6.1 Whip Grafting
  - Fig. 6.2 Sample Fruit Chart
3. Activity Sheet
  - AS 6.1 Exploring a Fruit Crop

## Teaching Procedures

### A. Review

Lesson five discussed cool, warm, and long season crops and key aspects of vegetable production. Lesson six will introduce students to small fruits, tree fruits, and various elements of fruit production.

### B. Motivation

Ask students to use a phone book to identify fruit producers in the area. Ask them what types of fruit are produced in the area. Where are these fruits sold?

### C. Assignment

### D. Supervised Study

Lead students in collecting the information needed to answer and discuss the study questions. The instructor may choose to work on one study question at a time or have students consider all the study questions before the discussion. Another option is to have students work in a cooperative learning environment by forming groups and assigning different study questions to each group.

### E. Discussion

Lead students in a discussion of the study questions. Supplement students' responses and information with additional materials when needed.

## 1. What are plant considerations in fruit production?

Ask students what they know about fruit production. What are some things that need to be considered? Why are those things important?

- a. Fruits are the matured ovaries of flowering plants that contain the seeds of the plant.
- b. A fruit crop is a perennial crop that produces true (botanical) fruit that is edible and of economic value.

- c. Different varieties and hybrids of fruits offer certain desirable characteristics, such as good size, flavor, and appearance and resistance to certain pests and diseases.
  - i. Variety: a plant that occurs naturally or through cultivation and differs from other members of its species by one or more characteristics
  - ii. Hybrid: a plant that results from interbreeding two distinct cultivars, varieties, or species
- d. Qualities such as size, flavor, and appearance are especially important when choosing fruit crops because these traits play a large role in appealing to customers.

### **2. What are small fruits?**

Ask students to explain what small fruits are. Why are small fruits important in fruit production?

- a. Small fruit crops produce small, soft fruit, usually on vines, plants, or shrubs.
  - i. Small fruits are not all in the same botanical family.
  - ii. They require little space relative to the amount of fruit they produce.
  - iii. Small fruit crops typically bear fruit one or two years after planting.
  - iv. Pests are generally easier to control than on tree fruits.
  - v. Examples: blackberries, blueberries, grapes, raspberries, strawberries

### **3. What are tree fruits?**

Ask students what fruit trees they have seen in the area. Why would someone grow fruit trees?

- a. Tree fruits are edible fruit crops that grow on trees.
  - i. Trees are woody plants that usually have a single main trunk and produce new growth in the branches of their canopy.
    - 1. Trees are distinct from shrubs, which typically have several stems instead of a single trunk and produce new growth from the ground.
    - 2. The growth pattern of trees makes them well suited to grafting.

### **4. How are fruit trees produced?**

Ask students if they know how most fruit trees are produced. What is grafting? Why is grafting important? Refer to Figure 6.1 Whip Grafting.

## Fruit and Vegetable Production

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- a. Grafting is a propagation method in which a bud, twig, or shoot—the scion—is taken from one plant and attached to a different but compatible plant, called the rootstock.
  - i. The grower can choose one tree for its ability to grow in a particular region or type of soil, its height, or disease resistance, and another for its fruit.
  - ii. Grafting allows the grower to combine the best traits of multiple plants and produce a better product.

### 5. What are the types of fruit trees?

Ask students if they know what the different types of fruit trees are. What are pome fruit trees? What are stone fruit trees? What are nut trees? Why is a nut considered a fruit?

- a. Pome fruits
  - i. Pome fruits are members of the Pomoideae subfamily of the family Rosaceae.
  - ii. The fruit, a pome, forms from a flower with an inferior, compound ovary.
  - iii. The edible portion that surrounds the seeds is formed by the nonovarian parts of the flower.
  - iv. Pome fruits are generally well adapted to cool, temperate climates.
  - v. They typically have a long storage life if proper conditions are provided.
  - vi. Examples: apples and pears
- b. Stone fruits
  - i. Stone fruits are members of the subfamily Prunoideae of the family Rosaceae.
  - ii. The fruit, a drupe, forms from a flower with a superior, simple ovary.
  - iii. The common name comes from the hard pit or “stone” in the center of the fruit.
  - iv. The stone is a specialized layer of ovary tissue called an endocarp that surrounds the seed.
  - v. Most stone fruits are native to warmer climates.
    - 1. They are very susceptible to injury from low winter temperatures.
    - 2. Stone fruits bloom early in the spring, which makes their flowers vulnerable to damage from spring frosts.
  - vi. Stone fruits are extremely perishable and have a very limited storage life.
  - vii. Examples: cherries, peaches, and plums

- c. Nuts
  - i. A nut is a dry indehiscent fruit in which the seed remains unattached to the ovary wall, and the ovary wall—the shell—becomes very hard at maturity.
  - ii. Indehiscent means that the fruit does not open when it ripens.
  - iii. Nut crops are not all in the same botanical family, but they do have similar processing requirements, such as hulling and drying.
  - iv. They are typically high in protein and low in saturated fats.
  - v. Nut trees can do well in less desirable growing conditions, which makes them a good choice for land that is too rough or steep for field crops.
  - vi. Examples: black walnuts, Chinese chestnuts, and northern pecans

### 6. What are the components of the fruit charts and what do they mean?

Ask students what they would need to know about a specific crop if they were going to grow it. How could knowing this information help them with production? Refer to Figure 6.2 Sample Fruit Chart.

- a. Different types of fruits will be discussed in this lesson using a chart format. Fruit chart components are discussed below.
  - i. **Interval From Planting to Fruiting:** The interval from planting to fruiting refers to the amount of time from planting until the first salable crop is produced.
  - ii. **Season of Ripening:** The season of ripening is a guideline for the time of year when the fruit will be ripe and ready to pick.
  - iii. **Soil:** This section of the chart explains what soil conditions are desirable for the plant to grow, such as the recommended soil pH, texture, and drainage.
  - iv. **Spacing:** Spacing requirements provide a guideline for how much space to leave between plants and rows to allow adequate room for growth, cultivation, and harvesting.
  - v. **Harvest:** The harvest section of the charts provides general guidelines to help determine when the crop is ready to be harvested and how to harvest the crop.
  - vi. **Postharvest:** Proper storage and handling procedures are listed in the postharvest portion of the chart.
  - vii. **Production Concerns:** Crop-specific information to facilitate proper growth and production is supplied in the production concerns section.
  - viii. **Pests and Diseases:** This section lists common pests and diseases that affect the specific crop.

- ix. **Structures and Equipment:** This section provides a guide to what structures and equipment are needed for proper growth and production.
- x. **Other Considerations:** This heading provides a place to include crop-specific concerns that are not associated with other areas of the chart.

### 7. What are the important production characteristics of individual fruit crops?

Ask students what fruit crops grow in the area. What types of fruit crops have students grown?

- a. The instructor should choose fruit charts to discuss in class from those provided or use blank charts to develop charts for other crops as needed.
- b. The instructor should distribute blank charts to students to fill out during class discussion or as part of their assigned work.
- c. Charts for the following fruits are included with this unit. A blank chart for student charts and other fruits is included with each group.
  - i. Small fruits
    - 1. Blackberries
    - 2. Blueberries
    - 3. Grapes
    - 4. Raspberries
    - 5. Strawberries
    - 6. Others
  - ii. Pome fruit trees
    - 1. Apples
    - 2. Pears
    - 3. Others
  - iii. Stone fruit trees
    - 1. Cherries
    - 2. Peaches
    - 3. Plums
    - 4. Others
  - iv. Nut trees
    - 1. Black walnuts
    - 2. Chinese chestnuts
    - 3. Northern pecans
    - 4. Others

### F. Other Activities

1. Have samples of each of the different crops studied in class for the students to see and taste.
2. Have examples of different fruits and ask the students to identify them as pome or stone fruits.

### G. Conclusion

Fruits are the matured ovaries of flowering plants that contain the seeds of the plant. Fruits can be divided into small fruits and tree fruits. Tree fruits can be divided further into pome fruits, stone fruits, and nuts.

The charts that accompany this lesson summarize a number of key elements needed to produce a successful fruit crop. Recommendations will vary depending on specific crops and growing conditions.

### H. Answers to Activity Sheet

#### AS 6.1 Exploring a Fruit Crop

Answers will vary.

### I. Answers to Assessment

1. Fruits are the matured ovaries of flowering plants that contain the seeds of the plant.
2. Students should list the following types of tree fruits. Examples of each type will vary.
  - A. Pome fruits
    1. Apples
    2. Pears
  - B. Stone fruits
    1. Cherries
    2. Peaches
    3. Plums
  - C. Nuts
    1. Black walnuts
    2. Chinese chestnuts
    3. Northern pecans



## Fruit and Vegetable Production

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3. Students should provide three of the following answers.
  - A. Blackberries
  - B. Blueberries
  - C. Grapes
  - D. Raspberries
  - E. Strawberries
4. Students should provide two of the following answers.
  - A. Small fruits require little space relative to the amount of fruit they produce.
  - B. Crops typically bear fruit one or two years after planting.
  - C. Pests are generally easier to control on small fruits than they are on most tree fruits.
5. Size and appearance are especially important when choosing fruit crops because these qualities play a large role in appealing to customers.
6. Grafting is a propagation method in which a bud, twig, or shoot—the scion—is taken from one plant and attached to a different but compatible plant, called the rootstock.

## Lesson 6: Fruit Production

**Short-Answer Questions: Write the answers in the space provided.**

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## Fruit and Vegetable Production

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4. What are two advantages of producing small fruits compared to tree fruits?
  - A.
  - B.
5. Why are qualities such as size and appearance especially important when choosing fruit crops?
6. What is grafting?

Figure 6.1

## Whip Grafting

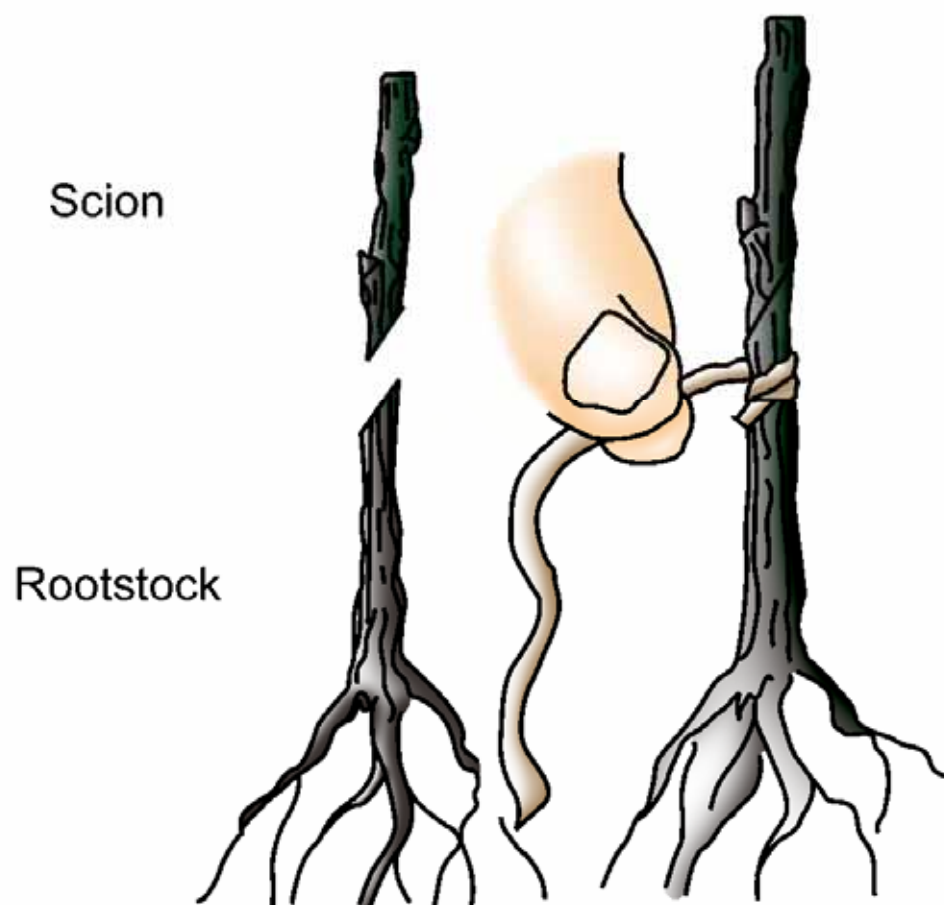




Figure 6.2

## Sample Fruit Chart

### Stone Fruit Trees

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<b>Interval From Planting to Fruiting</b>	
<b>Season of Ripening</b>	
<b>Soil</b>	
<b>Spacing</b>	
<b>Harvest</b>	
<b>Postharvest</b>	
<b>Production Concerns</b>	
<b>Pests and Diseases</b>	
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	



## Unit I: Fruit and Vegetable Production

AS 6.1

### Lesson 6: Fruit Production

Name: \_\_\_\_\_

#### Exploring a Fruit Crop

**Objective:** Identify key growing elements for a fruit crop.

**Directions:** Each student will receive a blank fruit chart. The instructor will assign each student a fruit to research. Students will complete the chart for the assigned fruit. Textbooks, seed catalogs, magazines, the Internet, and other sources may be used as references. After the chart is completed, students will present their findings to the class. Students will turn in their completed chart and a bibliography of their sources following their presentations.





# Fruit and Vegetable Production

**Unit Activity:** Developing a production calendar

**Unit Objective:**

Students will demonstrate their knowledge of production requirements for fruits and vegetables by developing a calendar for cultivating and harvesting 10 fruits and vegetables.

**Show-Me Standards:** 1.2, CA 3

**Reference:**

*Fruit and Vegetable Production Unit for Plant Science Core Curriculum.* University of Missouri-Columbia: Instructional Materials Laboratory, 2006.

Students may use additional outside sources to complete this activity (e.g., seed catalogs or gardening magazines).

**Instructional Strategies/Activities:**

- Students will engage in study questions in lessons 1 through 6.
- Students will complete AS 1.1, Distinguishing Between Receipts and Expenditures; AS 3.1, Evaluating a Possible Production Site; AS 4.1, Designing an IPM Strategy; AS 5.1, Exploring a Vegetable Crop; and AS 6.1, Exploring a Fruit Crop.
- Additional activities that relate to the unit objective can be found under the heading “Other Activities” in the following locations: p. 4, p. 33, p. 53, and p. 67.

**Performance-Based Assessment:**

Students will develop a yearlong calendar for establishing, maintaining, and harvesting 10 different fruits and vegetables. A real calendar or a different format, determined by the student, may be used for this activity. The calendar should include a combination of both fruits and vegetables.

Students will be assessed based on the overall presentation and content of their calendar.



## Instructor Guide

**The instructor should assign the unit-level performance-based assessment activity at the beginning of the unit. Students will work toward completing the activity as they progress through the unit lessons. The assessment activity will be due at the completion of the unit.**

1. Assign each student to develop a yearlong calendar for establishing, maintaining, and harvesting 10 different fruits and vegetables.
  - a. Students may use the information in their student reference or other reliable information they might acquire. They may not use the source information word for word and must provide a complete bibliography of their sources along with their calendar.
  - b. The calendar must include a combination of 10 different fruits and vegetables.
  - c. Special consideration should be given to certain crops because they may not be ready for harvest during that calendar year (e.g., seedling asparagus plants).
2. The students may be creative in the layout of their project as long as it is useful and easy to follow. An actual calendar may be used or a chart or diagram.
3. The calendar must include the following information and dates for each fruit or vegetable.
  - ☐ When and how to establish the ground prior to planting
  - ☐ When the plants should be planted
  - ☐ When and how to maintain the plants and soil prior to planting, during growth, and after harvesting
  - ☐ When and how to harvest the fruits and vegetables
  - ☐ Any other necessary practices that should be noted
4. Students will be assessed on the overall content and presentation of their calendar.



### Student Handout

1. Develop a yearlong calendar for establishing, maintaining, and harvesting 10 different fruits and vegetables.
  - a. You may use the information in the student reference or other reliable information you might acquire. You may not use the source information word for word and must provide a complete bibliography of the sources along with your calendar.
  - b. The calendar must include a combination of 10 different fruits and vegetables.
  - c. Special consideration should be given to certain crops because they may not be ready for harvest during that calendar year (e.g., seedling asparagus plants).
2. You may be creative in the layout of the project as long as it is useful and easy to follow. An actual calendar may be used or a chart or diagram.
3. The calendar must include the following information and dates for each fruit or vegetable.
  - ☐ When and how to establish the ground prior to planting
  - ☐ When the plants should be planted
  - ☐ When and how to maintain the plants and soil prior to planting, during growth, and after harvesting
  - ☐ When and how to harvest the fruits and vegetables
  - ☐ Any other necessary practices that should be noted
4. Students will be assessed on the overall content and presentation of their calendar.



# Fruit and Vegetable Production

## Scoring Guide

Name \_\_\_\_\_

Assessment Area	Criteria	0 Points	1 Point	2 Points	3 Points	4 Points	Weight	Total
Information and Content of Calendar	<ul style="list-style-type: none"> <li>❑ All facts are accurate</li> <li>❑ Practices are sound</li> <li>❑ Addresses all key topics</li> <li>❑ Facts or practices are listed in proper order</li> </ul>	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 20	
Presentation	<ul style="list-style-type: none"> <li>❑ Well organized</li> <li>❑ Useful format</li> <li>❑ Neat</li> <li>❑ No spelling or punctuation errors</li> </ul>	0 criteria met	1 criterion met	2 criteria met	3 criteria met	All 4 criteria met	X 5	
<b>TOTAL</b>								

**Final Assessment Total** \_\_\_\_\_/100 pts.

**Comments:**







## Nut Trees

### Black Walnuts

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>Grafted trees: 5 years to first nut production; 10 years to commercial production</li> <li>Seedling trees: 10 years to first nut production; up to 20 years for commercial production</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>Mid September to late October, depending on cultivar</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>pH: 6.5 to 7.5</li> <li>Well-drained soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>Between trees: 30 ft</li> <li>Between rows: 30 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>Harvest walnuts when the hull is green and can be indented with the thumb.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>Hull and wash walnuts immediately upon harvest. Dry hulled nuts at ambient temperature for 4 to 6 weeks before cracking.</li> <li>After cracking, allow nuts to dry for a day or two before refrigerating.</li> <li>Frozen nuts can last up to two years.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>Hull and clean walnuts while husks are still green.</li> <li>Allowing nuts to remain in the husk degrades nut quality.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>Pests: weevil, nut casebearer</li> <li>Diseases: anthracnose leaf disease</li> </ul>
<b>Structures and Equipment</b>	<ul style="list-style-type: none"> <li>Stake grafted trees when young. Protect young trees from deer browse and deer rub.</li> <li>Tree shakers and hullers are used in commercial production.</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>Use space between rows for grasses, winter wheat, vegetables, blackberries, blueberries, or raspberries.</li> </ul>

## Fruit and Vegetable Production

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*Growing Eastern Black Walnuts as an Orchard Crop in Missouri* (tentative title, publication forthcoming). University of Missouri Center for Agroforestry. [www.centerforagroforestry.org](http://www.centerforagroforestry.org) (accessed May 2, 2006).

Pastoret, J. *Home Production of Black Walnut Nutmeats*. University of Missouri Extension. <http://outreach.missouri.edu/explore/qa/images/blackwalnut.pdf> (accessed December 27, 2005).

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Warmund, M. *Fruit and Nut Cultivars for Home Planting*. University of Missouri Extension. <http://muextension.missouri.edu/explore/agguides/hort/g06005.htm> (accessed December 27, 2005).



## Nut Trees

### Chinese Chestnuts

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>Grafted trees: 3 years to first nut production; 6 to 9 years to commercial production</li> <li>Seedling trees: 5 years to first nut production; 8 to 12 years for commercial production</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>Mid September to mid October, depending on cultivar</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>pH: 5.5 to 6.5</li> <li>Well-drained, loamy to sandy loam soils</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>Between trees: 35 ft</li> <li>Between rows: 35 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>Chestnuts are gathered from the ground after they have fallen naturally off the tree.</li> <li>Harvest nuts every day to prevent molding and decay.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>Store chestnuts at 32°F in sealed plastic bags to retard molding.</li> <li>If weevils are present, harvest chestnuts promptly, follow with hot water treatment (122°F for 30 minutes), and refrigerate immediately to kill immature larvae and prevent weevil emergence.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>Train trees using a modified central leader system.</li> <li>Ensuring that trees have adequate water promotes growth and reduces stress, particularly in the first year.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>Pests: rabbits, voles, deer, yellowneck caterpillars, weevils, nut curculios</li> <li>Diseases: chestnut blight, Phytophthora root rot</li> </ul>
<b>Structures and Equipment</b>	<ul style="list-style-type: none"> <li>Stake grafted trees when young.</li> <li>Protect young trees from deer browse and deer rub.</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>Young trees must be protected from sunscald.</li> </ul>

## Fruit and Vegetable Production

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*Chinese Chestnuts*. University of Kentucky Cooperative Extension Service.  
<http://www.uky.edu/Ag/NewCrops/introsheets/chestnuts.pdf> (accessed December 20, 2005).

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Rieger, M. “Chestnuts.” Mark Rieger’s Fruit Crop Home Page. University of Georgia Department of Horticulture. <http://www.uga.edu/fruit/chestnut.htm> (accessed May 3, 2006).



## Nut Trees

### Northern Pecans

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>Grafted cultivars require 10 to 13 years to produce 5 pounds of nuts per tree, or approximately 250 pounds per acre.</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>Mid September to late October, depending on cultivar</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>pH: 6.0 to 7.5</li> <li>Deep, well-drained soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>Between trees: 40 ft</li> <li>Between rows: 40 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>As pecans dry, their shuck turns brownish black and curls away from the shell.</li> <li>Pecans are fully dry and ready to harvest when they fall from the trees. When the first pecans begin falling, the trees or limbs can be shaken to speed harvesting. More than one shaking may be required.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>Pecans can be stored at room temperature for approximately four months before becoming rancid.</li> <li>For best results, shell pecans and store the kernels in the freezer. Frozen pecan kernels can remain fresh for 2 years or more.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>Pecan trees will grow without irrigation in most parts of Missouri but must have an adequate water supply. Even mild drought conditions will reduce pecan size and quality.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>Pests: weevils, nut casebearers</li> <li>Diseases: scab, downy spots</li> </ul>
<b>Structures and Equipment</b>	<ul style="list-style-type: none"> <li>Tree shakers and nut harvesters are used in commercial production.</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>Train trees using a central leader system. Prune trees up eight feet to allow equipment to travel underneath.</li> <li>Trees become quite large and must be thinned out once limbs are about to touch between trees.</li> <li>Nitrogen is needed (100 lb/acre) for higher yields.</li> </ul>

## Fruit and Vegetable Production

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Fulbright, D. W., ed. *Nut Tree Culture in North America* Vol. 1. Northern Nut Growers Association, Inc. Saline, MI: McNaughton and Gunn, Inc., 2003.

Reid, W. *Growing Pecans in Missouri*. University of Missouri Center for Agroforestry. <http://extension.missouri.edu/explorepdf/agguides/agroforestry/af1002.pdf> (accessed December 7, 2005).

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## Nut Trees

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<b>Interval From Planting to Fruiting</b>	
<b>Season of Ripening</b>	
<b>Soil</b>	
<b>Spacing</b>	
<b>Harvest</b>	
<b>Postharvest</b>	
<b>Production Concerns</b>	
<b>Pests and Diseases</b>	
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	







## Pome Fruit Trees

### Apples

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>• 2 to 6 years</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>• July through October</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.0 to 6.5</li> <li>• Well-drained, light-textured soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Depends on scion and rootstock</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Fruit softens as it matures. Harvest apples based on intended length of storage.</li> <li>• In Missouri, most apples are harvested from mid September through October.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored several months at 32°F and 80% to 90% relative humidity, depending on variety</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Spring frosts and winter freezes are the main limiting factors.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: European red mites, codling moths, San Jose scale, plum curculios</li> <li>• Diseases: cedar apple rust, fire blight, powdery mildew, scab</li> </ul>
<b>Structures and Equipment</b>	<ul style="list-style-type: none"> <li>• Stakes</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Liberty, Red Delicious, and Golden Delicious are varieties that can be grown with success in Missouri.</li> </ul>

## Fruit and Vegetable Production

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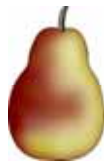
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## Pome Fruit Trees

### Pears

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>• 5 to 8 years</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>• Mid July through mid October</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.0 to 6.5</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between trees: 20 ft</li> <li>• Between rows: 26 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Pears should be firm and not fully ripe at harvest.</li> <li>• Seeds turn from white to dark brown when the fruit reaches maturity.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Pears can be stored for 2 to 4 months at 32°F and 90% to 95% relative humidity.</li> <li>• Ripen pears at 60°F to 70°F before using or selling.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Warm, wet springs increase the likelihood of fire blight.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: scale, stinkbugs, pear psylla</li> <li>• Diseases: fire blight, bot canker, flyspeck</li> </ul>
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Trees are usually pruned using a central leader system.</li> <li>• Pear trees are generally not pruned as much after the third year.</li> </ul>

## Fruit and Vegetable Production

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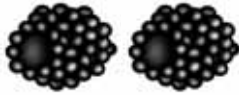
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## Pome Fruit Trees

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<b>Interval From Planting to Fruiting</b>	
<b>Season of Ripening</b>	
<b>Soil</b>	
<b>Spacing</b>	
<b>Harvest</b>	
<b>Postharvest</b>	
<b>Production Concerns</b>	
<b>Pests and Diseases</b>	
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	





## Small Fruits

### Blackberries

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>• 1 year</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>• Early June through late July</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.5 to 6.5</li> <li>• Well-drained soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 2 ft to 8 ft</li> <li>• Between rows: 8 ft to 12 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Harvest blackberries when fruit is sweet but still firm.</li> <li>• Blackberries are typically harvested by hand in Missouri, either by pickers or pick-your-own customers. Mechanical harvesters are generally used in larger operations.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be held for 2 to 3 days at 31°F to 32°F and 90% to 95% relative humidity</li> <li>• Highly perishable</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Pruning is key to production.</li> <li>• Blackberries are very sensitive to water stress.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: aphids, rednecked cane borers, raspberry crown borers, raspberry cane borers, strawberry weevils, psyllids, white grubs</li> <li>• Diseases: anthracnose, Botrytis blossom, Septoria cane and leaf spot, fruit rot, orange rust, spur blight, root rot, powdery mildew</li> </ul>
<b>Structures and Equipment</b>	<ul style="list-style-type: none"> <li>• Trellis for some varieties</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• There are thorny and thornless blackberry cultivars.</li> </ul>



## Fruit and Vegetable Production

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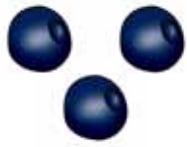
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## Small Fruits

### Blueberries

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>• 2 to 3 years</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>• Late May to mid July</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 4.3 to 4.9</li> <li>• Sandy loam soil with high organic matter content</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 4 ft to 8 ft</li> <li>• Between rows: 8 ft to 14 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Berries are harvested in June, July, and early August.</li> <li>• Berries turn blue 3 to 4 days before reaching peak flavor and sweetness. Berries that have a reddish tinge are not yet ripe.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Blueberries can be stored 14 days at 32°F and 90% to 95% relative humidity.</li> <li>• Cellophane covers reduce water loss from fruit.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Plants are very sensitive to too much water and too little water because of their shallow root systems. Good drainage is essential, and plants should be mulched and watered regularly.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: blueberry maggots, blueberry tip borers, cherry fruitworms, cranberry fruitworms, plum curculios, birds</li> <li>• Diseases: cane gall, mummy berry, Botrytis blossom blight, powdery mildew, twig blights, leaf spots</li> </ul>
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Plants usually do not need to be pruned for the first three years. Prune dormant plants during the fourth year.</li> </ul>

## Fruit and Vegetable Production

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## Small Fruits

### Grapes

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>• 3 years</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>• Mid August through early October</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.5 to 6.5</li> <li>• Adequate soil drainage is important</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 8 ft</li> <li>• Between rows: 10 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Size and color are two indicators of maturity.</li> <li>• Grapes harvested for table use can be picked when they taste good. Grapes for wine have specific ranges for sugar content, pH, and acidity that determine quality and acceptability.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• With forced-air cooling, can be stored up to 6 months at 32°F and 85% relative humidity, depending on variety</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Grapes require more significant and regular pruning than any other fruit crop.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: grape berry moths, mealybugs, leafhoppers, flea beetles</li> <li>• Diseases: black rot, powdery mildew, downy mildew, crown gall</li> </ul>
<b>Structures and Equipment</b>	<ul style="list-style-type: none"> <li>• Some type of trellising system is needed and plants must be trained to it.</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Grapes can do well in a variety of soil conditions.</li> <li>• Grapes are pruned when they are dormant. Late winter is the preferred season for pruning.</li> </ul>

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## Small Fruits

### Raspberries

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>• 5 months to 1 year</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>• June through early July for summer bearing varieties</li> <li>• August through October for fall bearing varieties</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.5 to 6.5</li> <li>• Well-drained soil with high organic matter content</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 2 ft to 6 ft</li> <li>• Between rows: 8 ft to 12 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Harvest raspberries when fruit is firm, has good color, and separates easily from the plant.</li> <li>• Raspberries are typically harvested by hand in Missouri, either by pickers or pick-your-own customers. Berries should be harvested directly into shallow sale containers to minimize handling and damage.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be held for 2 to 3 days at 32°F and 90% to 95% relative humidity</li> <li>• Highly perishable</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Black and purple varieties grow more heartily and require more pruning than red varieties.</li> <li>• Raspberries are very sensitive to water stress, and well-drained soil is necessary to avoid root rot.</li> <li>• Pruning essential to production.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: raspberry crown borers, rednecked cane borers, strawberry bud weevils</li> <li>• Diseases: anthracnose, Septoria cane and leaf spot, rust, blight, powdery mildew, fruit rot</li> </ul>
<b>Structures and Equipment</b>	<ul style="list-style-type: none"> <li>• Trellis in “T”, “I”, or “V” formation</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Training and pruning are usually the most expensive and time-consuming production concerns. The trellis system and training strategy must be matched to the variety of raspberry being grown.</li> </ul>

## Fruit and Vegetable Production

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## Small Fruits

### Strawberries

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>• 2 months to 1 year</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>• May through mid October</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.5 to 6.5</li> <li>• Well-drained soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 30 in. to 36 in.</li> <li>• Between rows: 42 in. to 48 in.</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Strawberries are ripe when they are fully red.</li> <li>• Harvest ripe strawberries daily and dispose of moldy berries to prevent rot from spreading.</li> <li>• Harvest berries directly into sale containers to minimize handling and damage.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be held 5 to 7 days at 32°F and 95% relative humidity</li> <li>• Highly perishable</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Strawberries need to be planted in a location that provides full sun.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: tarnished plant bugs, leaf rollers, mites, strawberry weevils or clippers, nematodes, slugs</li> <li>• Diseases: black root rot, red stele root rot, leaf spot, leaf scorch, Verticillium wilt, gray mold, leather rot</li> </ul>
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Strawberries should receive at least 1 in. of water per week during the growing season.</li> <li>• Weed control is particularly important in strawberry production. Weeds reduce plant establishment, plant density, budding, and fruit size, as well as make harvesting difficult.</li> </ul>



## Fruit and Vegetable Production

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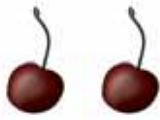
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## Small Fruits

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<b>Interval From Planting to Fruiting</b>	
<b>Season of Ripening</b>	
<b>Soil</b>	
<b>Spacing</b>	
<b>Harvest</b>	
<b>Postharvest</b>	
<b>Production Concerns</b>	
<b>Pests and Diseases</b>	
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	





## Stone Fruit Trees

### Cherries

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>• 3 to 5 years</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>• June through July</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.5 to 7.5</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between trees: 20 ft</li> <li>• Between rows: 20 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Trees are usually picked only once per season, except Rainier cherry trees, which are picked at least three times in a season.</li> <li>• Cherries that are overripe, immature, or too small are used for processing or discarded.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Sweet cherries can be held for 2 to 3 weeks at 30°F to 31°F and 90% to 95% relative humidity.</li> <li>• Sour cherries can be held for 3 to 7 days at 32°F and 90% to 95% relative humidity.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Sweet and sour varieties both have relatively high chilling requirements that prevent production in warmer climates.</li> <li>• Excessive rain and high humidity can contribute to fungal disease, rot, and cause some varieties of fruit to crack.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: plum curculios, fruit flies, birds</li> <li>• Diseases: brown rot, crown gall, cherry leaf spot, black knot</li> </ul>
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Trees are usually pruned using the central leader or open center pruning method.</li> <li>• The best time to prune is in late winter though early spring.</li> </ul>

## Fruit and Vegetable Production

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## Stone Fruit Trees

### Peaches

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>• 2 to 3 years</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>• Early July to mid September</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.0 to 6.5</li> <li>• Well-drained soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between trees: 20 ft</li> <li>• Between rows: 20 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Trees are usually picked 3 or 4 times at intervals of 2 or 3 days.</li> <li>• Peaches are harvested when the background color turns from green to yellow and the fruit are mature but firm.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored up to 2 weeks at 31°F to 32°F and 90% to 95% relative humidity</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Most peach varieties overbear fruit. Natural or hand thinning, depending on the variety, is necessary to prevent small peaches and broken branches.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: borers, oriental fruit moths, plum curculios, tarnished plant bugs, stink bugs</li> <li>• Diseases: bacterial leaf spot, brown rot, peach leaf curl, canker</li> </ul>
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Peach cultivars are either freestone or semifreestone.</li> <li>• Peach trees can be readily pruned into an open vase form.</li> </ul>

## Fruit and Vegetable Production

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## Stone Fruit Trees

### Plums

<b>Interval From Planting to Fruiting</b>	<ul style="list-style-type: none"> <li>• 3 to 5 years</li> </ul>
<b>Season of Ripening</b>	<ul style="list-style-type: none"> <li>• August through September</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.5 to 6.5</li> <li>• Well-drained soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between trees: 20 ft</li> <li>• Between rows: 20 ft</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Plums harvested for fresh market sale should have good color and be firm but not hard.</li> <li>• Plums harvested for drying can be more mature than fresh market plums.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored 2 to 4 weeks at 31°F to 32°F and 90% to 95% relative humidity</li> <li>• Hydrocool for best storage life</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Fertilize trees annually in early spring.</li> <li>• Thinning is necessary for some varieties to ensure that the remaining fruit reaches the proper size.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: European red mites, plum curculios</li> <li>• Diseases: black knot, leaf spot, brown rot</li> </ul>
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Can be pruned with a modified central leader or open center system</li> </ul>



## Fruit and Vegetable Production

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## Stone Fruit Trees

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<b>Interval From Planting to Fruiting</b>	
<b>Season of Ripening</b>	
<b>Soil</b>	
<b>Spacing</b>	
<b>Harvest</b>	
<b>Postharvest</b>	
<b>Production Concerns</b>	
<b>Pests and Diseases</b>	
<b>Structures and Equipment</b>	
<b>Other Considerations</b>	





## Cool Season Root Crop

### Beets

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 5 to 16</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 40 to 50</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.0 to 7.5</li> <li>• Sensitive to acidic soil</li> <li>• Well-drained, loose, sandy loam soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 2 in. to 4 in.</li> <li>• Between rows: 12 in. to 18 in.</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Beet greens are best at 4 in. to 6 in.</li> <li>• A full-grown beet is roughly the size of a tennis ball, depending on the variety.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Hydrocool by spraying or immersing vegetables in chilled water</li> <li>• Can be stored for 4 to 6 months at 32°F and 100% relative humidity</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Provide beets with consistent moisture, particularly during early development, but avoid overwatering.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: Mexican bean beetles, leafhoppers, leaf miners, wireworms, mice, rabbits</li> <li>• Diseases: Alternaria, Cercospora, Ramularia, damping-off</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Rotate crops to avoid Cercospora.</li> </ul>

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Source accessed November 14, 2005.





## Cool Season Root Crop

### Carrots

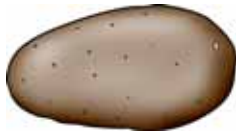
<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 6 to 18</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 70 to 85</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.5 to 7.0</li> <li>• Well-drained, sandy loam soils</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 3 in.</li> <li>• Between rows: 18 in. if cultivated by hand; 42 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Baby carrots: 4 in. to 5 in. long</li> <li>• Mature carrots: 3/4 in. to 1 1/2 in. in diameter</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored for 7 to 9 months at 32°F to 34°F and 98% to 100% relative humidity</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Provide 1 in. of water per week during growing season.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: carrot rust fly larvae, wireworms, leafhoppers</li> <li>• Diseases: leaf spot, soft rot, aster yellow</li> </ul>
<b>Other Considerations</b>	

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## Cool Season Root Crop

### Potatoes

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 10 to 14</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 100 to 120</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.0 to 5.5</li> <li>• Good drainage</li> <li>• High phosphorus, nitrogen, and potassium content</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 6 in. to 12 in.</li> <li>• Between rows: 30 in. to 36 in.</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• New potatoes: Check when plants are blossoming and harvest when potatoes reach the desired size.</li> <li>• Mature potatoes: Harvest when leaves die back.</li> <li>• Lighter, well-drained soils make harvesting easier.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Brush off the soil, but do not wash potatoes.</li> <li>• Cure potatoes in a dry, dark, cool place prior to prolonged storage.</li> <li>• Mature potatoes can be stored for 5 to 10 months at 40°F to 50°F and 90% relative humidity.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Provide uniform moisture throughout growing season.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: Colorado potato beetles, pocket gophers</li> <li>• Diseases: speckle leaf, black leg, potato blight, early blight, late blight, ring rot</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Potatoes can also be grown in trenches, hills, mulch, and structures such as vertical boxes and wire cages.</li> <li>• Growing potatoes in mulch works well in areas with rocky or compact soil.</li> <li>• Soil can dry out quickly when more surface area is exposed to the air, as in hills or wire cages. Monitor moisture levels closely.</li> </ul>



## Fruit and Vegetable Production

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## Cool Season Root Crop

### Radishes

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 4 to 12</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 25 to 35</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.5 to 7.0</li> <li>• Cool, moist soil</li> <li>• Maintain soil pH at 6.8 or higher to manage club root.</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 1 in. to 2 in. for smaller varieties; 6 in. for larger varieties</li> <li>• Between rows: 18 in.</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• To harvest, grasp radishes by the top and pull them from the ground.</li> <li>• Harvest radishes when they are 1/2 in. to 1 in. in diameter.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Wash and dry radishes thoroughly.</li> <li>• Hydrocooling improves shelf life and helps maintain crispness.</li> <li>• Washing with chlorinated water helps reduce black spot.</li> <li>• Radishes can be stored for 1 to 2 weeks at 32°F and 95% to 100% relative humidity.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Keep soil consistently moist to prevent radishes from becoming bitter and mealy.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: cabbage maggots, flea beetles, aphids</li> <li>• Diseases: generally free of disease</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Can be grown within other crops</li> </ul>

## Fruit and Vegetable Production

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## Cool Season Root Crop

### Turnips

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 3 to 7</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 35 to 70</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.0 to 6.8</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: Sow seeds 1 in. apart; thin plants to 2 in. to 6 in. apart</li> <li>• Between rows: 12 in.</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Turnips can be harvested from the time they reach 1 in. in diameter. Once they are roughly the size of a tennis ball, they tend to become woody and tough.</li> <li>• Harvest turnip greens when they are 4 in. to 6 in.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored for 4 to 5 months at 32°F and 90% to 95% relative humidity</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Provide plenty of water to help prevent woody stems.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: aphids, beetles, slugs, snails, cutworms, root maggots</li> <li>• Diseases: mildew, white blister disease</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Turnips can withstand several light freezes.</li> </ul>

## Fruit and Vegetable Production

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The Gardener's Network. "How to Grow Turnips."

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## Cool Season Root Crop

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<b>Days to Germination</b>	
<b>Days to Maturity</b>	
<b>Soil</b>	
<b>Spacing</b>	
<b>Harvest</b>	
<b>Postharvest</b>	
<b>Production Concerns</b>	
<b>Pests and Diseases</b>	
<b>Other Considerations</b>	





## Cool Season Surface Crop

### Asparagus

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 21</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 3 years from first planting</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.5 to 7.5</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 18 in.</li> <li>• Between rows: 48 in. if cultivated by hand or field implements</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Harvest spears when they are approximately 6 in. to 8 in. tall.</li> <li>• Spears should be dark green and firm with tightly closed tips.</li> <li>• Harvest spears by hand by snapping or cutting them just above the ground.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• With good ventilation, can be stored for 3 weeks at 35°F and 95% to 100% relative humidity</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Provide adequate moisture during the fern stage to avoid significant reductions in next spring's crop.</li> <li>• Avoid light, frequent irrigation during the fern stage to prevent foliage disease development.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: asparagus aphids, asparagus beetles, spotted asparagus beetles</li> <li>• Diseases: Fusarium, needle blight, purple spot, asparagus rust</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Because asparagus occupies a site for a number of years, soil preparation and fertilization are particularly important.</li> <li>• Asparagus grows more rapidly as the temperature increases.</li> </ul>



## Fruit and Vegetable Production

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Jett, L. W. *Vegetable Planting and Planning Calendar*. University of Missouri Extension. <http://muextension.missouri.edu/xplor/agguides/hort/g06201asparagus.htm>.

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## Cool Season Surface Crop

### Cabbage

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 4 to 14</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 70 to 80</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.5 to 7.0</li> <li>• Well-drained loam soil with high organic matter content</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 12 in.</li> <li>• Between rows: 24 in. if cultivated by hand; 42 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Harvest when heads are firm and before they split or burst.</li> <li>• Leave 4 to 6 wrapper leaves attached to heads harvested for fresh market display.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored for 5 to 6 months at 32°F and 98% to 100% relative humidity</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Provide an even supply of moisture but avoid overwatering transplants.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: flea beetles, cabbage loopers, aphids, cutworms, imported cabbageworms, diamondback moths</li> <li>• Diseases: Alternaria leaf spot, black rot, black leg, club root, wire stem, downy mildew</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Cooler temperatures improve cabbage flavor because plant cells convert starches to sugars to protect the plant from the cold.</li> </ul>

## Fruit and Vegetable Production

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Banse, G. *Growing Cabbage*. Farm and Garden. <http://www.farm-garden.com/growing-vegetables/cabbage>.

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## Cool Season Surface Crop

### Cauliflower

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 5 to 10</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 65 to 75</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.4 to 7.4</li> <li>• Well-drained loamy soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 24 in.</li> <li>• Between rows: 24 in. if cultivated by hand; 42 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Harvest cauliflower when the heads are 5 in. to 6 in. in diameter.</li> <li>• Cut cauliflower off the stalk just below the head.</li> <li>• For heads harvested for fresh market display, leave at least two leaves on heads for protection and presentation.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be held for 3 to 4 weeks at 32°F and 95% relative humidity</li> <li>• Highly perishable</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Cauliflower is blanched to maintain white heads. To blanch cauliflower, tie the outer leaves over the heads when the heads become visible.</li> <li>• Self-blanching varieties are also available.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: aphids, cutworms, flea beetles, cabbage loopers, imported cabbageworms, diamondback moths</li> <li>• Diseases: Alternaria leaf spot, black leg, black rot, club root, wire stem, downy mildew</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Cauliflower heads are easily damaged and require care when handling.</li> </ul>

## Fruit and Vegetable Production

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Banse, G. *Growing Cauliflower*. Farm and Garden. <http://www.farm-garden.com/growing-vegetables/cauliflower>.

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## Cool Season Surface Crop

### Lettuce

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 7 to 14</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 55 to 80</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.5 to 6.8</li> <li>• Good moisture retention</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 3 in. to 6 in.</li> <li>• Between rows: 18 in. if cultivated by hand; 42 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Harvest lettuce before flower stalks appear.</li> <li>• To harvest by the leaf, wait until removing 3 or 4 outside leaves will not harm the plant's growth.</li> <li>• To harvest by the head, wait until heads are bigger than a fist, well-formed, and solid.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Clean and cool lettuce by hydrocooling.</li> <li>• Head lettuce can be stored 2 to 3 weeks at 32°F and 98% to 100% relative humidity.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Provide continuous moisture to promote vigorous growth and keep lettuce from becoming bitter.</li> <li>• Grow lettuce in semi-shade to shade.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: aphids, armyworms, imported cabbageworms, loopers, slugs</li> <li>• Diseases: damping-off, downy mildew, big vein, mosaic virus, nematodes, Sclerotinia drop, soft rot, tip burn</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Very sensitive to ethylene gas</li> </ul>

## Fruit and Vegetable Production

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## Cool Season Surface Crop

### Spinach

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 7 to 14</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 40 to 50</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.2 to 6.9</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 3 in.</li> <li>• Between rows: 18 in. if cultivated by hand; 42 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Harvest spinach when leaves reach an edible size and before seed stalks develop.</li> <li>• To harvest, cut leaves from the plant or pull the whole plant from the ground.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored for 10 to 14 days at 32°F and 95% to 100% relative humidity.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Provide uniform moisture throughout the growing season.</li> <li>• Straw mulch can be used to retain moisture.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: armyworms, aphids, crown maggots, flea beetles, leafhoppers, loopers, leaf miners, slugs</li> <li>• Diseases: spinach blight, anthracnose, damping-off, downy mildew</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Spinach is highly perishable and is usually marketed or eaten soon after harvest.</li> <li>• Spinach is sensitive to ethylene gas.</li> </ul>



## Fruit and Vegetable Production

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## Cool Season Surface Crop

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<b>Days to Germination</b>	
<b>Days to Maturity</b>	
<b>Soil</b>	
<b>Spacing</b>	
<b>Harvest</b>	
<b>Postharvest</b>	
<b>Production Concerns</b>	
<b>Pests and Diseases</b>	
<b>Other Considerations</b>	





## Long Season Crop

### Cantaloupes

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 7 to 14</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 80 to 90</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.0 to 6.5</li> <li>• Well-drained sandy or silt loam soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 60 in.</li> <li>• Between rows: 48 in. if cultivated by hand; 60 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Cantaloupes are ripe when they separate easily from the vine and the skin takes on a slightly yellowish appearance.</li> <li>• Cantaloupes that will be shipped long distances can be picked just prior to ripening.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Ripe cantaloupes can be held for 5 to 14 days at 32°F to 36°F.</li> <li>• Cantaloupes are highly perishable.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Cantaloupes are frequently planted in hills, but this is not necessary and may not be practical when growing large quantities.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: aphids, cucumber beetles, squash bugs</li> <li>• Diseases: Fusarium wilt, anthracnose, Alternaria leaf spot, bacterial wilt, powdery mildew, gummy stem blight, damping-off, root rot/vine decline, root knot</li> </ul>
<b>Other Considerations</b>	

## Fruit and Vegetable Production

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## Long Season Crop Gourds

<b>Days to Germinations</b>	<ul style="list-style-type: none"> <li>• 10 to 15</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 100 to 180</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.5 to 6.8</li> <li>• Sunny, well-drained site</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 24 in.</li> <li>• Between rows: 60 in.</li> <li>• Hills: 48 in. to 60 in. apart with rows 84 in. apart</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Harvest gourds when the stems are dry and brown and before frost.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Clean gourds with soap and water, dry, and apply rubbing alcohol to the surface.</li> <li>• Curing Cucurbita and Lagenaria gourds is a two-step process. The first step, surface drying, takes approximately a week. This is followed by internal drying, which can take from 4 weeks to several months, depending on the variety.</li> <li>• Luffa sponges are prepared by removing the seeds, soaking and removing the skin, and bleaching the sponge to achieve the desired appearance.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Because of their long growing season, gourds should be started indoors 4 weeks before planting outdoors.</li> <li>• Gourds are often grown on a trellis or arbor. Gourds vary greatly in weight and size. Be sure the structure will support the weight of the gourds.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: aphids, cucumber beetles, squash bugs, squash vine borers</li> <li>• Diseases: angular leaf spot, bacterial wilt, mosaic viruses, powdery mildew</li> </ul>
<b>Other Considerations</b>	<p>There are three main types of gourds:</p> <ul style="list-style-type: none"> <li>• Cucurbita: ornamental gourds</li> <li>• Lagenaria: large, utilitarian gourds</li> <li>• Luffa: vegetable sponges</li> </ul>

## Fruit and Vegetable Production

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## Long Season Crop

### Pumpkins

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 6 to 10</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 95 to 120</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.5 to 6.5</li> <li>• Moderate potassium and phosphorus and high nitrogen content</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 12 in. to 18 in.</li> <li>• Between rows: 72 in.</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Pumpkins are ready to harvest when they are a deep solid color and the vine has begun to shrivel.</li> <li>• Harvest pumpkins before the first hard frost.</li> <li>• Leave 3 in. to 4 in. of stem attached to the pumpkin.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be held for 2 to 3 months at 50°F to 55°F and 50% to 75% relative humidity</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Water pumpkins regularly throughout growing season and keep plants evenly moist.</li> <li>• Watering plants early in the day and keeping water off foliage helps prevent mildew.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: squash vine borers, cucumber beetles</li> <li>• Diseases: bacterial wilt, anthracnose, downy mildew, powdery mildew</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Do not plant pumpkins until the danger of frost has passed and the soil has warmed.</li> </ul>



## Fruit and Vegetable Production

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## Long Season Crop

### Watermelons

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 7 to 14</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 85 to 95</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.0 to 8.0</li> <li>• Well-drained sandy or sandy loam soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 96 in.</li> <li>• Between rows: 96 in. if hand cultivated; 120 in. if field implements are used</li> </ul>
<b>Harvest</b>	<p>Timing is important because sweetness does not increase after harvest. Indications of ripeness include the following:</p> <ul style="list-style-type: none"> <li>• Ground spot (the portion of the melon in contact with the soil) turns from white to yellow</li> <li>• Tendrils near the fruit become brown and dry</li> <li>• Rind has a shiny appearance</li> <li>• Thumping produces a hollow sound—less effective on varieties with firmer flesh</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored for 2 weeks at 52°F to 60°F and 85% to 90% relative humidity</li> <li>• Not suited for long storage</li> <li>• Will lose flavor and color if stored below 50°F</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Adequate water early in the season improves vine growth and yield.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: aphids, cucumber beetles</li> <li>• Diseases: Alternaria leaf spot, anthracnose, downy mildew, Fusarium wilt</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Fruit disorders: misshapen melons, blossom-end rot, bursting, white heart, hollow heart, sunburn, rind necrosis</li> </ul>

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## Long Season Crop

### Winter Squash

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 6 to 10</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 80 to 120</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.5 to 6.5</li> <li>• Fertile, well-drained soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 60 in.</li> <li>• Between rows: 48 in. if cultivated by hand; 60 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Winter squash are ready to harvest when their stems begin to shrivel.</li> <li>• Cut squash off the plant and leave 2 in. of stem attached to the fruit.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Curing is often recommended for many types of winter squash to harden the skin and extend storage life. To cure, store squash for 10 to 20 days at 75°F to 80°F.</li> <li>• Fully cured squash can be held 84 to 150 days at 50°F to 55°F and 50% to 70% relative humidity.</li> <li>• Do not cure acorn squash. Acorn squash can be held 5 to 8 weeks at 50°F.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Keep squash evenly moist throughout the growing season.</li> <li>• Monthly application of a complete organic fertilizer is recommended to improve plant health and yield.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: aphids, cucumber beetles, squash vine borers, squash bugs</li> <li>• Diseases: bacterial wilt, anthracnose, downy mildew, powdery mildew</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Squash plants are not hardy and are susceptible to frost in the spring and fall.</li> </ul>

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## Long Season Crop

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<b>Days to Germination</b>	
<b>Days to Maturity</b>	
<b>Soil</b>	
<b>Spacing</b>	
<b>Harvest</b>	
<b>Postharvest</b>	
<b>Production Concerns</b>	
<b>Pests and Diseases</b>	
<b>Other Considerations</b>	





## Warm Season Crop

### Cucumbers

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 7 to 10</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 50 to 70</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.0 to 6.0</li> <li>• Warm, moist soil</li> <li>• Hate “wet feet”</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 12 in.</li> <li>• Between rows: 48 in.</li> <li>• For hills, space hills 4 ft apart, sow 3 to 5 seeds per hill, and thin to 2 to 3 plants per hill.</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Skin should be completely dark green, and cucumbers should be large enough to use.</li> <li>• Harvest cucumbers before they mature completely to keep the vine producing.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Wash and dry thoroughly</li> <li>• Can be stored for 2 to 4 weeks at 50°F to 55°F</li> <li>• Very sensitive to ethylene gas</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Cucumbers need plenty of water to stay crisp and juicy.</li> <li>• Water in the morning so that leaves can dry during the day.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: cucumber beetles</li> <li>• Diseases: bacterial wilt, mildew, leaf spot</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Frost sensitive</li> </ul>



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## Warm Season Crop

### Eggplants

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 10 to 14</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 80 to 90</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.0 to 6.8</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 24 in.</li> <li>• Between rows: 24 in. if cultivated by hand; 42 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Skin should be shiny and eggplants should be 4 in. to 5 in. long. Dull skin indicates overripening.</li> <li>• Cut eggplants off the plant with a sharp knife; leave at least 1 in. of stem attached to the fruit.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Market immediately after harvest</li> <li>• Can be stored for 7 to 10 days at 45°F to 50°F and 90% to 95% relative humidity</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• At least 2 in. of water per week is required during the growing season.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: cutworms, flea beetles, aphids, corn earworms, European corn borers, hornworms, cabbage loopers, Colorado potato beetles, spider mites, fruit flies, picnic beetles, whiteflies</li> <li>• Diseases: Phytophthora blight, Verticillium wilt, Phomopsis blight, Alternaria leaf spot, Cercospora leaf spot, anthracnose</li> </ul>
<b>Other Considerations</b>	

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Sources accessed October 17, 2005.



## Warm Season Crop Green Beans

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 5 to 8</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• Bush: 50 to 60</li> <li>• Pole: 60 to 70</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.0 to 6.8</li> <li>• Well-drained, loose-textured soil</li> <li>• Moderately high organic matter content</li> </ul>
<b>Spacing</b>	<p>Bush:</p> <ul style="list-style-type: none"> <li>• Between plants: 3 in.</li> <li>• Between rows: 24 in. if cultivated by hand; 42 in. if field implements are used</li> </ul> <p>Pole:</p> <ul style="list-style-type: none"> <li>• Between plants: 36 in.</li> <li>• Between rows: 30 in. if cultivated by hand; 42 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Beans should be thin, bright green, and snap easily when bent.</li> <li>• Beans can over-mature quickly, particularly when temperatures are high. Over-mature beans lose color and become tough.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored for 8 to 12 days at 41°F to 46°F and 95% to 100% relative humidity</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Sensitive to moisture stress</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: beetles, thrips, corn earworms, leafhoppers, aphids</li> <li>• Diseases: anthracnose, common blight, rust, damping-off, mosaic</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Bush beans require less space and produce more beans at one time, but pole beans provide a more constant supply.</li> <li>• Equipment considerations include poles for pole beans.</li> </ul>

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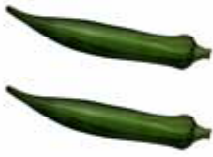
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Sources accessed October 17, 2005.



## Warm Season Crop

### Okra

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 5 to 14</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 55 to 60</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.5 to 7.5</li> <li>• Fertile, loamy soil</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 12 in.</li> <li>• Between rows: 30 in. if cultivated by hand; 42 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Okra pods are usually ready to harvest 4 to 7 days after their flowers open. Plants will bear until frost if pods are picked regularly.</li> <li>• Cut or gently pull okra pods from the plant while they are tender and free of fiber—2 in. to 4 in. long for most varieties.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored for 7 to 10 days at 45°F to 50°F and 90% to 95% relative humidity</li> <li>• Very sensitive to ethylene gas</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Provide even moisture throughout the growing season.</li> <li>• Monthly side dressings of manure and monthly applications of a complete organic fertilizer are beneficial.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: corn earworms, stink bugs, Japanese beetles, leafhoppers, European corn borers, vegetable leaf miners, aphids</li> <li>• Diseases: Fusarium wilt, root knot nematode, leaf spot, blossom and fruit blight, Southern blight, seedling disease, cotton root rot, charcoal rot</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Okra pods develop twice as fast with every 18°F rise in temperature. Harvest every other day in hot weather.</li> </ul>

## Fruit and Vegetable Production

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## Warm Season Crop

### Peppers

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 10 to 14</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 70 to 80</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.0 to 6.8</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 18 in.</li> <li>• Between rows: 30 in. if cultivated by hand; 42 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Peppers turn from green to the color that they will be at maturity.</li> <li>• Harvest peppers by cutting (not pulling) the mature fruit from the plant.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Store peppers at 45°F to 55°F and 90% to 95% relative humidity.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Peppers are shallow-rooted, so mulch can be used to prevent moisture loss.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: European corn borers, corn earworms, aphids, flea beetles, whiteflies, mites</li> <li>• Diseases: pepper tobamovirus, pepper mottle virus, bacterial spot, bacterial leaf spot, tobacco mosaic virus</li> </ul>
<b>Other Considerations</b>	



## Fruit and Vegetable Production

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## Warm Season Crop

### Summer Squash

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 6 to 10</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 80 to 90</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 5.5 to 6.5</li> <li>• Provide moderate potassium and phosphorus and high nitrogen.</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 48 in.</li> <li>• Between rows: 48 in. if cultivated by hand; 60 in. if field implements are used</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Summer squash are ready to harvest when they turn their mature color.</li> <li>• Harvest zucchini and straightneck and crookneck squash at 1 1/2 in. to 2 in. in diameter.</li> <li>• Harvest scallop summer squash at 3 in. to 4 in. in diameter.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Can be stored for 7 to 14 days at 41°F to 50°F and 90% to 95% relative humidity</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• Water evenly throughout the growing season.</li> <li>• Monthly applications of a complete organic fertilizer are beneficial.</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: cucumber beetles, squash vine borers, squash bugs</li> <li>• Diseases: anthracnose, downy mildew, bacterial wilt</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Water in the early morning to help avoid mildew.</li> <li>• Plants are very prolific.</li> </ul>

## Fruit and Vegetable Production

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## Warm Season Crop

### Sweet Corn

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 7 to 10</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• Mature 22 to 24 days after silking</li> <li>• Maturity dates depend on the variety used.</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.0 to 6.8</li> <li>• Medium textured soil, sandy loam soil</li> <li>• Good drainage</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 8 in. for early and short varieties; 12 in. for tall and late-maturing varieties</li> <li>• Between rows: 36 in. to 38 in.</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Harvest sweet corn when the ears are full at the tip, husks are tight, and the silks have dried.</li> <li>• Kernels should be full and produce a milky liquid when punctured.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• At 86°F, traditional types of sweet corn will lose half of their sugar within 24 hours.</li> <li>• Super sweet and ultra sweet varieties retain their sweetness much longer.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• 1 in. to 1 1/2 in. of water per week during June</li> <li>• 2 in. to 2 1/2 in. of water per week during July and early August</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: flea beetles, corn borers, corn earworms, cutworms, seed corn maggots, white grubs, wireworms</li> <li>• Diseases: Stewart's wilt, common smut, maize dwarf mosaic, wheat streak mosaic</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Cross pollination can adversely affect sweet corn appearance and taste. To avoid cross pollination, plant noncompatible types of sweet corn 250 ft apart or separate plantings by 14 days.</li> </ul>

## Fruit and Vegetable Production

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## Warm Season Crop

### Tomatoes

<b>Days to Germination</b>	<ul style="list-style-type: none"> <li>• 7 to 14</li> </ul>
<b>Days to Maturity</b>	<ul style="list-style-type: none"> <li>• 70 to 75 staked; 75 to 90 not staked</li> </ul>
<b>Soil</b>	<ul style="list-style-type: none"> <li>• pH: 6.5 to 7.0</li> <li>• Apply lime in late fall or early spring.</li> </ul>
<b>Spacing</b>	<ul style="list-style-type: none"> <li>• Between plants: 2 ft staked; 2 ft to 4 ft not staked</li> <li>• Between rows: 3 ft to 5 ft staked; 4 ft to 6 ft not staked</li> </ul>
<b>Harvest</b>	<ul style="list-style-type: none"> <li>• Tomato color and flavor is best when daily temperatures are an average of 75°F.</li> </ul>
<b>Postharvest</b>	<ul style="list-style-type: none"> <li>• Wrap tomatoes in paper and store at 60°F to 65°F.</li> </ul>
<b>Production Concerns</b>	<ul style="list-style-type: none"> <li>• At least 1 in. of water per week May through June</li> <li>• At least 2 in. of water per week July through September</li> </ul>
<b>Pests and Diseases</b>	<ul style="list-style-type: none"> <li>• Pests: cutworms, flea beetles, hornworms, leaf miners, stalk borers, stink bugs, tomato fruit worms, spider mites</li> <li>• Diseases: wilt, mosaic, leaf spot, anthracnose</li> </ul>
<b>Other Considerations</b>	<ul style="list-style-type: none"> <li>• Structure and equipment considerations include stakes, cages, and high tunnels.</li> </ul>

## Fruit and Vegetable Production

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## Warm Season Crop

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<b>Days to Germination</b>	
<b>Days to Maturity</b>	
<b>Soil</b>	
<b>Spacing</b>	
<b>Harvest</b>	
<b>Postharvest</b>	
<b>Production Concerns</b>	
<b>Pests and Diseases</b>	
<b>Other Considerations</b>	



