GREENHOUSE OPERATION AND MANAGEMENT

Unit VII: Greenhouse Business Management

Lesson 1: Commercial Greenhouse Crops

Objective:

Plan a commercial greenhouse crop.

Study Questions:

1. **Why are certain commercial crops selected for a greenhouse operation?**
2. **How does a growing schedule expedite the production of commercial crops?**
3. **What are the costs of producing commercial crops?**
4. **How is the quality of commercial crops evaluated?**
5. **What do commercial plants need after harvest and during marketing?**

References/Supplies/Materials

1. *Greenhouse Operation and Management* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2002.

2. Transparency Masters

   TM 7.1 Missouri's Commercial Floriculture Crops
   TM 7.2 Missouri's Popular Floriculture Crops

3. Activity Sheets

   AS 7.1 Selecting Commercial Crops and Devising a Growing Schedule
   AS 7.2 Cost Analysis of a Commercial Crop
   AS 7.3 Plant Care After Harvest and During Marketing

TEACHING PROCEDURES

A. Introduction

Unit VII focuses on two broad aspects of greenhouse business management: planning a commercial crop and developing a marketing plan. Lesson 1 describes factors in crop selection, growing schedule, cost analysis, crop evaluation, and caring for the crops postharvest and during marketing.

B. Motivation

Be sure that the plants grown in Unit IV are prominently displayed in the classroom. Ask students to discuss why they selected a certain type of plant to grow. Ask them to analyze the factors that influenced their choice. If they wanted to sell their plant, how would they care for it? A greenhouse owner resolves similar questions on a larger scale.

C. Assignment of Study Questions

D. Supervised Study

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

E. Discussion

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

1. Why are certain commercial crops selected for a greenhouse operation?

Refer to TM 7.1 to remind the class of the wholesale value of Missouri commercial crops. Ask students to use the data as they consider which floriculture crop(s) would be the most successful for a commercial greenhouse operation. Have them justify their choices. If a crop is not as profitable as others, should the greenhouse owner still grow it? How does demand from customers dictate the selection of commercial crops? During the discussion of specific types of commercial crops, refer to TM 7.2.

A. In response to market analysis
   1. Determine what types of crops to grow.
      a. Visit local nurseries, landscaping outlets, retail and wholesale operations.
      b. Determine if producing new crops is profitable.
   2. Identify types, sizes, and amounts of plants that customers want.
      a. Read trade journals (e.g., *Greenhouse Manager*, *Greenhouse Grower*, and *Grower Talks*).

b. Read popular magazines (e.g., *Midwest Living*, *Better Homes and Gardens*, and *House Beautiful*).

B. To determine sales potential of cut flowers
   1. Available in various retail outlets (floral shops, malls, grocery stores)
   2. Some cut flowers sold on special occasions (e.g., roses on Valentine's Day)
C. To determine sales potential of foliage
   1. Numerous species and varieties
   2. Several species produced year-round (e.g., foliar hanging baskets)
D. To determine sales potential of potted flowering plants
   1. Some plants (e.g., poinsettias, Easter lilies) are produced at specific times.
   2. Many plants are produced throughout the year (e.g., chrysanthemums).
E. To determine sales potential of bedding/garden plants
   1. Complement personal and commercial landscaping
   2. Produced for spring sales; some also available during summer and fall (e.g., impatiens, petunias)
   3. Represent nearly 59% of Missouri's floriculture crops in 1999

2. How does a growing schedule expedite the production of commercial crops?

Ask students if having a growing schedule is important. Have them explain whether a greenhouse owner should create such a plan. What would happen if the owner wanted to cultivate multiple varieties of plants but had no growing schedule? Then ask them to list the information that could be included in a crop schedule.

A. Identifies when to plant each crop
B. Outlines specific times for various cultural practices for each crop, for example:
   1. Planting
   2. Fertilization
   3. Irrigation
   4. Application of pesticides (See TM 6.14 - Sample Pesticide Application Log in Unit VI, Lesson 3.)
   5. Propagation
   6. Aeration
   7. Drainage
   8. Day-length treatment
   9. Harvest
   10. Postharvest
C. Identifies environmental conditions required, for example:
   1. Temperature
   2. Amount of light exposure
   3. Moisture/humidity levels
   4. Growing media
   5. Nutrients
   6. Foliar analysis
   7. Presence of diseases and pests

D. Records management procedures
   1. Order/reorder supplies
   2. Ship crops
   3. Billing
E. Develops crop rotation plan
   1. Plan efficient year-round use of bench space.
   2. Space plants very close together when they are first transplanted.
   3. As plants develop, allow more space between pots.
   4. Determine number and spacing of plants on benches.
   5. Calculate production time and space required per crop (measured in square foot weeks).
      a. Determine how many square inches there are per flat. (Multiply the dimensions of the flat.)
      b. Convert square inches to square feet by dividing the total number of square inches in the flat by 144 (the total number of square inches per square foot). The result is the amount of bench space per flat in square feet.
      c. Multiply the amount of bench space in square feet by the number of weeks required to grow the plant.
      d. The result is the amount of bench space required as measured in square foot weeks.

      Example: One coleus flat is 12 x 24 in. and it takes 6 weeks to grow.

      12 in. x 24 in. = 288 sq in.

      (1 sq ft = 12 X 12 sq in. [144 sq in.])

      Convert square inches into square feet. Divide the total number of square inches in the coleus flat (288) by 144 sq in. (1 sq ft).

      288/144 = 2 sq ft (amount of bench space per flat)

      2 sq ft X 6 weeks = 12 sq ft weeks (amount of bench space required in square foot weeks)

F. Identifies who is responsible for performing each task throughout growing cycle

3. What are the costs of producing commercial crops?

Draw upon students' SAE experiences in the greenhouse industry or other agriculture-related enterprises by asking them to identify types of expenses in those jobs. Explain that just like other businesses, greenhouse operations have expenses that are categorized into two groups. And all business operations must generate a cost analysis to assess profit and loss. AS 7.2 gives the students an opportunity to generate their own cost analysis.

A. Fixed (ownership) costs are paid regularly, regardless of amount of sales.
   1. Major categories: depreciation, interest, repairs and shelter, taxes, and insurance
   2. Greenhouse operations

a. Depreciation of greenhouse structure and equipment
b. Interest on land and building(s)
c. Repair expenses to maintain greenhouse structures, equipment, etc.
d. Taxes on property
e. Insurance for employees and greenhouse structure

B. Variable (operating) costs change with production level and amount of use.
1. Major categories: labor (salaries), fertilizer, chemicals, seed, gasoline and oil, inventory, supplies, advertising, utilities, telephone, principal payment
2. Greenhouse operations
a. Labor (seasonal and full-time employees)
b. Fertilizer, rooting and growing media, chemicals
c. Seeds and plants
d. Fuel for heating greenhouse
e. Inventory of growing and packing supplies (containers and labels)
f. Advertising and display expenses
g. Utilities, water, and telephone

C. Cost analysis calculates profit and loss of the operation and indicates the net return. A cost analysis statement lists the following information:
1. Amount of all variable expenses designated directly to specific crop
2. Income received from all crops
3. For fixed expenses: average weekly cost per square foot of bench space (used and vacant benches)

Formula: Total fixed costs/52 (number of weeks per year)/square foot bench space = average cost per week per square foot

Example: Total fixed costs = $15,000; total bench space = 20,000 sq ft

$15,000/52 = $288.46 per week

$288.46/20,000 sq ft = $0.014 per week per square foot

4. How is the quality of commercial crops evaluated?

The greenhouse owner must assess the quality of commercial crops before selling them to customers. Ask students to describe the characteristics of a plant they would consider buying.

A. Adequate nutrients and fertilization for optimal growth
B. Sufficient water, aeration, and drainage
C. Absence of yellow, broken, or dying leaves
D. Free of insect damage
E. Neat and clean plant container
F. Informative care tag provided for customer
G. Appealing packaging of plant and container

5. What do commercial plants need after harvest and during marketing?

After crops are harvested and ready for sale, they must be maintained under favorable environmental conditions and handled with care.

A. Postharvest
   1. Maintaining moisture in plants
      a. Keep relative humidity at optimal level for crops.
      b. Offset depletion of water during refrigeration and humidify storage area.
   2. Regulating respiration rate
      a. High temperatures raise respiration rate.
      b. Store plants at recommended cool temperatures.
   3. Handling crops carefully
      a. Do not touch plants more than necessary.
      b. Put plants in protective containers that are appropriately filled.
      c. Ensure plants' safety when loading onto trucks/vans for shipping.

B. Marketing
   1. Keep storage and display areas cool.
   2. Provide correct amounts of light and shade.
   3. Provide small amounts of fertilizer.
   4. Water only as needed.
   5. Elevate plants.
   6. Maintain cleanliness to prevent damage from ethylene production.

F. Other Activities and Strategies

1. Bring in various seed catalogs and have students plan a flower or vegetable garden. Ask them to justify their choices and compile a list of cultural and environmental procedures that each plant would require.

2. Show one or more videos from the *Landscape Design Series* available from CATER (Career & Technical Education Resources), University of Missouri-Columbia: *Volume I: Principles of Landscape Design* (AG V148), *Volume II: The Landscape Design Process* (AG V149), and *Volume III: Landscape Design Presentation* (AG V150).

3. Show other videos relating to commercial crops available from CATER: *A Professional's Guide to Success with Bedding Plants* (AG V160), *Planting Techniques Part II: Herbaceous Plants and Ground Covers* (AG V174), *Landscaping with Container Plants* (AG V176), and *Seasons of Beauty: Desert Plants for Your Landscape* (AG V245).

G. Conclusion

In selecting commercial crops for a greenhouse operation, the owner considers which types of plants are profitable to sell. Consumer demand is a major influence. A growing schedule is designed to systematically organize all stages of the production cycle. Greenhouse operations have fixed and variable expenses. The owner develops a cost analysis to determine profit and loss. In order to sell

the plants, they must be appealing to the customer and in good condition. After harvest and during marketing, the crops need special care.

H. Answers to Activity Sheets

AS 7.1 Selecting Commercial Crops and Devising a Growing Schedule

Answers will vary.

AS 7.2 Cost Analysis of a Commercial Crop

Answers will vary.

AS 7.3 Plant Care After Harvest and During Marketing

Answers will vary.

I. Answers to Assessment

1. Students may list any two of the following:
   A. Determine what types of crops to grow.
   B. Visit local nurseries, landscaping outlets, retail and wholesale operations.
   C. Determine if producing crops is profitable.
   D. Identify types, sizes, and amounts of plants that customers want.
   E. Read trade journals (*Greenhouse Manager*, *Greenhouse Grower*, and *Grower Talks*)
   F. Read popular magazines (e.g., *Midwest Living*, *Better Homes and Gardens*, and *House Beautiful*)
   G. Determine sales potential of cut flowers, foliage, potted flowering plants, and bedding/garden plants
2. A. Complement personal and commercial landscaping
   B. Produced for spring sales; some also available during summer and fall
   C. Represent nearly 59% of total horticultural sales (1999)
3. Students may list any four of the following:
   A. Planting
   B. Fertilization
   C. Irrigation
   D. Application of pesticides
   E. Propagation
   F. Aeration
   G. Drainage
   H. Day-length treatment
   I. Harvest
   J. Postharvest
4. A. Plan efficient use of bench space
   B. Determine number and spacing of plants on benches

5. Students may list any four of the following for each type of cost:

   Fixed Costs

   A. Depreciation of greenhouse structure and equipment
   B. Interest on land and building(s)
   C. Repair expenses to maintain greenhouse structures, equipment, etc.
   D. Taxes on property
   E. Insurance for employees and greenhouse structure

   Variable Costs

   A. Labor (seasonal and full-time employees)
   B. Fertilizer and growing media
   C. Seeds and plants
   D. Fuel for heating greenhouse
   E. Inventory of growing supplies
   F. Advertising expenses
   G. Utilities and telephone

6. A. The amount of all variable expenses, designated directly to each crop
   B. The income received from all crops
   C. For fixed expenses, the average weekly cost per square foot of bench space (used and vacant benches)
7. Students may list any four of the following:
   A. Adequate nutrients and fertilization for optimal growth
   B. Sufficient water, aeration, and drainage
   C. Absence of yellow, broken, or dying leaves
   D. Free of insect damage
   E. Neat and clean plant container
   F. Informative care tag provided for customer
   G. Appealing packaging of plant and container
8. Students may list any two of the following:
   A. Maintaining moisture in plants
   B. Keep relative humidity at optimal level for crops.
   C. To offset depletion of water during refrigeration, humidify storage area.
   D. Regulating respiration rate
   E. Store plants at recommended cool temperatures.
   F. Handling crops carefully
   G. Do not touch plants more than necessary.
   H. Put plants in protective containers that are appropriately filled.
   I. Ensure plants' safety when loading onto trucks/vans for shipping
9. Students may list any two of the following:
   A. Keep storage and display areas cool.
   B. Provide correct amounts of light and shade.
   C. Apply small amounts of fertilizer.
   D. Water only as needed.
   E. Elevate plants
   F. Maintain cleanliness to prevent exposure to ethylene gas (typically from automobile fumes).

UNIT VII: GREENHOUSE BUSINESS MANAGEMENT

Name _____

Lesson 1: Commercial Greenhouse Crops

Date _____

ASSESSMENT

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

1. What are two ways to decide which crops should be selected?

   A.

   B.

2. What are three reasons that bedding/garden plants are often selected as commercial crops in Missouri?

   A.

   B.

   C.

3. What are four cultural practices included in a growing schedule?

   A.

   B.

   C.

   D.

4. What are two reasons for having a crop rotation plan?

   A.

   B.

5. What are four examples of fixed and variable costs in greenhouse operations?

Fixed Costs	Variable Costs
A.	A.
B.	B.
C.	C.
D.	D.

6. What are three sources of information that a cost analysis provides?

   A.

   B.

   C.

7. When a greenhouse owner evaluates the commercial crop, what are four characteristics he or she looks for?

   A.

   B.

   C.

   D.

8. After harvest, what are two conditions that plants require?

   A.

   B.

9. What are two necessary conditions for plants that are ready for marketing?

   A.

   B.

TM 7.1

Missouri's Commercial Floriculture Crops

Crop	Wholesale Value*	Percent of Total
Cut Flowers	$ 281,000	0.8
Foliage Plants	2,192,000	6.4
Potted Flowering Plants	11,711,000	34.2
Bedding and Garden Plants	20,085,000	58.6
TOTAL	**$34,269,000**	**100%**

*Crops grossing $100,000 or more in 1999; *Missouri Farm Facts*, 2000

TM 7.2

Missouri's Popular Floriculture Crops

CUT FLOWERS*

Chrysanthemums
Daffodils/narcissus
Gladioli
Iris
Roses
Snapdragons
Tulips
Zinnias

FOLIAGE PLANTS**

Potted Foliage
Foliar Hanging Baskets

POTTED FLOWERING PLANTS**

African violets
Azaleas
Chrysanthemums
Easter lilies
Poinsettias
Potted cyclamens
Potted kalanchoes

BEDDING/GARDEN PLANTS**

Geraniums
Hardy/garden chrysanthemums
Impatiens (also New Guinea impatiens)
Petunias
Vegetable flats

* Examples taken from *1997 Census of Agriculture*, Volume 3, Special Studies Part 2. "Census of Horticultural Specialties (1998)." U.S. Department of Agriculture, National Agricultural Statistics Service.

**Crops grossing $100,000 or more in 1999; *Missouri Farm Facts*, 2000

Unit VII: GREENHOUSE BUSINESS MANAGEMENT AS 7.1

Lesson 1: Commercial Greenhouse Crops

Name_____

Selecting Commercial Crops and Devising a Growing Schedule

Objective: Select commercial crops for a greenhouse operation. Justify your choices and create a growing schedule that outlines when to perform key cultural, environmental, and management practices.

Directions: Work with a partner or on your own. Access the Internet, trade journals, university Extension publications, federal and state documents, etc., to obtain information about various greenhouse crops. Base your selections on the information presented in the following scenario.

You are in charge of a retail greenhouse in Missouri that has been in business for 4 years. Your staff includes a grower, three growing assistants, a production specialist, a greenhouse service technician, and a marketing manager. You want to start cultivating three to four new crops. The greenhouse has 14,000 sq ft of bench space. Since your operation began, a wholesale garden center and a landscaping business started and their sales are booming. Your community is growing as well. The housing market is flourishing and employment, representing diverse sectors, is at an all-time high.

Commercial Crop Selected	Justification
1.	
2.	
3.	
4.	

Growing Schedule

Create additional rows and columns as needed. Provide a different growing schedule for each crop. In addition to listing activities performed after planting, indicate when events should be done *before* planting by enclosing the week number within parentheses, e.g., "Order supplies (12)" in the "Week After Planting" column. Enter specific dates, e.g., 3/11-3/15 in the "Actual Week" column.

Note: If you have access to a spreadsheet, create a template for this crop schedule and enter the information online.

(Crop Name)

Step	Cultural, Environmental, and Management Practices	Week After Planting	Actual Week	Staff Member Responsible for Task	Date Completed
1.					
2.					
3.					
4.					
5.					

Unit VII Greenhouse Business Management

AS 7.2

Lesson 1: Commercial Greenhouse Crops

Name_____

Cost Analysis of a Commercial Crop

Objective: Generate a cost analysis for a greenhouse crop.

Directions: Work with a partner or on your own. Use the Internet, commercial catalogs, and other sources to finish filling out the blanks below and then answer the following questions. You may choose one of the crops from the previous activity sheet. Use the following scenario. Show all of your work.

The greenhouse has 5,000 sq ft of bench space. The production time for the crop is 20 weeks. Assume your crop consists of 750 cuttings grown in 6-inch pots. Your utilities for the year are $2,225 and labor costs are $1,480 for the year.

Crop: _____

Fixed Costs*

Depreciation: $2,000

Interest on Investment: $40,000 X 6% opportunity cost =_____

Repairs & Maintenance: $600

Taxes: $40,000 X 32% (commercial rate) X $5.20/$100 assessed value = _____

Insurance: $550

Total fixed costs: $_____

Average cost per week per square foot = total fixed costs/52 weeks per year/square foot bench space

Average cost per week per square foot = _____

*Estimates for the purpose of this exercise only

Variable / Operating Costs

Rooted Cuttings:	
Royalty/Cutting:	
Transportation/Cutting:	
Soilless Media:	
Containers:	
Fertilizer:	
Fungicides: *	
Insecticides: *	
Care Tags:	
Commission:	
Advertising/Mailing/Paper/Copying:	
Subtotals:	
Death Loss or Unsalable: (5% of subtotal)	
Totals:	

*May be optional for your crop

1. What are the total costs for the crop?
2. What is the total cost per plant?
3. What is the net profit for the plant?
4. At what sale price could you sell the plants and still make a profit?

Unit VII Greenhouse Business Management AS 7.3

Lesson 1: Commercial Greenhouse Crops Name_____

Plant Care After Harvest and During Marketing

Objective: Outline the specific care requirements after harvest and during marketing for two types of plants.

Directions: The table below lists the four floriculture crops produced in Missouri, including popular plants per crop. Select <u>two</u> different crops. For each crop, select <u>one</u> representative plant. (For example, you could select cut flowers and foliage as two different crops. Then you could select daffodils as a representative plant of the cut flower crop and potted foliage as a representative of the foliage crop.) Write the two crop names and the two plant names at the top of the After Harvest Care and Marketing Care tables. List the care requirements in the rows provided. If necessary, add more rows.

Floriculture Crops in Missouri			
Cut Flower Crop	**Foliage Crop**	**Potted Flowering Crop**	**Bedding/Garden Crop**
Chrysanthemums	Potted foliage	African violets	Geraniums
Daffodils	Hanging baskets	Azaleas	Hardy chrysanthemums
Narcissus		Chrysanthemums	Impatiens
Gladioli		Easter lilies	New Guinea impatiens
Iris		Poinsettias	Petunias
Roses		Potted cyclamens	Vegetable flats
Snapdragons		Potted kalanchoes	

Crop #1: **Plant #1:**	**Crop #2:** **Plant #2:**
AFTER HARVEST CARE	AFTER HARVEST CARE
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

Crop #1: **Plant #1:**	**Crop #2:** **Plant #2:**
DURING MARKETING CARE	DURING MARKETING CARE
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.