

Lesson B1–3

Using Automated Systems in the Greenhouse

Unit B. Floriculture

Problem Area I. Greenhouse Crop Production

Lesson 3. Using Automated Systems in the Greenhouse

New Mexico Content Standard:

Pathway Strand: Plant Systems

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

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

Performance Standard: 2. Manipulate and evaluate environmental conditions (e.g., irrigation, mulch, shading) to foster plant germination, growth and development. **3.** Evaluate and demonstrate planting practices (e.g., population rate, germination/seed vigor, inoculation, seed and plant treatments). **4.** Evaluate and demonstrate transplanting practices.

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

1. Discuss the advantages of automated systems.
2. Identify automated systems involved in planting.
3. Identify automated systems involved in moving plants in the greenhouse.
4. Identify automated systems involved in watering plants.

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

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

Biondo, Ronald J. and Dianne A. Noland. *Floriculture: From Greenhouse Production to Floral Design*. Danville, Illinois: Interstate Publishers, Inc., 2000.

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

Ball, Vic. *Ball RedBook*, Sixteenth Edition. Batavia, Illinois: Ball Publishing, 1998.

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

Boodley, James W. *The Commercial Greenhouse*, Second Edition. Albany, New York: Delmar Publishers, 1998.

McMahon, Robert W. *An Introduction to Greenhouse Production*. Columbus, Ohio: Ohio Agricultural Education Curriculum Materials Service, The Ohio State University.

List of Equipment, Tools, Supplies and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of student lab sheet
Computer
LCD projector

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

Automated pot fillers
Automated seeders
Automated transplanters
Capillary mats
Conveyor belt system
Drip irrigation
Ebb and flood
Intermittent mist system
Irrigation booms
Overhead sprinklers
Spaghetti tubing
Tray mechanization

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

Give the students two sets of mathematical problems to solve including addition, subtraction, multiplication, and division. Devise the problems to be lengthy. For example, you might have them add a column of twenty numbers. Some students might ask to use calculators. Refuse use of the calculators until the first set of problems has been completed with paper and pencil. Then, allow the students to use a calculator for the second set of problems. Ask the students why the second set of problems was so much easier to complete. Continue the discussion of how technology helps people accomplish tasks by focusing on greenhouse operations. Have the students develop a list of those greenhouse tasks that are labor intensive and could be made easier with technology.

Summary of Content and Teaching Strategies

Objective 1: Discuss the advantages of automated systems.

Anticipated Problem: What are some advantages of automated systems.

- I. Automated systems incorporate technological developments in the production of greenhouse crops.
 - A. The labor involved in propagating, potting, moving, growing, and harvesting greenhouse crops is intensive. Automated systems can greatly reduce labor costs.
 - B. Automated systems also allow for the management of much larger greenhouse operations.

Have students read sections from Floriculture: From Greenhouse Production to Floral Design that are related to automated systems used in the greenhouse as homework or during supervised study. Have students take notes on the major points presented in the reading. Follow up the reading assignment with a discussion of the material to evaluate student understanding.

Objective 2: Identify automated systems involved in planting.

Anticipated Problem: What types of automated systems are used in planting processes?

- II. Automated systems speed the planting and transplanting process.
 - A. **Automated pot fillers** are used to fill pots with medium. The medium is lightly packed, and the pots are stacked or move down a conveyor for planting.
 - B. **Automated seeders** permit the sowing of entire flats or plug trays in a few moments. The flats or trays move down a conveyor to a germination room or are taken right to the greenhouse.

- C. **Automated transplanters** remove small plants from plug trays and transplant them directly to pots.

Review material from readings in *Floriculture: From Greenhouse Production to Floral Design* related to automated systems used in potting, seeding, and transplanting. Have students take notes on the major points identified during the review. Arrange a field trip to a commercial greenhouse operation at a time of year when automated systems are in use. Request that the grower discuss how the systems operate. Actual demonstrations of the automated systems will enhance the learning experience. Be sure to prepare the students in advance so that they can ask educated questions. Also, assign lab sheet, LS: B1–3A, Greenhouse Field Trip Worksheet, Automated Systems to be completed during the field trip.

Objective 3: Identify automated systems involved in moving plants in the greenhouse.

Anticipated Problem: What systems are used in moving plants in the greenhouse.

- III. One of the most labor-intensive tasks in the greenhouse is the transporting of plants.
 - A. **Conveyor belt systems** are used to move plants from one area of the greenhouse to another.
 - B. **Tray mechanization**, first developed in Holland, has grown in popularity in the U.S. Individual trays or palletized benches that hold 100 pots or more roll on a series of rails from one area to another.

Use selected readings in the *Floriculture: From Greenhouse Production to Floral Design* text to strengthen student understanding of concepts. Also, obtain periodicals pertaining to the greenhouse industry and encourage students to review the articles and ads for information about automated systems used in moving plants. Have the students report to the class their findings. Use transparency masters TM: B1–3A to illustrate tray mechanization.

Objective 4: Identify automated systems involved in watering plants.

Anticipated Problem: What automated systems are used in watering plants?

- IV. Although hand watering is the most reliable method of watering, automated systems permit the watering of thousands of plants in a short period of time.
 - A. **Spaghetti tubing** is an automated system that involves small tubes connected to a main line. The end of each small tube is placed in a pot, and when functioning, dribbles water onto the medium. One advantage to spaghetti tubing is the flowers and foliage stay dry.
 - B. **Drip irrigation** consists of a system like spaghetti tubing but it differs in that it provides a slow steady drip. Drip irrigation is commonly used with hanging baskets. The advantage of drip irrigation is it wastes less water and fertilizer than spaghetti tubing.
 - C. **Ebb and flood** watering involves watertight benches in which pots are set. Water or nutrient solutions are pumped into the bench, the medium absorbs the water, and the water drains away. Little if any water is lost with this system, nutrient levels are easily adjusted, and plant foliage is kept dry.

- D. **Capillary mats** consist of porous mats placed on a bench and wetted. The medium in the pots absorbs the water through capillary action. This method is commonly used with African violets because the foliage stays dry and humidity around the plant is high.
- E. **Irrigation booms** move across the entire bench and well-placed nozzles flood the pots below as they pass over the plants. This method is commonly used with bedding plants, plug trays, and some potted flowering crops.
- F. The watering system involving **overhead sprinklers** consists of stationary sprinkler heads placed throughout the growing space. They deliver a large amount of water in a short period of time and are often used with bedding plants.
- G. **Intermittent mist systems** produce tiny droplets in the air for the purpose of keeping plant material wet. Intermittent mist systems are commonly used in the propagation phase of production to reduce water stress on cuttings. The mist can operate continually or be programmed to operate for a certain number of seconds every set number of minutes.

Incorporate appropriate readings from Floriculture: From Greenhouse Production to Floral Design that address the learning objective. Plan to have an outside resource person, knowledgeable in watering systems, to appear as a guest speaker in your class. Demonstrate how plants should be watered in the school greenhouse or have the grower in a greenhouse demonstrate watering systems during a planned field trip.

Review/Summary. Focus the review and summary of the lesson around the student learning objectives. Call on students to explain the content associated with each objective. Use their responses as the basis for determining any areas that need re-teaching. Questions at the end of the chapters in the textbooks may also be used in the review/summary. Use the lab activity as a guide for review of direct student learning experiences.

Application. Application can involve the following student activity using attached lab sheets:

LS: B1–3A—Greenhouse Field Trip Worksheet, Automated Systems

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is attached.

Answers to Sample Test:

Part One: Matching

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

Part Two: Completion

1. Automated pot fillers

2. Drip irrigation
3. Tray mechanization
4. Automated planters
5. Capillary mats
6. Hand watering
7. Ebb and flood
8. Automated systems
9. Intermittent mist systems

Part Three: Short Answer

1. Automated systems can greatly reduce labor costs. Automated systems also allow for the management of much larger greenhouse operations.
2. Automated pot fillers
Automated seeders
Automated transplanters
3. Conveyor belt systems
Tray mechanization
4. Spaghetti tubing
Drip irrigation
Ebb and flood
Capillary mats
Irrigation booms
Overhead sprinklers
Intermittent mist systems

Test

Lesson B1–3: Using Automated Systems in the Greenhouse

Part One: Matching

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

- | | | |
|----------------------------|-------------------------|------------------------|
| a. tray mechanization | e. conveyor belt system | i. overhead sprinklers |
| b. automated seeders | f. drip irrigation | j. spaghetti tubing |
| c. automated transplanters | g. ebb and flood | |
| d. capillary mats | h. irrigation booms | |

- _____ 1. Remove small plants from plug trays and transplant them directly to pots.
- _____ 2. Are used to move plants from one area of the greenhouse to another.
- _____ 3. An automated system that involves small tubes connected to a main line. The end of each small tube is placed in a pot, and when functioning, dribbles water onto the medium.
- _____ 4. Involves watertight benches in which pots are set. Water or nutrient solutions are pumped into the bench, the medium absorbs the water, and the water drains away.
- _____ 5. Consists of stationary sprinkler heads placed throughout the growing space.
- _____ 6. Palletized benches that hold 100 pots or more roll on a series of rails from one area to another.
- _____ 7. Permit the sowing of entire flats or plug trays in a few moments.
- _____ 8. Consists of a system like spaghetti tubing but it differs in that it provides a slow steady drip.
- _____ 9. Move across the entire bench and well-placed nozzles flood the pots below as they pass over the plants.
- _____ 10. Consist of porous mats placed on a bench and wetted. The medium in the pots absorbs the water through capillary action.

Part Two: Completion

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

1. _____ are used to fill pots with medium. The medium is lightly packed, and the pots are stacked or move down a conveyor for planting.
2. The advantage of _____ is it wastes less water and fertilizer than spaghetti tubing.
3. _____ was first developed in Holland, has grown in popularity in the U.S.
4. _____ remove small plants from plug trays and transplant them directly to pots.
5. _____ is commonly used to water African violets because the foliage stays dry and humidity around the plant is high.
6. _____ is the most reliable method of watering.
7. Little if any water is lost with an _____ watering system, nutrient levels are easily adjusted, and plant foliage is kept dry.
8. _____ incorporate technological developments in the production of greenhouse crops.
9. _____ produce tiny droplets in the air for the purpose of keeping plant material wet.

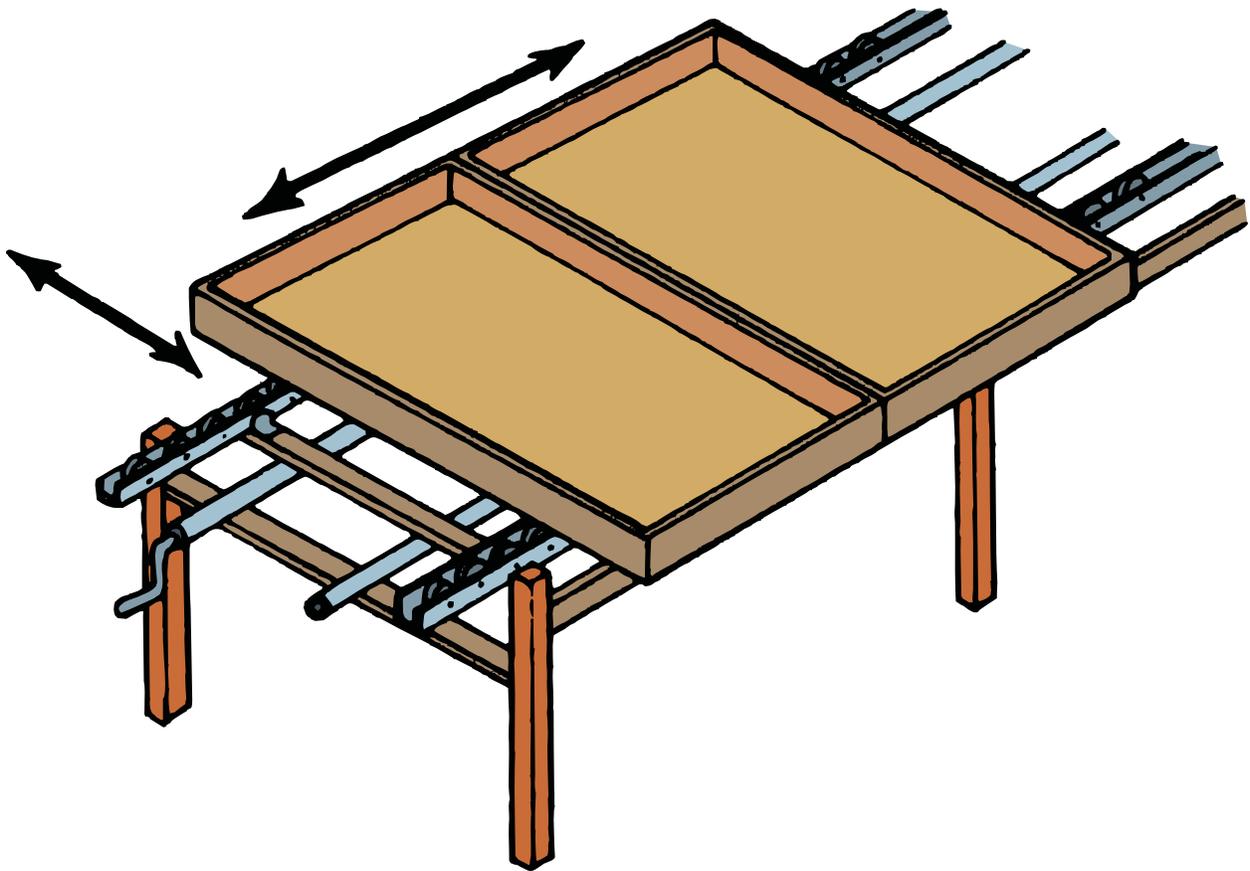
Part Three: Short Answer

Instructions. Provide information to answer the following questions.

1. What are two advantages to automated systems?
2. List three automated systems used in the planting and transplanting process.
3. Identify two automated systems used in transporting crops.
4. List seven automated systems used to water plants.

TM: BI-3A

TRAY OR PALLET MOVABLE BENCH WITH WHEEL CONVEYOR



Lab Sheet

Greenhouse Field Trip Worksheet Automated Systems

Purpose:

To identify automated greenhouse systems, their advantages and disadvantages, and their uses.

Instructions:

Answer the questions during a visit to a greenhouse operation. If necessary ask your greenhouse guide for assistance.

1. What types of automated systems does this operation utilize for potting, seeding or transplanting?
2. Does the grower use an automated system to move plants? Describe how the plants moved in this greenhouse operation.
3. What types of watering systems does this operation utilize?
4. Are certain watering systems used with certain crops? Why?
5. Does the grower like one watering system in particular?
6. What types of environmental control systems are used by this greenhouse operation?