



# California Vocational Agriculture Curriculum Guidelines Instructional Unit

GLASS AND SYNTHETIC MATERIALS

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## GLASS AND SYNTHETIC MATERIALS

### Unit Goal:

The goal of this unit is to familiarize students with the various types of glass and synthetic coverings used on greenhouses and shade buildings.

### Unit Performance Objectives:

Upon completion of this unit the student will be able to:

1. Distinguish the various kinds of synthetic coverings used.
2. Explain one or two advantages of each synthetic as compared to glass.
3. Explain safety precautions associated with each material described in this unit.

## Teaching Outline

### I. Introduction - Greenhouse Coverings

Several covering materials are available to the grower of greenhouse plants. Selection of the cover should be based on the durability of the materials, initial cost, and maintenance costs. The material selected must permit a maximum amount of light to pass through and maintain and control the environment within the greenhouse. Since the covering must permit a maximum amount of sunlight to pass through, a colored material cannot be used for a greenhouse covering.

### II. Glass Structures

- A. Placed on greenhouse similarly to shingles, except it is lapped about 1/4 of an inch.
- B. Set on a bedding compound which has been applied to the sash bars and held in place by glazing points.
- C. After glass has set, compound also applied to each side of the bar and painted to make waterproof.
- D. Glazing must be repainted every four to six years.
- E. Should be used if the grower is reasonably confident of being in same location for 25 years.
- F. Grower needs adequate capital, original investment plus yearly maintenance.
- G. Advantages:
  1. Most transparent
  2. Longest lived (TM - 1)
- H. Disadvantages
  1. Heavy weight
  2. High cost
  3. Easily broken
- I. How to cut
  1. Use diamond tip glass cutters, pulling cutter along a straight edge; Push down on glass with scored line along an edge such as a table edge.
  2. Wear gloves when handling glass panels.

### III. Plastic Structures - If starting capital is low, plastics are best to use because of low investment necessary.

- A. Four Types of Plastics Used:
  1. Rigid plastics
  2. Mylar
  3. Vinyl
  4. Polyethylene

### SUGGESTED LEARNING ACTIVITIES

- II. 1. Try building a simple glass terrarium as a way to practice glass cutting.
- III. 2. Have class build wood frames of 2" x 2" of 1 or 2 foot square dimensions. Divide class into 4 groups to fasten samples of each type of plastic onto frames. Discuss later any problems encountered. One group could do glass also.

Place frames outdoors. Use a light meter to check amount of light that passes through each material.

### SUGGESTED RESOURCE MATERIALS

1. V.E.P. Filmstrip - "How to Build a Terrarium."
2. Gather materials from various nursery supply houses or local contractors, building supply services.

### III. B. Descriptions of the Four Types

#### 1. Rigid plastics: Fiberglass

- a. A combination of glass fibers and plastic resin.
- b. Comes in flat sheets or more commonly corrugated panels.
- c. Advantages:
  - 1) Will stay installed for many years (TM - 1)
  - 2) Crop growth very good for first few years of use
  - 3) Little damage from hail
  - 4) Lighter in weight than glass
- d. Disadvantages:
  - 1) Gradual lowering of light transmission over several years
  - 2) The outer surface weathers allowing dirt to stick to the surface. Surface must be recoated with resin to restore.
  - 3) Should be washed periodically to maintain their translucent qualities.
- e. How to cut
  - 1) Material can be cut with hand held saws, sabre saws, radial saws.
  - 2) Precaution should be taken to wear dust masks and eye protection. The dust is essentially glass material.

#### 2. Rigid plastics: PVC or Polyvinylchloride or vinyls

- a. Can be found as a film also.
- b. Advantages:
  - 1) Very durable, lasting for a year or longer (TM - 1)
  - 2) Transmits more light when new than polyethylene.
  - 3) Because of its durability, vinyl is usually considered more suitable than polyethylene for year around structures.
- c. Disadvantages:
  - 1) Cost twice that of polyethylene.
  - 2) Becomes dirty more readily, light transmission may be less after several months.
  - 3) Rigid panels will break from impact or shock.

#### 3. Mylar Polyester Film

- a. Advantages:
  - 1) More transparent than polyethylene.
  - 2) Retains light transmission qualities much better than rigid plastics.
  - 3) Strongest of film plastics.
- b. Disadvantages - costs as much as glass but lasts only 3 to 5 years.

#### 4. Polyethylene

- a. This was the first material used as a greenhouse film covering. It is inexpensive and lightweight. Sheets are stretched over a frame and held down with chicken wire, hardware cloth or wire.
- b. Advantages:
  - 1) Initial cost is low.
  - 2) Available in widths that allow the covering of an entire roof with one sheet.
  - 3) Light transmission is good.
- c. Disadvantages - Degrades in sunlight, becomes brittle, cracks and tears easily; occurs more rapidly during summer.
  - 1) A house covered in the spring will need recovered in the fall.
  - 2) A house covered in October will last until spring.
- d. How to cut film plastics - Heavy duty scissors are best for cutting films. If the sheet is held tightly the open scissors can be pushed through the sheet as a faster way of cutting.

## SUGGESTED LEARNING ACTIVITIES

### General

1. Have samples of rigid and flexible plastics and glass for identification.
2. Which covering burns best?. Set up one sample of each type of plastic on a piece of wire held with clothes pins. Use samples no bigger than 6" x 6". Do this activity out in the open away from anything which might burn. Start all materials on fire at same time. Time how long it takes to ignite and how long it takes to burn.

## SUGGESTED RESOURCE MATERIALS

1. Obtain samples from supply-houses such as Jacob Bros. or hardware stores.
2. Obtain samples from nursery supply houses or local contractors, building supply services.

- III. B. 4. e. One of the latest methods used is the double poly method where a small inflation blower separates the two sheets of polyethylene and allows for an insulated structure.
- f. Plastics burn! Be sure and take all precautions when installing wiring, heating systems, lights or anything that might cause the plastic surfaces to get hot.

SUGGESTED LEARNING ACTIVITIES

SUGGESTED RESOURCE MATERIALS



### Student Evaluation

Answer in as short of answers as possible.

1. What two types of materials are used to glaze nursery structures?
2. What are the advantages of using glass as a glaze?
3. What are the disadvantages of using glass a a glaze?
4. Name two kinds of rigid plastics.
5. What are the advantages of using rigid plastics?
6. What are the problems associated with the use of rigid plastics?
7. What advantage does Mylar give the user?
8. What advantage does vinyl have over other materials?
9. Give a disadvantage for Mylar.
10. Give a disadvantage of vinyl over other materials (not cost).
11. What is the cheapest material to use for glazing?
12. When would you select glass as the material to use (what conditions would be necessary)?
13. Which of the coverings has the best light transmission?
14. Which material has better light diffusion than glass yet doesn't last as long?
15. Which material can you cut with a saw, would need eye protection and dust mask when cutting?
16. Which materials burn?
17. Which materials break easily?
18. Which material would you use if you raise quick crops (over a short period)?
19. Name the four types of plastics used in greenhouse glazing.

COMPARISON OF GREENHOUSE COVERINGS

Material	Life Span Exposure to Full Sun	Cost Per Sq. Ft.	Construction Cost Labor & Materials	% of Light Transmission	Heat Loss Factor	Hail Resistance	Plant Growth Response
Glass 26 oz.	Indefinite period	.16	\$3.00/sq. ft. for 1,000 sq. ft.	96%	1.13 BTU <sup>a</sup>	Very low	Excellent
Fiberglass	Varies; claimed 10 to 15 years	.20 to .40	Somewhat higher than glass for good 15-20 year structure	79% to 84%	0.92 BTU	Will withstand some hail	Better light diffusion than glass
Mylar Polyester Film	3 to 5 years	.16		80%	0.92 BTU	Will withstand some hail	Similar to fiberglass
Vinyl Film (Polyvinyl-chloride) or PVC	1 to 2 years	.09		75%	---	---	Similar to polyethylene for first few months
Polyethylene	3 to 6 months	.0125		78%	1.6 BTU	---	Similar to glass

<sup>a</sup>Heat loss factor is hourly heat loss in B.T.U.'s per sq. ft. in degree difference - indoors vs. outdoors.

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