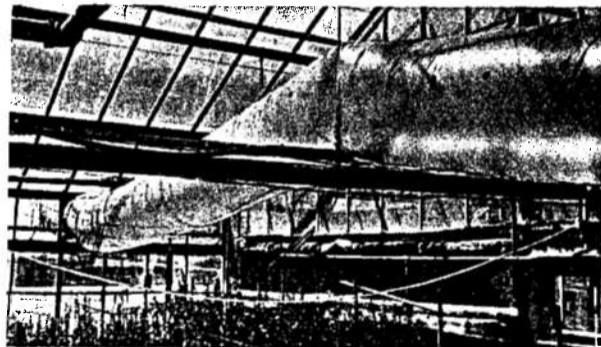


Winter Ventilation with Fans and Plastic Tubes

by W. D. Holley and K. L. Goldsberry

Exhaust fans can be used to cool greenhouses evenly when outside air is cold. A glasshouse serves as a plenum, allowing cold air to move in evenly through cracks between the glass when the interior is under slight vacuum. As soon as the temperature can no longer be kept down with this method, a larger volume of cold air is required. If this volume is supplied through side or top ventilators,



the differential in temperature from intake to exhaust fan may become too great, and chilling of the first plants hit by incoming air causes malformed flowers and uneven growth.

One means of correcting these problems due to temperature differential is to bring the cold air in through a polyethylene tube in which holes are placed at regular intervals. The plastic tubes may be attached to any side or end of the greenhouse, since they inflate and allow the inflow of cold air when exhaust fans operate. Although the engineering of flow has not been worked out, the following is presented as a guide:

1. Tubes are obtainable from most companies that stock polyethylene. The common size used in Colorado has been 29 inches in diameter. Larger tubes are available. Flat polyethylene can be sewn or taped into a tube. 1 1/2 mil thickness is satisfactory.

2. Take out a pane of glass and fasten one end of the tube securely around the hole. Extend the tube to its full length and tie off the end, or attach the tube to a hole in the opposite end or side of the greenhouse. Do not twist the tube.

3. Start one exhaust fan in a closed house and make the holes in the inflated tube. It is important that the holes be the same diameter and evenly spaced for uniform cooling. A wire circle of known diameter attached to a soldering iron has been used in making these holes at Colorado State University.

4. The tubes are installed with the outlet holes oriented so incoming air does not strike plants. Cold air will be completely mixed with the air in the house at a distance of 16 to 20 diameters of the outlet hole. Horizontal orientation of the holes is best when the flow is

across the tops of the plants. When tubes are placed near the glass, it is more desirable to have the air flow paralleled to the roof slope.

5. If the sum of the areas of all outlets is larger than the area of the intake, the tube will not inflate fully. This fact determines the maximum number and/or size of holes. For instance, a rough rule is that the hole made by removing a 20 x 20 pane of glass (somewhat less than 400 sq. in.) should supply air for approximately 120 2-inch outlets. These can be evenly spaced throughout the length of an area which probably should not exceed 100 ft. One tube may cool 36' x 100', or it may take two tubes if the heat load is high. By attaching the tube to intake holes at either end, the length of tube can be doubled.

Can go to 3X area of main inlet,

6. If the length is greater than 100 ft., it is advisable to attach the tube to intake holes at either end, or bring in a tube from the same end and start the holes in the second tube at the point where the first tube ends. Tubes need not originate opposite the fan. They may originate on any outside wall, even on the same wall with the fan.

7. Since the rise in temperature as the air moves through the tube is negligible, there is no need to vary the size and spacing of the outlet holes. The main rule to follow is that no more air can move out of the outlet holes than can move into the tube through the intake.

It is preferable to have the air intakes on sides away from the prevailing winter wind direction. Gravity or thermostatically controlled louvers can be used over air intakes. In some installations, no covering is used over air intakes. When ventilating fans are off, the tubes are deflated and serve as a barrier to heat loss.