Greenhouses

Greenhouses

Why – what plants

When – what season

Where

Greenhouses

Why – what plants

Greenhouses

When – what season

Spring – starts

All Year

Winter - overwinter

Greenhouses

Where

Greenhouses

(my assigned topic)

Ventilation - Temperature management

Critical in NM

Ventilation

Mixes air in the greenhouse – creates uniform temperatures

Air movement reduces disease problems

Ventilation

Essential for summer plant production

Ventilation

Fan types

Ventilation

These circulate air within greenhouse to make temperature uniform and reduce disease problems

Ventilation

Poly-tube good for bringing in cold air in winter and distributing it without plant injury

Ventilation

Fan Performance

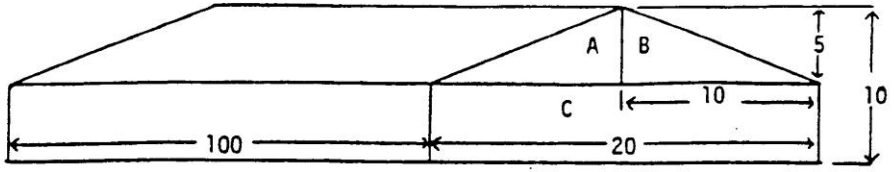
Ventilation

Determine number of air changes needed per minute and volume of the greenhouse

Ventilation

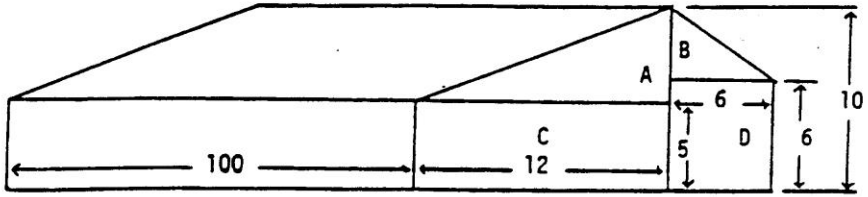
With manufacturers charts determine size of fan needed.

Figure 1. Greenhouse volume calculations.



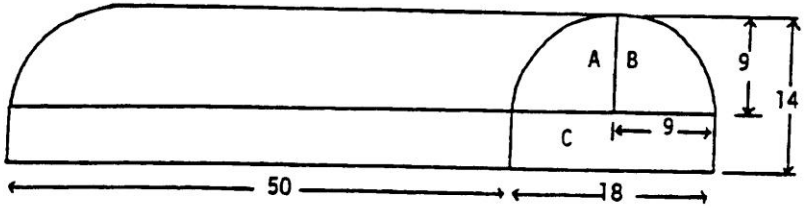
Even Span Structure

Area A and B = .5 (5 x 10) =25
Area C = 20 x 5 = 100
Total Area = A + B + C = 100 + 25 + 25 = 150
Volume = Length x Total Area = 100 x 150 x 15,000 cu. ft.



3/4 Span Structure

Area A = .5 (12 x 5) = 30
Area B = .5 (4 x 6) = 12
Area C = 12 x 5 = 60
Area D = 6 x 6 = 36
Total Area = A + B + C + D = 30 + 12 + 60 + 36 = 138
Volume = Length x Total Area = 100 x 138 = 13,800 cu. ft.



Roundtop Structure

Area A + B = .5 (πr^2) = 127
Area C = 5 x 18 = 90 sq. ft.
Total Area = A + B + C = 127 + 90 + 217 = 10,850 cu. ft.

Ventilation

Fan Selection

Ventilation

Centrifugal Fans - for specialized purposes

Axial Direct Drive – speed limited by motor design

Belt Drive – higher maintenance

Ventilation

Energy Use and Efficiency

Important Economic Considerations

Figure 2. Fan curves for greenhouse ventilating equipment

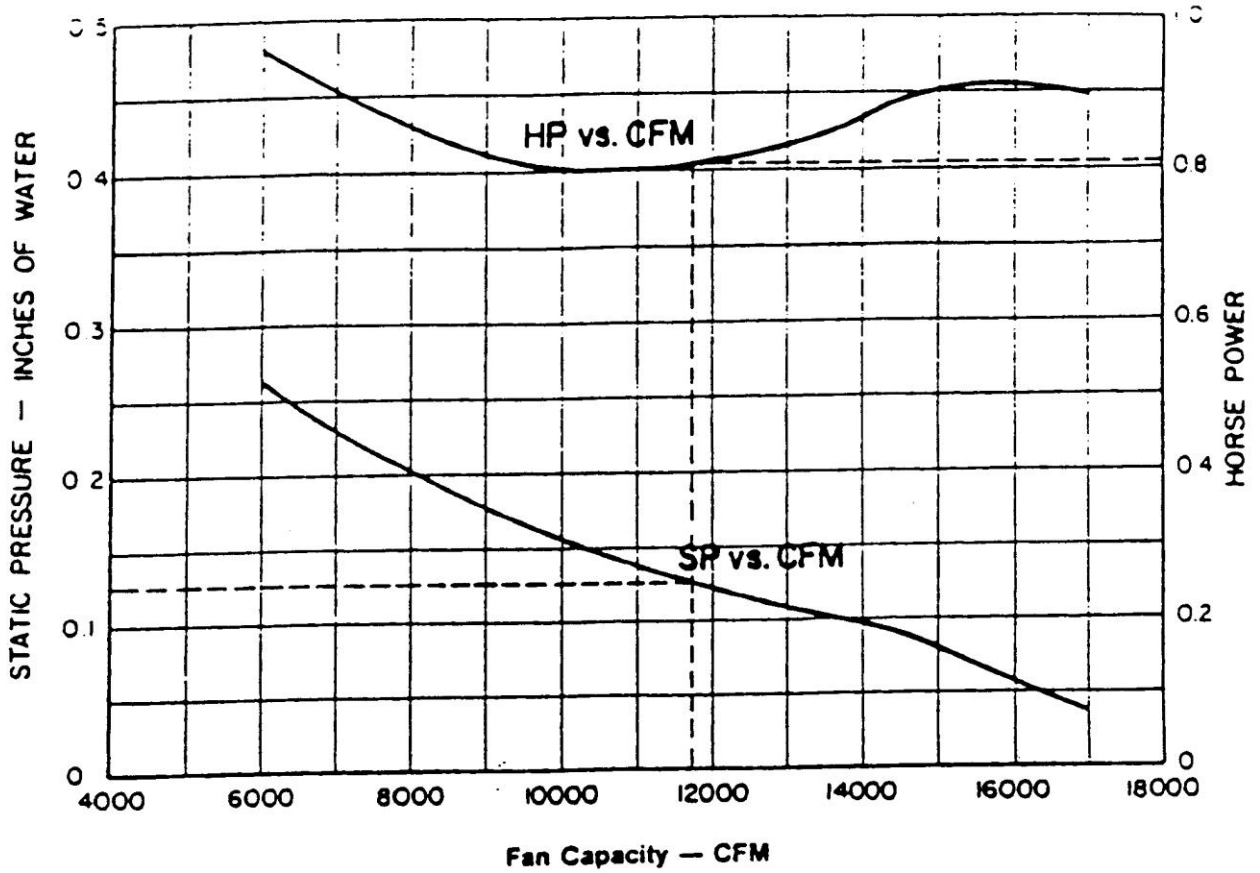
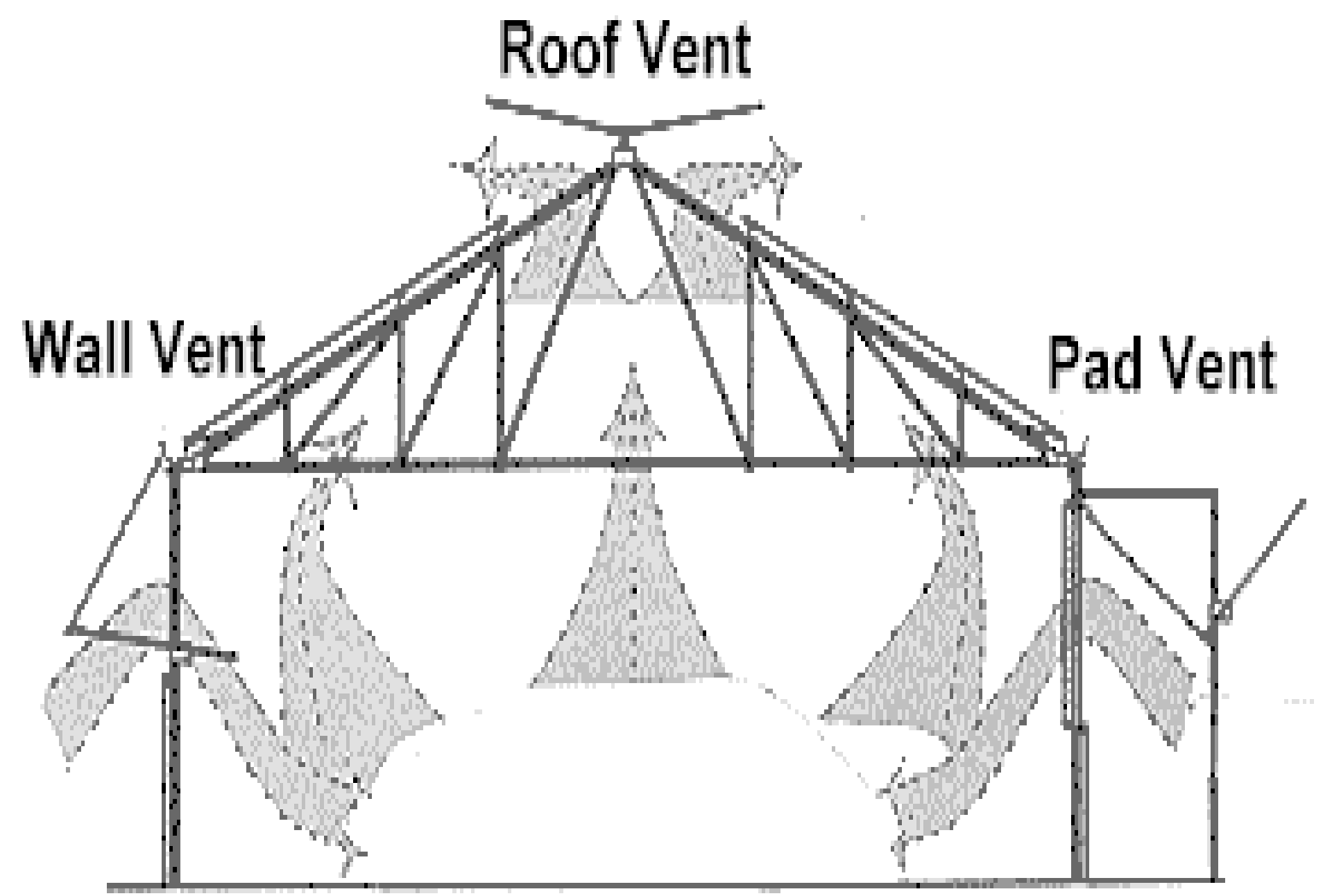


Table 1. Typical fan table for a normal 48-inch fan.

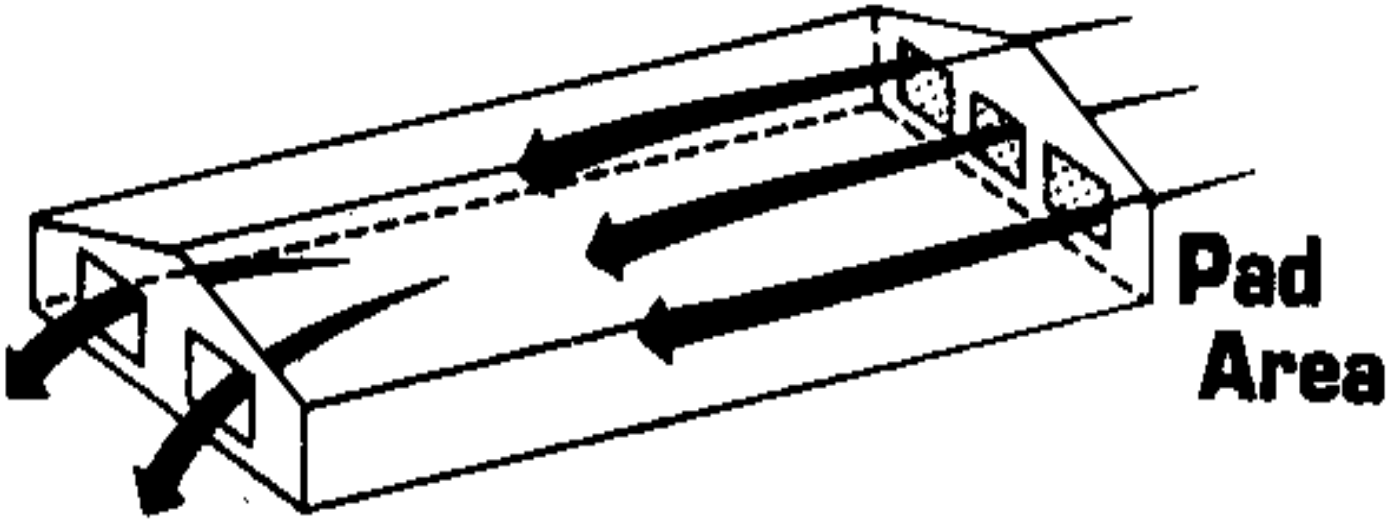
Maximum Motor Horsepower	RPM	Fan Capacity Cu. Ft. Per Minute						BHP
		0"sp	1/10"sp	1/8"sp	1/4"sp	3/8"sp	1/2"sp	
1.0	340	22,410	20,150	19,250	9,700			1.29
1.5	390	25,720	24,000	23,400	16,750			1.93
2.0	428	28,250	26,900	26,350	21,500	12,580		2.53
3.0	490	32,300	31,200	30,850	28,050	22,700		3.79
5.0	580	38,270	37,740	37,450	36,600	32,500	28,400	6.32



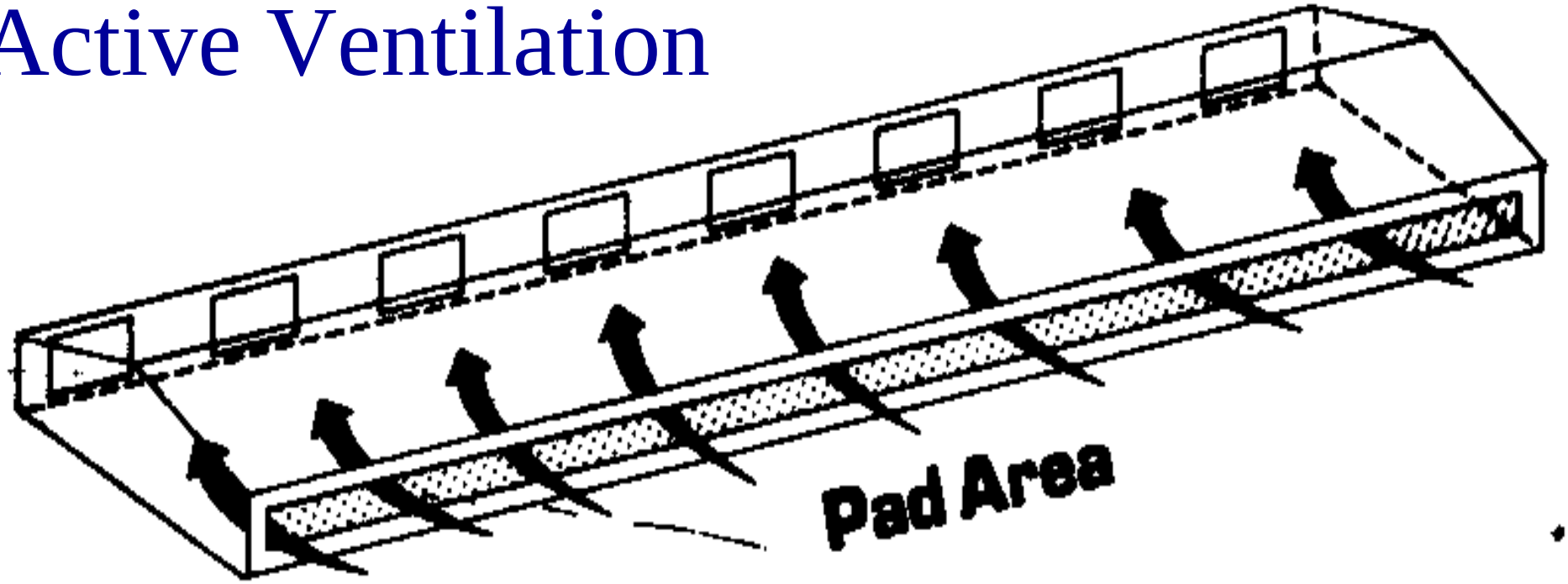
Passive Ventilation

Ventilation

Active Cooling Systems



Active Ventilation



Ventilation

Active Cooling Systems

- laminar air flow
- hot above and below plant level

Mist Cooling

Helps maintain humidity

Quick cooling


Mist Cooling

Additional Temperature Management

Sun Screens & Shade Fabrics

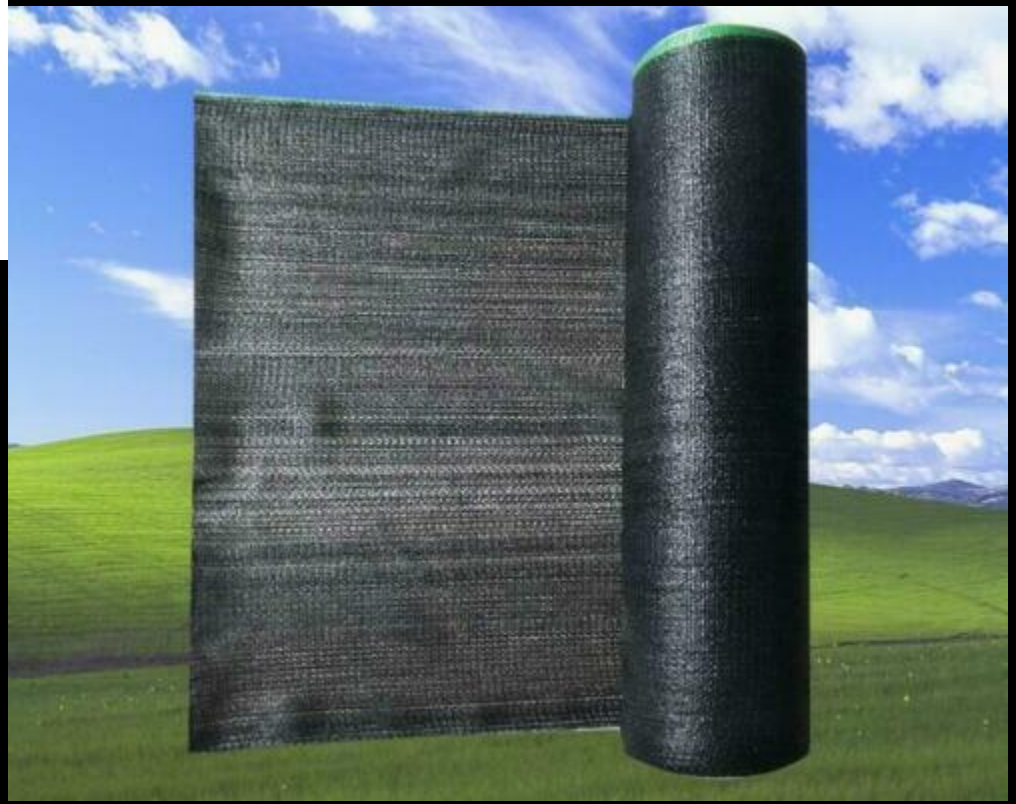
Sun Screens & Shade Fabrics

Shading cools

Reflect sunlight/heat away

White or aluminized best – diffused light

White Sand Green Black



Heating Systems

Essential for winter plant production

Heating Systems

Fuel sources

- gas
- electric
- solar
- wood

Heating Systems

All systems require ventilation in and out for fire

Incomplete combustion will cause problems

Heating Systems

Forced air most common

Poly-tube efficient, especially under bench

Heating Systems

Consider hot water under pot heating – greatest efficiency especially if used with thermal blanket

Compost heat

Supplemental solar heat – hot water storage in greenhouse

Thermal Blankets

In winter serve as thermal blanket to separate cold and warm air and reflect heat