



NSW Agriculture

# The greenhouse

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*The Ancient Romans developed a way of making rectangular sheets of glass and mica. Wealthy Romans used these sheets to cultivate many fruits and vegetables year-round.*

## WHAT IS A GREENHOUSE?

A greenhouse is a generic term referring to the use of a transparent or partially transparent material supported by a structure to enclose an area for the propagation and cultivation of plants.

Specifically, where the covering material is glass, the structure may be referred to as a glasshouse. A greenhouse or polyhouse refers to the use of plastic films or plastic sheeting. Greenhouses may make use of supplementary heating to maintain a required internal temperature or rely on air warmed in the day to maintain a minimum temperature at night. When the enclosing material is woven or otherwise constructed to allow sunlight, moisture and air to pass through the gaps, the structure is known as a shadehouse.

## ADVANTAGES OF THE GREENHOUSE

Reducing or managing risk is a key to business success. All businesses suffer 'business risk'. This includes competition, variable input costs and uncertain returns. In horticulture, an extra problem is 'environmental risk' causing uncertain levels of production, difficulty in forecasting when you will have product to sell and even producing for when prices are likely to be higher.

A better quality product can be achieved by eliminating adverse environmental conditions using a greenhouse to:

- provide an optimum growing environment
- create longer growing seasons
- grow crops out of season
- get faster growth and higher yields



## Division of Plant Industries

- grow different varieties
- protect crops from cold weather, hail, damaging wind and rain
- keep pests and diseases out of the crop.

Shade houses are used to protect crops and sensitive plants from intense sunlight, heat and wind.

## GREENHOUSE TERMS

The pitch is the angle of the roof to the horizontal. Pitch should be more than 23° so that condensation will not drip onto plants.

Ridge height is the distance from the floor to the greenhouse's highest point (ridge or apex).

A vent is an opening to allow warm air to escape. There are different types of vents including ridge, ridge window and eave vents. Effective ventilation is very important in the greenhouse.

A purlin is a horizontal beam in the roof which supports the coverings. The trusses are the structures forming a rigid framework. Posts (columns) are vertical structural supports. The eave is the highest part of the vertical wall. The span of the greenhouse refers to the wall to wall width.

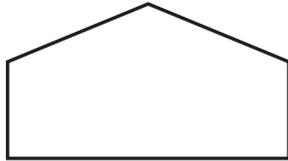
## TYPES OF GREENHOUSE STRUCTURES

The shape of the structure influences:

- the amount of light transmitted
- the amount of natural ventilation
- the useable internal space
- efficient use of structural materials
- condensation run-off
- heating requirements.

A gable shaped roof is the best design for natural ventilation, provided sufficient vents are incorporated.

### Gable (single span)



A multi-span provides greater internal space that can be more readily managed than a number of single free standing greenhouses. Various greenhouse designs (gables and tunnels) can be constructed as multi-spans.

### Gable (multi-span)



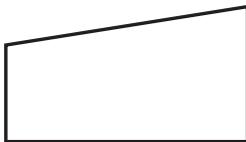
Multi-spans are efficient in terms of heat energy requirements because the total surface area is less than that needed for single spans of the same floor area. The distance from the sides to the centre of a multi-span, however, can present a ventilation problem and overheating can occur in the centre of a multi-span.

### Sawtooth



The sawtooth is erected with the vertical side of the ridges facing away from the prevailing wind. The design provides effective, natural removal of hot air from the greenhouse.

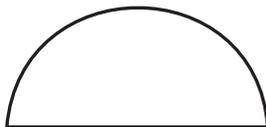
### Skillion



The flat roof design transmits the least amount of light due to the reflection of light when the sun is low.

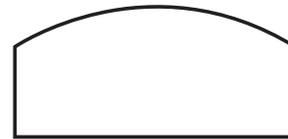
Curved roofs offer the greatest annual light transmission but ventilation is less effective as the flat 'apex' can trap hot air.

### Tunnel (igloo)



The relatively cheap igloo is the most common structure. Adequate ventilation is often lacking with this design which increases crop stress.

### Flat arch



The flat arch adds height to the tunnel structure, stabilising the internal environment and the vertical walls increase the area of useable internal space.

### Raised dome



The raised dome incorporates more height into the tunnel design. Height increases the inside volume of air which makes the environment more stable. This reduces temperature fluctuations and reduces plant stress.

Higher walls increase construction and heating costs and increase the wind load on the structure, but the advantages of height tend to over-ride any disadvantages. A rule of thumb is to have vents at least 3.6 metres above the ground level to improve natural ventilation.

### COSTS

A basic poly tunnel house costs about \$20/m<sup>2</sup>. Automation adds to the price but can provide production benefits and labour savings. Climate controlled greenhouses range in price from about \$40/m<sup>2</sup> up to \$100/m<sup>2</sup>. Glass is more expensive, but has a range of advantages, as does polycarbonate sheeting.

The amount of money invested in a structure must be considered in the context of how much is expected to be earned in the following years. Remember—horticulture is a business!

### FURTHER INFORMATION

Garzoli, K.G. (1988) *Greenhouses*, Aust. Govt. Publishing Service, Canberra.

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