Essay Competition 2015 1st Prize Winner

How do you manage your Orchid collection without relying on artificial heating and/or cooling?

By Brian Dear

"A low tech shade-house for growing orchids in a climate of extremes"

Growing a diverse range of orchids in inland regions of southern Australia is a challenge with a climate unsuitable for all but a few hardy genera. However that's part of the fascination and challenge of orchid growing, successfully growing spectacular flowering plants from exotic locations with climates vastly different to ours. It's a huge leap from the high altitude cloud forest environments of the Andes in South America to the relatively arid inland areas of southern New South Wales with its Mediterranean like climate and cold winters.

It is an even larger challenge to grow them without the expense of additional heating and cooling from external sources or a climate controlled glasshouse. Most of the published literature on orchid culture, often from the United Kingdom(1) and the United States, lists the optimum growing temperatures for many orchids, including the cooler growing types, as falling between 12°C and 28°C. Similarly, humidity levels of between 50% and 80% are quoted as optimum with statements that humidity should never be allowed to fall below 40%. If these limits were taken at face value, growing most of the unique and fascinating orchid genera from Asia and the Americas would be beyond our reach.

Fortunately this is not the case and published temperature and humidity requirements should really only be regarded as being the 'optimum values' as orchid growers have been able to push the boundaries well beyond these accepted limits. Plants may not grow as rapidly or flower as profusely outside their 'optimum' temperature range, but they can still be very rewarding for those willing to have a go and not be discouraged by the very demanding requirements often quoted.

The climate at Wagga Wagga in southern New South Wales, where I and my fellow orchid society members grow our orchids, experiences a temperature range from -6°C to 45°C. On average there are 14 days in July with a minimum ground temperature below -1°C. Mean temperature figures are not a reliable guide to the growing conditions, however, as it is the extremes that are the real temperatures that plants must cope with, as an unexpected frost, which can occur over an 8 month period, or a week of exceptionally high temperatures and very low humidity in summer, can decimate an orchid collection. A quick browse of Table 1 below demonstrates the potential to experience both very high and very low temperatures over many months of the year at Wagga Wagga. It also shows how mean monthly temperatures mask the magnitude of the range in temperatures experienced which are better demonstrated by the daily maximum and minimum values. The mean number of days with ground temperatures below -1°C shows the significant potential for frosts for each month.

Table 1. Monthly mean maximum and minimum temperatures and daily high maximum and low minimum temperatures and number of days where ground temperatures are below -1°C at Wagga Wagga, New South Wales.

	J	F	M	A	M	J	J	A	S	O	N	D
Monthly mean max	32	31	28	23	17	14	13	15	18	22	26	30
Monthly mean min	16	16	13	9	6	4	3	4	5	8	11	14
Daily high max	45	45	40	35	27	23	23	27	32	36	43	43
Daily low minimum	3	2	3	-2	-4	-5	-6	-5	-4	-2	0	3
Mean number days with ground minimum below -1°C	0	0	0	2	7	11	15	12	8	3	1	0

Based on the table, the climate would appear to significantly limit the number of orchid species that could potentially be grown in this environment, however local orchid growers have in fact successfully grown a wide range of species often with only reasonably simple structures and devices to reduce the impact of high and low temperatures to create a more favourable microclimate. This gave me the incentive to persevere.

My goal was to construct a shade house with materials that I was capable of erecting with basic carpentry skills, was relatively inexpensive to build and had nil running costs with only passive heating and cooling, but afforded me the opportunity to grow a wide variety of orchid species. Most of the ideas incorporated were gained from researching articles on the web, books(2) and helpful advice from local orchid growers. The key features of the shade-house which consists of a treated pine frame covered in shade-cloth are described below.

Shade-house location

Given the very hot summers in the Riverina, the location of the shade-house was chosen to maximize light but minimize heat load in the hottest period of the year. The shade-house was located with a deciduous flowering *Prunus nigra* on the eastern side to reduce the summer morning heat load but allow plentiful sunlight from May onwards through autumn and winter as the tree loses its leaves relatively early.

The western side is protected from the hot westerly summer winds and afternoon sun by evergreen shrubs. These also reduce cold air drainage effects in winter as they are on the upper side of the slope.

Polycarbonate roof

Many orchids like a dry winter rest period and the polycarbonate roof allows plants to be kept drier over the winter period when rainfall is highest. The roof material has a 40% shade factor that is adequate for all but the hottest four months of the year. This allows good light over winter when many orchids need higher light levels to promote flower initiation. The polycarbonate roofing material has the additional advantage of producing a more diffuse light than a similarly rated shade-cloth. The solid roof also greatly reduces the risk of frost damage in the colder months.

An additional temporary layer of 70% shade-cloth is suspended over the top of the polycarbonate roof in summer to reduce heat gain and also further restrict light levels. It is removed in autumn as days become shorter and more light and warmth is required.

Shade-house sides

The sides of the shade-house are covered with 40% shade-cloth. This allows good airflow in the warmer months. From May to August plastic horticultural grade sheeting is wrapped around the sides of the shade-house that largely seals it, although there are some small gaps for airflow. On a sunny autumn-winter day this raises the daytime temperature in the shade-house from around 12°C to 22°C. Night temperatures are little affected by the plastic but the duration of low temperatures each day is greatly reduced and providing there is sun, the shade-house warms up rapidly in the morning during autumn-winter with daytime temperatures consistently 8-12°C warmer inside the shade-house.

The bottom 30 cm of the shade-house sides have a solid fc fibre-board sheeting. This was a later addition and had a surprisingly large beneficial effect on humidity, increasing it by about 10 percentage points in summer compared to when only the shade cloth alone went down to ground level.

Floor

The floor of the shade house has a central brick path to provide additional thermal storage mass in winter and a clean walking area. The area surrounding the path has a thick layer of gravel to retain moisture and increase humidity during the warmer months.

Watering and humidity system

Hand watering is practiced where possible but an automatic watering system is also installed to allow some flexibility to travel (and to visit orchid shows). A central overhead spray system is set to drench the plants three times a week for about four minutes depending on the weather during the hottest months. The watering frequency and duration can be increased or decreased depending on ambient temperatures. A free draining potting mix containing 30% perlite is an essential part of the watering regime to ensure plants can cope with the relatively frequent watering.

In addition to the micro spays, an overhead misting system is installed to provide increased humidity and to cool the air. I have found plants can tolerate higher summer temperatures for short periods providing humidity is increased. The misters come on automatically every hour for 15 seconds between 10am and 4pm every day in hot weather. The misters raise the ambient humidity from a value of around 20% in hot weather in mid-summer to around 40-45%. Although the effect is only transitory, it does have a noticeable cooling effect.

The mister system also has an under bench micro spray system connected to it that waters the gravel and path further raising the humidity. The above ground mister can be turned off with an inline tap located in the poly pipe and only the under bench sprays are used when daytime temperatures subside to avoid wetting the plant leaves unnecessarily and encouraging fungal diseases.
To further increase humidity around the plants, large shallow gravel filled trays containing water are placed on the benches and pots are stood on these in summer.

Heat banks

Two 60 litre black poly crates under the benches are filled with water to act as a heat bank in the cooler months, absorbing heat during the day and releasing it in the evening.

Matching the right orchids to the climate

Some care must be taken to select the more cold tolerant genotypes and hybrids within each of the orchid species, however it is still possible to grow many species well outside the accepted temperature and humidity ranges frequently quoted without resorting to a more sophisticated and expensive heating and cooling system.

My low tech, low cost shade-house allows me to grow a wide range of orchid genera and species including *Beallara, Odontoglossum, Oncidium, Odontocidium, Coelogyne, Thelychiton, Cymbidium, Rhyncattleanthe, Colmanara, Dendrobium, Degarmoara, Cattleya, Laelia, Laeliocattleya, Bletilla, Miltassia, Odontioda, Potinara, Miltonia, Wilsonara* and *Vuylstekeara*.

Local growers and those from more southern regions are good sources of cold tolerant species and genotypes. Publications such as *Growing Orchids in Cool Climates of Australia*[(2)] and web articles by Brian Milligan[(3)], Ross Pascoe[(4)] and the Santa Barbara Orchid Estate[(5)] in the USA list orchids with proven cold tolerance and are a valuable guide for selecting orchids suitable for growing in a protected shade-house in cooler inland areas.

Bibliography

1. *Orchids, A Practical Handbook* by B. and W. Rittershausen (2001)
2. *Growing Orchids in Cool Climate Australia* (2nd Edn) by MJ Fraser, J Wright, W Ferris (2013)
3. *Two Cool-Growing Laelias* by Brian Milligan.
   http://www.oscov.asn.au/articles/laelia2.htm
4. *Cold Tolerant Orchids of the Cattleya Alliance* by Ross Pascoe.
   http://www.oscov.asn.au/articles/catcold.htm
5. Santa Barbara Orchid Estate web site.
   http://www.sborchid.com/sboe_collection.php?collection_name=Laelia+anceps

Figure 1. Shade-house consisting of treated pine frame with polycarbonate roof and shade cloth slides. The shade-house is wrapped in removable horticultural film secured with Velcro in cooler months with a door flap that can be folded back to prevent overheating. The deciduous tree on the eastern side shades in summer but allows the sun in during autumn-winter.

Figure 2. Base of shade-house is closed in with fc fibre-board to increase humidity.

Figure 3. Black plastic containers filled with water are placed under benches as a heat bank to store heat during the day and release it at night.

Figure 4. The automated watering system comprises a combination of overhead misters (foreground) and under bench sprays for cooling and raising the humidity and micro sprays (background) for watering.