Overwintering Container Grown Ornamentals

How can container grown plants be stored for winter? Plants produced in containers may require winter protection to protect them from desiccation and root damage from freezing. Most plants grown in regions 5 and 6 require some type of protection from freezing temperatures, although some plants with very low root killing temperatures will survive with minimum protection. The type of overwintering technique used (structureless or structure) is determined by the plant species and the ability of their roots to withstand cold temperatures during winter.

Growers must first determine the extent of winter protection required for the plants he grows. Table 1 lists some plants along with their root killing temperatures. Plants whose roots are killed at higher temperatures than the average low temperature in their area will need some type of protection. Plants with roots that can withstand colder temperatures may only need to be consolidated and the outside perimeter protected with bales of hay or bags of leaves. This can save valuable time and money compared to using more significant systems.

Following are several overwintering systems for container grown plants:

Polyhouse - This is the most common type of overwintering structure and allows the most protection to plants. A Quonset type structure is the most common and is generally 14’ wide, 7’ high in the middle, and approximately 100’ long. Construction is simple and fairly inexpensive. They are built from 3/4" galvanized water pipe or 1" heavy walled electrical conduit which is bent into a half circle (or 2 quarter circles can be connected easily when using electrical conduit) and placed at 4’ to 5’ intervals. Securing the bent pipe over steel rods hammered into the ground supports these. The ends are enclosed by plywood with vent doors placed at each end. Exact construction details can be obtained through the Cooperative Extension Office.

Polyhuts - These are similar to polyhouses but are low, copolymer-covered structures used mostly for herbaceous perennials, ground covers, and low growing woody ornamentals. The structure is 5 - 6’ wide, 4’ high, and any length. Construction is similar to the polyhouse.

Both of these structures are covered with 4 - 6 ml white polyethylene for the best protection. White polyethylene is preferred over clear poly since it reflects solar radiation and will not heat up as much at mid-day as clear polyethylene thus reducing temperature fluctuations and heat build up.
The temperature inside polyhuts has been shown to stay warmer and maintain higher relative humidity than polyhouses but the variation in temperature is greater and may be undesirable. This also means temperatures inside polyhuts will increase faster in late winter due to decreased buffering capacity. Also, it is harder to monitor and work on plants during the winter in ployhuts compared to polyhouses.
House orientation has been shown to influence the temperature inside the house. Houses oriented in a north-south direction are cooler at mid-day than houses in a east-west orientation. Houses in an east-west direction therefore have larger temperature fluctuations over the course of the day. Reducing these temperature fluctuations is important to reduce cold damage and desiccation injury. It is not uncommon for temperatures in a house covered with clear poly and oriented in a east-west fashion to approach 70°F and the leaf temperature to approach 100°F on a clear winter day with temperatures of 30°F. In this situation transpiration and plant desiccation can occur especially if the relative humidity is low and the media is frozen. It is important to maintain a high relative humidity to reduce transpiration. By using white poly and orienting overwintering structures north-south, cooler leaf and air temperatures inside the house are obtained thus reducing transpiration.

These two systems work satisfactorily for most plants. When growing plants which can sustain root injury at relatively high temperatures, such as *Ilex crenata* sp., *Ilex meserveae*, *Ilex aquifolium*,

Cotoneaster sp., Magnolia sp., Pyracantha sp. and Euonymus sp. additional protection may be necessary. This protection can include covering the plants with microfoam or a layer of clear poly. Microfoam is a flexible, high efficiency, lightweight insulation sheeting which is very effective. Another option for protecting root sensitive species grown in areas where winter temperatures are low is the concept of 'minimum heat'. In this system some type of heat is employed to keep the soil temperature at a minimum of 25°F. It is important to note that the temperature sensor should be placed in the media to determine media temperature rather than air temperature in the house.

The temperature around the inside perimeter of the house will be colder than the middle of the house. When the plants are placed pot to pot, the pots on the outside edge are only protected on 3 sides. These plants will be colder in the winter and will warm up first in the spring. If possible, place cold sensitive species in the center of the house and more tolerant species around the edge. Another approach would be to place bags of leaves or bales of hay around the outside edge of the house or place styrofoam sheets around the inside.

Structureless systems - Another method of overwintering plants is by laying protective covers directly over plants and securing the edges. These systems provide more insulating protection to the plants than structure-supported systems but are not used as commonly for several reasons. The big disadvantage of this system is you can not check the plants as easily. Once the plants are covered, they should remain sealed for the winter. Also, towards the end of the winter when day temperatures increase, venting to inhibit plant growth is more difficult. When using these systems larger plants are laid on their sides with the crowns towards the middle.

Poly-straw-poly - An older but less common method is to consolidate the plants and cover them first with a layer of clear poly, then 6" - 12" of straw, and then a layer of white poly. They straw acts like an insulation barrier, protecting the plants. A main disadvantage of this system is the straw becomes wet from condensation and clean up can be messy.

Microfoam-poly cover - A more effective and cleaner method is to consolidate the plants and cover with microfoam. White poly is laid over the microfoam and secured around the perimeter.
No covering - Some plants are root hardy enough that no protection may be necessary unless very unusual winter temperatures are experienced. Plants such as *Juniperus horizontalis* "Wiltoni", *J.* h. "Plumosa", *Picea glauca*, *Picea omorika*, and *Potentilla fruticosa* have low root killing temperatures. These plants may only need to be consolidated and left uncovered. If the area is not protected from winter winds, then it may be advantageous to protect the perimeter with bales of hay or bags of leaves. If this system has not been a regular practice at your nursery, it is advisable to try this with a few plants of each species. The advantage of this system is valuable overwintering space is freed up and your production area is increased.

Caring for overwintering plants:

Covering the plants for winter - Plants should be completely dormant or hardened off before covering for the winter. Plants begin the dormancy process by responding to the increasing length of darkness. The second stage of acclimation is caused by exposure to cold temperatures such as autumn frosts. Plants should not be covered before they have acclimated to cold temperatures. In zone 5 and 6, this is sometime in November and most nurserymen have completely covered their houses by Thanksgiving. Cover plants that are prone to stem splitting from early frosts, such as evergreen azaleas, by late October or early November as long as there is ample ventilation during sunny days.

Watering - Before covering, consolidate plants as close as possible and water well. Moist media freezes slower and releases heat compared to dry media offering protection to the roots. The moisture

level of the media should be checked during the winter and irrigated if necessary. This will also increase the relative humidity, which helps guard against desiccation. Structureless systems will not need watering if sealed properly.

Uncovering - After the plant's chilling requirement has been satisfied, plants can respond to warm temperatures. In late winter as the temperature increases, plants can deacclimate to cold temperatures. If the temperature decreases slowly, plants can reacclimate to colder temperatures but fast drops in temperature can cause cold injury to plant tissue. Although white polyethylene covered houses warm up less, vent the house by opening the end doors if the inside temperature approaches 45-50°F. Plants should not be uncovered until after the danger of subfreezing temperatures. In early spring, some nurserymen cut holes in the poly to ensure adequate ventilation while still providing adequate protection from frosts. Although difficult, it is important to check that growth of plants under structureless systems hasn't started. Depending on the materials used to protect plants they can have a high insulating value that is effective at retaining heat. Etiolated growth can occur and be very susceptible to cold injury. By uncovering, the plants will remain dormant. This can be a nuisance where mild temperatures occur periodically during the winter.

In summary, proper overwintering of container grown ornamentals is essential to maintain high plant quality. Several overwintering systems have been developed. The choice depends on capital as well as the amount of protection required by the plants. Economically, it doesn't make sense to over-provide winter protection. To overwinter plants, group the plants together, water thoroughly, and cover the plants after they have acclimated to the cold but before danger of subfreezing temperatures. Adequate moisture should be maintained and irrigation may be necessary during the winter when using some overwintering systems. Uncover the plants when temperatures begin to increase in early spring but after danger of subfreezing temperatures.

Table 1. Average killing temperatures for roots of selected species of woody ornamental plants.

Scientific Name	**Common Name**	**Killing Temperature °F**
Magnolia soulangiana	Saucer Magnolia	23
Magnolia stellata	Star Magnolia	23
Cornus florida	Flowering Dogwood	20
Daphne cneorum	Garland Flower	20
Ilex crenata 'Convexa'	Convex Japanese Holly	20
Ilex crenata 'Hetzi'	Hetz Japanese Holly	20
Ilex crenata 'Stokesii'	Stokes Japanese Holly	20
Ilex opaca	American Holly	20
Pyracantha coccinea	Fire Thorn	18
Cryptomeria japonica	Japanese Cedar	16
Cotoneaster horizontalis	Rock Cotoneaster	15
Viburnum carlesii	Korean Spice Viburnum	15
Cytisus praecox	Warminster broom	15
Buxus sempervirens	Common Boxwood	15
Ilex glabra	Inkberry Holly	15
Euonymus fortunei 'Carrierei'	Carrier Euonymus	15
Euonymus fortunei 'Argenteo-marginata'	Variegated Euonymus	15

Scientific Name	Common Name	Killing Temperature °F
Hedera helix 'Baltica'	Baltic Ivy	15
Pachysandra terminalis	Japanese pachysandra	15
Vinca minor	Common Periwinkle	15
Pieris japonica 'Compacta'	Compact Pieris	15
Acer palmatum 'Atropurpureum'	Bloodleaf Japanese Maple	14
Cotoneater adpressa praecox	Nan-Shan Cotoneaster	10
Taxus media 'Nigra'	Black Anglojap Yew	10
Rhododendron 'Gibraltar'	Gibraltar Azalea	10
Rhododendron 'Hinodegiri'	Azalea hybrid	10
Pieris japonica	Japanese Pieris	10
Leucothoe fontanesiana	Drooping Leucothoe	5
Pieris floribunda	Flowering Pieris	5
Euonymus fortunei 'Colorata'	Purple Leaf Wintercreeper	5
Juniperus horizontalis	Creeping Juniper	0
Juniperus horizontalis 'Douglasii'	Waukegan Juniper	0
Rhododendron carolinianum	Carolina Rhododendron	0
Rhododendron catawbiense	Catawba Rhododendron	0
Rhododendron P.J.M. hybrids	P.J.M. Rhododendron	-10
Potentilla fruticosa	Shrubby Cinquefoil	-10
Picea glauca	White Spruce	-10
Picea omorika	Serbian Spruce	-10

Highest temperature that killed more than 50% of root system and reduced top growth.
SOURCE: Havis, J.R. 1964. Root hardiness of woody ornamentals. HortScience 11(4):385-386.