Growing Conifers

2ND EDITION BY **JOHN MASON**

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CREDITS

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John is a well respected member of many professional associations, and author of over thirty five books and of over two thousand magazine articles. Even today, John continues to write books for various publishers including Simon and Shuster, and Landlinks Press (CSIRO Publishing).

The author, John Mason, at Monet's Garden in Giverny outside Paris.

CHAPTER 1 INTRODUCTION

The great thing about conifers is they look good all year round. Most of them are grown for foliage, and in general, foliage remains the same pretty well all year. Unlike other trees and shrubs, you do not have a month of attractive flowers, followed by an obscure plant the remainder of the year. A brilliant blue of gold foliage conifer will be blue or gold month in, month out.

There are many features which attract people to conifers. Chemicals in their foliage tend to deter many pests from attacking them and inhibit weed growth on the ground below. The heady aroma of conifer foliage is unique and for many people it is attractive.

Many conifer varieties are slow growing. While some see this as a disadvantage, it can also be an advantage. Once a conifer garden is established, the slower growth generally means the effect remains stable. Unlike fast growing shrubs, conifers are less likely to become shabby and overgrown, and require much less frequent pruning.

Callitris collumellaris

Conifers are an ancient group of plants, which were the dominant species when the world's climate was colder. The range of modern conifers is diverse, with cultivars to suit to virtually all types of climates and environments.

Even though there are more varieties to suit cold or temperate climates, there are still plenty of conifers also which grow in hotter areas (hot dry or even wet tropics).

CLASSIFICATION OF CONIFERS

There are several ways of classifying plants. Different texts that you read will classify conifers in different manners, particularly in terms of the higher or uppermost levels. There appears to be much greater consistency between the different systems at the lower levels of classification (i.e. family, genus & species).

In many texts, particularly older ones, conifers are classified in a plant division called the **"*Gymnospermae*" which** are more commonly called the Gymnosperms. This term means literally **"naked seed'** and these plants are seed producing plants where the seeds are not enclosed in an ovary. The most familiar sub-group of the gymnosperms are the conifers. This classification refers to the way in which conifer species produce ovules (which will become seeds once fertilized) as exposed immature cones or flowers. Other gymnosperms include cycads and the *Gingko*.

In more recent times the gymnosperms have commonly been split into four separate plant divisions as follows (although the general term gymnosperms is still commonly used as a collective for these four divisions):

Kingdom Plantae (The Plant Kingdom)

SUB KINGDOM	DIVISION
Bryophytes	*Bryophyta* (bryophytes)
Vascular Plants	
Seedless vascular plants	*Psilophyta* (psilopods) *Lycophyta* (lycopods) *Spenophyta* (horsetails) *Pterophyta* (ferns)
Seed Plants	*Cycadophyta* (cycads) *Ginkophyta* (gingko) *Coniferophyta* (conifers) *Gnetophyta* (gnetophytes) *Anthophyta* (angiosperms) Class Dicotyledones Class Monocotyledones

Cycadophyta

These are the cycads. Cycads have an appearance like palms, but unlike palms they do not flower. They have sluggish cambial growth, pinnately compound, palmlike or fernlike leaves, and they produce a cone in the centre of their crown (not unlike a conifer cone). Cycads are mainly subtropical southern hemisphere plants, though there are some which come from other areas. There are about 10 genera and about 100 species.

Gingkophyta

Containing only one species (Gingko biloba), which has considerable cambial growth, fan-shaped leaves, ovules and seeds exposed, with the seed coats fleshy. This species is commonly included loosely as a conifer in many gardening texts.

Ginkgo biloba

Gnetophyta

This is an isolated group of plants of three genera: *Gnetum*, *Ephedra* and *Welwitschia* which contain about 70 species. They are not commonly grown.

Coniferophyta

These are the conifers. Most are trees, and most are from cooler climates, however there are also some tropical species. They have active cambial growth and simple leaves. There are about 50 genera and 550 species (plus thousands of cultivars).

CONIFER FAMILIES & GENERA

Araucariaceae

Evergreen trees & shrubs, from Sth Hemisphere, broad or needle-like foliage. Two genera in this family: *Agathis, Araucaria*

Cephalotaxaceae

Evergreen trees or shrubs with narrow, erect, evergreen leaves, similar to *Taxus*. One genus in this family: *Cephalotaxus*

Cupressaceae

Usually heavily branching plants, trees or shrubs, upright or spreading, leaves in whorls or 3 (occasionally 4). *Genera* in this family include: *Actinostrobus*, *Callitris*, *Calocedrus* (Incense Cedar), *Chamaecyparis*, *Cupressus*, *Diselma*, *Fitzroya*, *Fokienia*, *Juniperus*, *Libocedrus*, *Microbiota*, *Neocallitropsis*, *Papuacedrus*, *Sabina*, *Tetraclinis*, *Thuja*, *Thujopsis*, *Widdringtonia*

Ephedraceae

Shrubs, twiggy growth with sparse foliage. One genus in this family: Ephedra

Pinaceae

Mainly trees, occasionally shrubs, usually with needle like foliage, from Northern hemisphere. Genera in this family include: *Abies, Cathaya, Cedrus, Keteleeria, Larix, Picea, Pinus, Pseudotsuga, Pseudolarix, Tsuga*

Larix decidua (European Larch)

Podocarpaceae

Evergreen trees & shrubs; flattened, scale or needle-like foliage. Genera in this family include: *Acmopyle, Dacrydium, Microcachrys, Microstrobos, Phyllocladus, Podocarpus*

Taxaceae

Genera in this family include: *Amentotaxus, Austrotaxus, Pseudotaxus, Taxus, Torreya*

Taxodiaceae

Tall trees, evergreen or deciduous, foliage usually arranged spirally around stems. Genera in this family include: *Athrotaxis, Cryptomeria, Cunninghamia, Glyptostrobus, Metasequoia, Sciadopitys, Taiwania, Sequoia, Sequoiadendron, Taxodium*

Welwitchiaceae

Low growing plants with a short woody stem, long leathery strap-like leaves.

One genus in this family: Welwitschia

Many conifer species are very hardy, and can survive climatic conditions. Their softwood that is easily worked, and the fast growth of some species make some conifers very valuable for their timber. While many large conifer plantations exist solely for the production of softwood products, increasingly landowners are applying agroforestry concepts to their farming practices as the benefits of such versatility comes to be better understood.

In addition, there are a huge number of conifer cultivars in an amazing array of colours, sizes, and shapes for use as ornamentals.

CARING FOR CONIFERS

Conifers require the basic care expected for all plants. This refers to the obvious requirements of fresh air, soil, water, fertiliser, correct temperature, plus general plant maintenance.

FRESH AIR

Conifers tend to originate in mountainous zones of the world. As such they have a reference for clean non-polluted air. The gardener in such a location has an advantage.

For the gardener who does not live in ideal locations, then a few steps will help in growing your conifers:

- allow plenty of space between plants to maximise ventilation
- do not locate conifers near the driveway or where cars park or idle
- reduce the use of any products that increase air pollution

Sloped land tends to have more air movement at ground surface than flat land. This feature could be utilised to help conifers grow better by aiding ventilation.

SOIL

Conifers prefer most well drained fertile soils. Excessively sandy or clay soils are generally not liked by most.

If establishing conifers on clay based soil it is important to raise the level of soil, by either importing fresh soil onto your property or by adding bulk to the existing soil (i.e. adding compost). Both methods should treat the existing soil first with gypsum powder to be dug into the clay or a liquid solution (eg. 'Clay Breaker') which is liberally applied to the soil. It is imperative to get the root system above the established water table. For this reason raised garden beds should be about 30cm minimum high. Sloped land will aid drainage, but may actually impede water penetration as most rainfall will just wash over the surface and travel downhill.

WATER

Conifers are best kept moist but never wet. Exception to this rule includes the swamp cypress (*Taxodium distichum*).

Allowing the root zone to dry out may increase sunburn damage due to the dehydration effect on the plant.

Most conifers handle the occasional dry spell well but should never be subjected to drought. Newly planted specimens should be well watered until established. It is important that young evergreen conifers receive adequate water during autumn as a dry root system in winter may be disastrous.

When watering by irrigation it is best to water in such a manner as to avoid excessive wetting of the foliage. Applying water directly to the roots, by drip irrigation or low-riser sprinklers, is regarded as a better watering technique compared to overhead watering. Wet foliage may lead to increased humidity and decline in conifer health.

MULCHING

Mulching helps to trap moisture in the soil thereby reduces the chances of drought symptoms. Additionally, watering combined with mulching will lower the soil temperature making it more conducive to conifer growth especially in the hot summer months. Mulch during winter aids in keeping freezing temperatures away from the roots.

Mulch is best kept at a depth of 10-15cm deep. It should not be in direct contact with the base of the trunk as this may increase the chances of collar rot or similar diseases. Mulch material may include pine leaves, bark chips, straw bales, pebbles, etc. Organic mulches help to improve the soil condition over time and provide small amounts of nutrient. Inorganic mulches do not add nutrient value but still conserve moisture and cool the soil.

On a sloped site, mulching will also aid rainfall and irrigation to penetrate into the soil. This also reduces the occurrence of possible erosion on such slopes.

FERTILISER

Conifers generally have a low fertility requirement. Over fertilising may cause either excessive weak growth or toxic burn. Best recommended fertilisers include organic based composted material such as compost, leaf mould or well-rotted manures.

PH

pH refers to the acidity and alkalinity of a soil. Some plants prefer acid soils (eg azaleas and camellias) and others alkaline soils (eg many herbs). Conifers are variable. An example of some pH preferred growth ranges are as follows:

PLANT	PH LEVEL
Abies balsamea	5.0-6.0
Abies excelsa	5.5-6.5
Abies picea	5.0-6.0
Chamaecyparis thyoides	4.5-5.0
Gingko biloba	6.0-7.0
Juniperus communis	5.0-6.0
Juniperus virginiana	5.5-7.0
Larix decidua	6.0-7.0
Larix laricina	5.0-6.5
Pinus rigida	4.5-5.0
Pinus silvestris	5.5-6.5
Pinus strobus	4.5-6.0
Pinus taeda	5.0-6.0
Taxus sp.	5.5-6.5
Thuja occidentalis	6.0-7.5

Preferred pH means the plants grow best in that range. Growth will still occur outside that range but will not be at optimum level.

TEMPERATURE

Most conifers benefit from a fairly uniform temperature fluctuation during the day. Extremes of day and night are locations best avoided. Varieties from cold districts are best located where they can have a prolonged winter dormant period, protected from winds.

Locations exhibiting winter shade, well drained soil and protection from drying winds is a safe guide for new conifer growers.

Consider the temperatures experienced on the site where you wish to plant a conifer. Is it exposed to full afternoon sun? Or is it full sun only in the morning?

Frost and ice damage may occur on evergreen conifers if temperatures are too low for that particular species. Deciduous twigs may also be damaged by heavy snow and low temperatures.

SUNLIGHT

Generally conifers do best in full sun. Winter shade is good for some varieties as discussed above.

Full shade will develop poor foliage coverage and possible tilted growth - the result of phototropism (where a plant grows towards a light source).

Too obtain a full bodied conifer hedge, specimen or topiary, the plant should be in full sun.

Sun scorch may occur when temperatures exceed 35°C (95°F) causing branches to die back several centimetres. If this should occur in conjunction with drought conditions, there is a very high probability of limb or even plant death.

Sunlight will effect the colour of the foliage to some degree. Yellow foliaged conifers will be more brilliant in full sun, and more lime-green in shade. Those conifers that exhibit winter colours will produce more pronounced colourations if grown in full sun. Variegated plants in shade that lose their variegation can occasionally be restored if placed in full sun.

Pinus mugo var. pumilo

WEEDS

Weeds will compete for nutrients, water and sun. Additionally they can increase humidity around the base of conifers which may lead to disease infection. They are therefore best controlled at the earliest opportunity - once established they may be hard to eradicate.

Weeds may include trees (ie trees species that are not wanted in your garden) or small annual or perennial weeds (eg clover, oxalis, bindii). Manual removal or chemical spray are best methods to control weeds.

If there is potential that weed removal may damage to roots, use another technique (ie chemical). When using chemicals be very careful with air-drift which may adversely affect a conifer.

LEAF FALL AND BROWNING

Leaf fall occurring in conifers is not necessarily a bad indicator. Remember that some genera are deciduous in nature, ie they drop leaves (needles) in winter.

When evergreen conifers drop a substantial number of leaves, this may require further investigation as to the cause. It may lack of water, disease or pest infection. Possible soil contamination may also be blamed.

Conifers like Thuja typically exhibit natural leaf browning and shedding. As the previous season's growth is not required it is shed to make way for the new, stronger growth with superior photosynthetic capabilities. In good seasons the leaf drop is not apparent as the shedding occurs over a long period of time. In cases where shedding occurs over a short period, worry is not warranted, it is just a reaction to an external influence like climatic changes.

In areas of high to medium humidity in conjunction with high temperatures, tight compact habit conifers tend to display a large proportion of internal leaf browning. This is generally an indicator that the plant is struggling in the climate and that a better plant selection should have been made. Either persist with this plant and accept the browning throughout summer, or replace it with a more appropriate conifer selection.

CONIFER PROBLEMS

Conifers are relatively pest and disease free in cold or temperate climates, though there are still some problems which may arise.

In hot humid climates, diseases can become more of a problem. In the tropics and subtropics, you are far more restricted as to the range of conifers which can be grown, and the way in which they are grown.

Humidity and prolonged warm conditions will tend to promote fungal diseases. The impact of such problems can be reduced significantly by spacing plants (to improve ventilation), and avoiding getting water onto the foliage when irrigating (as much as possible).

General plant health is important to maintain good plant health - 'a healthy tree indicates a healthy garden'. This means that if watering, fertilising, plant selection and all other plant requirements are right, then the plant will be able to fight off most problems (pests and diseases inclusive).

In cases where conifer trees have started to become a little less thrifty, then improvements in general culture need to be looked at. Consider applying a seaweed solution to revitalise the conifer. Keep the water availability high but avoid over-watering. Consider if the plant in the right climate and getting the right amount of sunshine?

SELECTED CONIFER DISEASES

DISEASE	SYMPTOM	REMEDY
Canker/Blight (*Crytospora fungi*)	Browning and death of branches from the ground up. Resin patches that are white in colour may be observed. If infected area is sawn, black fruit of fungi can be seen.	Trees can be treated only through removal of all infected branches. Pruning should not occur during wet period as this will aid the spread of the fungus. Maintaining healthy well fed trees is best prevention.
Needle blight (*Dothistroma*)	Red bands on needles on current season's growth. Black pustules will develop where conditions are favourable to the fungus. Especially prevalent during very wet or damp seasons.	Controlled by application of copper fungicides.
Needle-cast disease (*Cyclaneusma* minus)	Yellowing of needles and brown blotches occurring followed by senescence. After casting needles are covered in waxy, yellow fruits that are responsible for further spread of disease through spores.	Good pruning techniques should be used to remove infected material. Also fungicides can be used a secondary treatment – sometimes required as many as 5 times per year.

SELECTED CONIFER PESTS continued

DISEASE	SYMPTOM	REMEDY
Fungi (*Lophodermium*)	Similar symptoms to needle blight and often mistaken for this disease although by no means as destructive to tree as growth does not appear to be severely affected. Can be distinguished from needle blight by the addition of lesions found on the needles (usually black) which are not found in cases of Dothistroma.	Bordeaux mixture or any other copper spray. Use a wetting agent. Maintain good hygiene. Prune off infected material if possible.
Rusts (*Chrysomyxa ledi*)	Rust fungi that occurs in the needles of picea species. It appears as a white fungi on leaf surfaces.	Can be treated by wettable sulfur or ferbam sprays. You can use a ferbam-sulfur mixture.
Wood decay (*Fomes*, *Polyporus*, *Trametes fungi*)	These attack the tree through wounds and scars. Trees that are poorly cared for are more susceptible and if seriously infected will usually be lost.	No control is feasible in severe situations. Trees should be kept in good health if possible. Good hygiene important. Avoid wounding trees.
Root rot (*Pythium*, *Fusarium*, *Armillaria*)	Seedlings of conifers die at early age	Effective treatment is difficult. Soil drenches or fungicides can help and replace soil to a depth of 30cm.
Die back (*Phytophthera cinnamoni*)	Many pines and other conifers die back from tips. Trees prematurely die.	Try phosphoric acid or phosphite fungicide treatments.
Twig Blight (*Phomopsis juniperovora*) (*Pestaloti afunerea*)	Tips turn brown, progressively dying back till whole branch or tree is dead. Young plants under 5 years susceptible to disease. Spotting on leaves and bark	Prune out infected branches – restrict pruning and shearing to periods of dry weather. Spray with appropriate fungicides in the growing season. Try copper sprays.
Witches Broom	Causes mutation of dwarfed needles and branching.	No remedy or control is available once the fungus in on the tree, however regular pruning will help reduce the spread if spores are identified on particular areas.

SELECTED CONIFER PESTS

PEST	SYMPTOM
Aphids	Insects suck sap resulting in drying out of twigs.
Mealy Bug	Such sap resulting in discolouration of foliage
Scale	Cause discolouration and defoliation
Thrips	Yellowing of needles
Spider mites	Yellowing and drooping of needles usually in dry conditions
Caterpillars, sawflies, web worms and moths	Occasionally occur on some conifers, feeding on tender tips of foliage. Sawflies: severe infestation may defoliate trees. Web worms: tie masses of foliage together.
Borers	Burrow down centre of branches causing wilt and dieback. More prone to attack weakened conifers.
Beetles	Larvae eat bark and sapwood. More prone to attack weakened conifers.

Remedies and treatments in pest control may vary from country to country, and changes take place over time. Please consult experts/authorities in your region for current recommendations.

CHAPTER 2 PROPAGATING CONIFERS

This chapter aims to provide general information on the propagation of conifers. More specific information will often be included in the listings in this book for specific genera.

The methods commonly used to propagate conifers are fairly uniform, with a few exceptions. Seed propagation is mainly used for large scale propagation of timber species, for breeding new varieties and where there is very little variation in progeny from the parents. Cuttings produce progeny genetically identical to the parent. This is important when propagating named cultivars, or when selecting new ones to spread. Cuttings can also be taken when the parent plant may not produce viable seed, or seed is not otherwise available.

Seed propagation may require specialised treatments such as stratification (chilling the seeds) or scarification (nicking the seed coat). Germination periods may vary from days to months or even years, and growth at the early stage of a seedling can be very slow. For many of the intergeneric hybrids (hybrids between different genera), now available, seed propagation will usually yield offspring that vary considerably to that of the parent.

Cutting propagation often produces a profitable size plant more quickly.

Tissue culturing has recently been used for rare specimens. Due to the scarcity of specimens in existence, and the rarity of seed, the vast reproduction capacity of tissue culture has yielded many hundreds of new plants of such rare for distribution around the world.

SOME METHODS FOR IMPROVING THE SUCCESS OF PROPAGATION

BASAL WOUNDING

This is using a sharp knife or blade of some sort to either:

i) Place a short cut across the base of the prepared cutting. The depth of the cut will depend on the thickness of the cutting, but will generally be no more than 2-3 millimetres. The aim is to expose more of the cambium layer, which is where callusing occurs. Callusing is the growth of new plant tissue that occurs after a plant has been wounded, and it is from here that new roots will commonly develop.

ii) Take a sliver of wood from one or both sides of the stem near the base of the cutting. The cut does not need to be deep, or very long (generally no more than a centimetre or so is required), although this can vary according to the thickness of the bark, and the thickness of the cutting stem. This technique also exposes more of the cambium layer, resulting in greater callusing, and hopefully encourages greater and quicker root development.

HORMONE TREATMENT

This is the treatment of the bottom (base) of a cutting with a chemical that stimulates root development. These may be naturally occurring plant hormones or synthetic versions. Common hormones used to promote root development are indolacetic acid (IAA), indolbutyric acid (IBA), and napthaleneacetic acid (NAA).

These hormones are most commonly in a liquid or powder form. The liquid formulations can have their concentration of active ingredient readily adjusted to suit different plant species, and different stages of growth (e.g. hardwood, semi-hardwood). The powder formulations come in set concentrations and are widely used where a wide range of plants are treated using a similar concentration of hormone, when mixing different concentrations for each plant being propagated is cumbersome and time consuming, or when little is known about specific concentrations that best suit individual plants.

Liquid hormones are commonly applied in two main ways:

i) The quick dip method where the base (bottom centimetre or two) is dipped in a concentrated solution for a few seconds. This can vary from one or two seconds up to ten or so.

ii) The dilute soaking method where the bases of the cuttings are left to soak in a dilute solution of the hormone for an extended period ranging from a couple of hours up to 24 hours.

Powder hormone preparations are applied by dipping the bottom centimetre or two of the cutting into the powder and then lightly shaking off the excess powder, and then inserting the cutting into the propagation mix. Ideally, the base of the cutting should be moist so that the powder will readily stick to it. Sometimes a combination of the quick dip method using a liquid preparation is combined with a powder application - the cutting is first dipped into the liquid then this is followed up with a dip into a powdered preparation before insertion into the propagation mix.

When using hormones, start by adding a small volume into a suitable container. This should be only enough to fulfil your immediate needs. Any excess should be disposed of once you have finished the current batch of cuttings. This is to reduce the likelihood of spreading disease and to minimise the likelihood of the hormone preparation deteriorating.

STRATIFICATION

Sometimes also called cold chilling, this technique is used to overcome germination dormancy that may exist in the seed of some species. Such species commonly derive from areas subject to very cool winters. The technique involves storing the seed for a time at low temperature. The length of time will depend on the species, and when you want to sow the seed (i.e. seed is often cold chilled over winter and sown in spring). The temperature at which seed is stored is usually in the range of 2-5°C, which is approximately the temperature you will find near the bottom shelf of the average domestic refrigerator. Some seeds prefer to be stored dry, while others need to stay moist (e.g. stored in squeezed sphagnum moss).