

# BENCH TOP-WORKING OF ORNAMENTAL TREES, SHRUBS, AND CONIFERS

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A definition of top-working can be expressed as a specialized method of grafting in which the scion, either as a stem with multiple buds or as a single bud, is normally worked onto the rootstock 0.3 to 1.8 m (1 to 6 ft.) above soil level. The genera and species for top-working are varied, ranging from evergreen and deciduous shrubs, conifers, roses, and trees to ground covers.

The scope of bench top-working can be appreciated by summarizing the reasons why propagators use this method:

1. It is particularly useful for producing unusual and novel plant material. Examples of novel bench grafting combinations include *Cotoneaster horizontalis* on *C. frigidus*, *Hedera helix* 'Pixie' on  $\times$  *Fatsyhedera lizei*, *Euonymus fortunei* 'Emerald 'n' Gold' on *E. europaea*, *Juniperus chinensis* var. *procumbens* 'Nana' on *J. virginiana* and *Betula pendula* 'Trost's Dwarf' on *B. pendula*.

2. Novelties can also be described as "custom-built" trees—for example, using interstems of the attractive peeling bark of *Prunus serrula*. The *P. serrula* is grafted onto *P. avium* Mazzard 'F12/1' and then one of the Japanese hybrid cherries (such as *P. serrulata* 'Shirotae', or, for the smaller garden, *P. 'Okame'*) is grafted onto the stem of *P. serrula* at the desired height. Another good example of custom-built trees is the container production of espalier fruit trees where 3 pairs of buds are chip-budded at 38 to 45 cm (15 to 18 in) intervals up the stem. The growth resulting from each pair of buds is espaliered to produce a saleable product for retail sales after one growing season.

3. Some trees normally grow as shrubs unless top-worked onto a rootstock stem—particularly those which have a natural weeping effect. Highlighting these plants on a stem can give them a very different visual effect. Examples include, *Salix caprea* 'Pendula' on *S.  $\times$  smithiana*, *Piptanthus nepalensis* [syn. *P. laburnifolius*] on *Laburnum anagyroides*, *Acer pseudoplatanus* 'Brilliantissimum' on *A. pseudoplatanus*, and *Juniperus horizontalis* 'Blue Chip' on *J. virginiana* 'Skyrocket'.

4. With certain species, it provides the propagator with the ability to produce a saleable product within a shorter period of time.

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For example, the slow-growing *Chamaecyparis obtusa* 'Nana Gracilis' can have numerous scions grafted onto *C. lawsoniana* or *Thuja occidentalis*. This concept can be used to change cultivars of *Acer palmatum*. A five-gallon crop of *Acer palmatum* cvs. which have not sold can be changed to a more saleable cultivar by stick budding up to twenty buds to framework the rootstock.

5. It is an effective method for inducing vigorous early growth in weak species that fail with bottom-working—for example, *Quercus robur* 'Concordia'.

6. Bench top-working allows the propagator to re-work certain species that are surplus to requirements. There are often open-ground trees which require lifting and transferring into a greenhouse for top-working. For example, the weeping *Cotoneaster* × *watereri* 'Pendulus' may be conveniently top-worked onto other cultivars within the Watereri group such as *C.* 'Cornubia' and *C.* 'St. Monica', and *Laburnum anagyroides* 'Pendulum' and *Cytisus battandieri* can be conveniently top-worked onto unsold stems of *L. anagyroides*.

#### TOP-WORKING GRAFTING IN BRITISH COLUMBIA

As part of the Plant Introduction Scheme of the University of British Columbia, we are currently evaluating new and unusual scion/rootstock combinations to produce plants for retail sales. Currently being researched is a very good pink form of the low-growing *Prunus prostrata*. To date, the rootstock with which it is compatible is Myrobalan B, but we have yet to ascertain whether this vigorous rootstock has disadvantages in producing trees for small gardens and patios. Through the research work of Agriculture Canada, two of our clones of *P. glandulosa* are in the final phases of being made virus-free. We will be assessing the suitability of these two clones for top-working.

With the emphasis on retail sales, Geoff Schwyn of Westham Island Nurseries, Delta, B.C., has developed a unique product where demand has exceeded supply. First-grade layers of the apple rootstock 'M.26' or 'Quince A' are potted directly into 27 cm (10½ in.) diameter containers. Then two or three pairs of scion buds are chip-budded at about 38 cm (15 in.) intervals up the stem in late July to early August. The pairs of buds are either three distinct cultivars or just one cultivar. Budding in pairs can prove difficult as the buds may fall out from the chip before or during the tying-in procedure, but this can be prevented by placing a short length of sticky tape across the front of the bud shield and adjoining rootstock following the matching of the chip bud. This allows the propagator to tie in both buds with a strip of polyethylene tape. The following February after budding, the rootstock is headed back to just above the top pair



of buds. A pre-fabricated wooden trellis is slotted into the container adjacent to the inner wall and the subsequent lateral growth is espaliered and tied onto this trellis. The espaliered trees are sold in the following fall or spring with a colored tag label and cultural booklet attached to the wooden trellis.

Top-working of ornamental *Prunus* has been a very successful retail product for Rick Sorenson, Homestead Nurseries, Clayburn, B.C. First-grade layers of *Prunus avium* Mazzard 'F12/1' are purchased and then heeled outdoors in sawdust. The rootstocks are lifted from the holding area during January and bare-root whip, or basal root grafted and tied in with rubber grafting ties. Following waxing of the union and scion, the grafts are tied into bundles of 15 and the roots plunged into peat moss or sawdust in an unheated greenhouse. A polyethylene bag can be placed over the scion and tied in beneath the union if there is a need to increase the humidity around the union. In February, some six weeks after grafting, the rootstocks can be potted into 27 cm (10½ in.) containers and kept within the polyethylene greenhouse before being transferred to the outdoor container site. The top-worked trees are ready for sale by the following fall. The leaders and side shoots are pruned up to three times during the year in order to produce trees with full heads. Cultivars produced satisfactorily so far include *Prunus* 'Accolade', *P.* 'Okame', *P.* 'Pink Perfection', *P. serrulata* 'Shirotae' and *P. subhirtella* 'Autumnalis'.

The encouraging thing about this propagation schedule is that staff with a minimum amount of training have achieved excellent results. Criteria for success with novice staff, besides good instruction, is to ensure that only fully dormant scion wood is used by collecting it early at the turn of the year and that tying-in is tight and secure. Firm tying-in and good matching between scion and rootstock very often can compensate for uneven cut surfaces on the different grafting techniques used. A disadvantage of top-working *Prunus* is that the union can become unsightly at eye level in subsequent years.

Miniature standard conifers are becoming increasingly popular. The graft is sited some 30 to 45 cm (12 to 18 in.) above the rim of the pot. A side veneer or side wedge graft is used. Graft combinations include *Juniperus horizontalis* 'Blue Chip' and *J. horizontalis* 'Emerald Spreader' onto *J. virginiana* 'Skyrocket', *Picea pungens* 'Globosa' on *P. abies*, *Pinus mugo* 'Prostrata' on *P. sylvestris*, and *Pinus strobus* 'Nana' on *P. strobus*.

Through the understanding of growth habits and graft compatibility, bench-top grafting provides the opportunity for the propagator to use his or her ingenuity. This paper provides some of the principles involved and some specific examples being used in British Columbia. The appendix to this paper provides a selection of effective scion/rootstock combinations for top-working.

A SELECTED LIST OF SCION/ROOTSTOCK COMBINATIONS  
FOR ORNAMENTAL DECIDUOUS AND EVERGREEN BROAD-  
LEAVED TREES, SHRUBS, AND CONIFERS SUCCESSFULLY  
PROPAGATED BY TOP-WORKING

NOTE:—The grafting times in this list have been taken as an optimum range for both North America and Europe. The geographical location of a nursery may mean that grafting is carried out before (or after) the times listed here.

Scion	Rootstock	Time of Year	Bare-Root (B.R.) or Pot-Grown (P.G.)	Type of Graft
<i>Cedrus atlantica</i> 'Glauca Pendula' (weeping blue Atlas cedar)	<i>C. deodara</i> (Himalayan cedar)	late July– Aug or Jan–Feb	P.G.	Side
<i>Chamaecyparis obtusa</i> 'Nana Gracilis' (dwarf Hinoki cypress)	<i>C. lawsoniana</i> (Lawson cypress) <i>C. pisifera</i> (Sawara cypress)	Jan–Feb	P.G.	Side
<i>Juniperus horizontalis</i> 'Blue Chip'	<i>J. virginiana</i> 'Skyrocket' (skyrocket juniper)	Jan–Feb	P.G.	Side
<i>J. horizontalis</i> 'Emerald Spreader' (creeping juniper cvs.)	<i>J. virginiana</i> 'Skyrocket'	Jan–Feb	P.G.	Side
<i>J. horizontalis</i> 'Wiltonii' (Wilton carpet or blue rug juniper)	<i>J. virginiana</i> 'Skyrocket'	Jan–Feb	P.G.	Side
<i>J. procumbens</i> 'Nana' (Dwarf Japan garden juniper)	<i>J. virginiana</i> 'Skyrocket'	Jan–Feb	P.G.	Side
<i>J. sabina</i> 'Buffalo'	<i>J. virginiana</i> 'Skyrocket'	Jan–Feb	P.G.	Side
<i>J. sabina</i> 'Calgary Carpet' (savin juniper cvs.)	<i>J. virginiana</i> 'Skyrocket'	Jan–Feb	P.G.	Side
<i>J. scopulorum</i> 'Tolleson's Blue Weeping' (Rocky Mountain juniper cv.)	<i>J. virginiana</i> 'Skyrocket'	Jan–Feb	P.G.	Side
<i>J. squamata</i> 'Blue Star'	<i>J. virginiana</i> 'Skyrocket'	Jan–Feb	P.G.	Side

Scion	Rootstock	Time of Year	Bare-Root (B.R.) or Pot-Grown (P.G.)	Type of Graft
(Single-seed or scaly-leaved Nepal juniper cv.)				
<i>Larix decidua</i> 'Pendula' (weeping European larch)	<i>L. decidua</i> (European larch)	Jan–Feb	P.G.	Side
<i>L. kaempferi</i> 'Pendula' (weeping Japanese larch)	<i>L. kaempferi</i> (Japanese larch)	Jan–Feb	P.G.	Side
<i>Picea abies</i> 'Inversa' (drooping Norway or drooping spruce)	<i>P. abies</i> (Norway spruce)	late July–Aug or Dec–Feb	P.G.	Side
<i>P. pungens</i> 'Globosa' (globe Colorado blue spruce)	<i>P. abies</i>	late July–Aug or Dec–Feb	P.G.	Side
<i>Pinus mugo</i> 'Prostrata Wells' (Wells' prostrate mugo pine)	<i>P. sylvestris</i> (Scots pine)	Nov–Jan	P.G.	Side
<i>P. strobus</i> 'Nana' (dwarf white pine)	<i>P. strobus</i> (eastern white pine)	Nov–Jan	P.G.	Side
<i>P. sylvestris</i> 'Glauca Nana' (dwarf blue scots pine)	<i>P. sylvestris</i>	Nov–Jan	P.G.	Side
<i>Acer palmatum</i> 'Burgundy Lace'	<i>A. palmatum</i> (Japanese maple)	July–Aug or Jan–Feb	P.G.	Side
<i>A. palmatum</i> 'Dissectum' and similar cvs. (Japanese maple cvs.)				
<i>A. platanoides</i> 'Globosum' (globe Norway maple)	<i>A. platanoides</i> (Norway maple)	Jan–Feb	P.G. or root-balled	Side
<i>A. pseudoplatanus</i> 'Brilliantissimum'	<i>A. pseudoplatanus</i> (sycamore maple)	Jan–Feb	P.G. or root-balled	Side or Whip
<i>A. pseudoplatanus</i> 'Prinz Handjery' (sycamore maple cvs.)				
<i>Aesculus × carnea</i> 'Briotii' (ruby horse-chestnut)	<i>A. hippocastanum</i> (common horse-chestnut)	Jan–Feb	P.G. or root-balled	Side or Whip

Scion	Rootstock	Time of Year	Bare-Root (B.R.) or Pot-Grown (P.G.)	Type of Graft
<i>A. pavia</i> 'Koehnei' (red buckeye cv.)	<i>A. hippocastanum</i> <i>A. pavia</i> (red buckeye)	Jan–Feb	P.G. or root-balled	Side or Whip
<i>Betula nana</i> (dwarf birch)	<i>B. pendula</i> (European white or common silver birch)	Jan–Feb	P.G.	Side
<i>B. pendula</i> 'Youngii' (Young's weeping birch)	<i>B. pendula</i>	Jan–Feb	P.G.	Side
<i>B. pendula</i> 'Trost's dwarf'	<i>B. pendula</i>	Jan–Feb.	P.G.	Side
<i>Caragana arbores-</i> <i>cens</i> 'Pendula' (weeping Siberian pea shrub)	<i>C. arborescens</i> (Siberian pea shrub)	Jan–Feb	P.G.	Whip
<i>C. arborescens</i> 'Walker' (Walker Siberian pea shrub)	<i>C. arborescens</i>	Jan–Feb	P.G.	Whip
<i>C. frutex</i> 'Globosa' (Russian pea shrub cv.)	<i>C. arborescens</i>	Jan–Feb	P.G.	Whip
<i>Catalpa</i> <i>bignonioides</i> 'Aurea' (golden Indian bean)	<i>C. bignonioides</i> (Indian bean) <i>C. speciosa</i> (western catalpa)	Jan–Feb	Balled & burlapped	Whip
<i>C. bignonioides</i> 'Nana' (umbrella catalpa)	<i>C. bignonioides</i> <i>C. speciosa</i>	Jan–Feb	Balled & burlapped	Whip
<i>Corylus avellana</i> 'Contorta' (Harry Lauder's walking stick)	<i>C. colurna</i> (Turkish Filbert)	Jan–Mar	B.R.	Whip
<i>C. avellana</i> 'Pendula' (weeping European filbert or hazelnut)	<i>C. colurna</i>	Jan–Mar	B.R.	Whip
<i>C. maxima</i> 'Purpurea' (purple giant filbert)	<i>C. colurna</i>	Jan–Mar	B.R.	Whip
<i>Cotoneaster</i> <i>adpressus</i> var. <i>praecox</i>	<i>C. bullatus</i> (hollyberry cotoneaster)	Jan–Feb	P.G.	Whip



Scion	Rootstock	Time of Year	Bare-Root (B.R.) or Pot-Grown (P.G.)	Type of Graft
(early cotoneaster)	<i>C. frigidus</i> (Himalayan cotoneaster) <i>C. × watereri</i> cvs. (Waterer cotoneaster)			
<i>C. horizontalis</i> (rock cotoneaster, rockspray)	<i>C. bullatus</i> <i>C. frigidus</i> <i>C. × watereri</i> cvs.	Jan–Feb	P.G.	Whip
<i>C. × watereri</i> 'Pendulus' [syn. <i>C.</i> 'Hybridus Pendulus']	<i>C. bullatus</i> <i>C. frigidus</i> <i>C. × watereri</i> cvs.	Jan–Feb	P.G.	Whip
<i>Crataegus laevigata</i> 'Gireoudii' (English hawthorn cv.)	<i>C. laevigata</i> 'Paulii' (Paul's scarlet hawthorn)	Jan–Mar	B.R.	Whip
<i>C. monogyna</i> 'Flexuosa' (common hawthorn cv.)	<i>C. laevigata</i> 'Paulii'	Jan–Mar	B.R.	Whip
<i>Cytisus battandieri</i> (Atlas or Moroccan broom)	<i>Laburnum anagyroides</i> (Common Laburnum)	Jan–Feb	P.G.	Inlay or Whip
<i>C. scoparius</i> cvs. (Scotch broom)	<i>Laburnum anagyroides</i>	Jan–Feb	P.G.	Inlay or Whip
<i>Elaeagnus pungens</i> 'Maculata' (golden elaeagnus)	<i>E. umbellata</i>	Jan–Mar	P.G.	Side
<i>Euonymus fortunei</i> 'Emerald 'n' Gold' (winter creeper euonymus cv.)	<i>E. europaeus</i> (European spindle tree)	Jan–Feb	P.G.	Side
<i>Fagus sylvatica</i> 'Purpurea Pendula' (weeping copper beech)	<i>F. sylvatica</i> (European beech)	Jan–Feb	P.G.	Side
<i>Fraxinus excelsior</i> 'Pendula' (weeping European ash)	<i>F. excelsior</i> (European ash)	Jan–Feb	P.G.	Whip

Scion	Rootstock	Time of Year	Bare-Root (B.R.) or Pot-Grown (P.G.)	Type of Graft
<i>Hedera helix</i> 'Pixie'	× <i>Fatsyhedera lizei</i> (botanical-wonder)	Aug Oct–Nov	P.G.	Side
<i>H. helix</i> 'Silverdust' (English ivy cvs.)				
<i>Hibiscus syriacus</i> 'Hamabo' (rose-of-Sharon cv.)	<i>H. syriacus</i> (Rose-of-Sharon)	Jan–Feb	P.G.	Whip, Wedge
<i>Laburnum alpinum</i> 'Pendulum' (weeping golden-chain or Scotch laburnum)	<i>L. × watereri</i> 'Vossii' (Voss' Long-cluster golden-chain tree)	Jan–Mar	B.R.	Whip
<i>Malus prunifolia</i> 'Pendula' (weeping plum-leaved apple)	M.M. 106 <i>M. 'Bittenfelder'</i>	Jan–Mar	P.G. or B.R.	Whip, Whip & Tongue
<i>M. 'Royal Beauty'</i>	<i>M. sylvestris</i> (crab apple, French crab)	Jan–Mar	P.G. or B.R.	Whip, Whip & Tongue
<i>Morus alba</i> 'Chaparral'	<i>M. alba</i> var. <i>tatarica</i> (Russian mulberry)	Jan–Mar	B.R.	Side
<i>M. alba</i> 'Pendula' (weeping mulberry)				
<i>M. alba</i> 'Venosa' (white mulberry cvs.)				
<i>M. bombycis</i> 'Issai'	<i>M. alba</i> var. <i>tatarica</i>	Jan–Mar	B.R.	Side
<i>M. latifolia</i> 'Spirata'	<i>M. alba</i> var. <i>tatarica</i>	Jan–Mar	B.R.	Side
<i>Piptanthus nepalensis</i> (evergreen laburnum) [syn. <i>P. laburnifolius</i> ]	<i>Laburnum anagyroides</i> (common laburnum)	Jan–Mar	B.R.	Whip
<i>Prunus × cistena</i> (purple-leaf sand cherry)	<i>P. c. 'Myrobalan B'</i> (Myrobalan plum) <i>P. c. 'Myrobalan B'</i> <i>P. mahaleb</i> (Mahaleb cherry)	Jan–Feb	P.G., B.R.	Whip
<i>P. fruticosa</i> 'Globosa' (European cherry or ground cherry cv.)	<i>P. avium</i> (mazzard, gean cherry)	Jan–Mar	B.R.	Whip



Scion	Rootstock	Time of Year	Bare-Root (B.R.) or Pot-Grown (P.G.)	Type of Graft
<i>P.</i> 'Okame'	<i>P. avium</i> Mazzard 'F12/1'	Jan–Feb	P.G., B.R.	Whip
<i>P. serrulata</i> 'Shirofugen'	<i>P. avium</i> <i>P. avium</i> Mazzard 'F12/1'	Jan–Mar	B.R.	Whip
<i>P. subhirtella</i> 'Pendula Plena Rosea' (double weeping rosebud cherry)	<i>P. avium</i>	Jan–Mar	B.R.	Whip
<i>P. triloba</i> 'Multiplex' (flowering almond cv.)	<i>Prunus cerasifera</i> Myrobalan 'B' <i>P. cerasifera</i> St. Julien 'A', 'Brompton'	Jan–Feb	B.R.	Whip
<i>Rhododendron</i> 'Elisabeth Hobbie'	<i>R.</i> 'Anna Rose Whitney'	Jan–Mar	P.G. or root-balled	Side
<i>Robinia hispida</i> var. <i>macrophylla</i> (smooth rose acacia)	<i>R. pseudoacacia</i> (black locust)	Jan–Feb	P.G.	Whip, Whip & Tongue
<i>R. pseudoacacia</i> 'Umbraculifera' (mop-head acacia)	<i>R. pseudoacacia</i>	Jan–Feb	P.G.	Whip, Whip & Tongue
<i>Rosa</i> 'Dorothy Perkins'	<i>R. canina</i> 'Pfander' (dog rose cv.)	Jan–Feb	P.G. or B.R.	Whip, Rind
<i>R.</i> 'Little Buckaroo'	<i>R. multiflora</i> (baby or Japanese rose) <i>R. canina</i> 'Inermis' (dog rose cv.)	Jan–Feb	P.G. or B.R.	Whip, Rind
<i>R. moyesii</i> (Moyes' Rose)	<i>R. canina</i> 'Pfander'	Jan–Feb	P.G. or B.R.	Whip, Rind
<i>Salix caprea</i> 'Pendula' (Kilmarnock willow)	<i>S. × smithiana</i>	Jan–Mar	B.R.	Whip
<i>S. hastata</i> 'Wehrhahnii' (halberd-leaved willow cv.)	<i>S. × smithiana</i>	Jan–Mar	B.R.	Whip
<i>S. helvetica</i> (Swiss willow)	<i>S. × smithiana</i>	Jan–Mar	B.R.	Whip
<i>S. purpurea</i> 'Pendula' (weeping purple	<i>S. × smithiana</i>	Jan–Mar	B.R.	Whip

Scion	Rootstock	Time of Year	Bare-Root (B.R.) or Pot-Grown (P.G.)	Type of Graft
willow)				
<i>Sophora japonica</i> 'Pendula' (weeping Japanese pagoda tree)	<i>S. japonica</i> (Japanese pagoda tree)	Jan–Feb	P.G.	Side
<i>Ulmus</i> × <i>elegantissima</i> 'Jacqueline Hillier'	<i>U. glabra</i> (Scotch or Wych elm)	Jan–Feb	P.G.	Whip, Whip & Tongue
<i>U. × glabra</i> 'Camperdownii' (Camperdown elm)	<i>U. glabra</i>	Jan–Feb	P.G.	Whip, Whip & Tongue
<i>U. glabra</i> 'Crispa' (fern-leaf elm)	<i>U. glabra</i>	Jan–Feb	P.G.	Whip, Whip & Tongue
<i>U. glabra</i> 'Nana' (Scotch elm cv.)	<i>U. glabra</i>	Jan–Feb	P.G.	Whip, Whip & Tongue
<i>U. parvifolia</i> 'Geisha'  (Chinese elm cv.)	<i>U. glabra</i>	Jan–Feb	P.G.	Whip, Whip & Tongue
<i>Wisteria venusta</i> (silky wisteria)	<i>W. sinensis</i> (Chinese wisteria)	Jan–Feb	P.G.	Side

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