

Tools of the Trade



Conifer Understocks From *Abies* Through *Tsuga*

Grafting involves attaching a twig from the desired plant to a seedling that is compatible with that twig. After the twig combines with the seedling (cambiums grow together), the portion of the seedling above the graft union is removed, and the twig becomes a Dr. Frankenstein sort of plant with the twig using the seedling's root system as its own.

The twig is called a scion, while the seedling is called an understock. The origin of the term scion can be traced back to its definition as "the descendant of a notable family". However, the source of the term understock is more evident since it is the lower or underpart of the newly created plant.

Here I want to focus on conifer grafting. I will have comments on deciduous grafting in a future newsletter.

The choice of understock is relatively simple, but some considerations need to be followed. The species of the cultivar must be related to the seedling's species, and the process of grafting can have various effects on the resultant plant.

Cultivars of *Abies* (true firs) are compatible with any of the various *Abies* species of understock. However, the actual selections are restricted to a few species mainly due to availability considerations.

For example, three fir species are most commonly used in North America. *Abies balsamea* is possibly the most popular species used. The plants

created cannot be grown in warmer climates as the roots cannot withstand constant high temperatures and hot sun. *Abies fraseri* is preferred in the northwest since greenhouses are exceptionally humid during the grafting season, and winters are mild and wet. This species appears to tolerate these conditions better than *balsamea*. Cultivars propagated on this species can be grown in a broader range of climates.

Abies concolor has always been a popular understock in the northeast, but it performs poorly throughout the northwest, primarily when grown in containers.

I used *Abies procera* as an understock for *Abies procera*, *concolor*, and *lasiocarpa*. They perform well and do not develop a large burl of callous tissue at the graft union, which can occasionally happen with other species' understocks.

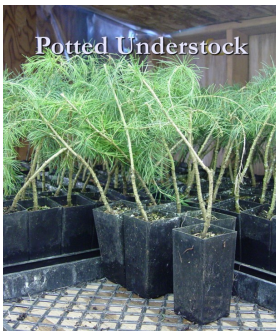
Abies koreana is a popular understock throughout much of Europe. It would probably be more extensively used in America, but the seedlings are not widely grown. As my *Abies koreana* cultivars matured in my Eatonville garden, I collected cones and grew many seedlings. I found them compatible with my fir grafts, and they seldom formed knots at the graft unions with other species.

The big push today is for firs grafted onto *Abies firma*, especially for the southeastern United States. Supposedly it adapts to the climate better than other firs. Personally, I

doubt that very much. Root systems have a different climate from that of the foliage and stems. Firs cannot tolerate heavy clay soils. However, some species are more tolerant than others. I believe that *Abies firma* fits in that category. For example, if a cultivar of *Abies koreana* or *Abies nordmaniana* can survive in the southeastern heat and humidity when grafted on *Abies firma*, then the climate is not the limiting factor for those species and their root systems should not have a problem with the climate either. The soil climate has to do with moisture content and aeration. Roots that can tolerate poor soil conditions may do better in southern soils and *Abies firma* may fit that criteria whereas others may not.

A true test would be to select five fir species to use as understocks, including *Abies firma* as one of them. Select five different cultivars and graft 25 of each onto each different understock. Then create five groups of grafted plants for testing (125 plants in each group with each species of understock having 5 each of 5 different cultivars). Prepare one field so that it has optimum growing conditions and line out one group of plants and record survivability and growth rates. Plant the other four groups into different fields with different growing conditions and do the same recording. That type of a controlled experiment should demonstrate whether or not *Abies firma* is

Potted Understock



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needed for southern fir growth. Just working with a scattering of firs throughout an area does not answer that question. Neither does working with just a few individual plants. There are too many variables, especially if the plants are container grown.

Cedrus atlantica, *brevifolia* and *libani* are all grafted onto *Cedrus deodara*, the least hardy of the three. There are several reasons for this choice. First, the hardiness is not a factor since the *deodara* root system in the ground is at least as hardy as any species of *Cedrus* cultivar above ground. Secondly, the root system is more fibrous and better developed than the other species making it a much better choice for nursery use.

Chamaecyparis species are relatively easy to propagate from cuttings, so grafting is seldom used as a propagation method. *Chamaecyparis obtusa* (hinoki cypress) is compatible with *Chamaecyparis lawsoniana* and *Thuja occidentalis*. Since *Chamaecyparis lawsoniana* has disease problems, it is not used in North America as an understock. In Europe, it works well but eventually creates a deformed graft union when it develops a much larger diameter than the cultivar.

Chamaecyparis obtusa is often grafted for two reasons. First, it will grow faster than a rooted plant and become saleable in a shorter period of time. Eventually, the growth rate will return to normal. Secondly, when it is grafted onto *Thuja occidentalis*, it can be grown in heavier or

wetter soils.

Chamaecyparis lawsoniana has limited use in America due to disease entering the root systems. Grafting could prevent this problem and allow the wide use of hundreds of cultivars nationwide. There is no control for this disease but researchers have found a *Phytophthora lateralis* resistant strain of Lawson cypress. Nurseries are growing the plants from cuttings and using them as understocks for the propagation of cultivars by grafting. It is very important not to let the graft union come in contact with the soil or the plant above the union will send out its own roots and contract the disease. Grafting onto a disease resistant understock is a process that may make this species and its treasure house of cultivars very popular in much of the United States.

Cupressus macrocarpa and *glabra* can occasionally be rooted but are most commonly propagated by grafting since rooting of cuttings is an inconsistent process and the plants cannot be grown in the field for digging when sold. Those species have terrible root systems and once planted must stay put. Some propagators contend that they can be grafted onto *Juniperus* or *Thuja occidentalis*. However, there is a strong tendency for *Cupressus* propagated in this manner to overgrow the understock and be very susceptible to blow over. *Cupressus x-leylandii* has been used in Australia for

many years, and I also used it for my understock. The compatibility is excellent, with no understock overgrowth and a sound root system supporting the growing tree.

Juniperus cultivars are compatible with any *Juniperus* species, but few are grafted since most cultivars are relatively easy to root. On the other hand, *Juniperus virginiana* cultivars are difficult to root and generally grafted. The understocks most commonly used are *Juniperus x-pfitzeriana* 'Hetzii' or *Juniperus scopulorum* 'Moonglow' or 'Skyrocket'. They all root easily and rapidly grow into a graftable size.

Larix cultivars can be grafted onto any of the species. However, if a dwarf selection is grafted as a standard, the understock may not develop the necessary caliper to support the plant without falling over. This issue is especially true for the Newport series of dwarf selections. The higher the graft, the more severe the problem. It can be alleviated by leaving branches along the trunk for several years.

Spruce (*Picea*) cultivars may be grafted onto any species of spruce understock. *Picea abies* is the most abundant understock grown from seed and is most commonly used. *Picea pungens* is also used by many growers in the northwest because it develops a more fibrous root system on plants that are field grown in the nursery.

Pine cultivars are best grafted onto seedlings with the



This picture shows the graft union between *Cupressus glabra* 'Chaparral' and its understock of *Cupressocypripus x leylandii* 'Star Wars', a variegated sport from 'Castlewellan'. Notice how there is a nice size balance between the tree and the understock.



Insert Scion

The origin of the term scion can be traced back to its definition as “the descendant of a notable family”.



Tie Tight

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same number of needles per fascicle as the cultivar.

Pinus strobus is the most common understock used in North America for species cultivars with five needles per fascicle. *Pinus peuce* is used in parts of Europe, and *Pinus parviflora* is occasionally used as an understock for *Pinus parviflora*. I have seen large specimens of *Pinus parviflora* grafted onto *Pinus strobus* that were healthy even if the trunk of the parviflora had a 12” diameter and the *Pinus strobus* understock had an 18” diameter. Such a thing can be unsightly on older plants with a high graft union, but *Pinus parviflora* seedlings are expensive and hard to find.

Pinus thunbergiana is used by some people as an understock for *Pinus parviflora* since it gives a higher salt tolerance to the plant. Bonsai growers especially like this combination; it even works with some five-needled pine species. However, there is a lower grafting success rate, and some plants die each year due to delayed scion/understock incompatibility. I heard a story about a bonsai master in Japan who was showing his collection to a visitor. The visitor touched an old specimen of *parviflora*, which broke at the graft union. The Master told him not to worry. It was an effect of using *thunbergiana* understock on *parviflora*.

Pinus bungeana is a three-needle pine and only grafts successfully onto five-needle understock. I used *Pinus strobus* with great success.

The two-needle pines are fairly well inter-compatible, but different grafters have different preferences. For example, *Pinus sylvestris* is a universal understock used worldwide, with the Spanish strain preferred due to its superior root system. *Pinus nigra* is used by many nurseries for all two-needle pines with success. I have found that *Pinus contorta v. latifolia* (lodgepole) is an excellent universal understock for two-needle pines and is by far the root hardiest of them all. I have had good luck with ‘Frisian Gold’ and ‘Chief Joseph’ using this understock when other species have failed. *Pinus thunbergiana* is another universal understock but is the least hardy of the group.

Some grafters like to put *Pinus leucodermis*, *mugo*, *nigra*, *virginiana*, and *thunbergiana* onto *nigra* and the others onto *sylvestris*. However, using too many different kinds of understocks increases expenses and impacts production schedules, so most grafters like using the fewest possible.

Pseudotsuga menziesii (Douglas fir) is usually grafted onto hardy strains of the species grown from seed harvested from the mountains of the western United States. As a result, the cultivars don’t show many compatibility problems since most of the cultivars originated from the hardier varieties of the species.

Tsuga canadensis should never be propagated by grafting. There is always a delayed incompatibility problem with this

species. If 100 plants are grafted, count on several deaths yearly until 10-20 attain a mature size before eventually dying. Since cultivars from this species do root, that is how they all need to be propagated.

Taxus (yews) root from cuttings with a few exceptions among the *Taxus baccata* that need to be grafted. *Taxus media* ‘Hicksii’ is a common understock since it is compatible and readily roots from cuttings.