Top Grafting of *Salix*

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INTRODUCTION

Miniature standard willows are attractive small trees, and they lend themselves well to smaller gardens. Because of the varying forms of crowns, as well as, the shape and color of the leaves and flowers (catkins), these miniatures can be part of garden landscape throughout the year.

Small willow standards are produced by top-working the attractive shrubby willows. Most often scions are used from the creeping mountain taxa, and they are grafted onto strong growing willows. Grafted standards have an overall height between 30 and 170 cm and a small crown.

GRAFTED SELECTIONS

Most commonly known grafted standards are *Salix caprea* 'Klimarnock' and *S. integra* 'Hakuro-nishiki'; however, there are over 30 interesting species and cultivars which are propagated as standards.

Salix alpina has weeping shoots, covered with oval, slightly hairy leaves with wavy edges. It naturally grows in the Alps and high parts of the Carpathians. It is a ground-hugging plant among the rocks and is very frost resistant.

Salix arbuscula has short shoots, is strongly branching outward and slightly weeping. Shoots are covered by a densely clustered mass of green, glossy leaves. The average-sized catkins appear in May with the first leaves; in full bloom they are a golden color. This species is very attractive and suitable for planting in rock gardens. The most prevalent disease symptom is stained leaves.

Salix bockii has shoots which spread out over the sides and are covered by small leaves. Leaves are dark green on the top and silvery on the bottom. Plenty of small, spreading gray catkins appear in the autumn. The shoots will freeze at -15C and have to be covered before the winter.

Salix brevipens has free-growing shoots, slightly weeping. They are densely covered by narrow elliptical leaves; dark green on the top and lighter on the bottom. Small, pretty catkins bloom with the first leaves; a slow-growing willow.

***Salix caprea* 'Kilmarnock'**, also known as 'Pendula', has a dignified crown which looks like an umbrella. Its stiff shoots firmly pressed down towards the ground. 'Kilmarnock' is covered by large leaves that are green at the top and grayish green on the bottom. Large silvery catkins (up to 4.5 cm) appear in March long before the leaves. It is a male clone and the stamens are golden yellow in full bloom.

***Salix caprea* 'Curly Locks'**, a sport *S. caprea* 'Klimarnock', is distinguished from the latter by imaginative curly shoots. It looks very nice and has been extremely popular in many countries the last few years.

***Salix cinerea* 'Tricolor'** has upright growing shoots covered by long oval-shaped, green-red-white leaves. It becomes picturesque in the garden. 'Tricolor' is a strong-

growing willow which requires pruning back 3 to 5 times during the growing season. This pruning reduces the surplus growth of shoots and provides favorable conditions for more colorful shoots.

Salix* ×*cottetti has weeping shoots covered by elliptical, dark green, glossy leaves. Only the male clone is cultivated. It produces (before the leaves develop) a mass of medium-sized (1-1.5 cm) golden catkins.

Salix* ×*finnmarchica is covered by small (to 2.5 cm), oval, blue-green leaves and has red hanging shoots. Catkins are small and appear just before the leaves. Only the female clone is cultivated. This plant looks similar to some *Cotoneaster* or *Vaccinium* plants. It is suitable for rock gardens.

Salix foetida has hanging shoots, covered by dark green leaves, with sharp edges. Catkins unfold together with the leaves. This species grows naturally in the Alps and Pyrenees.

***Salix* ×grahamii** has hanging shoots covered by elliptical-shaped, dark green, glossy leaves with wavy edges. Catkins bloom together with the leaves. This natural cross (*S. aurita* × *S. herbacae* × *S. repens*) was found in Scotland.

***Salix hastata* 'Wehrhahnii'** is an upright, slow-growing plant covered at the start by silky, mossy leaves, which turn dark green in the summer. It has beautiful white, cotton-like hair, large (4 to 7 cm) catkins, and when in full bloom is covered by golden stamens.

Salix helvetica is a beautiful plant with silvery leaves, and rising, thick twisting shoots, which in early growth are covered by a silvery nap. Large hairy catkins (3 to 4 cm) appear together with the first leaves. It grows naturally in the Alps and Tatry Mountains. It is very sensitive to rust.

***Salix integra* 'Hakuro-nishiki'** is a plant that grabs one's attention thanks to the white, rose, and green colored leaves. The leaves look beautiful on young shoots, especially in places where there is a lot of humidity in the air (worth pruning often for new growth). The red shoots look nice when they are without leaves. Catkins are small and bloom just before the leaves. During very cold winters the shoots can be injured.

***Salix integra* 'Pendula'** has weeping shoots covered by oval, green, lightly rose-colored leaves when they are young. Its red shoots are attractive before leaves appear. Catkins are small and bloom just before the leaves. During very cold winters the shoots can be injured. This willow has much charm and airy quality.

Salix lanata is a slow-growing, stiffly branched willow. The large (4 to 6 cm), elliptically shaped leaves are covered with nap — very interesting. The winter buds are spherical and covered with yellow glossy scales, quite unusual. The large, yellowish green, hairy catkins (6 cm) bloom in May amongst the leaves.

Salix moupinensis is an exotic-looking plant; thick, red shoots branch out and give the appearance of horns. The winter buds are long, dark brown, and glossy. The leaves are oval, 6 to 20 cm long; when young they are partly purple, later after maturation they become dark green and glossy with a distinctive marked venation. In the spring, long catkins (more than 10 cm) bloom. It is native to China and is frost resistant.

Salix nakamura* var. *yezoalpina is the most beautifully colored willow in the autumn. Weeping shoots are covered with large (up to 8 cm) dark green leaves in the summer changing to golden yellow in the fall. The large (up to 8 cm) male catkins appear with the leaves.

***Salix purpurea* 'Pendula'** is a charming tree with a loose, elegantly weeping crown. It has thin shoots covered with tiny, narrow leaves.

Salix pyrenaica has stems which form a dense spherical crown with lightly hanging shoots. The leaves are rounded, slightly mossy with undulating edges. Catkins are dark green and unassuming. It comes from the Pyrenean Mountains.

Salix repens* var. *argentea has a weeping crown decorated with leaves having a very densely set silvery-blue pubescence.

***Salix repens* 'Bergen'** has thin, strongly weeping spread shoots. It is covered by small, elongated, dark green leaves.

***Salix* 'Boyd's Pendulous' (syn. *S. repens* 'Boyd's Pendulous')** is a male clone, with long weeping shoots, covered by wide oval-shaped green leaves. It produces a very narrow crown.

***Salix repens* 'Iona'** has a nice, wide, crown weeping covered by oval, dark green glossy leaves. Male catkins bloom before the leaves and create a golden halo around the willow.

***Salix repens* 'Voorthuizen'** has thin, weeping, strongly spread shoots. Shoots are covered by tiny silky green leaves.

Salix subopposita has dense foliage and a naturally rounded crown. Leaves are broadly lanceolate glabrous above and glaucous beneath. Small silky white catkins (approximately 2 cm) bloom before the leaves and are decorative for a long time (over a month). The male catkins are especially golden when fully developed. Species is native to Japan and South Korea.

Salix tarraconensis is a slow-growing species. Spreading shoots are covered with interesting leaves which are small and rounded with undulating edges. Catkins are small (0.5 to 1 cm) but very numerous, blooming before the leaves.

PROPAGATION

Propagation of willows is simple and very quick. Even when top grafting willows on a rootstock with no roots, one can obtain a marketable plant in about 5 to 6 months.

The best rootstock for us is *S.* ×*smithiana*. It produces long straight shoots, roots readily, and is compatible with the majority of species, varieties, and cultivars. When seating the mother stock, the hardwood cuttings are made and lined out in the field. In the 2nd year after the lining, provided the conditions are good, shoots sprout over 2 m long which make them perfect for grafting. The mother stock can be exploited at least 5 more years.

One can graft from January until March. Shoots for understocks from the stockbeds are cut 1 to 2 days before grafting. Indoors the shoots are cut again into segments of 60, 80, 100, 120, 140, and 160 cm making every effort to take advantage of the whole shoot. At this time we remove all side branches and cover with a

protective paint containing a fungicide. Shoots are wrapped in plastic and placed in the cooler. Understock are grafted as unrooted shoots.

Scions are prepared just before grafting by cutting 8 to 10 cm from the bases of shoots (without flower buds). Branched scions are excellent since they produce nice crowns sooner.

The height of the understock should be proportional to the strength of the growth, the form of the taxa grafted, and site where it is to be planted. Relatively strong-growing *S. caprea* 'Kilmarnock' should have a understock between 120 to 160 cm in length. The weaker growing *S. repens* var. *argentea, S. purpurea* 'Pendula' and *S. helvetica* look better when they have shorter trunks from understock between 80 and 120 cm. For dwarfs, such as *S. arbuscula*, *S. ×finnmarchica,* and *S. repens* 'Iona' and 'Voorthuizen', it is enough if they have trunks with a height of 60 to 80 cm.

The species with upright-growing branches look nice on shorter trunks of 60 to 100 cm. This is recommended for *S. integra* 'Hakuro-nishiki', *S. subopposita*, or *S. bockii*. Strong-growing species can also be grafted on shorter trunks, if during cultivation they are sprayed with growth retardant.

We side graft using a very sharp Tina knife. The grafts are then tied with rubber strips and the graft union is dipped into hot (approx. 70C, 158F) grafting wax (Rebwachs WF. Stahler Agrochemie GmbH, Postfach 2047, Stade 21660, Germany) which contains 0.1% hydroxichinolin. Once the wax hardens, the grafted shoots are placed in pails or containers with water. They are covered with a thin polyethylene film and placed in a room (it can be dark) at a temperature of 6 to 7C (42F), for about 3 to 4 weeks. During this time, a union occurs and also on the base of understock the roots are initiated.

Before the roots are fully emerged on the understock we stick the grafted material into 2-, 3-, or 5-liter containers in a cold plastic tunnels. The medium is a mixture of peat moss, pine bark, and styrofoam (5 : 3 : 1, by volume); calcium is added to get pH 5.5; as well as, NPK fertilizer mixture at a dose of 1 g $liter^{-1}$. After potting we thoroughly water and arrange the containers in 2 or 3 layers to make maximum use of the space. Sometimes we cover the entire ridges with a thin polyethylene film and during sunny days we try hard to shade them as much as possible.

Sucker shoots from the rootstocks must be removed before they harden, by delicately breaking them off. The newly sprouting shoots from the scion are cut in half when they reach 5 to 10 cm in length. This operation should be repeated 2 to 3 times to create strong branching in the crown.

Towards the end of May we move the plants outside, placing them in shallow troughs filled with water and tying them to lines stretched between poles. Plants are fertilized with Osmocote 5-6 months at 5 g $liter^{-1}$.

DISEASES

Rust can occur on the leaves of willows as orange spots which are visible on the bottom of the leaf. *Salix helvetica* is especially sensitive to rust, however, it can also occur on *S. caprea* 'Kilmarnock', *S. ×cottieti*, and sometimes on other species. Spots on leaves most often occur on *S. arbuscula*. Usually it is a matter of simply tearing off the leaves on which the first signs of rust occurs and burning them. You can also spray for the rust by applying rust-reducing fungicides such as Baycor 300EC, Saprol, or Tilt.

SELLING

We begin selling the plants in mid July. Unsold willows are overwintered outside with a bark mulch in November; they are sold in the spring. Some customers purchase them for Easter, keeping them inside the house for a while, and then planting them outside in the garden.

Top-grafted willows can be planted separately or in groups. They are especially nice in rock gardens and planted near a pond or growing in containers. They grow in average soils, but when choosing the place to plant them, remember they love sunlight and that they do not grow well on very dry soils.

Willows tolerate pruning. Branches of the crown should be cut back to give the plant the desired shape. Pruning the branches several times during the year (stop before August) is necessary especially for *S. integra* 'Hakuro-nishiki' and *S. cinerea* 'Tricolor'. Pruning lessens the size of the plant and gives the crowns the right shape. It also induces new shoots, which look better. Other willows should be pruned back once a year in the spring, after the catkins bloom. They should be pruned rigorously, leaving only a few buds at the base of the shoot.

Top grafted willows have a large market potential because they are attractive to garden lovers and also very easily grown by nurserymen.