

Soil Conservation Practice USES AND MANAGEMENT OF WILLOW SPECIES

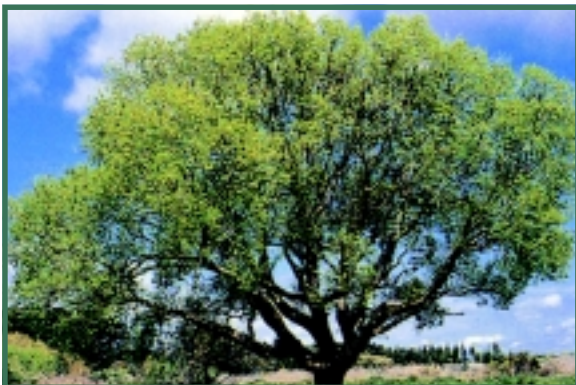
Introduction

High root mass, fast growth rate and good tolerance of wet soils mean willow species are ideal for controlling erosion on river and stream banks. Willows are also a multipurpose group of species, with traditional uses ranging from fencing and basket work to charcoal manufacture. Internationally, willow wood is currently used for boxing, pulp and fibre board production, and items such as cricket bats. In New Zealand willows are used for erosion control, shelterbelts and sometimes as a fodder source for bees or livestock.

The willow family (*Salix* species) is a group of a highly evolved, deciduous, riparian species which compete vigorously with most indigenous plants. In New Zealand erosion control cultivars, as opposed to naturalised species, have been carefully selected with minimal capacity for invasive spread. End users should be aware of this and select the correct clonal material when planting around wetlands or waterways. **Use only named, male cultivars in these situations.**

Selecting Willow Cultivars

Within the willow family there are two sub-genera, commonly known as tree willows and the shrub willows. Tree willows grow up to 20m high and have single trunks (sometimes as short as 2m) between 60cm and 90cm in diameter. Leaves are lance shaped with long tapered tips and catkins (flowers) appear at the same time as new leaves in spring.



The spreading form of crack willow (S. fragilis), a naturalised tree willow species



A S. matsudana x alba tree willow clone bred for soil conservation

Note improved form compared with naturalised species.

Shrub willows comprise two sub groups; the osiers and the sallows. Osier willows form medium size shrubs up to 8m high with multiple stems arising from the base of the plant. Stem diameters can vary from 12–15mm up to 20cm depending on species and age of plants. Leaves are 5–10 times longer than they are wide and catkins appear 2–3 weeks before leaves.

Sallows are also multiple stemmed and carry stout branches. Form varies from low shrubs to small trees depending on the particular species. Leaf length is 2–3 times that of leaf width, and leaves are oval to round in shape. Catkins appear several weeks before leaves.

For soil conservation purposes tree willows are used where a deep, extensive root mass is required for soil stabilisation. Shrub willows are used to control erosion by running water because their dense root mats resist scouring. Shrub willows also have a smaller aerial mass (compared with tree willows) which is a management advantage in some situations. Although the root mass of shrub willows is dense it is limited in extent. Under conditions of high stream bank erosion pressure, these limited root systems can be under cut, and mixed tree/shrub willow plantings are recommended where this risk is present.

Establishment and Management

All willow material will strike readily from woody cuttings and no specialised propagation techniques

Table 1 — Tree Willow Cultivars

Species	Cultivar (Clone No)	Characteristics	Uses
<i>Salix matsudana</i>	PN 227	Tolerates drier soils than most other willows; develops early rough bark. Large spreading tree becoming prone to wind damage with age. Moderate susceptibility to leaf rust. Female	Soil conservation, shelterbelts (requires side trimming)
<i>S.matsudana</i>	Shanghai (PN 695)	Faster growing than PN 227 but similar drought tolerance and early rough bark formation. Broad crown, best planted in gullies and form pruned to reduce wind breakage. Moderate susceptibility to leaf rust. Female .	Soil conservation.
<i>S.matsudana</i>	Tsinan (PN 694)	Similar to PN 695 but faster growing and more susceptible to wind damage. Has less palatability to possums in the second year after planting. Moderate susceptibility to leaf rust. Female .	Soil conservation.
<i>S.matsudana x alba</i>	Adair (NZ 1143)	Reasonably narrow crown; leafs out early in August. Male .	Soil conservation, shelterbelts, river control.
<i>S.matsudana x alba</i>	Aokautere (NZ1002)	Susceptible to Marsonnina leaf spot disease and not recommended for humid areas. Fairly narrow crown, less susceptible to wind damage than PN 227 parent. Male .	Soil conservation.
<i>S.matsudana x alba</i>	Hathaway (NZ 1317)	Growth rate and form intermediate between NZ 1130 and NZ 1149. Has a degree of possum resistance. Male .	Soil conservation, river control, amenity.
<i>S.matsudana x alba</i>	Hiwinui (NZ 1130)	Rather spreading crown and pendulous lower branches. Male .	Soil conservation, river control, bee forage, amenity.
<i>S.matsudana x alba</i>	Moutere (NZ 1184)	Fast growing, reasonably narrow crown. Good for erosion control on streambanks, in gullies and on foot slopes. Male .	Soil conservation, shelterbelts, river control.
<i>S.matsudana x alba</i>	Tangoio (NZ 1040)	Better form for shelter and not as vigorous as other hybrids. More drought tolerant than Moutere and more suitable for planting on hillsides. Female	Soil conservation, shelterbelts.
<i>S.matsudana x alba</i>	Wairakei (NZ 1149)	Fast growing, moderately spreading crown. Male .	Soil conservation.

are required. Willows can be planted out directly as 20cm cuttings, 60– 100cm stakes or as 2.5m–3.0m long poles.

For establishment of cuttings and stakes, exclude livestock from plantings and control weeds or moisture competition will cause heavy losses in the first season. The preferred material for establishing tree willows in shelterbelts is one year old sapling material (2.5 – 3 m high) commonly called “rooted cuttings”. All willow planting, of rooted or unrooted material, should be done during dormancy i.e. June to August.

To establish tree willows in the presence of livestock, plant 3m poles to a depth of at least 80cm using a pole driver. (see adjacent photo). If cattle are present, such material should have a butt (large end) diameter of at least 80mm, and the pole should be straight. A pole protector is also required.



Using the ‘Y Bar’ pole planter. Spiked end forms 60cm deep guide hole and pole is driven at least 20cm lower than depth of guide hole.

Table 2 — Shrub Willow Cultivars

Species	Cultivar (Clone No.)	Characteristics	Uses
<i>Salix purpurea</i>	Booth (PN 249)	Shrub or small tree (7-8m), flexible branches resistant to breakage. Best in gullies or along stream banks, can be used as an initial stabiliser on sites being revegetated with native plants. Triploid female, Sterile .	Soil conservation, revegetation, river control.
<i>S.purpurea</i>	Holland (PN 605)	Shrub (to 7m) with spreading habit and flexible branches, similar to Booth. Best in gullies and along stream banks. Male .	Soil conservation, river control.
<i>S.purpurea</i>	Irette (PN 608)	Shrub to small tree (7-8m), upright habit. Performs well at higher altitudes but not drought tolerant. Good dense root system for stream bank stabilisation. Male	Soil conservation, river control, lower stratum in windbreaks.
<i>S.purpurea</i>	Pohangina (NZ1087)	Shrub (7-8m) moderately spreading. Vigorous, slender, flexible stems. Male .	Soil conservation, river control.
<i>S.elaeagnos x daphnoides</i>	Tiritea (NZ 1012)	Shrub (to 8m), very vigorous. Multi-stemmed with an open upright habit and flexible branches, slightly susceptible to leaf rust, not tolerant of dry conditions. Male	Soil conservation, river control.
<i>S.glaucophylloides</i>	Glenmark (CM4)	Clonal mix shrub (6-8m), multi-stemmed and spreading. Vigorous on most sites and grows well on high country sites. Tolerates acid soils. Foliage moderately palatable to possums. Male .	Soil conservation, river control
<i>S.repens x purpurea</i>	Kumeti (NZ1057)	Semi prostrate shrub (2-3m) with many almost horizontal branches. Medium growth rate, suitable for low ground cover. Male .	Soil conservation, river control.
<i>S. x reichardtii</i> (= <i>S. "discolor"</i>)	PN 215	Shrubby tree (to 10m), erect, multi-stemmed habit. Tolerates drier conditions than most willows, moderately tolerant of salt winds and tolerates acid soils. Slightly susceptible to leaf rust. Male .	Soil conservation, windbreaks
<i>S. viminalis</i>	Kinuyanagi (PN 386)	Large shrub to small spreading tree (6 x 6 m) very vigorous on moist fertile sites once established. Leaves are silvery underneath. Performs well as a coppice fuel wood and forage species. High tannin levels in foliage reduce palatability to livestock after mid summer. Male .	Forage, fuel wood, amenity.

If the planting is not going to be exposed to cattle for the first two seasons, a Treeguard® (plastic netting) sleeve is suitable. This requires fixing in place with a small (15mm) staple top and bottom, and will eventually breakdown at around 6 or 7 years after planting when the tree has developed robust bark and a diameter of 20cm or more.

If the planting is going to be exposed to cattle at the outset, the use of Dynex® (smooth plastic) sleeves is recommended. This sleeve discourages stock rubbing but poles may be broken if less than the minimum recommended butt diameter. Dynex® sleeves are designed to split off trees as they outgrow the sleeve. When this happens, bark under the sleeve is tender and has a limited period of susceptibility to stock damage. When trees show the first signs of outgrowing Dynex® sleeves, remove the sleeves and

exclude stock from the planting for at least three weeks to allow bark to harden. This operation is best performed in late summer/early autumn.

Pole plantings benefit from pruning, to maintain good form and reduce pasture shading. Two years after planting, most of the growth on the top of the pole can be removed to leave a single strong leader. Subsequent pruning can be applied at two-yearly intervals to remove forking and to maintain a single leader. Once stem diameter has attained at least 12cm, side lift pruning will reduce pasture shading and provide some forage. Willow leaves and soft stems have a digestibility of up to 80% and are readily eaten by livestock. Some species have high tannin levels which can benefit stock health. All pruning operations are best carried out in early autumn.



Cattle browsing one year old coppice growth in a fodder block of 'Kinuyanagi' willow.

Pest and Diseases

Certain willows suffer a degree of susceptibility to leaf spot and rust diseases (see Table 1 and 2). Under highly humid seasonal conditions these may lead to partial defoliation in mid to late summer. This reduces the vigour of the host plant but rarely results in plant death. Willows are also susceptible to the systemic fungus known as silver leaf (*Chondrostereum purpurea*) which enters plants through pruning wounds and is most commonly found in pole nurseries. A spray containing 3% solutions of the fungicides Captan and Euparen® is used on freshly cut stumps to protect against this disease. Field pruning under dry conditions (in autumn) generally avoids infection.

Two types of sawfly attack willows in New Zealand. One, *Pontania proxima*, typically forms reddish galls on the foliage of certain tree willows in mid summer, but has a limited effect in tree health/vigour. The other, *Nematus oligospilus*, eats foliage and where rapid expansions of this insect population occur in mid summer, significant (but temporary) defoliation of established trees can result. Naturalised species such as the crack willow and the Golden Willow are severely affected. This insect is a relatively recent introduction and information is still being gathered about its behaviour in New Zealand. Laboratory tests indicate that most tree willows are generally palatable to this insect, while shrub willows exhibit varying degrees of resistance.

Most tree willows, especially the *S.matsudana x alba* hybrids, are also susceptible to possum attack. The 'Hathaway' cultivar has some resistance but will be attacked where possum numbers are high. Dynex® sleeves offer some protection against possums, otherwise protectors can be made from sections of aluminium printing plate folded into tube shapes and stapled onto poles. Alternatively, consult an Environment B·O·P Animal Pest Officer about suitable methods for possum control.



Willow pole one year after planting protected by Treegard® sleeve and aluminium possum protector

For further information contact a local Environment B·O·P soil conservator on freephone 0800 ENVBOP (0800 368 267)

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6 Rata Street	Mt Maunganui
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25 Church Street	Opotiki

Email: info@envbop.govt.nz

Further Reading

Plant Materials Handbook for Soil Conservation, Vol. I & II CWS van Kraayenoord and R L Hathaway (eds.) Soil and Water Misc. Publication No. 93 & 94, NWASCO, Wellington (1986)

Introduced Forest Trees in New Zealand, No. 15 The Willows CWS van Kraayenoord, B. Slui and F B Knowles. FRI Bulletin No. 124 Forest Research Institute (1995)

Sustainable Options SC16/98 Farm Shelterbelts Environment B·O·P (1998)

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