Plant & Food Research
Rangahau Ahumāra Kai

RESEARCH BRIEF 05

Root development in poplar and willow clones (a pot study)

Willow root growth is greater in the less compact soil

Main points

- A range of willow (*Salix*) and poplar (*Populus*) clones were used in the study.
- There was variation among clones in the rate of root production.
- Root production was generally greater in lower bulk density soil than in higher bulk density soil.
- Upper slope soils often have a higher bulk density than lower slope soils, and particularly where erosion has occurred previously.
- Upper slope trees will extend their root system at a slower rate than lower slope trees, and will achieve soil protection over a longer time period.
- Willows root much more readily in water and in soil than poplars do.
- *S. matsudana* PN227 × *pentandra* PN670 willow was notable for its high rate of root production.
- Poplar clones having a *P. trichocarpa* parent produced greater root length.
- Hybrid vigour is apparent in root production and can be used as a selection criterion.
- Field studies are needed to further confirm performance of these clones.
- Field material planted into eroded soil will take longer to spread roots because of the higher bulk density.
- Roots spread more readily in river or stream silt than in compact soil.
- Poplar root establishment will be slower in wet or waterlogged situations.
- Use of poplar clones having a *P. trichocarpa* parent should be explored more in locations where low branching is suitable.
- *S. matsudana* PN227 × *pentandra* PN670 willow hybrids could provide useful material for field plantings in the future.
- This information is important for river engineers, land managers and landowners seeking to match planting material to situation.

Method

For each clone, 5 cuttings with an approximate length of 200 mm and diameter between 25 and 35 mm were placed into each of the three media: clay-loam (bulk density 1.58 g/cm3, sandy-loam (1.26 g/cm3) and water, in 10-L plastic buckets in a greenhouse.

The water treatment trial ran for 4 weeks and the soil treatment trials ran for 10 weeks.

For the soil treatment, root length for all roots ≥0.5 mm in diameter was measured and recorded, as was the shoot and root dry weight, and the number of nodes initiating roots.

For the water treatment, root length for all roots ≥10 mm in length (a restriction applied to reduce the considerable measuring task), shoot and root dry matter (DM), and node number were measured and recorded.

Root length for roots <0.5 mm diameter were estimated by a sample method.

Salix Clones	Populus Clones
S. matsudana PN227	*P. nigra* PN874
S. alba PN355	*P. trichocarpa* PN470
S. alba var. vitellina PN353	*P. maximowiczii* PN503
S. lasiandra 110-014	*P. deltoides* × *nigra* 'Veronese'
S. pentandra 'Dark French' PN 670	*P. maximowiczii* × *nigra* 'Pecam'
S. nigra PN 731	*P. maximowiczii* × *nigra* 'Geyles'
S. matsudana × *alba* 'Tangoio'	*P. trichocarpa* × *nigra* PN877
S. matsudana PN227× *pentandra* PN670	*P. trichocarpa* ×*nigra* PN874
S. matsudana PN227 × *lasiandra* 110-014 (1)	*P. maximowiczii (-04)* × trichocarpa
S. matsudana PN227 × *lasiandra* 110-014 (2)	*P. maximowiczii (-01)* × trichocarpa
S. lasiandra 111/6 × *pentandra* PN670	

Table 1. The 11 Salix and 10 Populus clones used in the experiment (see method).

Willow and poplar cuttings bursting bud in the greenhouse

Results

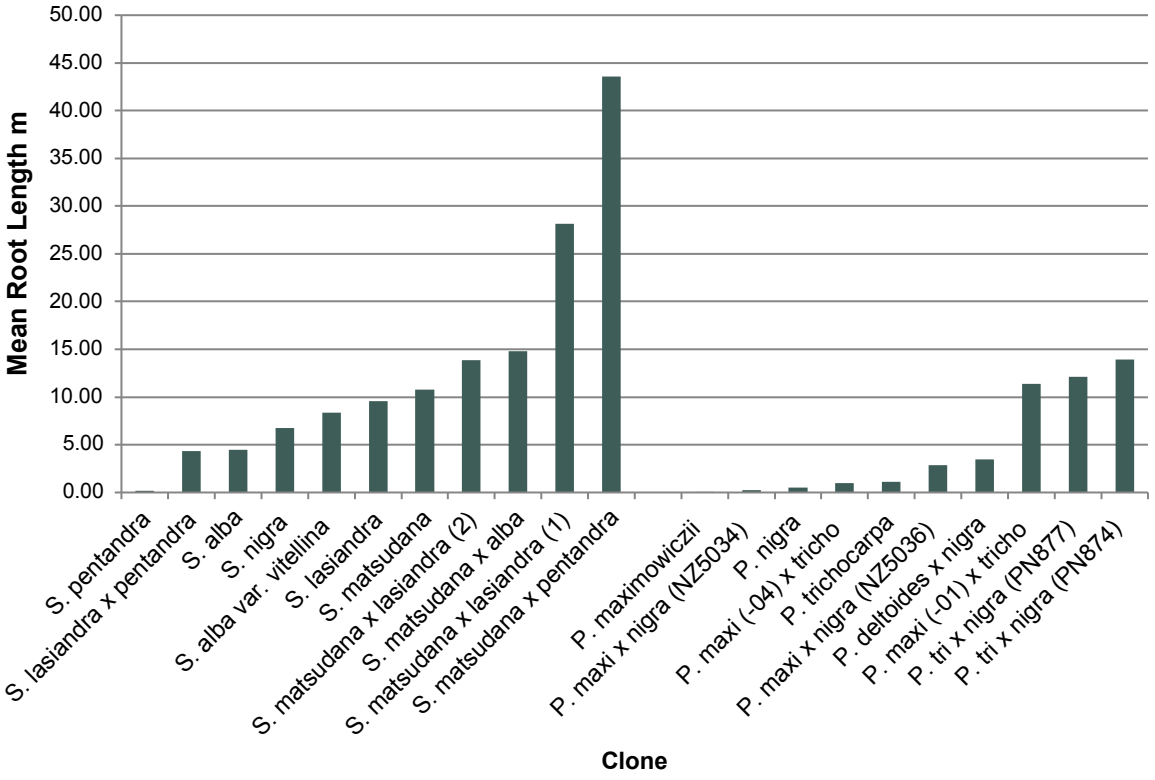

Figure 1. Mean root length for *Salix* and *Populus* clones grown in water.

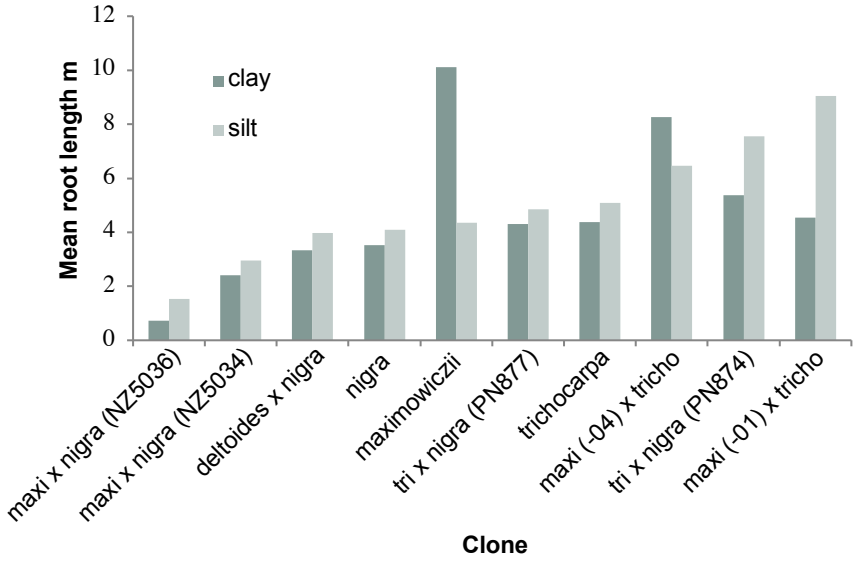

Figure 2. Mean root length (m) of roots ≥ 0.5 mm in diameter for *Populus* clones grown in clay-loam and sandy-silt loam soils. Data in the graph are ranked for sandy-silt loam.

Figure 3. Comparison of root development in *Salix alba* var. *vitellina* grown in clay-loam (L) and sandy-silt loam (R).

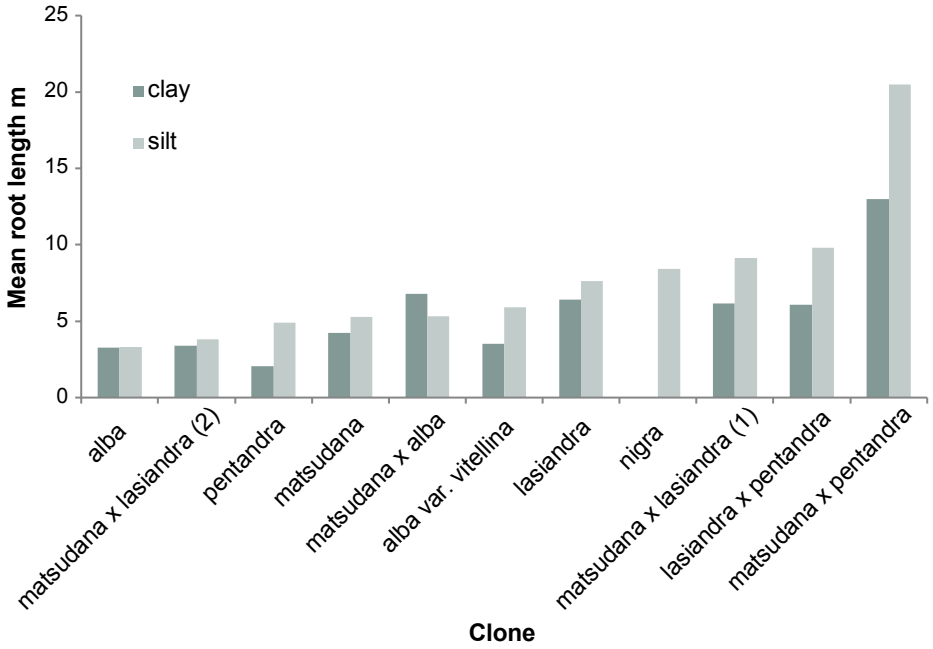

Figure 4. Mean root length of roots ≥ 0.5mm in diameter for *Salix* clones grown in clay-loam and sandy-silt loam soils. Data are ranked for sandy-silt loam.

The mean mass distribution of roots <0.5 mm in diameter was 48% (52% for *Salix*, 46% for Populus) of root DM in sandy-silt loam, and 22% (21.5% for *Salix*, 24% for *Populus*) in clay loam. The mass distribution was similar for both species, so root length of roots <0.5 mm in diameter for both species was calculated from the mean % of root DM given above. In sandy-silt loam, 93% of root length was represented by roots <0.5 mm in diameter, and in clay loam 82% of root length was represented by roots <0.5 mm in diameter.

Conclusions

Genetic differences in root development were apparent between clones in both Salix and Populus species; in particular, root development was greater overall for hybrid clones in comparison with their parent clones. Root development was greater in the lower bulk density soil, and roots were longer, thinner and had a more developed fibrous root system. Soil bulk density is an important environmental influence on root development in Salix and Populus species, modifying the inherent root behaviours. This has implications for the rate at which roots will extend. Roots of poplars or willows planted high on a slope are likely to experience greater soil resistance than those of trees planted lower on the slope, particularly where erosion has occurred in the past. Upper slope trees will grow slower and protection will be achieved over a longer time period. Landowners need to understand this.

Roots of willow cutting grown in water

For more information

This is one in a series of research briefs about Poplars and Willows that can be found at poplarandwillow.org.nz

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