Root Tensile Strength as an indicator of performance of indigenous riparian plants – How do they rank?

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Introduction

If the magnitude of the shear stress exceeds the soil shear strength, the additional stresses acting within the soil will begin to mobilise the tensile resistance of the enclosed roots.

If the soil fails, roots can respond in a number of ways:

(1) The roots may pull out. The full reinforcement potential, of particularly shallow roots, is often not realised as soil failure occurs before peak tensile strength is reached. Under these circumstances the resistance provided by the roots is supplied by the cohesion of the root-soil interface.

(2) The roots rupture at or near the shear plane. In this scenario the reinforcement provided by the root tensile strength is fully utilised.

(3) The roots rupture at some point within the soil regolith. The full reinforcement potential of the roots is realised, and after root rupture there remains some residual reinforcement as the roots are pulled through the soil.

Method

Compressed air delivered through an air lance was used to remove soil from around the root system

Root tensile strength testing was carried out using a Floor Model 1195 Instron Universal Testing Machine

Results

Common name	Mean Root Tensile Strength (Mpa)	Number of roots tested
Lacebark	51.3	23
Kowhai	43.7	28
Manuka	41.7	22
Kohuhu	29.3	18
Fivefinger	28.2	52
Rewarewa	26.8	24
Cabbage tree	26.4	48
Ribbonwood	21.5	22
Lemonwood	16.4	24
Tutu	15.7	29
Karamu	8.4	13

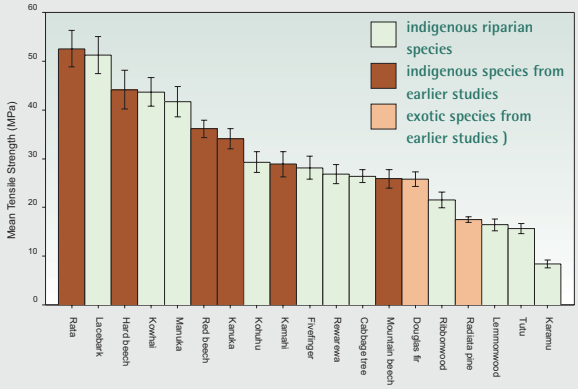
(1) Lacebark was significantly stronger than all others species.

(2) Both kowhai and manuka had significantly greater tensile strengths than kohuhu, fivefinger, rewarewa, cabbage tree, ribbonwood, lemonwood, tutu, and karamu.

(3) Kohuhu, fivefinger, rewarewa and cabbage tree roots had significantly greater tensile strength than ribbonwood, lemonwood, tutu, and karamu.

(4) The tensile strength of ribbonwood was significantly stronger than lemonwood, tutu, and karamu roots.

Roots were also selected from earlier tensile strength tests investigations of the native tree species southern rata, kanuka, kamahi, red beech, hard beech and mountain beech, and the exotic plantation species radiata pine and Douglas fir, to allow a wider-ranging comparison of root-wood tensile strengths of trees and shrubs commonly found growing in potentially unstable slope and/or riparian environments.



Conclusion

Roots impart a resilience to the soil through a combination of their tensile strength, frictional resistance, and soil bonding properties.

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