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**ESTABLISHMENT AND SILVOPASTORAL ASPECTS OF
WILLOW AND POPLAR**

A thesis presented in partial fulfilment
of the requirements for the degree of

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Plant Science



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Abstract

Willow and poplar are the main trees used for soil erosion control in New Zealand (NZ) with successful establishment critical to greater use of this technology. Five experiments were conducted at the Pasture and Crop Research Unit, Massey University Palmerston North, NZ to examine the ability of willow and poplar to establish as a willow/poplar pasture system in NZ over a period of 3 years from December 2002 to April 2005. With an objective to select the best size for low cost planting, stem diameters (10 mm, 25 mm and 35 mm) were planted vertically and stem lengths (50 mm, 200 mm and 600 mm) were planted horizontally to determine their growth, establishment, biomass production and regrowth after browsing. From December 2002 to March 2003, three management treatments, mowing, herbicide and control (no weed control) treatments, were designed and applied to determine their effects on growth and shoot biomass production. From September 2004 to April 2005, mowing was replaced by sheep browsing and the effect of browsing, herbicide and control treatments on soil and tree water status (soil water content, soil water loss and deficit, and stem water potential) were examined. Longer (600 mm) and thicker stem diameters (35 mm) produced the greatest shoot biomass (edible biomass, total biomass and root biomass) compared to the thin stem cuttings (50 mm length and 10 mm diameter). Higher tree survival was also found for longer (600 mm) and thicker stems diameter (35 mm). The mown treatment produced significantly more edible and total shoot dry matter (DM) than the herbicide and control treatments, with willow clone 'Kinuyanagi' producing higher total shoot DM than 'Tangoio'. Pasture management had no significant effect on soil water content during spring 2004 and late summer/autumn 2005, however, it was significant during early and mid summer. Strong relationships between (i) soil water content and stem water potential (SWP), and (ii) SWP and soil water deficit were found and could help growers to predict the amount of water required during the growing season. The results clearly demonstrated that sheep grazing had negligible damaging effect on willow and poplar (main stem, branch breakage and tree leaning) and tree mortality, and that young trees can be browsed during pasture shortages in summer drought. Cutting size and

understorey control for establishing willow and poplar into pasture have been better defined by this research. It is recommended that farmers establishing willow and poplar for fodder plant thick (vertical planting) and long stems (horizontal planting) for higher growth and biomass production.

Keywords: willow; poplar; stem diameter; stem length; planting depth; understorey management; fodder biomass; soil water; sheep grazing.

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