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## Factors affecting pasture growth in a densely planted willow browse block

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**Key words** : Salix, soil moisture

**Introduction** Willow browse blocks consisting of densely planted trees (>6000 ha<sup>-1</sup>) kept at sheep browsing height are a source of supplementary green forage during summer droughts. Planted on poorly utilised swampy pastures these blocks also provide more readily grazed understorey pasture due to decreased soil moisture. This paper reports on factors affecting pasture growth in a densely planted willow browse block on a wet site in New Zealand.

**Materials and methods** There were two treatments; willow pasture (WP) and open pasture (OP), with four replicates of each. Willow, *Salix matsudana x alba* Tangoio were established in 2001 from 0.7 m long stakes at 1.2 m × 1.2 m spacing near Masterton (40°57'35" South and 175°39'27" East), New Zealand. The trees were coppiced to stump level in their second winter and then grazed with sheep twice annually. Willow plots (10 m × 5 m) were browsed with sheep in late November 2004 and closed to further grazing. Soil Olsen P and pH (0-75 mm depth) were measured once and soil moisture (0-150 mm depth) and net herbage accumulation (NHA) rate were measured monthly using Time Domain Reflectometry equipment and the Radcliffe trim technique, respectively. Photosynthetically active radiation (PAR) under trees was measured in summer with a LI-COR (LI-250) light meter.

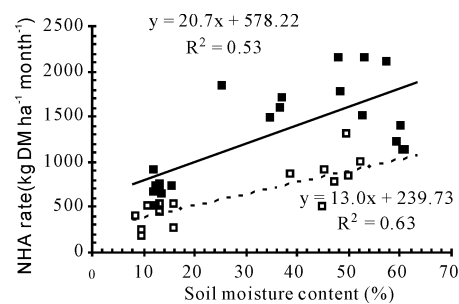
**Results and discussion** Soil Olsen P ( $\mu\text{g g}^{-1}$ ) and soil pH were higher in OP ( $24.6 \pm 0.92$  and  $5.5 \pm 0.02$ , respectively) than in WP ( $20.7 \pm 2.08$  and  $5.3 \pm 0.03$ , respectively). The NHA rate was significantly greater in OP than in WP in all seasons except winter (Table 1). The soil moisture contents in summer and autumn were below the required level for best pasture growth while winter results confirmed the wet condition of the site (Table 1).

**Table 1** Seasonal soil moisture range (%) and NHA rate (kg DM ha<sup>-1</sup> day<sup>-1</sup>) for open pasture (OP) and willow pasture (WP) treatments.

Parameters	Spring	Summer	Autumn	Winter
Soil moisture range				
OP	33.5-58.3	13.3-18.9	20.3-37.2	58.6-61.0
WP	34.5-63.2	10.7-21.5	22.9-39.5	63.7-65.1
NHA rate				
OP	54 ± 3.56	41 ± 3.51	14 ± 1.99	9 ± 2.24
WP	28 ± 2.43	19 ± 2.14	10 ± 1.21	6 ± 1.41
Significance	$P < 0.01$	$P < 0.01$	$P < 0.05$	$P > 0.05$

The PAR under willow was 12-42% of that in OP. NHA rate was related to soil moisture for November 2004 to March 2005 but NHA in OP was approximately double that of WP at any soil moisture content suggesting that light was limiting pasture growth under willow (Figure 1). However, winter NHA in OP and WP was mainly affected by low temperatures and very high soil moisture contents.

**Conclusion** Pasture growth under willow on a wet site was mainly limited by being shaded by the willow, but willow browse can compensate for the reduced pasture growth in summer and autumn.



**Figure 1** Relationship between NHA rate (kg DM ha<sup>-1</sup> month<sup>-1</sup>) and soil moisture content (%) during the period of November 2004 to March 2005 in open pasture (OP) (straight line closed symbols) and in willow pasture (WP) (broken line open symbols) treatments.