Effect of space-planted ‘Veronese’ poplars on pasture production in hill country

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Review

- Erosion reduction 50-95%
- Understorey pasture reduction 20-40%
- 69% NZ’s slopes greater than 12°
- 2% yearly reduction in pasture production at 100 sph planting density
- 20-40 years to regain 80% original pasture production
Purpose

• To determine the impact space-planted poplars of different ages have on understorey pasture growth compared with open pasture.
  • Light intermission through canopy cover
  • Soil moisture
  • Stock exclusion cages
Tree-pasture Sites

- 10 m spacing in grid formation
- Mahoenui Silt Loam
- Western aspect 22.4 degree slope
- 10-12 years old
- Diameter breast height 26-31 cm
- Canopy width approximately 3 m
- Average canopy closure 29 %
Tree-pasture Sites

- 11 m spacing in grid formation
- Purimu Silt Loam
- Western aspect 23.5 degree slope
- 20-25 years old
- Diameter breast height 51-54 cm
- Average canopy closure 78 %
Method:

- Exclusion cages within each experimental unit at various distances.
- Samples collected every 60 days (Random quadrat sampling).
- Quantum sensors to measure photosynthetically active radiation (PAR) transmitted through tree canopy.
- PAR measurements every 15 seconds to CR10X datalogger.
- Time domain reflectometry (TDR) to measure the soil's volumetric water content.
- TDR measurements every minute, averaged for every hour.
Results

Mean DM production (kg/ha/d) at the two sites and four cage positions, averaged over 10 months. Error bars represent one standard error of the mean

- 65-90% reduction in light level to the ground
## Results

<table>
<thead>
<tr>
<th>Month</th>
<th>Position</th>
<th>TPA</th>
<th>TPB</th>
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<tbody>
<tr>
<td></td>
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<td>Mid-canopy</td>
<td>Middle</td>
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<tr>
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Modelled impact of trees on net pasture production

Figure 5 Modelled pasture production over 12 months for 11 yr tree-pasture system based on data of pasture production measured for the exclusion cages and long term climate data (Jan 2000-Jan 2013). We calculate an annual pasture production of 7400 kg/ha.
Modelled impact of trees on net pasture production

Figure 6 Modelled pasture production over 12 months for 22 yr tree-pasture system based on data of pasture production measured for the exclusion cages and long-term climate data (Jan 2000-Jan 2013). We calculate an annual pasture production of 5700 kg/ha.
Annual pasture production was significantly decreased, with pasture growth at 77% for Site A and 44% at Site B in comparison to an open pasture system.

Pasture production decreased with proximity to tree trunk.

Leaf fall led to an increase in light transmission from 20% to 36% at Site A and from 13% to 30% at Site B (full leaf canopy to leaf fall).

Figure 7. The average light transmission measured by an array of 7 PAR light sensors placed on the ground under the mature poplar trees at Site B (markers). The line represents a simple empirical function fitted to the data point to describe the light level on the ground, $\Phi_G$, that is used to model pasture production via Eq. 3.
Summary

- Tree age is a major factor for pasture production
- Average annual pasture production in the 11 year site at 77% and 44% at the 25 year site
- Annual decrease of 140 kgDM/ha/yr in understorey pasture production
- Lower soil moisture availability may have a major influence on understorey pasture production
- Further investigation into the impact slope and aspect has on space-planted understorey pasture production
Importance of Management