Simulating the potential of sub-tropical grasses to fill feed gaps in a Mallee environment

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Aim

For a sub-tropical grass established in the Mallee environment, to assess the pattern and reliability of growth and its potential as a fodder source using simulation models.

Take home messages

- *On average in the Mediterranean Mallee environment, sub-tropical grasses grow best during late spring and early summer when soil temperatures are rising and soil moisture is available*
- *Unless significant rain occurs after December, the growth rate of sub-tropical grasses is typically low in the period December to April*
- *Subtropical grasses are dormant in the winter months, so weed control measures are relatively easy and the inclusion of annual medics may be possible*
- *The standing fodder of sub-tropical grasses can potentially be carried over for grazing later in summer.*

Method

Using a prototype sub-tropical grass model available in APSIM, simulations of the long-term pattern of pasture growth of the summer-growing grass species Panicum coloratum cv. Bambatsi were undertaken for the Mediterranean Mallee environment. These simulations were run continuously from 1955 until 2008 assuming that after the pasture was planted at the start of the simulation (1 August 1955), it remained at the same density throughout the simulation. Historical meteorological data was sourced for Hopetoun from the SILO database (Jeffrey *et al*. 2001). A soil that had been characterised previously at Hopetoun was selected from the APSOIL database (www.apsru.gov.au). This was a typical Mallee sandy loam, 100cm deep with a plant available water capacity (PAWC) of 129mm. The simulation was not grazed, but above ground foliage was removed if dry matter (DM) exceeded 3t/ha. Surface residue was reset on 1 August annually to 1t/ha to stop the build-up of surface residues influencing the simulations. In each year of the simulation on 15 September, 15kg/ha of N fertiliser was applied to the surface to limit any effect due to a run down in mineral N in the simulation. The simulation also assumed that there were no weeds at any time of the year. Therefore soil moisture may be stored from the winter rainfall when the sub-tropical grasses are dormant.

Weather records:	Hopetoun (1955-2008)
Soil type:	Sandy loam, 100cm deep, PAWC =129mm
Sowing date:	1 August 1955
Plant density:	4 plants/m^2 and this was assumed to be constant
Pasture type:	*Panicum coloratum* cv. Bambatsi

Assessing potential grazing value

To see if the seasonal production of this sub-tropical grass is useful as a fodder source, a spreadsheet analysis of the outputs of weekly DM was undertaken to assess the timing and number of grazing days that could be obtained. This analysis was for a crash grazing system where the pasture was grazed at 10 DSE/ha. A running total of DM growth over the previous 12 weeks was maintained to estimate the amount of available DM and metabolisable energy (ME) available for grazing animals (Standing pasture is assumed to have a life of 12 weeks with no decrease in pasture quality during that time). When DM exceeds 500kg/ha, grazing was initiated. The quality of the tropical grass was assumed to be 56 percent dry matter digestibility (DMD) or 7.95 MJ ME/kg DM. DM allowance for grazing stock was estimated based on the ME requirements of a dry sheep equivalent. It was also assumed that 50 percent of pasture was wasted or not grazed. Hence the allowance for each DSE was 1.91kg DM/DSE/day and this amount was removed from the available DM pool until DM fell below 150kg DM/ha. Based on these assumptions and rules, an estimate was made on the timing and duration a sub-tropical grass would be available for grazing and the number of grazing days during each year.

Results

The pattern of pasture growth

Averaging simulated weekly pasture growth rate for the 53 years, the major peak of pasture growth occurs in spring, particularly between September and December (Figure 1). This occurs as soil temperatures rise and presumably due to any spring rainfall and soil moisture stored from the winter period when no pasture growth occurred. After December, pasture growth rate declines rapidly and remains low until April, due to the low incidence of rainfall and high potential soil evaporation. Between April and September, growth rate is negligible, primarily due to low temperatures. Frosts which regularly occur post-May will rapidly senesce the pasture.

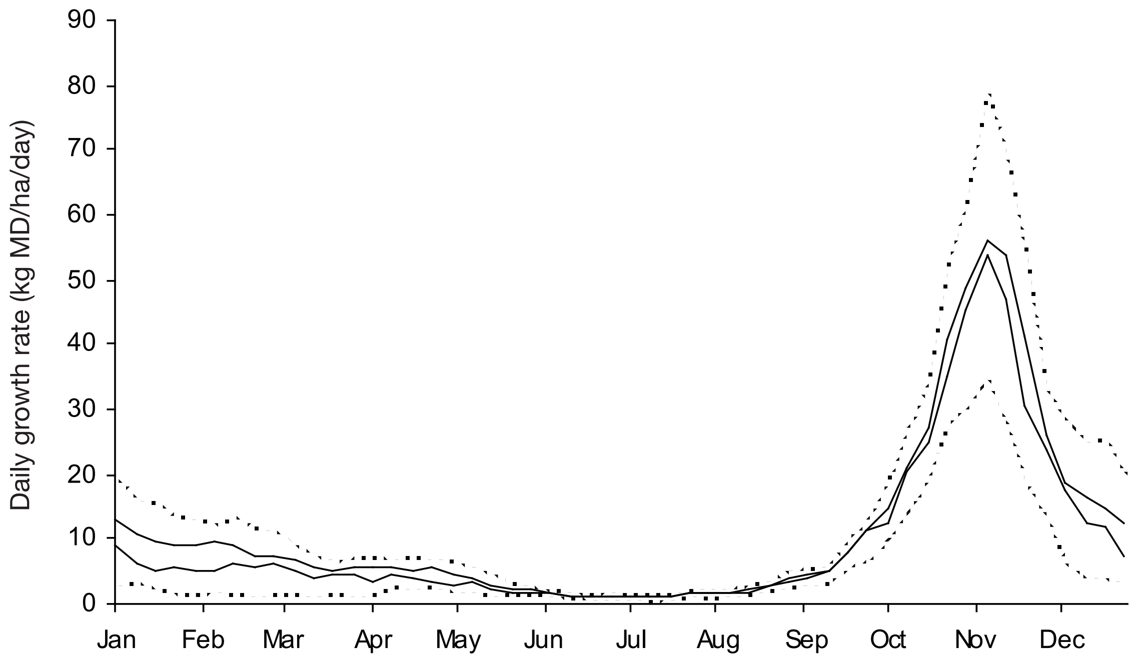

Figure 1. Simulated daily growth rate of *P. coloratum* cv. Bambatsi throughout the year at Hopetoun. Heavy line = mean; lighter solid line = median; and dotted line = upper and lower quartiles for each week.

Potential grazing value

In 80-90 percent of years, there will be adequate forage available for grazing from late October until mid December (Figure 2). In the period post-December, the proportion of years that pasture was available declined rapidly due to the decline in pasture growth (Figure 1). It must be noted that we have assumed 12 weeks as the period of time a standing pasture is available for. If this is longer (which is unlikely), then good quality hay may be available further past December.

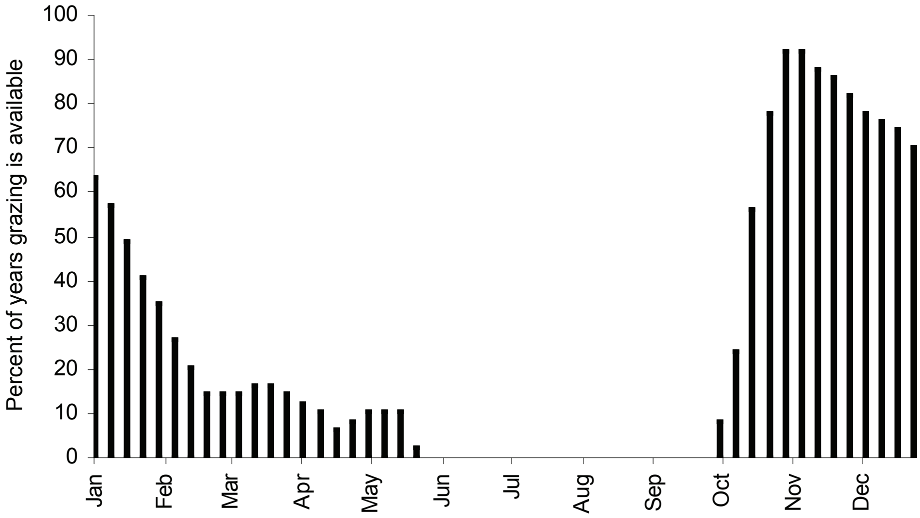

Figure 2. Frequency of years that *P. coloratum* cv. Bambatsi could provide grazing during the year at Hopetoun (ie. when >500kg DM was available at start of grazing and >150kg DM was maintained for a stocking rate of 10 DSE/ha).

Interpretation

Craig *et al.* (2009) in this publication (see article 'Sub-tropical pastures in the Wimmera Mallee'), report that *Panicum maximum* cvv. Petrie and Gatton, *Panicum coloratum* cv. Bambatsi and *Digitaria milanjiana* cv. Strickland were successfully established in November 2006, maintained adequate plant numbers and produced 1.4-4.5t dry matter/ha in 2007 and 1-1.8t dry matter/ha in 2008. This is the first evidence that sub-tropical grasses may indeed be productive in a Mediterranean Mallee environment. Whether these species can recruit seedlings and persist in the medium- to long-term needs to be further investigated. While the simulation of pasture growth in this environment needs further validation against measured data, the pattern of pasture production is likely to be realistic. This shows a short period of rapid growth in late spring and early summer corresponding with moisture availability and adequate soil temperatures. Throughout the 53 years simulated, there were very few occasions when significant or sustained pasture growth occurred in the January to March period. This reflects the generally low incidence of significant rainfall with follow-up rainfall events in that period.

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Application

The potential for summer-growing grasses to fill critical 'autumn' feed gaps has been the reason behind this work. Simulation has shown that September to December is the period of most rapid growth and, provided that pasture quality can be maintained, there is potential for this feed to carry over for use later in summer. The control of volunteer weeds during the winter period in this system is relatively easy as the sub-tropical grasses are dormant at this time. Where annual medics or other legumes can be grown in this pasture system, there may be benefits arising from improved nitrogen cycling, feed quality and ground cover.

References

Craig, S., Chapman, K. and Whitbread, A. 2009. Sub-Tropical Pastures in the Wimmera Mallee Region. BCG 2008 Season Research Results.

Jeffrey, S.J., Carter, J.O., Moodie, K.B., Beswick, A.R. 2001. Using spatial interpolation to construct a comprehensive archive of Australian climate data. Environ. Modelling Software. 16, 309–330. (www.bom.gov.au/silo/, accessed 30/11/2008).