Sub-tropical pastures in the Wimmera Mallee

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Aim

To evaluate if sub-tropical pastures can be successfully established and productively grown in the Wimmera Mallee.

Take home messages

- *Six out of seven sub-tropical species were successfully established*
- *The Panicum maximum cultivars (cv.) of Petrie and Gatton, Panicum coloratum cv. Bambatsi and Digitaria milanjiana cv. Strickland established well and produced in excess of 1.4t dry matter/ha in 2007 and 1t dry matter/ha in 2008*
- *Panicum maximum cv. Petrie produced the most biomass in both 2007 (4.5t dry matter/ha) and 2008 (1.8t dry matter/ha)*
- *Panicum maximum cv. Gatton, Digitaria milanjiana cv. Strickland and Panicum coloratum cv. ATF-714 performed best when sown at the higher rate*
- *Sub-tropical pastures may have a fit in the Mallee if these species are able to persist under grazing and this should be tested under commercial conditions*
- *Modelling pasture growth suggests that most of the growth of sub-tropicals will occur in late spring and early summer, with very little growth past Christmas because of the low incidence of rainfall events and high evaporation.*

Method

The purpose of this trial was to investigate whether seven sub-tropical pasture species would be suitable in the Mallee environment. The varieties were chosen based on the recommendations of a species audit (Pengelly 2006). The audit short-listed several sub-tropical pasture species that could potentially fit in farming systems of the Wimmera-Mallee region, especially under a climate scenario where significant summer rainfall events occur more frequently. Sub-tropical pastures have traditionally been grown in the summer-dominant rainfall zone of northern NSW and southern QLD for cattle and sheep grazing, although in recent years have found a niche in the northern WA wheatbelt.

Seven pasture species (six grasses and one legume, Table 1) were chosen to be evaluated in a replicated small plot trial at Hopetoun on a sandy loam with clay at depth and moderate subsoil constraints (EC > 0.5dS at 50 cm). Of these seven species, seed size varied widely, subsequently each variety was sown at two rates (3kg/ha and 6kg/ha) to identify the most successful sowing rate. The pastures were sown using a conventional seeder with rolling 'sheep feet' harrows on 10 November 2006. Only *Bothriochloa bladhii ssp. Glabra* (cv. Swann) was broadcast and harrowed in as it did not consistently flow through the seeder.

A knockdown herbicide (1.5L/ha Roundup® PowerMax™) was applied at sowing. A base rate of 55kg/ha of Granulock Supreme Z (N11:P21.7:K0:S1) was applied with the seed at sowing. Buctril

MA® (1.4L/ha) was applied on 24 February 2007 for control of common heliotrope (*Heliotropium europaeum*) and Caltrop (*Tribulus terrestris*). Afghan Melons (*Citrullus lanatus*) were hand-weeded from the site.

Plant densities (plants per metre square, pl/m^2) were assessed by randomly placing a 50cm ruler within the plot and recording the number of sown pasture species on both sides of the ruler. This was repeated six times in each of the plot counts on 13 March 2007 and 13 March 2008. Total biomass was measured by cutting all plant material of the sown pasture species within a randomly placed quadrat. Biomass production was measured on 11 July 2007 and 10 June 2008.

Location: Hopetoun

Replicates: 4

Sowing date: 10 November 2006

Sowing Rate: 3kg/ha and 6kg/ha

Pasture type: Listed in Table 1

Seeding equipment: Conventional (combine), 150mm sweeps, rolling harrow, 175mm row spacing.

Table 1. Subtropical pasture species sown at Hopetoun in November 2006.

Species	Cultivar (cv.)
Panicum maximum	Gatton
Panicum maximum	Petrie
Panicum coloratum	Bambatsi
Panicum coloratum	ATF-714
Digitaria milanjiana	Strickland
Bothriochloa bladhii ssp. glabra	Swann
Desmanthus virgatus (legume)	Marc

In addition to this field data, simulations of the long-term pattern of growth modelling for the Hopetoun site were undertaken using a sub-tropical grass model in APSIM (see 'Modelling sub-tropical grass growth' article).

Results

The majority of species germinated in late January/early February 2007 in response to 15mm of rain that fell on 20 January of that year. *B. bladhii* cv. Swann failed to germinate in 2007 after it was broadcast, while the legume *D. virgatus* cv. Marc was very slow to emerge. Monthly rainfall between March and May 2007 exceeded the long-term average, as it did in November and December 2007 (Table 2). A series of frosts were recorded in July 2007 (-3.5°C at 9am on 27 July 2007) and all species senesced shortly afterwards.

Table 2. Monthly rainfall (mm) recorded at the site in 2007 and 2008 and the long-term averages (LTA) for Hopetoun.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2007	15	19	29	24	92	15	37	4	12	5	48	29	329
2008	29	0	1	13	30	16	29	7	4	6	24	36	195
LTA	14	12	12	16	29	32	32	35	30	27	20	15	348

Rainfall during the 2006/2007 summer and the following autumn was considerably above average, with over 200mm falling from December 2006 to June 2007 (29mm in December 2006).

Significant differences in plant densities were found between the two sowing rates for some species (Table 3). *P. maximum* cvv. Gatton and Petrie, *P. coloratum* cv. ATF-714 and *D. milanjiana* cv. Strickland all had significantly higher plant densities in 2007 when sown at the higher sowing rate (6kg/ha). Despite good germinations of *D. virgatus* cv. Marc in 2007, this legume grew very little biomass and appeared to have failed by the end of summer. However, these plants did survive with reasonable numbers of plants regrowing or new plants germinating in summer 2008 (Table 4).

Table 3. Plant densities of each sub-tropical species sown at two sowing rates (3 and 6kg/ha) at Hopetoun assessed on March 2007. [Least Significant Difference (LSD) P<0.05; Coefficient of Variation (CV)]

Sowing rate	Plant density/m^2					
	Gatton	**Petrie**	**Bambatsi**	**ATF-714**	**Strickland**	**Marc**
3kg/ha	25	31	31	30	34	21
6kg/ha	36	44	37	40	48	24
LSD **CV %**	**P<0.05** **38%**	**NS**	**NS**	**P<0.05** **36%**	**P<0.05** **27%**	**NS**

Establishment counts in March 2008 found significantly more *P. maximum* cv. Petrie plants survived the winter dormancy when sown at the higher sowing rate (Table 4). There were no significant differences between any of the other varieties.

Table 4. Establishment (pl/m^2) counts made in March 2008 for all varieties at both sowing rates (3, 6kg/ha).

Sowing rate	2008 establishment (plants/m^2)					
	Gatton	**Petrie**	**Bambatsi**	**ATF-714**	**Strickland**	**Marc**
3kg/ha	21	20	14	9	16	11
6kg/ha	26	28	16	7	22	14
LSD **CV %**	**NS**	**P<0.05** **44%**	**NS**	**NS**	**NS**	**NS**

Significant differences in biomass were found between varieties in both 2007 and 2008 (Tables 5 and 6). There was no significant difference in biomass between the two sowing rates in 2007 (Table 5). *P. maximum* cv. Petrie produced significantly more biomass than all the other varieties. *P. maximum* cv. Gatton was significantly higher in biomass than *P. coloratum* cvv. ATF-714 and. Bambatsi. In 2008, *P. maximum* cv. Petrie again out-performed most varieties with significantly greater biomass than *P. maximum* cv. Gatton, *P. coloratum* cv. ATF-714, *B. bladhii* cv. Swann and *D. virgatus* cv. Marc.

Table 5. Biomass production recorded at plant senescence (May 2007) for subtropical species sown at two sowing rates (3 and 6kg/ha) at Hopetoun.

Sowing rate	Biomass production kg/ha					Statistical analysis
	Gatton	Petrie	Bambatsi	ATF-714	Strickland	
3kg/ha	2796	4540	1119	793	1180	**P<0.05** LSD=2467 **CV=53%**
6kg/ha	1988	4468	903	681	1667	P<0.05 **LSD=1989** **CV=50%**
LSD	**NS**	**NS**	**NS**	**NS**	**NS**	

Biomass production in 2008 was less than in 2007. *P. maximum* cv. Petrie produced significantly more biomass than all the other species except *P. coloratum* cv. Bambatsi at the lower sowing rate (Table 6). At the higher sowing rate *P. maximum* cvv. Petrie and Gatton and *P. coloratum* cv. Bambatsi produced significantly higher biomass than the other species. There was no significant difference in biomass between sowing rates for any of the species in 2008.

Table 6. Biomass production recorded at plant senescence (June 2008) for subtropical species sown at two sowing rates (3 and 6 kg/ha) at Hopetoun.

Sowing rate	Biomass production kg/ha						Statistical analysis
	Gatton	Petrie	Bambatsi	ATF-714	Strickland	Marc	
3kg/ha	1327	2113	1567	973	1153	70	**P<0.05 LSD=764 CV=20%**
6kg/ha	1533	1953	1760	787	1180	120	**P<0.05 LSD=687 CV=15%**
LSD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	

Interpretation

Establishment and biomass production in 2008 were less in all species than in 2007. This is probably related to lower rainfall and more days with temperature >40°C, and also related to the decline in plant numbers. Apart from the fertiliser applied at sowing, no further nitrogen was applied and typically pastures begin to slow their growth in response to the decline in soil mineral N. At the time of measurement (June/July), plants are senesced and some of the biomass produced over summer would be lost. Sub-tropical pastures become dormant over winter (particularly with the onset of frost events) and regenerate in spring once moist soil reaches temperatures of 18°C or greater in the topsoil (0-10cm depth). Provided that winter-growing pasture or weed species are controlled, the dormancy of these sub-tropical species over the winter months may mean that some of the winter and early spring rainfall can be stored in the soil profile until plants begin to grow in spring. The 2007 spring rainfall was below average, which would have limited production in November and December, despite later months receiving above average rainfall.

The grasses *P. maximum* cv. Petrie or Gatton and *P. coloratum* cv. Bambatsi have shown to be the most productive and appear suitable for the region, assuming that they continue to persist. In comparison, the grasses *P. coloratum* cv. ATF-714 and *B. bladhii* cv. Swann produced much less growth and are less likely to be good pasture options. Whilst the legume *D. virgatus* cv. Marc produces low biomass, it does have adequate plant numbers to be a viable pasture and in practice is a key 'high protein and N-fixing' component of a mixed grass/legume pasture.

The significant difference in plant densities between the sowing rates in 2007 would be expected. Biomass production was not affected by sowing rate in either year. This would also be expected because plots with lower plant densities will experience less competition and equal biomass production, which was the case in this trial.

Due to the exceptional growth and competitive nature of the sub-tropical pastures, it was observed that there was less barely and ryegrass during winter where there was successful pasture establishment. There were high densities of ryegrass observed in the *D. virgatus* cv. Marc and *B. bladhii* cv. Swann plots. The site did not require any further herbicide application or hand-weeding in the summer of 2007/2008, except in the plots where establishment failed.

Application

The cost of the seed for most of the varieties used in this trial is relatively expensive (approximately $20/kg). At this cost, based on the data presented in this trial, the lower seeding rate (3kg/ha) would be recommended. The summers of 2006/2007 and 2007/2008 were exceptional for summer rainfall and this favoured the establishment and productivity of these varieties. If the incidence and magnitude of summer rainfall increased under climate change, then sub-tropical pastures could find a fit in Victorian Mallee farming systems provided these species can persist under commercial grazing. Sub-tropical species may also be an option for the hay market, as out-of-season hay production could be profitable. They may also have potential as a tool to assist with management of resistant ryegrass.

Capturing and making the most of any out-of-season rainfall can be time-consuming and expensive. Having a highly competitive pasture that can provide good competition against summer weeds, green feed over summer and nearly 100 percent ground cover, would be extremely valuable. However, good establishment is essential, and more work needs to be done to ensure the results obtained in this trial can be repeated on different soil types and in different seasons.

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MCP

References

Pengelly, B.C., Hall, E., Auricht, G., Bennell, M. and Cook, B.G. 2006. Identifying species and species mixes with potential for grazing systems in the Mallee-Wimmera. CSIRO Sustainable Ecosystems, Canberra. (87 pp). Report commissioned by the Birchip Cropping Group.