PASTURE TERMINATION

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TAKE HOME MESSAGES

- August pasture termination may produce water and nitrogen benefits for the following crop, compared to leaving the pasture to grow, but these may be neutralised by dry summers and other limitations in an average growing season.
- Termination timing is only as important as your ability to capitalise on the benefits with either livestock (extra pasture growth) or crop (extra water and nitrogen).

KEY WORDS

Medic, pasture, termination, timing, vetch.

BACKGROUND

The management of pastures in the Wimmera and Mallee can affect the growth and yield of a cereal crop in the following year. Much research into medic pasture management in the Mallee has focused on the grass component of the pasture, which can host cereal diseases. Research into summer weeds, and drier seasons have, in recent years, highlighted the importance of stored water and also nitrogen for the following crop. If a pasture is to be terminated (killed altogether) and converted into a fallow, it would be good to know the trade-off that is occurring between growth of the pasture and growth of the following crop, so that the timing of termination can be managed appropriately.

The growth of the pasture can be converted into wool and meat, ground cover, and with good medic growth, atmospherically fixed nitrogen. In turn, the pasture uses soil water and nitrogen. Depending on soil characteristics and subsequent rainfall, this may affect the water and nitrogen available to the following crop. How this is used depends on the following season, so the effects of termination timing need to be considered in the context of the range of possible seasons which might follow the year when it is happening.

AIM

To measure the trade-off between medic pasture growth and yield of a following cereal crop, with different termination timing of the medic pasture.

METHOD

Jil Jil 2012/13

The trial was located in a 62ha grazed, volunteer medic pasture paddock on a calcarosol soil. Some volunteer oats were present from the previous crop. The paddock contained gilgais (crab-hole) landforms but a part of the paddock was chosen where these were less pronounced, and away from headlands, gateways etc.

Netherby 2012/13

The trial was located in a 73ha grazed, sown vetch paddock on a vertisol soil.

In 2012 four medic (vetch at Netherby) pasture termination treatments (Table 1) were laid out in a randomised complete block design with three adjacent replicates, and buffer plots of the January treatment between replicates and at either end of the design. The buffer plots were sampled at each treatment as an attempt to control against spatial variation. Each plot was 2m wide and 28m long, with the long side parallel to the longest fence in the paddock so that the farmers sowing operation did not transfer soil from one plot to the next.

Soil samples were taken before the August treatment, and after the pasture had died (November). Soil samples were also taken before sowing the following crop (April 2013) and after harvest. The average soil water after harvest in 2013 was taken as the crop lower limit at each site.

Dry matter samples were taken from the pasture at each treatment date, and from the 2013 wheat crop at GS30 and GS65. Plots were harvested with a plot harvester to measure yield, and grain tested for protein, test weight and screenings.

Locations:	Jil Jil (20km N Birchip), Netherby	
Replicates:	Three	
Sowing date:	Jil Jil	18 May
	Netherby	14 May
Seeding density:	60kg/ha	
2013 Crop types:	Mace (Jil Jil) and Yitpi (Netherby) wheat	
Grazing:	Jil Jil: August 2012-February 2013, part of paddock grazed at approx. 4 DSE/ha (varying mobs) with supplementary feeding (not close to the trial). Netherby: cut for hay and then grazed for two weeks following this.	
Inputs/fertiliser:	25kg/ha 27:12 (Jil Jil), 5t/ha gypsum (Netherby)	
Operations:	Jil Jil: 20 Feb 2013 tilled. Netherby: 20 Feb 2013, 5 Mar 2013 tilled with narrow points to incorporate gypsum.	
Seeding equipment:	Jil Jil: Horwood Bagshaw seeder (knife points, press wheels, 17cm row spacing) Netherby: Knife points and press wheels on 30cm row spacing.	

Table 1. Medic pasture termination timings in 2012. At each treatment, previously treated plots also were resprayed when full kill was not achieved.

Termination treatment	Timing – Jil Jil	Timing – Netherby	Method
August	3 September	28 August	spray*
September	25 September	1 October	spray*
October	31 October	24 October	spray*
November	16 November	22 November	died naturally/heavily grazed

*Spray = as required to kill the pasture and/or weeds present.

Spatial variation and statistics

The buffer plots and November termination treatments were checked for trends in spatial variation for soil water, nitrogen, crop and pasture growth and yield measurements. There were no consistent trends that might justify a more complex spatial analysis (not shown). Measurements from the buffer plots were therefore included in the analysis as extra replicates of the November treatment.

A probability of 10% (p=0.1) was adopted for 'significance' in the analysis, recognising the likely errors in-field measurements of pasture plots and the minimal replication (three).

RESULTS AND INTERPRETATION

Rainfall

How the termination trade-off works is going to depend on what the season is like for the pasture, and for the crop that follows it. The 2012 season was quite dry (149mm April-October at Jil Jil; 156mm at Netherby) and was followed by a dry summer in 2012/13 (Figure 1). From May onward, the 2013 growing season was average at Jil Jil (209mm) and wetter than average at Netherby (326mm), with relatively even rainfall distribution.

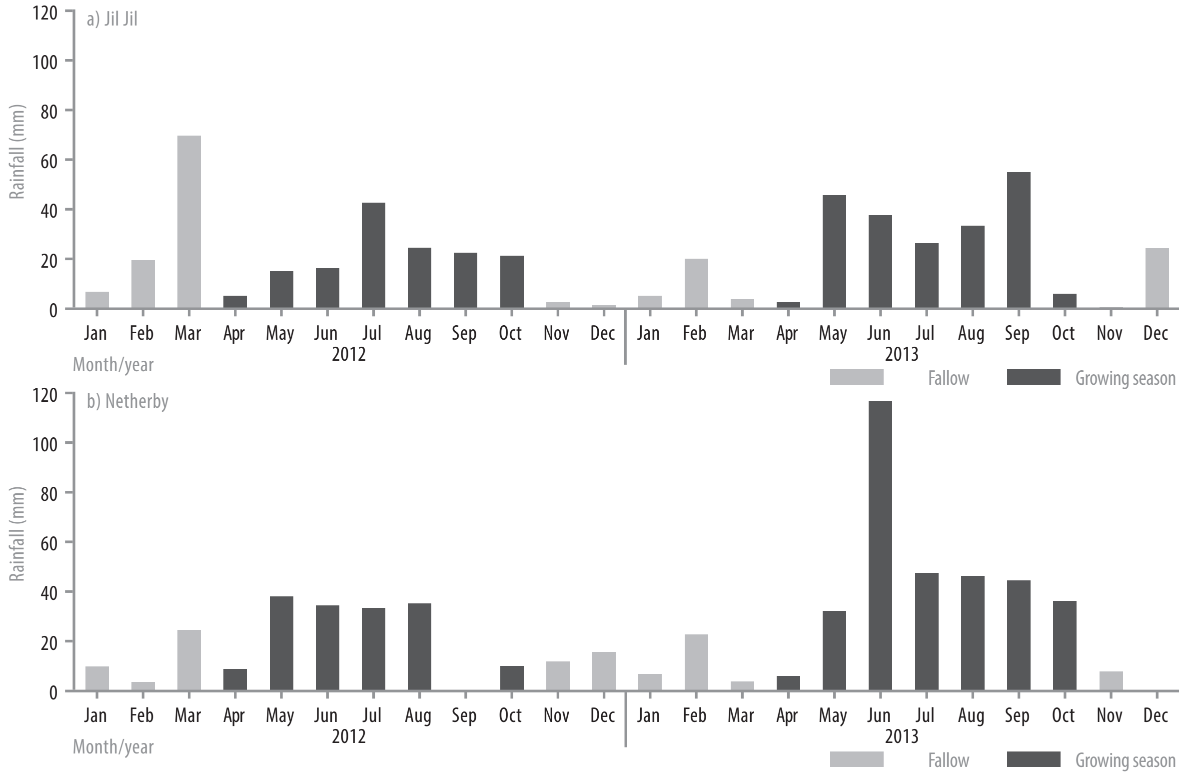

Figure 1. Monthly rainfall at Jil Jil and Netherby in 2012 and 2013 (figures from farmer records, Jil Jil, and the Culgoa and Lorquon Bureau of Meteorology weather stations).

Pasture and following crop growth

Pasture dry matter was considered too low to measure after termination at Jil Jil (bare ground; grazed heavily) and was only measured after each termination timing at Netherby. Heavy grazing at Jil Jil kept dry matter low, whereas vetch growth accumulated during September/October at Netherby, finally dropping at the November measurement (Figure 2). A measurement on the August treatment at both sites in September showed that soon after termination, biomass on it was negligible. The combination of grazing pressure at Jil Jil, and poor rainfall in spring 2012 meant that seed was not set.

In the following crop in 2013, there were no significant differences in growth at either early stem elongation (growth stage 30) or anthesis (growth stage 65).

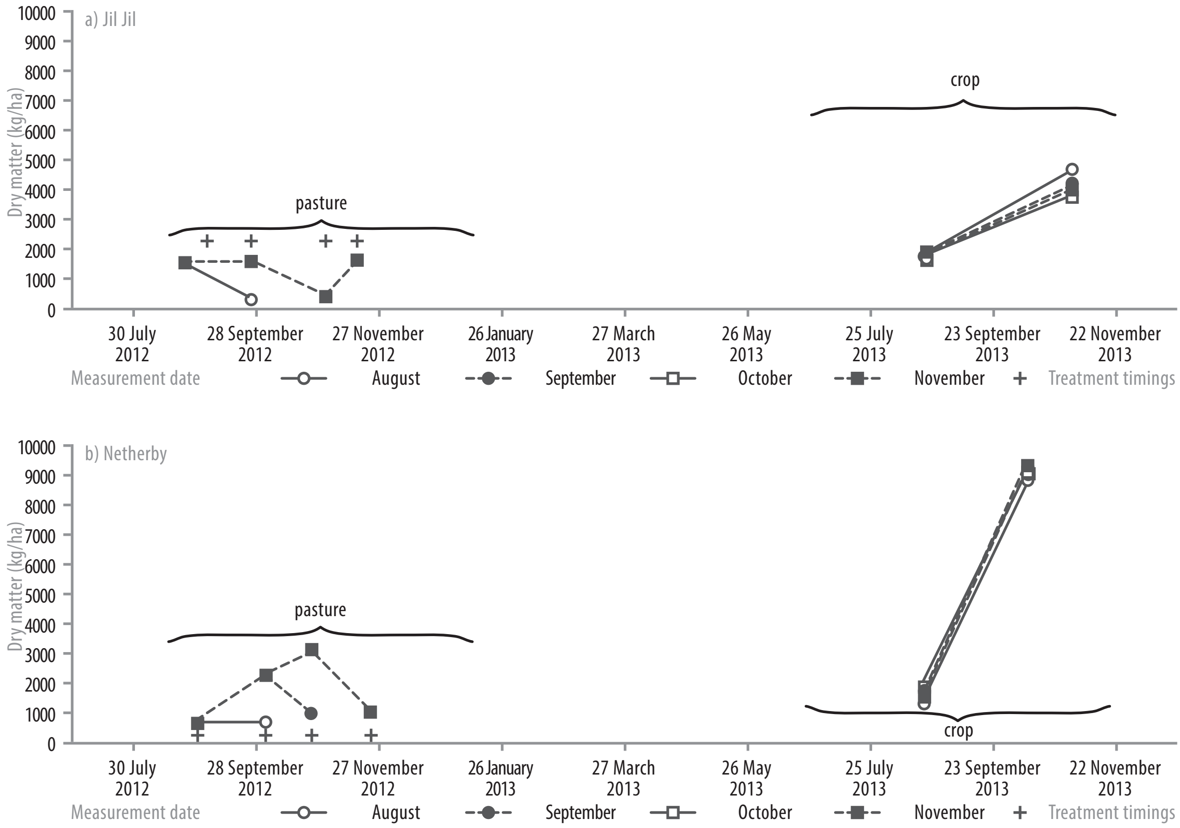

Figure 2. Change in pasture and crop dry matter over the course of the Jil Jil (a) and Netherby (b) experiments. All differences non-significant. The exact timing of treatments is shown with crosses.

Crop growing after the early termination treatment had higher per cent biomass nitrogen at early stem elongation (Figure 3; not significant at Jil Jil; $P<0.001$ at Netherby).

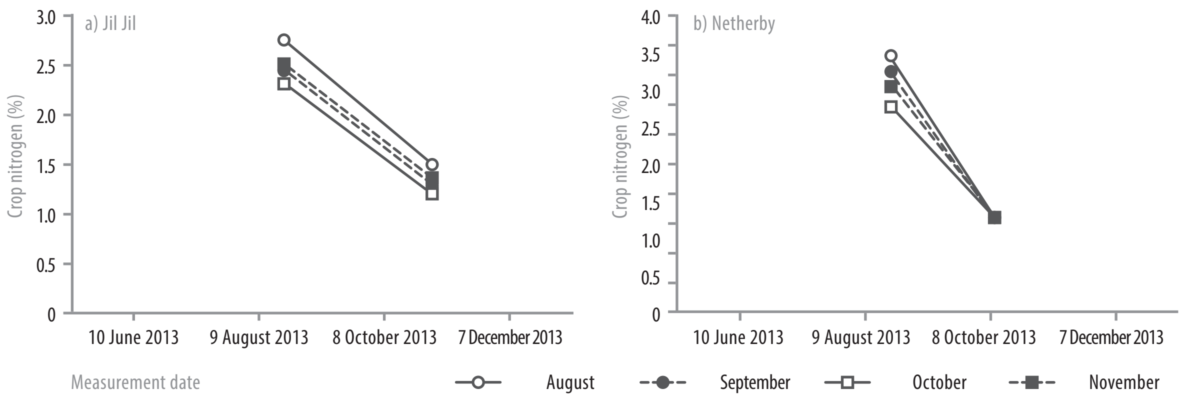

Figure 3. Wheat crop biomass per cent N at Jil Jil (a) and Netherby (b) in 2013.

Soil water, nitrogen and Colwell P

At both sites, the soil was at its driest pre-sowing. No water accumulated during the dry fallow period. Soil available water was higher for the August termination treatment, compared to the others, when measured in November (Figure 4a, b; for Jil Jil $P=0.057$). The difference was much smaller (Jil Jil) or negligible (Netherby) after the fallow period.

Soil mineral nitrogen was highest at both sites at the time of the first termination treatment, and lower after the pasture and pre-sowing (Figure 5a, b). If nitrogen was fixed by the vetch pasture, it may have mineralized during the 2013 growing season; low pre-sowing nitrogen is in keeping with the dry fallow period. As with available water, soil mineral nitrogen was also higher for the August termination treatment, significantly so at Netherby (Figure 5a, b; at Netherby P=0.002 in November; P=0.02 pre-sowing). Harvest soil nitrogen data at Netherby was not available at the time of writing.

Colwell P was measured at each sampling, and dropped from average 26-28mg/kg in pasture to 22mg/kg in-crop at Jil Jil. At Netherby Colwell P was 18mg/kg in pasture and 21mg/kg pre-sowing, on average. Treatment differences weren't significant at either site.

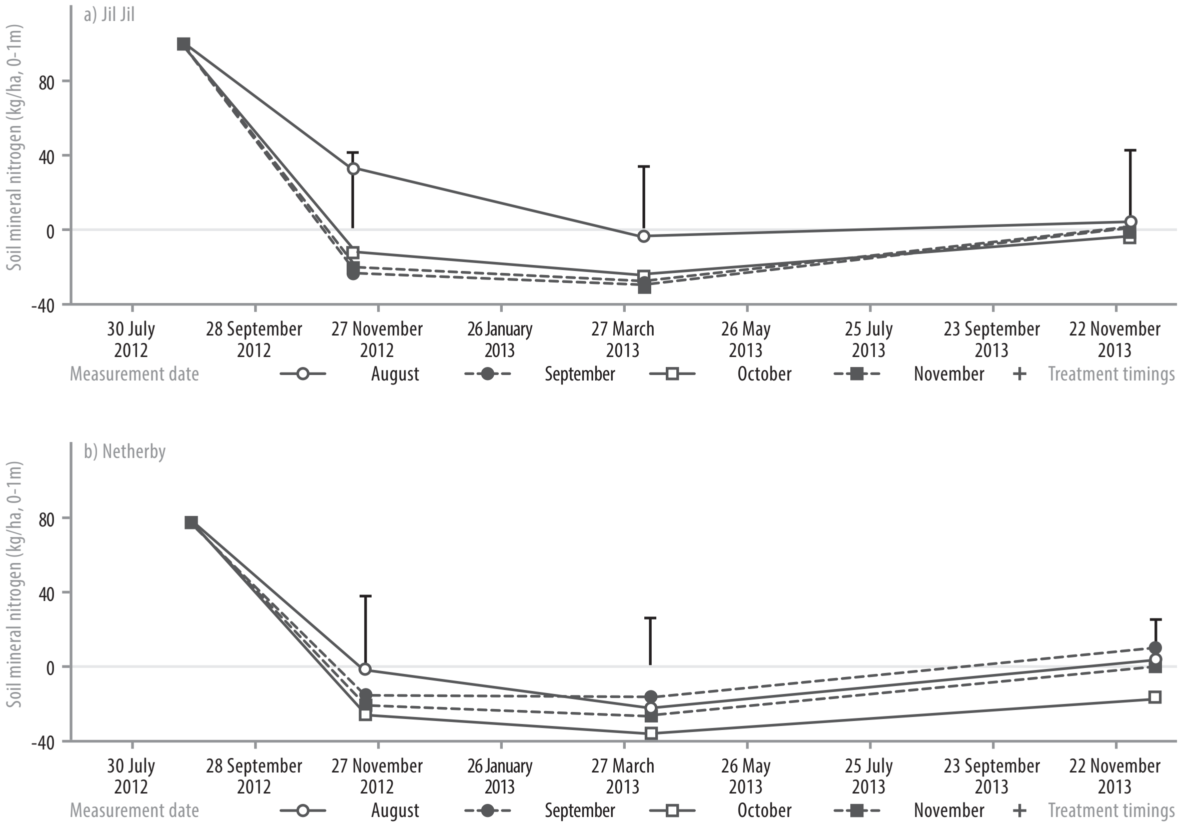

Figure 4. Soil available water in Jil Jil (a) and Netherby (b) 0-1m for termination treatments. Water measurements were significantly different at Jil Jil in November (P=0.057).

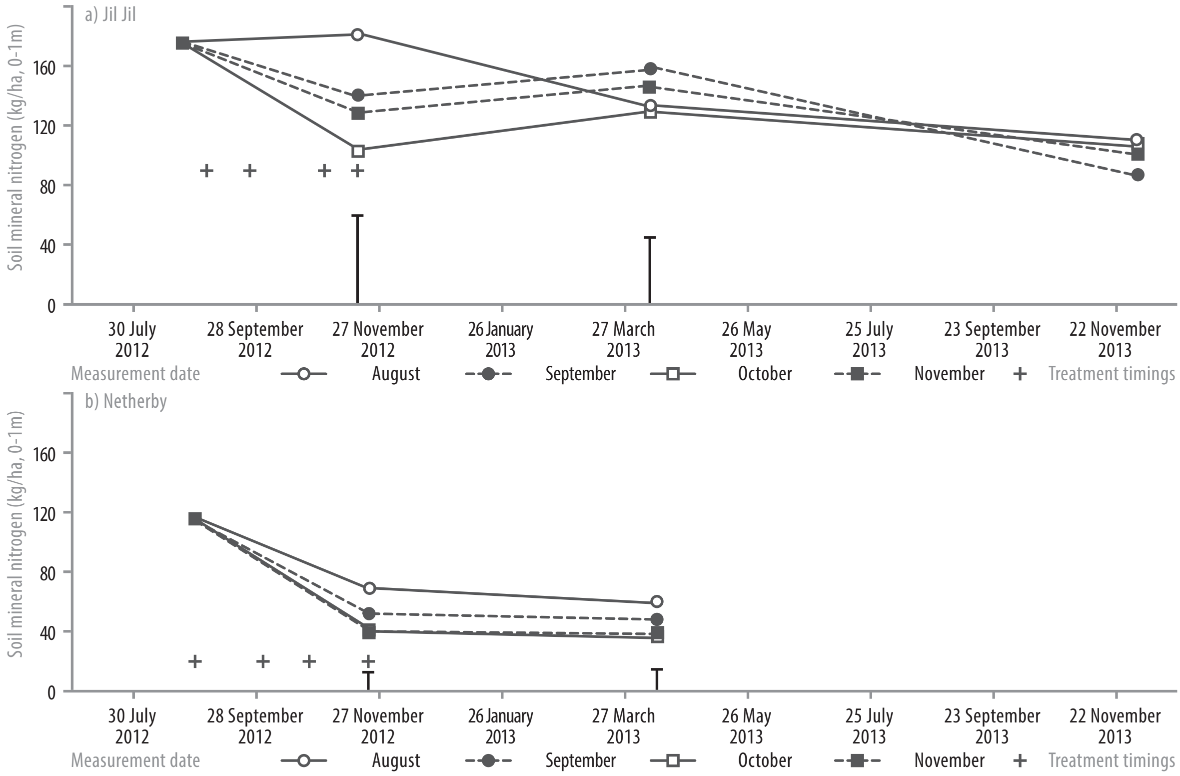

Figure 5. Soil mineral nitrogen at Jil Jil (a) and Netherby (b) 0-1m for termination treatments. Soil mineral nitrogen differences were significant at Netherby in November (p=0.002) and pre-sowing (p=0.021).

Crop yield

Yields from both experiments seemed lower than what might be expected from growing season rainfall (Table 2) and crop dry matter (Figures 2a,b). At Netherby, pre-sowing mineral nitrogen was low and grain proteins were also low, implying a nitrogen limitation. Nitrogen was not a limitation at Jil Jil and proteins were correspondingly high. There were no treatment differences in either experiment, apart from in test weight at Netherby. The October termination treatment had significantly higher test weight than the August treatment; this is difficult to interpret. Screenings (not presented) were measured but were low (<5%) and mostly a result of threshing damage.

Table 2. Wheat grain yield, grain protein and test weight for termination treatments in 2013.

Termination treatment	Yield (t/ha)	Protein (%)	Test weight (kg/hl)
Site	**Jil Jil (209mm GSR)**		
August	1.8	14.2	76.7
September	1.58	13.9	74.5
October	1.68	13.5	74.3
November	1.35	13.6	75.3
Sig. diff.	**NS**	**NS**	**NS**
CV%	**13.9**	**6**	**2.3**
Site	**Netherby (326mm GSR)**		
August	2.66	11.3	80.4
September	2.73	10.3	81.3
October	2.6	9.7	82.2
November	2.74	10.1	81.4
Sig. diff.	**NS**	**NS**	**P=0.049**
LSD			**1.2**
CV%	**5.1**	**9.7**	**0.78**

The results in both 2012/2013 experiments follow a similar theme to the 2011/2012 Jil Jil site. The 'early' (late August) termination treatment did reduce water use and result in increased soil mineral nitrogen during the pasture (most likely because it wasn't taken up by the pasture), but the impact of this was reduced by pre-sowing. In the crop there was again evidence for some benefit of early termination in nitrogen nutrition, but less obviously soil water. It was surprising that the nitrogen differences measured pre-sowing and in-crop at Netherby did not translate into measurable yield or protein differences, but there may have been a difference in mineralisation patterns between early and late termination which neutralised any differences that were evident early on.

On the pasture side, delaying termination allowed some spring pasture growth in 2012, especially at Netherby (vetch). Because of the season at Netherby, and stocking pressure at Jil Jil, there was no benefit of late termination for seed set.

The trade-off at Netherby favours later termination. The nutrition benefits of earlier termination were neutralised in-crop, and later termination provided additional pasture growth. The trade-off at Jil Jil is less clear; if the experiment was more precise and the differences in soil water and yield measured proved accurate, late August termination might be justifiably better than leaving the pasture to die (the November treatment), but some sort of termination in October might produce the best of both pasture growth and crop yield.

COMMERCIAL PRACTICE

With modest pasture growth in a relatively dry growing season, early termination (late August) may spare water and nitrogen. With a dry following summer, however, the sizes of the differences are reduced by the time of sowing, and may be neutralised by other limitations in an average growing season. The timing of termination can be chosen to suit either enterprise, but in that sort of season later termination would probably benefit the grazing enterprise, provided groundcover levels were maintained to prevent erosion. Termination timing would be most critical where early termination might deplete the seedbank (in the case of medic pasture).

The crop benefit from early pasture termination (late August) is likely to be smaller, and less reliable than a long fallow (i.e. termination in June – early July).

In years in which pasture is growing slowly, termination timing may be less critical, provided grass in the pasture and disease carryover are not an issue.

Prioritise paddocks which need medic seed set for future regeneration, but terminate more pastures later if feed is an issue.

Economic consequences

It is impossible to predict the following summer and growing season at the time of termination; the main variable is how fast the pasture is growing. Both crop and pasture benefits scale with the rate of pasture growth, and this helps to keep the trade-off with termination timing flat – with the proviso that the pasture growth is utilised, and that crops are managed so that other limitations are not the issue.

REFERENCES

Jones, B., and McMillan, D. 2012 BCG Season Research Results, 'Trade off: when to terminate medic pastures in the
Mallee', pp 151.

ACKNOWLEDGMENTS

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