Introducing perennials into grasslands in south west Australia increases gross margins for dual purpose Merino enterprises

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Keywords: Perennial pasture, gross margin, grazing, sheep, whole-farm simulation.

Introduction

Dual purpose Merino enterprises on the south coast of Western Australia (WA) typically utilise agricultural grasslands that comprise entirely of annual plant species. These grasslands face a range of challenges including a variable Mediterranean climate coupled with mostly infertile fragile sandy soils. As a consequence livestock producers have to manage potentially high supplementary feeding costs particularly in summer and autumn while running sufficient livestock to remain profitable. Sowing summer-active perennial species into these grasslands has been shown through short-term livestock trials to allow an increase in stocking rates and reduce the amount of supplement fed. The objective of this investigation was to use a validated GrassGro simulation to determine the highest gross margin (GM) system for a dual purpose Merino enterprise over a 41-year period in contrasting rainfall environments by varying a range of management factors.

The hypothesis tested was that the addition of summer-active perennials would consistently raise GM in all rainfall environments simulated.

Methods

All the simulations presented used GrassGro version 3.2.4 (Moore *et al*. 1997). Grassland and livestock data collected from a grazing demonstration in Wellstead, WA that ran from 2006 to 2008 was used to validate the model. During validation the model was paramatised to represent the Wellstead site including soil and climate parameters. This simulation formed the basis of simulations for this location from 1970 to 2010 with an average annual rainfall of 467 mm. The climate file for this period was constructed using SILO data (Jeffery *et al*. 2001) and WA Department of Agriculture and Food local weather stations. Weather station data was given preference over SILO data and historical SILO data was corrected based on the relationship between SILO and weather station data over the last 15 years. The following factors were varied for this location: (1) the proportion of ewes carrying twins; (2) time of lambing; (3) stocking rate; (4) proportion of the whole feed base that is perennial; and (5) the number of days ewes were set stocked on kikuyu in autumn. The individual grassland systems simulated are presented in Table 1, with the proportions of the different species of pasture selected to

Table 1. Description of grassland systems simulated. All were validated for the Wellstead location

System	Subclover, ryegrass & capeweed pasture	Kikuyu & subclover pasture	Lucerne, ryegrass & subclover pasture	Tall fescue & subclover pasture
Annual	100%	Nil	Nil	Nil
25% Perennial	76%	16%	8%	Nil
50% Perennial	48%	30%	11%	11%
75% Perennial	24%	35%	15%	26%
100% Perennial	Nil	44%	27%	29%

reflect a combination of previous research findings, local producer experience, livestock feed requirements and site conditions including soil type. The simulation used Merino ewes joined to Poll Dorset rams rotationally grazed. Time of lambing was varied from April to August in monthly time steps with weaning taking place four months later. Shearing was set to occur two months prior to lambing. Initial runs consistently showed that GM increased in a linear fashion with more twin lambs, so the decision was made to run all simulations with 50% singles and 50% twins to wean at 120% as this was regularly achieved at the field site and higher weaning percentages were considered impractical for Merinos.

For contrasting rainfall environments two additional locations on the south coast of WA were chosen to be modelled, Ongerup and Mt Barker, with long term annual rainfall values of 376 and 656mm respectively. The climate files for the new locations were constructed using SILO, and the soil descriptions used were identical to Wellstead. Since neither of these locations was validated the results must be viewed with caution.

Results and discussion

Introducing summer-active perennials kikuyu (Pennisetum clandestinum), lucerne (*Medicago sativa*) and tall fescue (*Festuca arundinacea*) consistently increased GM in all three rainfall environments modelled, primarily due to a reduction in supplementary feed (Fig. 1). The optimal time for lambing across all three locations was, on average, in May, but optimal
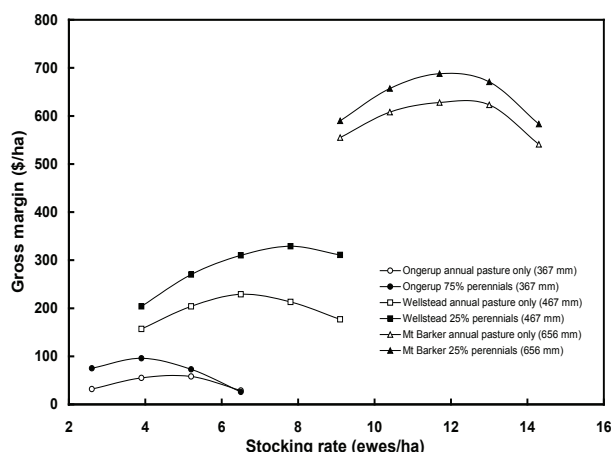
Figure 1. Average simulated GM from 1970 to 2010 for perennial systems that recorded the highest GM compared to grassland based entirely on annuals at three rainfall environments at various stocking rates. All systems are based on a May lambing and in the case of perennials ewes were set stocked on kikuyu for between 30 and 40 days in autumn.

lambing was later as the proportion of perennials in the system increased (data not presented). Set stocking the kikuyu between 30 to 40 days in autumn provided gains in GM over rotational grazing. All these responses are understandable given that perennials lengthen the growing season and partly fill the feed gap in summer and autumn (Sanford *et al.* 2003; Masters *et al.* 2006). Interestingly the findings suggest that the lowest rainfall environment (367 mm) required the highest proportion of prerennials to maximise GM (75% versus 25% for the 467 and 656 mm rainfall environments). This outcome most likely reflects the difference in season lengths; that is, low rainfall zones have a short growing season and long out-of-season feed gap which perennials can effectively fill.

High rainfall environments are characterised by long growing seasons and shorter feed gaps to which perennials make a smaller impact. At Wellstead, unlike the other two locations, introducing perennials lifted the optimal stocking rate from 6.5 to 7.8 ewes/ha (Fig. 1). It is likely that similar gains could be made at the other locations if the scenarios modelled were validated and the mix of perennials perhaps better suited rather than simply transferred directly from the Wellstead location.

Conclusion

The findings of this analysis suggest that dual purpose Merino enterprises on the south coast of WA that receive between 400 and 650mm annually can increase GM if they introduce suitable summer-active perennials to make up between 25 and 75% of their feed supply based on the amount of rainfall they receive.

Acknowledgements

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