Grain & Graze National Feedbase Project

Lucerne, stocking rate and seasonal risk in the Avon region

MJ Robertson

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Enquiries should be addressed to:

Dr Michael Robertson

CSIRO Centre for Environment and Life Sciences
Private Bag 5
Wembley WA 6913
Michael.Robertson@csiro.au

The integration of lucerne pastures into the cropping-dominant farming systems of the Central wheatbelt of WA has received considerable attention in recent times. It is clear that there are some major blocks to the use of lucerne by cropping farmers despite apparent economic advantages. It is possible that climate risk associated with perennial pastures in the farming system has induced a perception that lucerne is too risky. The project team thought that there could be some advantage in trying to quantify the risks and variability of production from lucerne (particularly summer production) and the consequences this would have for livestock production. As the scope for increased stocking rate is a focus of the Avon project, the analysis was conducted over a range of stocking rates.

Sheep production systems on lucerne in the Avon range from conventional wool-only systems to prime-lamb production with crossbreds. The risks involved with each of these enterprises will be different; hence it was decided to evaluate the risks associated with each. One of the main consequences of seasonal risk is the variation in call upon supplements. Hence, analyses were configured so that variation in the need for lupin grain to supplement lucerne forage was quantified. Finally, close utilisation of summer pastures carries with it the risks of over-grazing, low ground cover and associated erosion risk. We attempted to quantify the tradeoff between pasture utilisation and ground cover (as a surrogate for erosion risk) across the various management regimes. Previously tools such as "SummerPack", produced by DAWA to explore summer feeding strategies for sheep in WA have not considered seasonal risk, and so the approach used here builds upon that earlier work.

Methods

Simulations were conducted with APSIM with the following components (modules) plugged in: soil water, soil nitrogen, lucerne, management, supplement (from GrazPlan), stock (from GrazPlan).

The climate record for 1975-2005 at Kellerberrin (31°62' S, 117°43' E) in the low-medium rainfall zone (330 mm MAR) of the central wheatbelt in WA was used. Figure 1 indicates the degree of variation in summer (November-March) rainfall. Low summer rainfall in recent seasons (2000/01 to 2004/05) has contributed to the perception of lucerne being a high risk option for summer feed in the low-medium rainfall zone in Avon.

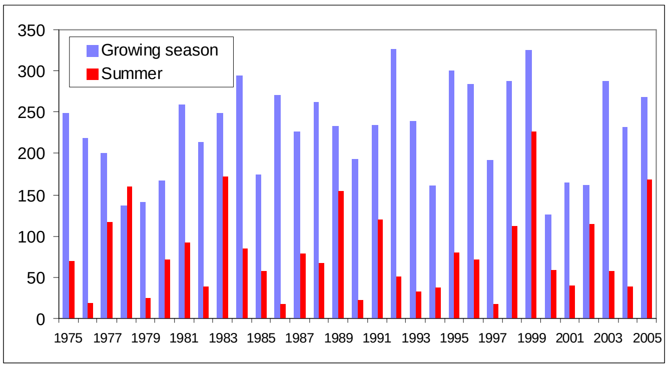

Figure 1: Variation in growing season (April to October) and summer (November to March) rainfall over the climate record used in the analysis.

A deep loamy duplex soil was used. An established stand of pure lucerne cv. Sceptre (100 stems/m^2) was simulated through the climate record and various livestock production regimes were imposed on the 1st November and then de-stocked at the end of April.

Fleece weight, live weight, supplements supplied, feed on offer, lucerne biomass, ground cover were output.

Table 1: Livestock systems simulated at Kellerberrin.
Note that the “without supplementation” regime was not applied at the 15 head/ha stocking rate.

System	Livestock production system	Stocking rate (per ha)	Supplementation
1 and 2	Adult Merinos, initial live weight 55 kg, wool production. Supplement fed to maintain condition score above 2.	5	Yes and no
3 and 4		10	Yes and no
5		15	Yes
6 and 7	Weaner merino crossbred, initial LW 25 kg, meat production. Supplement fed to achieve a target LW of 45 kg at end April.	5	Yes and no
8 and 9		10	Yes and no
10		15	Yes

Results

With the wool production system, higher stocking rates lead to greater pasture utilisation, greater live weight gain and wool production per hectare but at the cost of greater supplementation and lower ground cover (Table 2). As an indication of the economics lupin grain as a supplement would cost roughly $200/t while wool could be valued at 700 c/kg. Therefore, on average, when going from 5 to 15 sheep per ha supplements cost an extra $140/ha while wool income increases by $245/ha. This analysis however does not account for follow on impacts of summer feeding regime on subsequent reproductive performance. Higher stocking rates will also be associated with more erosion risk, shown by both lower annual average ground cover and more of the year with less that 10% cover.

At the 5 head/ha stocking rate there was no effect of supplements on wool production. However, live weight gain is less and this will have impacts on wool quality and subsequent reproductive performance of breeding stock. A doubling of stocking rate to 10 head/ha does not double wool production and also results in a net live weight loss.

The mean performance in Table 2 hides considerable seasonal variation that must be managed in reality by a farmer. Figure 2 shows the variation in pasture on offer and the negative correlation this has with supplements required. In around half of the seasons, less than 1000 kg/ha of lucerne will be on offer and this means supplementation of at least 20 kg/head or de-stocking (not examined here) is required. Variation in feed on offer will have consequences for live weight gain even where supplements are provided (Figure 3).

With the prime lamb production system, similar trends were evident to those in the conventional wool system (Table 3). In this case the key production parameter is live weight gain with the target being an increase of 20 kg/head to reach 45 kg by the end of the summer period. Wool production is a secondary consideration. At 5 and 10 lambs/ha, with 40 and 200 kg/ha of supplements fed respectively, the target live weight gains of 100 and 200 kg/ha, respectively, were met. However, at 15/ha the target fell well short and at considerable expenditure of supplement. Without supplements, at 5 lambs/ha, an average of 17 kg/ha of live weight gain was possible. At a higher stocking rate of 10/ha there was no extra gain in live weight per ha.

In contrast to the wool-only system the variation in supplements needed for prime lamb production was less (Figure 4) with little needed if feed on offer was greater that 1000 kg/ha on average over the summer season. This is due to lambs being more energetically efficient than adult sheep at converting feed intake into live weight gain. In this case even though the average live weight gain for the 1975-2005 record was 20 kg per head this masks considerable year-to-year variation. Figure 5 shows that in about 50% of seasons the 20 kg/head gain was not achieved. This underscores the inherent variability in the systems and the difficulty even with supplements in mitigating this risk.

Table 2: Mean performance indicators (1975-2005) for the wool production system at Kellerberrin.

	With supplements			Without supplements	
Stocking rate per ha	5	10	15	5	10
Pasture intake per ha (kg)	1139	1915	2397	1195	2009
Supplement intake per ha (kg)	110	402	821	0	0
Live weight change per ha (kg)	48	80	107	27	-28
Fleece growth per ha (kg)	20	39	55	19	33
Annual average cover	26%	22%	20%	26%	22%
% days < 10% cover	35%	45%	50%	35%	45%

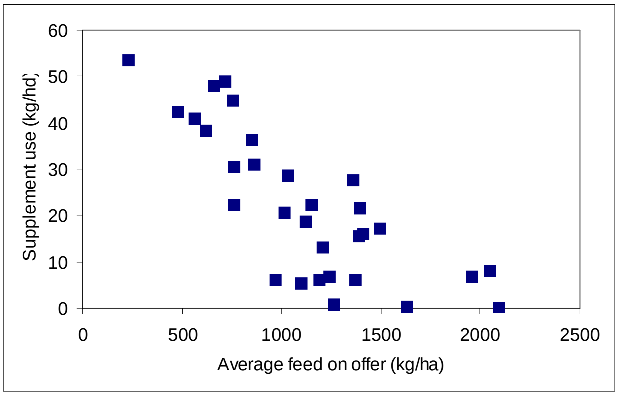

Figure 2: Year-to-year variation (1975-2005) in lucerne feed on offer and supplements consumed in the wool-only system at 10 sheep/ha.

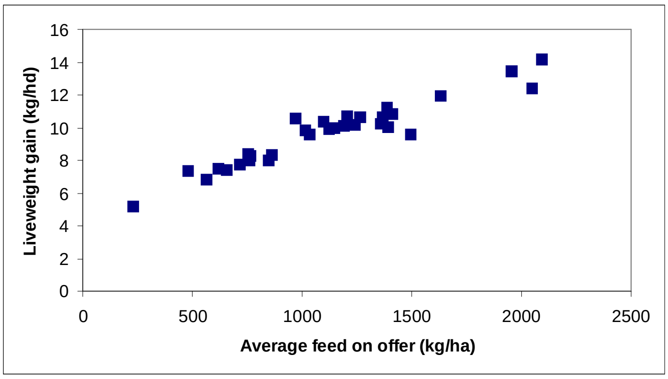

Figure 3: Year-to-year variation (1975-2005) in feed on offer and summer live weight gain in the wool-only system at 10 sheep/ha.

Table 3: Mean performance indicators (1975-2005) for the prime lamb production system at Kellerberrin.

	With supplements			Without supplements	
Stocking rate per ha	5	10	15	5	10
Pasture intake per ha (kg)	1197	1960	2429	1203	1988
Supplement intake per ha (kg)	38	208	491	0	0
Live weight change per ha (kg)	96	156	207	85	89
Annual average cover	27%	22%	20%	27%	22%
% days < 10% cover	35%	44%	49%	35%	44%

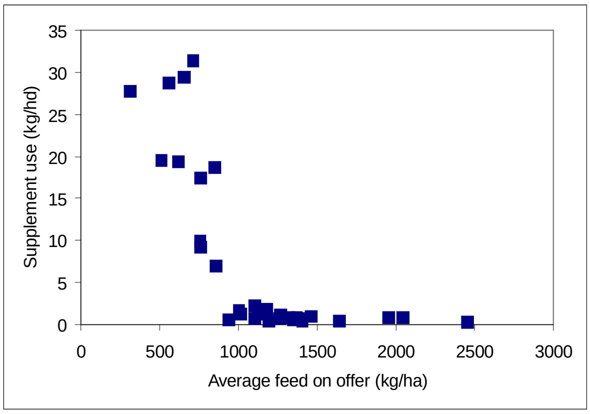

Figure 4: Year-to-year variation (1975-2005) in lucerne feed on offer and supplements consumed in the prime lamb system at 5 head/ha.

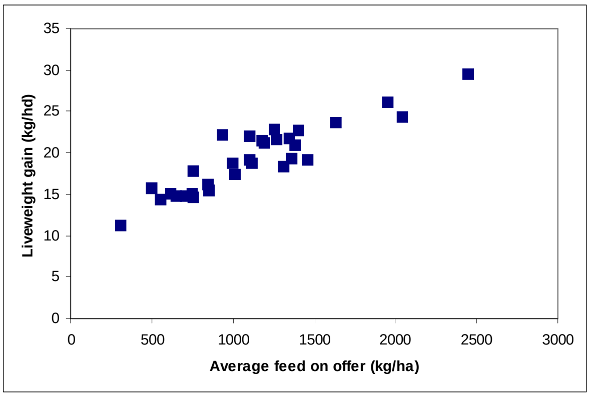

Figure 5: Year-to-year variation in lamb live weight gain as a function of average summer lucerne feed on offer

Implications and further analyses

This preliminary analysis has highlighted the riskiness of lucerne as a summer forage source in the low-medium rainfall zone of the Avon, where summer rainfall is highly erratic. It also shows that higher stocking rates, while increasing average production per hectare above the costs of extra supplementation, will have adverse effects on ground cover and hence erosion risk.

The strength of the simulation tools used here is that the management rules for pasture and flock management can be flexibly specified and hence many more options than those presented here can be explored with Avon project staff and their stakeholders.

Since these analyses were conducted the emphasis in the Avon project has shifted from an explicit focus on lucerne to a more general one of the scope for increased stocking rate. Futures simulations will be conducted with the project staff addressing this issue and will require consideration of utilisation of annual pastures and crop stubbles and the impacts on crop production. The analysis will be done in close collaboration with the whole-farm economics project, and will bring a seasonal risk element to their MIDAS approach which used an “expected” season.