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Sheep Updates 2007 - part 3

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Benchmarking demonstrates both the potential and realised productivity gains in the sheep and wool industry

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ABSTRACT

199 businesses contributed to a benchmarking programme as part of The Sheep's Back programme. We report some results that illustrate the magnitude of local and state wide variation between sheep enterprises highlighting the opportunity for change. Variation in key performance criteria based on per hectare production consistently outweighed those based on price or per head production. The data suggest that a 10% increase in stocking rates are possible over the life of the program, and highlights the key performance indicators of the sheep system.

INTRODUCTION

The sheep and wool industry has a poor reputation for productivity gains and has lost significant area to competing industries such as broad acre cropping. A lack of factual financial and production information combined with popular myths has tended to exacerbate the situation. In contrast sheep and wool consultants have observed that their clients continued to achieve excellence in productivity gains and subsequent profits which have allowed these businesses to rapidly expand during the same time frame.

THE SHEEPS BACK™ (TSB) Program is an Australian Wool Innovation, Farmbis and grower funded programme comprising 21 groups spanning the agricultural region of WA. It currently has 356 members encompassing 241 farming operations. TSB began with 6 pilot groups in the spring of 2004. The purpose of these initial groups was to validate TSB as an effective extension model. Following the success of the pilot programme 15 formal TSB Groups were formed in 2005.

TSB is a motivational facilitated adoption program run at a local level. It was designed to facilitate measurable improvements in productivity and profitability to sheep producers. The core message of TSB is that stocking rate drives profit. However, to increase stocking rate to an environmental potential a series of exit strategies or 'Back Doors' need to be in place to manage the poor season.

Utilising financial and production benchmarking should be a key element to the success of any extension program. This would enable participants to identify the necessary profit drivers and highlight any pertinent opportunities for change to their business. Benchmarking enables participants to properly evaluate the current state of the enterprise and the variation already existing within the local environment. This allows an estimate of the potential to change. ICON also has utilised the benchmarking process (the groups are benchmarked three times throughout the program) to measure its ability to make change and to demonstrate to AWI its worth. To date this is the only extension program to attempt this process.

The aims of the benchmarking were to 1) Examine the technical efficiency of the sheep enterprise, 2) demonstrate the range of possible outcomes in any one environment and hence

the potential for change, and 3) Illustrate the key performance indicators of the enterprise to TSB participants.

METHOD

A total of 21 groups were formed across the state in locations ranging to the south west of an arc from Geraldton to Merredin and Esperance. Benchmarking forms were distributed to participants in each year of the programme. This included 1 'retrospective' year. Completed forms were collected by the facilitators of each group and submitted to the program coordinator for analysis and presentation.

All results were calculated as described by AAAC (WA) Inc 2006 financial standards. The results are calculated and presented to participants both on an individual basis and a group basis ranked according to gross margin per winter grazed hectare (GM/WGHa). Based on this ranking averages were then calculated for the lower 30%, whole group and the top 30% of each group to allow individuals to estimate their position in the group. In general, ram sellers were removed from the calculation of each sub group to avoid bias from ram sales.

RESULTS

The data presented in this paper comprises a summary of three years of "Pilot" group data and two years data from full time members of "TSB" groups.

199 businesses participated in the formal TSB benchmarking process. By industry standards return rates were high at 95% in 2004/05 and 83% in 2005/06. Survey respondents were largely, but not entirely identical in each year. This level of response from TSB members has allowed the programme to rapidly develop one of the largest sheep benchmarking data bases in Australia (excess of 460 responses over the two years).

Table 1: Physical and production traits (mean) of all groups and variation (%CV) between each group surveyed in 2005/06.

Sheep	Mean	CV (%)	Sheep Trading	Mean	CV (%)
Total DSE	7584	43.9%	Marking %	86.3%	5.4%
Ewes	56.18%	6.6%	Lambs/ha (No/ha)	2.64	39.5%
Wethers	7.70%	47.3%	Sale Price (\$/hd)	\$47.5	7.6%
Hoggets	31.29%	9.0%	Wool Production		
Stocking Rate			Wool Price (\$/kg)	\$4.15	7.9%
DSE/WGHa	7.20	42.3%	Total Kg	33479	43.2%
DSE/WGHa/100mm RF	1.76	22.7%	Kg Wool / DSE	4.46	13.6%
			Kg Wool / WGHa	31.1	42.2%

Table 1 demonstrates that the typical wool grower attending a TSB programme was well above the national average in scale of flock and total output. The sample means indicated that respondents of the program were in the top 15% of the national average for sheep numbers and wool production and slightly above both state and national average marking rates (K. Curtis, 2007).

The flock structures were dominated by ewes, representing over 56% of all sheep, whilst adult wethers formed by far the smallest component of the flocks at 7.7%. In general this represented wethers that had not made export shipping specifications, rather than sheep held for wool production or risk management.

Considerable variation between the groups can be seen in the per hectare traits such as stocking rate (42.3%), wool production (42.2%) and lamb production per ha (39.5%). These data are consistent with variation in rainfall across the state. In contrast the variation in stocking rate per 100mm of rainfall fell to 22.7% implying a consistent approach to stocking rate regardless of location.

Surprisingly the 'so called' key performance traits such as lamb marking (5.4%), wool production per DSE (13.6%), sheep sale price received (7.6%) and net wool price received (7.9%) showed very little variation between groups. If we assume that the net price received is a reflection of an amalgam of premiums and discounts for quality traits then the consistent prices implies remarkable similarity in both production and quality across the state.

The financial results presented in table 2 illustrate clearly that the production similarities illustrated in table 1 flow into financial results. In particular both income and expenditure per DSE showed small and consistent variation. It became clear during the analysis that localised expenditure patterns varied a great deal between groups, particularly for fertiliser and feed costs. The fact that income per DSE varies less than expenses implies a lack of response to some inputs.

The results illustrated that on average, the sheep enterprise were capable of very respectable returns with a gross margin of \$134/WGHa and a cost efficiency of 41%. Large variation between the per hectare results is in line with rainfall locations.

Wool income represented 58% of total sheep income compared to sheep trading income contributing 42% of the total indicating that even at a relatively low wool price of \$4.15/kg, and a high sheep sales price of \$48/hd, wool income remains the dominant feature of the sheep enterprise. These results surprised many participants, who were convinced that wool income was negligible and were considering a switch to meat production.

Table 2: Financial results expressed both as Gross Margin per DSE and per WGHa (means) of all group and variation (%CV) between all groups surveyed in 2005/06.

\$/DSE	Mean	CV (%)	\$/WGHa	Mean	CV (%)
<i>Income</i>			<i>Income</i>		
Wool Proceeds	\$18.51	13.2%	Wool Proceeds	\$132.73	46.6%
Profit ex Sheep Trading	\$14.06	13.0%	Profit ex Sheep Trading	\$98.22	35.3%
Total Sheep Income	\$32.57	9.8%	Total Sheep Income	\$230.95	41.2%
<i>Expenses</i>			<i>Expenses</i>		
Total Sheep Costs	\$7.42	10.5%	Total Sheep Costs	\$51.83	37.6%
Fertiliser & Pasture	\$2.88	38.7%	Fertiliser & Pasture	\$22.13	64.0%
Feed	\$3.03	21.8%	Feed	\$22.70	48.5%
Total Variable Costs	\$13.33	11.5%	Total Variable Costs	\$96.66	42.5%

Gross Margin / DSE	\$19.25	17.1%	Gross Margin / WGHA	\$134.29	42.7%
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When we examined variation within groups by comparing the difference between the low and high 30% of each TSB group we found remarkably similar outcomes (Table 3). There was often only small differences between the high and low performing sub-groups in commonly held key performance indicators such as lambing %, sheep sales price, wool price and wool production per DSE. In contrast the parameters expressed on a per hectare basis such as stocking rate, lambs/ha and wool production per hectare were consistently greater in the high 30% sub-group.

Table 3: Mean % differences between the high 30% and low 30% grouping, for selected physical parameters in each of the 15 groups (ranked on GM/Wgha), and the variation in that difference (CV%) between each group.

Sheep Nos. & Structure	Mean	CV (%)	Sheep Trading	Mean	CV (%)
Total DSE	21.8%	233%	Lambing %	9.3%	164%
Ewes	8.7%	148%	Lambs/ha (No/ha)	67.5%	72%
Wethers	21.0%	345%	Sale Price (\$/hd)	12.9%	85%
Hoggets	-4.8%	-340%	Wool Production		
Stocking Rate			Net Wool Price	12.8%	134%
DSE/WGHa	45.6%	77%	Total Kg	46.9%	185%
DSE/WGHa/100mm RF	33.2%	125%	Kg Wool / DSE	15.2%	200%
			Kg Wool / WGHa	67.4%	63%

There was large financial variation between the high and low 30% sub-groups (Table 4). The mean difference in GM/WGHa was 179% which in turn implied a difference of \$110/WGHa between the high and low rankings in all groups. It was this level of variation that attracted great interest from participants of the survey and provided financial motivation to many in the group.

Benchmarking the each group over time has demonstrated changes in production achieved. Table 5 outlines these changes for this programme. The Pilot Groups increased total sheep numbers by a huge 20% over the 3 years of the study and managed to increase stocking rate by nearly 13%. This resulted in a 30% increase in wool production and 11% increase in lamb production. The TSB groups also increased total sheep numbers by 10% and demonstrated an intention to increase stocking rates for the 2006 season by an average of 12%.

Table 4: Mean % difference between the high 30% and low 30% grouping, in financial performance per DSE and per WGHa in each of the 15 groups (all ranked on GM/Wgha), and the variation in that difference (CV%) between each group.

Gross Margin / DSE	Mean	CV (%)	Gross Margin / Ha	Mean	CV (%)
<i>Income</i>			<i>Income</i>		
Wool Proceeds	27.3%	124%	Wool Proceeds	86.7%	68%
Profit ex Sheep Trading	75.4%	117%	Profit ex Sheep Trading	155.7%	74%
Total Sheep Income	40.8%	86%	Total Sheep Income	105.9%	48%
<i>Expenses</i>			<i>Expenses</i>		
Total Sheep Costs	6.4%	306%	Total Sheep Costs	56.2%	83%
Fertiliser & Pasture	29.4%	350%	Fertiliser & Pasture	83.6%	190%
Feed	34.3%	516%	Feed	75.0%	263%
Total Variable Costs	4.9%	502%	Total Variable Costs	52.7%	100%
Gross Margin / DSE	94.4%	119%	Gross Margin / WGHA	179.0%	58%

Although the 2006/07 benchmarking results are not yet available, for the formal TSB groups it is hoped that stocking rates were in fact reduced by at least 15% due to the state wide poor season. The key platform of TSB is that stocking rates need to be actively managed in poor

Table 5: Change in benchmarks over time for Pilot Groups and TSB participants over time.

	Pilot Groups	TSB
Benchmark Years	2003-2005	2004-2006
Total Sheep Numbers	+16.80%	+9.95%
Total DSE	+19.61%	+7.14%
Lambs per Ha	+10.99%	+2.02%
Stocking Rate /WGHa	+12.76%	+1.13%
Intended S/R in 2006	N/A	+11.91%
Wool Production (kg/ha)	+29.28%	+8.60%
GM/WGHa	+27.95%	+16.01%
Cost Efficiency	+17.36%	+16.31%

CONCLUSION

This program has demonstrated both the capacity to achieve large scale collection of benchmarking data sets and the significant variation in key performance indicators like total sheep income, stocking rate and lamb and wool production per hectare within local areas.

Benchmarking an enterprise becomes both the key and the tools to begin implementing change. Localised data was, and continues to be seen as essential by TSB participants despite the results suggesting that output per DSE varies much less than output per hectare. However the localised data sets also allowed individual participants to focus upon targets that were readily achievable in their own particular area, which in turn developed the confidence to implement change. In all cases the data showed sufficient variation to allow scope for improvement using existing technology, rather than reliance upon new technology. Exposure to benchmarking and detailed analysis has rapidly improved farmers understanding of their sheep enterprise and highlighted strategies to improve particular aspects of their business. Benchmarking has demonstrated that education and change is occurring within TSB. Sheep systems are now being treated more as business opportunities with an associated profit focus rather than historical production systems.

KEY WORDS

The Sheep's Back, sheep management, benchmarking, survey

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Australian Wool Innovation, Farmbis, and the 225 farm businesses associated with TSB.

Paper reviewed by: Ashley Herbert (Agrarian Management).

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Improving sheep genetics will increase farm profitability

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ABSTRACT

The experiment used 5 genotypes selected from a ewe trial run at Katanning to calculate whole farm profit. The 5 genotypes had 50 ewes each and were run together for 3 years. Whole farm profitability was calculated using 3 years of data for each of these genotypes in the Great Southern version of the MIDAS model. Seven price scenarios were used in the calculations. One genotype was more profitable than the rest for every scenario. There was high variation in profitability between the 5 genotypes. This means that some ewe trial participants can identify areas to improve their sheep genetics and therefore increase whole farm profitability. The calculations would be improved with more reliable information on ewe survival, lamb survival and ewe condition.

AIMS

Ewe trials compare the performance of different genotypes in the same environment. This comparison allows participants to identify areas where their genotype has potential to improve. Using whole farm modelling to compare the profitability of these genotypes in different price scenarios shows which genotypes are generally more profitable to run in the Great Southern. This paper tests the hypothesis that ewe trials can be used to identify genotypes that are consistently more profitable than others at any meat and wool price.

METHOD

The Great Southern version of the MIDAS model (Young, 1995) was used for the calculations of whole farm profit. The information used to do the simulations is from a ewe trial which was run at the Great Southern Research Institute in Katanning in Western Australia.

[Ewe trial](#)

The ewes in the trial were run together in groups of 50 for 4 years. Five groups of ewes were picked for the calculations because they showed the extremes of the genotypes in the ewe trial. The information for these ewes are presented in table 1. The measurements are the averages from 3 shearings and 2 lambings. The average live weight at weaning is the live weight of the progeny of the ewes. The ewes lambed in July and were mated to Merino rams. The ewes were shorn when the lambs were weaned in October.

Table 1. Average measurements for each of the genotypes used in the calculations

Genotype	Average clean fleece weight (kg)	Average fibre diameter (µm)	Average live weight (kg)	Average live weight of progeny at weaning (kg)	Weaning percentage (%)
1	3.3	19.4	47.3	23.5	78.2
2	2.2	18.3	48.3	24.6	86.8
3	2.9	21.3	55.6	26.6	83.5
4	1.9	18.4	40.4	23.4	81.3
5	2.0	21.3	56.9	26.4	89.0

MIDAS model analysis

The MIDAS model represents a 1000 ha farm in the Great Southern Region of Western Australia. The calculations were based on a self-replacing Merino flock. Surplus ewe hoggets were sold off shears at 1.5 years old. Cast for age ewes were sold at 5.5 years. Wethers can be sold as lambs at the saleyards or as mature shipping wethers depending on which is more profitable. The pasture production is based on a mixed sub-clover, annual grasses and herbs pasture which is typical of farms in the region.

The measurements in table 1 were used to simulate the production of the ewes for 5.5 years from birth to sale. The seven price scenarios used in the calculations are shown in table 2. The highlighted numbers show how each scenario is different from the standard prices.

Table 2 The prices used for each simulation.

Simulation	18 μ m (¢/kg clean)	21 μ m (¢/kg clean)	Hogget Ewe (\$/head)	CFA ewe (\$/head)	Wether (\$/head)
Standard	1615	1091	48	45	50
High Wool price	1077	727	48	45	50
Low wool price	2153	1454	48	45	50
High meat price	1615	1091	63	60	65
Low meat price	1615	1091	33	30	35
High FD premium	1873	1122	48	45	50
Low FD premium	1217	1034	48	45	50

The calculations of energy requirements of the ewes were based on live weight and assumed all genotypes followed a similar condition score profile throughout the year. However, the genotypes could have different condition score profiles and this would impact stocking rate, supplementary feeding and profitability.

RESULTS

The whole farm profitability of the 5 genotypes are presented in table 3. Genotype 1 is the most profitable and genotype 5 the least profitable in all of the simulations.

Table 3 Whole farm profitability of the 5 genotypes for each simulation.

Ranking	Standard	High Wool price	Low wool price	High meat price	Low meat price	High FD premium	Low FD premium
Most profitable	1	1	1	1	1	1	1
	\$316,259	\$175,262	\$490,147	\$253,580	\$361,064	\$247,527	\$400,684
	2	2	2	3	2	2	2
	\$234,805	\$130,159	\$346,828	\$184,573	\$275,941	\$159,152	\$315,137
	3	3	4	2	4	3	4
	\$199,798	\$105,882	\$298,251	\$171,435	\$235,040	\$129,450	\$276,825
	4	4	3	4	3	4	3
	\$197,949	\$95,050	\$292,716	\$139,505	\$208,091	\$120,597	\$270,530
Least profitable	5	5	5	5	5	5	5

	\$135,078	\$70,812	\$198,647	\$125,267	\$140,630	\$59,801	\$214,275
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CONCLUSION

Amongst the five genotypes selected on extreme performance values, one genotype was identified as more profitable than the others at all seven price scenarios. There is a large variation in profitability between the 5 genotypes. This means that the participants of the ewe trial can identify potential areas to improve their genotype and increase whole farm profit.

The genotypes that grew more wool per kg of live weight (high wool production potential) were the most profitable. The calculations could be improved with more reliable information on ewe survival, lamb survival (only 50 ewes in each group) and ewe condition.

The analysis suggests that the ewes with a high wool production potential are most profitable when run at high stocking rates. In reality there are risks associated with running sheep with high production potential at high stocking rates (Herselman *et al*, 1998).

KEY WORDS

Whole farm modelling, Ewe trial, MIDAS

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MEAT, MERINOS AND MAKING MONEY IN WA PASTORAL ZONE

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ABSTRACT

Meat sheep and Rangeland Goat enterprises are rapidly replacing the more traditional Merino wool enterprise in the WA southern rangelands. These new enterprises may have the necessary characteristics, productive performance and markets to generate satisfactory business returns in the region. However, managing these enterprises is not without potential risks and costs. This paper presents preliminary results from ongoing DAFWA research partly funded by MLA that is investigating the productive performance of Damara, Merino and Rangeland Goat flocks on commercial stations in the WA pastoral zone.

AIMS

Merino sheep enterprises continue to decline across the rangelands while cattle, meat sheep, and goat production is expanding. In 2005/06 alternative meat sheep breeds were run on an estimated 30 stations (total of 313 stations in WA southern rangelands) and constitute approximately 30% of the region's total flock. Rangeland Goat production also has become a dominant enterprise in the region (Rangeland Goat enterprises involve routine husbandry practices as opposed to basic feral goat harvesting). In 2005/06 total goat numbers (combined Rangeland and feral goats) represented 30% of the total livestock in the WA Southern Rangelands.

There is concern by some parties that meat sheep breeds, principally Damaras and also Rangeland Goats have a greater capacity to adversely affect rangeland condition. In addition, there is limited empirical data on the productivity of these livestock species in arid regions.

To address these questions a demonstration trial was initiated by industry and the Department of Agriculture WA (DAFWA). The primary aim of this Meat and Livestock Australia (MLA) PIRD funded trial was to investigate the performance of Damaras, Rangeland Goats and Merinos and their relative impacts on rangeland condition. A key objective of the trial was to demonstrate the economic and ecological benefits of matching stocking rate to carrying capacity based on seasonal variation regardless of the livestock enterprise.

METHODS

The trial commenced in mid-2006 and has taken a participatory approach which involves four pastoral stations in the region. These include: two Merino stations and two Damara stations (one which is also managing a Rangeland Goat enterprise). Participating stations vary in size from 120 000 ha to 400 000 ha with average stocking rates of 1 DSE/12 ha. Average rainfall for the stations is 250 mm. Measurable economic and ecological goals were defined by the pastoralist and were used as the framework to manage towards. Monitoring of animal productivity (lambing percentages, weight gain, body condition score, faecal egg counts), rangeland condition (pasture monitoring sites), food-on-offer (FOO) paddock assessments, seasonal conditions (rainfall, NDVI) and economic performance (gross margin per paddock) was conducted on two representative paddocks on each station.

RESULTS

The seasonal conditions on all stations have been below average since the commencement of the trial. The following results are from one individual station managing a Damara enterprise and exemplify the type of information collected and the management strategies employed in response to the seasonal conditions and related FOO.

In November 2006, ewes (ages 2 to 4 year old) were weighed (average weight: 52 kg), body condition scored (average BCS: 2.5) and their lactation status (wet or dry) was noted (lambing occurs all year round with a peak period between June to September). Lambs were weighed (average weight: 15 kg), sexed and tagged. Food-on-offer estimates in the paddock at the time indicated that there would only be sufficient feed for 48 days before animal performance would be compromised and/or range condition would be adversely impacted. Due to management logistics, and the lack of feed generally, livestock were left in the paddock for 78 days before they were moved in February into a new paddock. This had an expected impact on livestock productivity and rangeland condition, including: a decline in BCS and lamb weight gains, the over-utilisation (+70%) of favourable perennial grass and shrub species and the breakdown of woody patches.

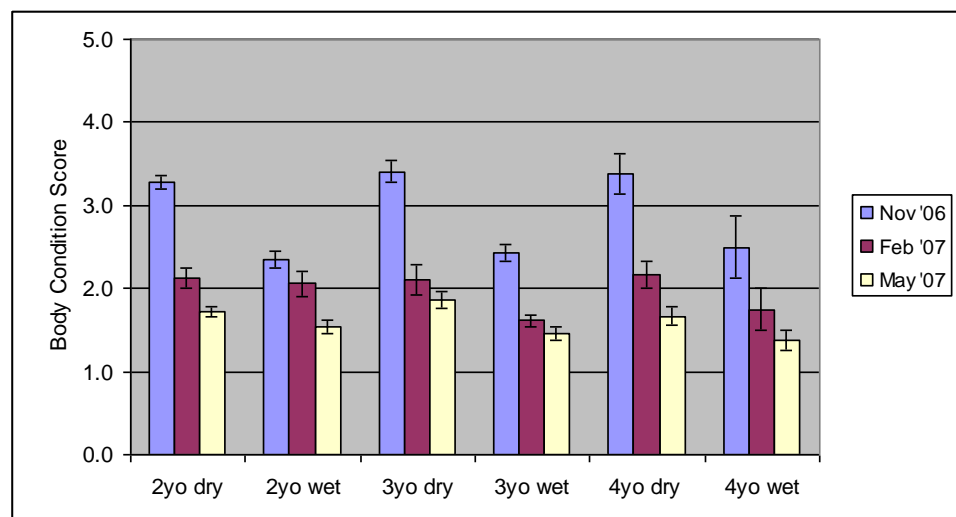


Figure 1: Change in body condition score of Damara ewes November to May 2007

± 1 standard error bars illustrated.

Feed supply in the new paddock between February and May also was limiting (estimated 59 grazing days) and this resulted in a further decline in performance. Figure 1 illustrates the general decline in BCS of both the dry and lactating ewes between November to May 2007. The average decline ranged between 0.5 to 1 BCS. The average weight gain of the lambs over this period was 65.8 grams/head/day. The lambing percentage for the trial flock was expected to be 120% had feed conditions remained adequate. Following the May results, in the interests of business performance and rangeland condition, station management significantly reduced the trial flock numbers and conducted a major destock of the whole station.

CONCLUSION

These preliminary results support the concept that regardless of the livestock enterprise, matching stocking rate to carrying capacity is of first importance. This will only be achieved through calculated management of stocking rates by working towards the business's economic and ecological goals. The trial is continuing.

KEY WORDS

meat sheep, Rangeland Goats, food-on-offer, rangeland condition, stocking rate

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Nitrogen – farmers' friend or foe?

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ABSTRACT

One of the main consequences of the persistent cost/price squeeze occurring in most sectors of agriculture is the continued development of more intensive production systems. Nowhere is this more evident than in the livestock industries, where increasing use of nutrients (particularly nitrogen) by agriculture, brings significant environmental risks. Intensive pasture-based animal production systems in Australia now rely on large net imports of nitrogen (N) and other nutrients, in the form of inorganic fertilisers and feeds. The United Nations Millennium Ecosystems Assessment identifies fertiliser nitrogen as the world's second worst source of ecosystem decline. The Greener Pastures project has two aims. The first is to develop practical management strategies that will deliver higher nitrogen use efficiency and profitability, with lower levels of nitrogen leaching/runoff for the grazing industries. The second aim is to direct development of natural resource management policy.

AIMS

Greener Pastures is a five year project that will enable farmers to develop systems to increase their profitability through improved nitrogen fertiliser efficiency, while at the same time reducing the risk of nitrogen losses off the farm. While Greener Pastures has been developed by the WA dairy industry, its research and findings is equally applicable and relevant to other livestock industries as they import more nutrients to drive more intensive production systems.

METHOD

The Greener Pastures project is based at the Vasse Research Centre. It comprises a number of components and activities including five dryland nitrogen farmlets (0 - 2 kg N/ha/day), two semi-commercial innovation farms (one irrigation and one dryland) and four partner farms acting as both co-researchers and regional commercial farm demonstration sites.

The rapid increase in nitrogen use on Australian dairy farms since 1990 is based on the assumption that more nitrogen equates to more pasture, which results in more milk, and consequently more profit. While plant growth responses to nitrogen are well documented and relatively easy to predict, the introduction of the grazing animal makes the assumption that more nitrogen leads to greater profitability less predictable.

The grazing animal is a very inefficient user of the nitrogen it harvests from plant material (Fillery, 2001). Ruminants typically excrete 70-80% of their total nitrogen intake in urine and dung. Urine patches in dairy pasture contain nitrogen concentrations of up to 1000 kg/ha, greatly exceeding the uptake capacity of pasture plants. Surplus nitrogen, which escapes use by plants, can be a major cost to livestock farmers. Nitrogen balances for the intensive WA dairy farms indicate unproductive surpluses of over 400 kg/ha/year, equivalent of nearly 1 tonne of urea (worth \$530 at current values) per hectare per year. Reducing this surplus through reduced fertiliser input or techniques that allow better use by plants, represents an opportunity for productivity and sustainability improvement.

There is increasing evidence from Australia and New Zealand, that intensifying dairy pasture production systems through higher stocking rates and concentrate and/or fertiliser inputs, often results in greater exposure to financial and environmental risk rather than greater profits (Monaghan et al., 2004). WA grazing industries will be increasingly challenged to manage high

performance pasture systems that meet the expectations of a community that is increasingly sensitive to environmental issues.

RESULTS

One method for evaluating nitrogen use is to calculate nitrogen efficiency ('output/input ratio') as part of a farm nutrient budget. This accounts for all nitrogen inputs in terms of fertiliser, fixation, purchased feeds and livestock, and all outputs in terms of milk, forage and livestock. A nitrogen budget for two of the Greener Pastures nitrogen farmlets is shown in Table 1. Nitrogen surpluses increased over 400% and nitrogen efficiency declined from 32% to 19% for a pasture system using 2 kg N/ha/day and stocked at 2.25 cows/ha compared to a system using 0 kg N/ha/day and stocked at 1.25 cows/ha.

Table 1. Farmlet Nitrogen Budget (kg N/ha/year) for Farmlet 1 (0 kg N/ha/day and 1.25 cows/ha) and Farmlet 5 (2 kg N/ha/day and 2.25 cows/ha)

		Farmlet 1	Farmlet 5
N inputs		163	568
N outputs		52	110
N surplus		111	458
	Laneways	8	28
	Effluent pond	16	57
	Deep leaching	4	4
	Runoff	20	16
	Gas losses?	63	353
N efficiency		32%	19%

Deep nitrate leaching from the highly enriched perched aquifer (less than 2 m deep) to useable aquifers below such as the Leederville and Yarragadee appears unlikely at the Vasse Research Centre because of the thick, fine clay and silt formations that separate them. Nitrogen losses through surface runoff have been measured at 20 kg/ha/year. The amount lost appears to be related to the volume of runoff rather than specific farm management practices or nitrogen budget. While this is a small proportion of the nitrogen budget, the concentrations of nitrogen are high enough to be of concern for the aquatic environment.

CONCLUSION

Despite the long history of intensive grazing in the south west, high nutrient concentrations in the perched aquifer do not translate to pollution of deeper aquifers. This is great news and is in marked contrast to findings for dairy farms in Europe and New Zealand, where nitrate leaching into deeper aquifers is arguably the main pollution issue. However, the large unexplained losses of nitrogen to the atmosphere as gasses justify further investigation to determine its potential for environmental impact.

KEY WORDS

Grazing, intensification, nitrogen, pasture use, nutrients imported and exported, environment

ACKNOWLEDGMENTS

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Paper reviewed by: Emma Giumelli, Department of Agriculture and Food.

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Drought proofing grazing systems – a case study from Binu 2006/07

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ABSTRACT

A project commenced in early 2006 in the Binu region investigating the possibility of increasing stocking rates whilst reducing erosion. The project involved 8 farmers who had a variety of innovative grazing systems established. Stocking rates for every paddock on the farms were calculated from the stock movement records, and adjusted for hand feeding. Ground cover was measured for the paddocks on the 23 May 2007 before the break of season. The results from one farm are presented.

The established perennial grass (6.37 DSE/ha) and tagasaste (6.19 DSE/ha) carried more stock than annual pasture on sand (0.83 DSE/ha) and gravel (3.04 DSE/ha). It was found that for each extra Dry Sheep Equivalent per hectare there was 10% less ground cover in autumn with annual pastures. For any given stocking rate the perennial grasses had 41% more ground cover in autumn than annual pasture on gravel, and 79% more than annual pasture on sand. The farm carried 2,142 DSE for the 12 months and 41% of the land was badly eroded. It is predicted that if all the sand was established to perennials then the farm could have carried 4,268 DSE through the drought without causing erosion.

AIM

The Binu region experienced their worst season on record during the 2006 winter and into 2007 autumn. Rainfall from May 2006 to April 2007 was only about 30% of the long term average.

Farmers in this region had to reduce stock numbers by 50 to 100%, with almost all remaining stock having to be hand fed during autumn 2007. Crop yields were also reduced by more than 80% and no grain was delivered to the bin from this region. Erosion was wide spread and severe. Winds of approximately 100 km/hr on the 9 March 2007 blew away much of the remaining stubbles and dry pasture. Hundreds of kilometres of fencing were covered with sand.

The aim of this project is to compare the affect of annual and perennial pastures on carrying capacity and autumn ground cover in an extreme drought.

METHOD

A range of new pasture systems are being trialled by farmer members of the Northern Agri Group (NAG) in the Binu region of WA. An NLP / NACC funded project has monitored all paddocks on 8 selected farms. The stocking rate for the growing season (May 2006 to April 2007) was calculated from the farmers stock movements records. Grazing records were adjusted to Dry Sheep Equivalents (DSE). The DSE numbers were reduced to account for hand feeding at 1 kg feed = 1 DSE grazing day. Ground cover was assessed visually at 15 sites in each paddock in late autumn (23 May 2007). Satellite imagery was also used to assess ground cover, but it was not accurate in all paddocks.

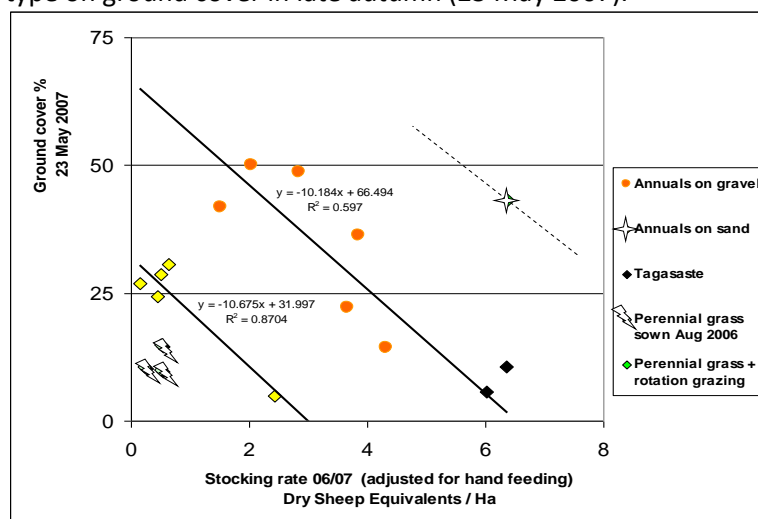
The results from Jim Wedge's farm at west Binu are presented here. This farm has two soil types (sand and gravel). Annual paddocks were either volunteer pasture or oats sown for grazing. Tagasaste and sub tropical perennial grass mixes had been sown on some sand paddocks. Two of the three perennial grass paddocks were only sown in August 2006 and are not yet mature.

RESULTS

Established perennial grasses and tagasaste carried significantly more stock than annual pastures and grazed oats. Despite this heavy grazing, the perennials had adequate ground cover to prevent

erosion. Annual pastures and cereal fodder crops suffered major wind erosion throughout the 2006/07 summer. With annual pastures and fodder oats, increasing the stocking rate resulted in less ground cover in autumn. For each 1.0 DSE/ha extra there was 10% less ground cover in late autumn. This reduction in ground cover was similar for both the sand (-10.7 % per DSE, $R^2 = 0.8704$) and the gravel paddocks (-10.2 % per DSE, $R^2 = 0.597$). With the annual pasture and fodder oats, at any given stocking rate there was 34% more ground cover on the gravel paddocks than the sand paddocks.

Figure 1; Affect of stocking rate (2006/07), pasture type and soil type on ground cover in late autumn (23 May 2007).



The sand in the inter row of tagasaste had only 9% ground cover. However, these paddocks did not erode as the tagasaste effectively gives a 1 ½ m tall wind break every 8 m across the paddock. The whole farm carried 2,142 DSE for the 2006/07 season at 2.37 DSE/ha, but suffered severe wind erosion over 41% of the whole farm. The safest strategy would have been to run no stock on the sand paddocks and only 1,918 DSE on the 529 ha of gravel, tagasaste and established perennial grass. This

would have resulted in an 11% reduction in stock, but a 75% reduction in the area grazed.

Our results suggest that if all the sand paddocks were established to perennial grass + rotational grazing and tagasaste, then the farm could have run 4,268 DSE through the 2006/07 drought at an average of 4.72 DSE/ha with no erosion.

DISCUSSION

If we assume the established perennial grass paddocks has the same relationship between stocking rate for the year and late autumn ground cover as for annual pastures (i.e. -10% ground cover per 1.0 DSE/ha), then at equivalent stocking rates the perennial grass + rotational grazing on sand would have 41% more ground cover in autumn than the annuals on gravel, and 79% more than the annuals on sand.

For the 2006 drought on this farm it would have been possible to run 2 DSE/ha on annual pasture and fodder oats in the gravel paddocks and not cause erosion (i.e. 50% ground cover target). There would have been 66% ground cover if there had been no grazing in these gravel paddocks. With the annuals on sand paddock there would have only been 32% ground cover in sand paddocks if not stocked. So erosion was inevitable even without grazing the sands. The perennial grass in the sand paddock could have carried 5.5 DSE/ha without the risk of erosion.

CONCLUSION

It is considered that there should be a minimum of 50% ground cover in autumn to prevent erosion. Most of the Binnu region suffered from wind erosion and the '50% ground cover' rule seemed to be appropriate. This project has shown that a shift to a perennial pasture based grazing systems could cope with extreme droughts. The perennial pastures themselves could make a significant contribution to limiting climate change through the sequestration of Carbon in the soils. Soil tests before and after establishing Jim Wedges first perennial pasture paddock suggests that the perennial grasses could

be sequestering 15 t CO₂eq /ha/year. However, much more detailed soil testing would be required to accurately determine the sequestration rate.

The project will continue until the end of the 2008 season. Hopefully 2007 is a wetter years so that impact of perennials can be assessed in a more normal season. The results will be used to conduct whole farm economic analysis of these high stocking rate systems. Soil samples have been collected to determine how much Carbon is being sequestered under the perennial pasture systems. The potential for Carbon Credits will be included in the economic analysis.

The 2006 drought was an extreme weather event. Events like this could be expected every few centuries as part of natural climate variability. Alternatively, this drought fits with the 'global warming' scenarios. If droughts like this did become more common, traditional agriculture will collapse in the northern sand plain region. Farmers could not sustain many events that caused as much environmental and financial damage as the 2006 drought.

KEY WORDS

Perennial pasture, sub tropical grass, tagasaste, annual pasture, grazing days, ground cover, erosion

ACKNOWLEDGMENTS

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Paper reviewed by: Wayne Parker, Department of Agriculture & Food WA, Geraldton

Minimising 'Esperance Storm' livestock losses

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INTRODUCTION

On 3 January 2007, ex Tropical Cyclone Isobel interacted with a deep trough that was approaching southern Western Australia (Bureau of Meteorology). On 4th and 5th January southeast Western Australia (WA) received up to 220 mm of rain (Table 1). Local and state media warned producers of the approaching storm. However, 50 000 sheep and a small number of cattle and alpacas still died. This paper discusses the management decisions during and following the storm, and revisits previous similar events in WA to see if anything could have been done differently.

*Table 1: Daily rainfall (mm) over the storm period. Source Bureau of Meteorology. * >3 hours data loss.*

Location	4 Jan	5 Jan	Total	Previous Record for Jan	Date
Esperance Aero	49.0	*172.0	*221.0	101.4	6/1/1999
Munglinup	25.8	153.6	179.4	62.4	8/1/2006
Ravensthorpe	28.4	112.8	141.2	102.9	20/1/1939
Salmon Gums	41.4	79.0	120.4	no record broken	

SURVEY METHOD

On Monday 8 January, thirty producers were contacted by phone to determine initial stock losses. A one-page survey, simplified from the one used following the 1999 Esperance flood, was later sent to 400 farmers. The results of both surveys were combined, with the written results taking precedence over duplicate phone results. 50 000 sheep were reported to have died, with 16 000 sheep deaths reported via the initial phone survey.

RESULTS

At Esperance Downs Research Station, the average daily temperature in the week before the event was 30.3°C. During the storm (4 to 6 January), the average daily temperature was only 16.8°C.

Sheep shorn in December and January made up 36% (15,611) of the reported sheep deaths. Jon Glauert, DAFWA Katanning, reported that the Great Southern district's losses of up to 91 000 sheep (in March 2005) were mainly in newly shorn weaner sheep, old sheep in poor condition and others recently off shears (up to six weeks). In January 1990, 11 500 recently shorn sheep died after 48 hours of rain in the Avon Valley; equivalent to 26% mortality per farm (1).

The average loss per farm following the storm this year was at least three times more than the usual average ewe, wether or ram losses on farms around Esperance (Table 2).

The survey did not seek other livestock deaths, but 2 steers, 25 breeders and 11 calf mortalities were recorded. Five breeders from one property were old. One of two alpacas reported dead was shorn days before the storm. Anecdotally another 12 alpacas also died.

Table 2: Numbers of dead sheep from 140 producers who responded to the survey. Prices based on livestock reports and sheep sales in the WA rural press on 18 and 25 January 2007.

Class of sheep	Number of sheep	Number of dead sheep	Proportion of dead sheep (%)	Sheep value per hd replacement
Ewes	347 302	13 355	4	\$667 750
Rams	7 327	214	3	\$107 000

Wethers	35 893	1 362	4	\$54 480
Lambs	202 611	25 634	13	\$769 020
Total	622 672	43 255	7	\$1 598 250

DISCUSSION

Heat loss from sheep during the 2007 event at Esperance was due to or associated with the following: (a) recently shorn sheep losing approximately 100 mm of insulating wool; (b) the air temperature dropping by half from the week before (around 17°C); (c) the wind chill around the animal breaking up the still 'blanket' of air next to the animals body; (d) rainfall increasing 'evaporation loss'; and (e) rain falling onto the sheep, and as the water dripped off, taking heat from the body (2). Sheep will shiver to increase heat production, and if they are mobile enough they will seek shelter, or huddle together in the mob (2). Hypothermia then becomes an issue when there is insufficient heat produced and the body temperature decreases. Newly shorn sheep survive better if they are acclimatised to the cold conditions. Recent cold exposure takes about two weeks to adapt and then two months to disappear (2). But sheep in Esperance and Ravensthorpe, in the Avon Valley in 1992 (1) and in Darkan in 1982 (2), were not acclimatised for an out-of-season event. Over one third of the sheep that died in the 2007 storm had been shorn in the previous six weeks and most likely died of hypothermia. This means that the remaining two thirds may have also died by hypothermia and / or drowning. (2) suggested that length of time animals were wet (24 – 48 hours) influenced mortality at Darkan in 1982. Shelter lost its advantage when the sheep were wet for so long, unless it was impermeable shelter, giving them a chance to dry out.

Farmers were advised in a special storm issue of the Esperance Agmemo, on radio and in the rural press to include an adequate energy supplement in the rations being fed while pastures established. This was especially important for pregnant ewes. The most vulnerable stock were the recently shorn lambs and weaners. With little fat reserves they had no buffer under the extreme conditions. In comparison less ewes, rams or wethers died because they generally had greater energy reserves (Table 2). Lucerne and kikuyu pastures grew rapidly, lasted longer and provided higher quality feed than annual pastures. Annual pasture seedbanks were slightly reduced following the event.

What could have been done differently?

Most farmers were aware of protecting their livestock from the weather. Many farmers used shelter, or continually moved stock. Although tree belts are better shelter than an open paddock, the provision of shelter at sheep height is most important. Therefore, thick stubble above the flood line would be better than a tree belt along a creekline. Sheep will not seek 'artificial' shelter provided by hay bales in paddocks (3). Priority should be given to providing shelter to the most valuable and vulnerable animals in the flock, i.e. the ewes, lambs and weaners. Some farmers were shearing up to the storm, and left the newly shorn sheep in the shed with hay. This was a good technique, as after shearing, sheep require up to 40% more feed to maintain themselves without their fleece (2). Supplementary feeding should have been carried out on the Wednesday and into Thursday during the storm. After rain, feed is less palatable (2) so supplement feeding was important during the storm if farmers could access the feed and the sheep. With an average flock size of approximately 2500 sheep per farm in the Esperance area, some of the proposed techniques to minimise the problems (1, 2, or 3) would not have been feasible for producers to use. These included using plastic garbage bags as coats, bedding down and covering with hay, or calcium borogluconate injections. However, these options may have been useful for small numbers of stud animals, or for small landholders with sheep.

CONCLUSION

Up to 220 mm of rain fell in the Esperance region on 4 and 5 of January 2007. Media warned about the impending storm, yet there were still 50 000 sheep deaths. Over one third of the deaths were sheep up to six week off shears with no insulating wool layer. Sixty per cent of deaths were lambs. Farmers may have done more if they weren't constrained: by time and labour (to move sheep); lack of feed supplies; or lack of adequate shelter in paddocks. Access to shelter at sheep height at the end of the paddock where the sheep would end up walking in the storm wind was best. It also had to be shelter above the storm water line, as many paddocks turned into lakes, and producers needed access to provide supplementary feed. The observations from the 2007 event in the Esperance region could help farmers plan future shelterbelts for use in similar events.

ACKNOWLEDGMENTS

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Paper reviewed by: Keith Croker

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Sub-tropical grasses in WA – what is their potential?

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ABSTRACT

A series of trials was established across the agricultural area to measure the seasonal production (quantity and quality) of sub-tropical grasses. The results demonstrate that sub-tropical grasses have a long-term role in farming systems in the northern agricultural region and on the south coast. Well adapted species show good persistence through dry summers while in years with summer rain they show excellent production providing there is an adequate plant density. In favourable conditions at Esperance the sub-tropical grasses have shown spectacular production. The results from Kojonup also provide evidence of a 'cold zone' that reduces the persistence of many sub-tropical grasses..

INTRODUCTION

There is increasing interest in growing sub-tropical (warm season, or C4) grasses in south-western Australia for producing out-of-season green feed, smoothing out the annual feed profile, increasing water use and reducing wind erosion. However, there is minimal data on the seasonal production, feed quality and persistence of sub-tropical grasses in different environments in WA, with the exception of kikuyu. This information is essential for producers to make informed decisions on their possible role. The results of 5 trials sown across the agricultural area of WA to address these issues are presented.

METHODS

Perennial plots were established at Mingenew, Buntine, Badgingarra and Kojonup in spring 2004 and at Esperance in spring 2005. Each site contained 12 to 20 treatments, including lucerne and annual volunteer controls. A range of annual legume plots (plus annual ryegrass) were established alongside the perennial trial in the following autumn. All plots were 7 m x 3.6 m with 3 treatment replicates. Super:potash (3:1) @ 120-200 kg/ha was applied each autumn, while 20-30 kg/ha of N fertiliser was applied in autumn and spring..

Biomass and pasture composition were measured in summer-autumn and every 4-6 weeks during the winter growing season. After each assessment plots were crash grazed or mowed. A sub-set of the treatments was sampled for feed quality. Persistence, in terms of both plant number and frequency, was also measured each year in early summer and following the break of the season.

RESULTS AND DISCUSSION

Northern agricultural region

The widespread rain in January to early February 2006 was an opportunity to measure the summer production of sub-tropical grasses. All three sites in the northern agricultural region received between 60-90 mm in the period from January to early February, with the highest yielding treatments producing 33, 25 and 19 kg dry matter/ha per mm of rainfall at Badgingarra, Mingenew and Buntine respectively.

The site at Buntine (325 mm average annual rainfall) in the north-eastern wheatbelt had very dry conditions over the first summer and with limited rainfall and cooler conditions during the annual growing season it has been a harsh test for the sub-tropical grasses. There has been good persistence of Rhodes grass and fair to good persistence of Bambatsi panic, panic grasses, veldt grass (C3) and lucerne. The other treatments have either poor persistence or have failed to survive.

In general biomass production has been modest with only Callide and Katambora Rhodes grass with 1.1 and 1.5 t DM/ha respectively producing more than 1 t DM/ha following the summer rainfall in early 2006 (82 mm). These results show that in lower rainfall areas the role for exotic C4 grasses appears to be limited in areas where there is no subsoil moisture. Results to date indicate that Rhodes grass is the best C4 grass option available for sandy soils.

Great Southern

The Kojonup trial had very good to excellent establishment of all treatments, with 35 to 77 plants/m². There was a high mortality of all the sub-tropical grasses over the first winter, except for kikuyu, and to a lesser extent Katambora Rhodes grass (Table 1). Narok setaria had the best winter survival of the bunch grasses, but these plants died over the second winter, as did most of the Rhodes grass.

Table 1. Persistence of sub-tropical grasses at Kojonup in terms of frequency. Bunch grasses are denoted with a (B)

Grasses	Av. plant frequency (%)			% survival over winter
	Nov 04	May 05	Dec 05	
Whittet kikuyu	75	96	100	104
Katambora Rhodes	89	94	58	62
Narok setaria (B)	78	69	20	29
Callide Rhodes	73	99	3	3
Signal grass (B)	84	68	0	0
Gatton panic (B)	69	59	0	0
<i>Lsd 0.05</i>	17.8	15.3	23.1	

These results provide clear evidence of a 'cold zone' in WA where there is poor persistence of many sub-tropical grasses, especially bunch grasses, over winter. This appears to be due to a combination of cold, wet soils and frosts. On the other hand, kikuyu was unaffected. The 'cold zone' has been spatially defined from maps of

South-coast

The Esperance site had excellent conditions with good rainfall from seeding in September 2005 right through to the autumn and winter of the 2006 growing season. It was not until dry conditions in late spring that growth slowed down.

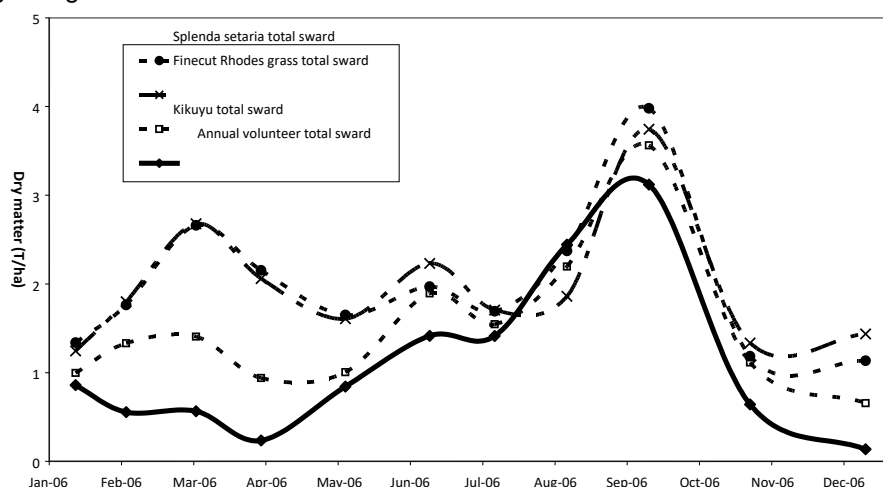


Figure 1. Seasonal production (DM T/ha) of Splenda setaria, Finecut Rhodes grass, kikuyu and annual volunteer pasture at Esperance with monthly cuts (except November)

Most lines of sub-tropical grasses had excellent establishment and combined with the favourable seasonal conditions resulted in high biomass production (Figure 1). The best lines Finecut Rhodes grass and Narok setaria produced 15 t DM/ha of sown species from 11 biomass cuts in 2006 (rainfall 457 mm). Plant persistence of most species has been excellent, except for signal grass which is sensitive to cold and many plants died over the first winter.

Feed quality

Within the winter growing season the annual legumes and annual ryegrass had a higher feed quality than the sub-tropical grasses. However the quality of out-of-season feed was far superior. The feed quality of the annual volunteer and subterranean clover treatments fell quickly once they senesced

and by mid-November 2005 had a dry matter digestibility (DMD) of 38-40%, compared with 58-66% for the sub-tropical grasses.

In general, Rhodes grass is suitable for maintaining the weight of livestock out-of-season (DMD $62.0 \pm 2.7\%$), while, panic grasses have a slightly higher feed quality and are suitable for growing animals (DMD $64.7 \pm 4.7\%$).

CONCLUSION

The good persistence through the dry seasonal conditions in 2006 and the dry summer of 2006/07 has demonstrated that sub-tropical grasses will persist in the long-term in WA. The results also demonstrate that to take advantage of out-of-season rainfall and autumn rainfall there needs to be a good perennial plant density.

The results are providing some clear guidelines as to where the various sub-tropical grasses are well suited, where they are marginal and where they are not suited. The best performed species to date across a range of sites (with the exception of the 'cold zone') are Rhodes grass and the panic grasses (Gatton, green panic). On the south coast, a range of species can be successfully grown including kikuyu, setaria, Rhodes grass and the panic grasses.

KEY WORDS

Rhodes grass, kikuyu, feed quality, Western Australia

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