FEEDING VALUE AND COST OF NATIVE SPEAR GRASS HAY IN WESTERN AUSTRALIA

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SUMMARY
Spear grass hay was harvested from 4 sites on Kanandah Station, Western Australia. In the lead up to harvesting, seasonal conditions were among the best on record. Feeding trials involving steers and wethers were undertaken to evaluate animal performance when fed spear grass hay, with or without access to supplements. The findings indicate that, occasionally, brief opportunities may appear when spear grass range on the Nullarbor Plain can be successfully harvested and made into reasonable quality hay, but the harvesting window of opportunity is short and choosing the best harvesting time is essential. Yields of spear grass hay compared favourably with those of other native grass pastures reported by Queensland researchers. Animals readily consumed the spear grass hay, although both the sheep and cattle lost weight when fed only spear grass hay. However, providing a small amount of supplement (100-200 g/d for wethers; 1 kg/d for steers) maintained livestock. On-station spear grass hay production on the Nullarbor was a cheaper option than importing hay. Based on our findings, if the highest estimated cost of on-station production is used ($153/t), feeding costs are $1.15/hd/d for cattle and $0.15/hd/d for sheep. Alternatively, if the lowest estimated cost of production is used ($64/t), feeding costs are $0.48/hd/d for cattle and $0.06/hd/d for sheep.

Keywords: *Austrostipa* spp., spear grass hay, feeding value, cattle, sheep

INTRODUCTION
The perennial grasslands of the Nullarbor Plain consist mainly of spear grasses (*Austrostipa* spp., primarily *A. scabra*) and wallaby grass (*Austrodanthonia caespitosa*). The total area occupied by spear grass across the Nullarbor Plain has been roughly estimated at 17,400 km^2, or 30% of the pastoral land. These grasslands respond to winter rainfall and growth is exceptional in years of above-average winter rainfall coinciding with annual rainfall in excess of approximately 200 mm. Good summer rainfall will produce more growth than the same amount of winter rain, and long periods for which soil moisture remains adequate will produce more growth than isolated large falls. The grasses are readily grazed during their active growth, but their nutritive value and consumption rapidly decline at the onset of maturity. Spear grass, in particular, produces an elongated, sharp seed-head that can penetrate and debilitate animals. Conserving this species before seed set can effectively extend its usefulness as a fodder for livestock. A trial was conducted to (1) assess the practical and economic feasibility of on-station harvesting and production of spear grass hay; and (2) determine the usefulness of this hay as a source of feed for sheep and cattle in the extensive regions of south-eastern Western Australia.

MATERIALS AND METHODS
Hay production
During August 2001, 4 harvest sites were identified on Kanandah Station (30.0-32.0°S, 124.0-124.7°E), Western Australia. In the lead up to harvesting, seasonal conditions were among the best on record. Good rain in the summer of 1999/2000 was followed by a light winter season, but this was topped up with over 50 mm of rain in November 2000. Soil moisture remained high throughout December and January, and approximately 150 mm fell in February 2001.

Plant samples were taken from the 4 harvest sites to determine feed value. Results indicated that the spear grass contained adequate levels of crude protein (>8%) and metabolisable energy (>8 MJ/kg DM) to warrant harvesting for hay. A contractor was used to cut (pre seed-set) and bale the spear grass at the 4 sites. An economic analysis was undertaken to determine the cost of on-farm fodder production compared to importing hay from the agricultural regions of Western Australia.

Feeding trials

In follow-on feeding trials, 18 Murray Grey-Brahman cross steers (aged 12-16 months) with an average weight of 309 kg (± 17.8 kg) were randomly allocated on a stratified weight basis to the following treatment groups:

(1) Basal diet: spear grass hay fed *ad libitum* (trial 1);
(2) Basal diet + 1 kg/hd/d fortified molasses (89% molasses, 1% urea, 9% dicalcium phosphate (DCP), 1% vitamin and mineral premix (Px) (trial 2); and
(3) Basal diet + 1 kg/hd/d fortified lupins (90.7% lupins, 8.1% DCP, 0.2% magnesium oxide, 1% Px) (trial 2).

Thirty Merino wethers (2 years of age) with an average weight of 28.8 kg (± 4.42 kg) were randomly allocated on a stratified weight basis to 5 treatment groups in follow-on feeding trials:

(1) Basal diet: spear grass hay fed *ad libitum* (trial 1);
(2) Basal diet + 100 g/hd/d fortified molasses (trial 2);
(3) Basal diet + 100 g/hd/d fortified lupins (trial 2);
(4) Basal diet + 200 g/hd/d commercial (GlenLea™) sheep pellet (trial 2); and
(5) Basal diet + 200 g/hd/d grains/mineral mix (52.3% barley, 43.6% lupins, 3.6% DCP, 0.5% Px) (trial 2).

The supplements were designed to provide the additional nutrients required to meet maintenance requirements, based on the predetermined nutritive value of the spear grass hay used in this trial.

All animals were ear tagged and penned together in treatment groups in large yards and given free access to water and their respective treatment diets. The live weights of the steers and wethers were measured weekly over the 6 weeks trial periods. The hay was fed out in round bales, which were placed in hay feeders. The supplements were fed out in troughs. Average intake of the hay was determined by subtracting the weight of refusals (recorded whenever the bales were replaced) from the initial weight of the bales and then dividing by 6 (the number of animals per pen).

RESULTS

Feeds

From a total area of 40.6 ha (determined using GPS mapping technology), 113 t of hay were produced, giving an average yield of 2.78 t/ha. The hay cost $200/t to produce. This included GST and all transport costs associated with transfer from the 4 harvest sites to the Kanandah homestead (approximately 100 km). In this trial, the window of opportunity to harvest spear grass hay was approximately 3 weeks (from initial assessment of sites until seed set occurred).

Table 1. Nutritive characteristics (on a DM basis) of the spear grass hay used in the feeding trials and the nutritive characteristics of oaten hay used as a reference standard.

	DM (%)	DMD (%)	CP (%)	ME (MJ/kg)	Lignin (%)	Ash (%)	P (%)
Spear grass hay[A]							
- mean	88.6	50.8	7.5	7.3	9.9	4.5	0.04
- range	83.1-95.8	49.9-51.6	5.8-8.7	6.9-7.6	9.2-10.7	4.4-6.8	0.03-0.05
Oaten hay[A]	90	55-60	7	8	6		

[A] analyses provided by Independent Lab Services, Western Australia

Table 2. Crude protein (CP), metabolisable energy (ME) and cost of supplements used in the feeding trials.

Supplement	CP (%)	ME (MJ/kg DM)	Cost[A] ($/t) Including GST	Cost ($/hd/d)	
				Steers	Wethers
Fortified molasses	28.6	12.0	448	0.45	0.05
Fortified lupins	29.5	12.5	386	0.38	0.04
Commercial sheep pellets	17.0	11.7	495	-	0.10
Grains/mineral mix	19.9	12.3	344	-	0.07

[A] Cost does not include freight. Costings for the grain supplements based on 20 t bulk loads ex mill in metro Perth.

Samples were obtained from each bale of hay fed and subsequently analysed for nutritive value. The nutritive characteristics of the spear grass hay is shown in Table 1. There was a considerable range in the nutritive value, particularly with respect to dry matter content and crude protein levels. When the

samples were visually assessed before being analysed, there was some green material observed amongst a large proportion of dry leaf and stem material. The nutritive value and cost of the supplements used in the feeding trials are given in Table 2.

Feeding trials

The animals readily and immediately consumed the spear grass hay, although both the sheep and cattle lost weight when fed only spear grass hay (Table 3). However, all treatment groups fed supplements consumed the entire amount and gained weight. A few days were required for the trial animals to get used to the supplements. Cattle readily took to the molasses, however, it took longer for the sheep offered the fortified molasses to recognise the supplement and for the first couple of days they needed a grain trail to induce them to eat the molasses.

Table 3. Average daily feed intake, and live weight gain of cattle and sheep fed spear grass hay, with or without supplementation

Diet	Hay intake		Live weight gain (g/d)	
	Steers (kg/d)	Wethers (g/d)	Steers	Wethers
Hay	6.8	1115	-281	-24
Hay + fortified molasses	9.5	943	682	112
Hay + fortified lupins	9.5	1052	884	111
Hay + commercial sheep pellets	-	1030	-	44
Hay + grains/mineral mix	-	986	-	89

DISCUSSION

The yield of hay in this trail was well above previously reported yields of native pasture hays (average of 1.2 t/ha, range of 0.8-2.0 t/ha; McLennan 2002). The yield of native pasture depends largely on the amount and distribution of rainfall during the growing season. The conditions were clearly ideal for the grass growth needed to cut hay. However, for this to be an ongoing management option, some assessment is needed of the proportion of years in which similar conditions might make hay cutting viable. On the basis of local rainfall and climate records, the potential for cutting hay occurs at a frequency of about once every 30 years.

The hay harvested at Kanandah cost $200/t to produce. Pilot studies are normally far more expensive than subsequent commercial activities, as it is during these initial trials that problems are identified and improvised solutions implemented without the benefit of hindsight. In commercial operations, past experience would play a major role in refining the production process, increasing efficiency and reducing the cost of production. A number of assumptions have been applied to assess the economic feasibility of native fodder production on Nullarbor stations. These include: (1) contract harvesters are available; (2) distance to harvest sites (for this economic evaluation, it was assumed that contract harvesters would need to travel around 700 km); (3) haulage and transport charges of $4.51 per km (GST inclusive) (Farm Weekly Farm Budget Guide 2003); (4) contract harvester has own haulage equipment, therefore, transport costs charged 1-way only; (5) contract rates for cutting and baling round bales of hay are $15 + GST per bale (Farm Weekly Farm Budget Guide 2003); (6) each bale weighs 275 kg, therefore costing $60/t to cut and bale (GST inclusive); (7) allowance for repairs to machinery set at $1000; and (8) wash-down costs associated with biosecurity (particularly weed control) set at $500. Economic analyses based on the above assumptions with variations in the area harvested and the potential yield are presented in Table 4. Additional costs associated with on-station haulage of the hay have not been included in this budget. Options for transport would include the contractor's haulage equipment or on-station vehicles. It may be a cheaper option to use on-station vehicles, but more time-efficient to use the contractor's haulage vehicle.

On-station production presents a much cheaper option for providing fodder to livestock on the Nullarbor Plain than importing it from surrounding agricultural areas. Oaten hay has been used as a reference in this analysis because it is the most commonly available fodder in WA and its nutritive value in terms of crude protein and metabolisable energy (Butler and Milton 2001) are comparable to spear grass hay. The current minimum price of oaten hay is approximately $100/t. Hay is a bulky feed and only about 22 t can be transported on a carrier. On the basis of distance associated with the Kanandah harvesting (700 km at $4.51/km), the haulage costs would be $143.50/t, giving a total

landed price of $243.50/t. This estimated importation cost is $90.50/t more expensive than the dearest on-station processing estimate ($153/t).

Table 4. Cost of hay production on the Nullarbor Plain according to yield and area baled.

Hectares harvested	Yield (t/ha)			
	1.0	1.5	2.0	2.5
50	50 t @ $153/t	75 t @ $121/t	100 t @ $107/t	125 t @ $99/t
100	100 t @ $107/t	150 t @ $91/t	200 t @ $85/t	250 t @ $81/t
200	200 t @ $85/t	300 t @ $76/t	400 t @ $71/t	500 t @ $69/t
400	400 t @ $71/t	600 t @ $68/t	800 t @ $65/t	1000 t @ $64/t

Both sheep and cattle readily and immediately consumed the spear grass hay, indicating there were no problems with palatability. Anecdotal reports from producers who have previously imported oaten hay suggest animals require an adaptation period to acclimatise to the new fodder. During this period, it is common for the animals to lose weight. A key advantage of feeding locally produced, native grass hay is that the animals eat it straight away. This provides a critical advantage, especially if the animals have been deprived of adequate nutrition for an extended period, a common situation during intensive husbandry operations such as shearing and/or transfer dictated by drought.

Both the sheep and cattle lost weight when fed only spear grass hay. In a situation where sheep and cattle are yarded for a couple of days without access to hay or in a paddock with very little feed (which is frequently the case when animals are kept in holding paddocks), anecdotal evidence suggests that weight losses are routinely significantly higher than those presented in Table 3. However, by feeding a small amount of supplement (1 kg/d for steers and 100-200 g/d for wethers), it was possible to not only curb weight losses, but actually promote weight gain in sheep and cattle fed spear grass hay. From a management perspective, this has important ramifications in situations where stock are held temporarily in yards or at those times of the year when stock are not quite ready to turn-off and paddock feed is quickly running out or in short supply.

Based on an average intake of 7.5 kg spear grass hay/hd/d for cattle and 1 kg/hd/d for sheep, if the highest estimated cost of on-station hay production is used ($153/t; Table 4) feeding costs are $1.15/hd/d for cattle and $0.15/hd/d for sheep. Alternatively, if the lowest estimated cost of production is used ($64/t), feeding costs are $0.48/hd/d for cattle and $0.06/hd/d for sheep.

Problems that may arise with long-term feeding of spear grass hay to sheep include the contamination of facial wool and possible ulceration of the gums caused by seeds. Providing a barrier around the hay bales can effectively decrease the incidence of contamination and also serve to reduce fodder wastage. Harvesting pasture before seed set will greatly reduce the incidence of contamination, reduce the incidence of gum problems and ensure higher nutritive value.

In conclusion, spear grass swards on the Nullarbor Plain can be successfully harvested and made into reasonable quality hay at a cost that is a cheaper option than importing hay to provide fodder to livestock. The use of suitable purchased supplements, used in conjunction with this hay, can significantly increase livestock performance.

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