SHEEP PRODUCTION ON AN ANNUAL AND PERENNIAL PASTURE IN SOUTHWEST AUSTRALIA

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ABSTRACT
Sheep production on an annual and perennial pasture stocked at 11.5 dse/ha, was compared in a mediterranen environment at Manypeaks in Western Australia. The annual sward comprised of 48% subterranean clover (*Trifolium subterraneum* L.), 20 % annual grasses (*Lolium rigidum* Gaudin, *Hordeum leporinum* Link, *Vulpia bromoides* (L.) S.F. Gray) and 32% capeweed (*Arctotheca calendula* L.). The perennial sward was 19% kikuyu (*Pennisetum clandestinum*), 36% subterranean clover, 43% annual grasses (*Lolium rigidum* Gaudin, *Hordeum leporinum* Link, *Vulpia bromoides* (L.) S.F. Gray) and only 2% capeweed which was displaced by kikuyu. Both pasture types had similar growth rates in autumn, winter and spring (25 to 29, 24 to 26 & 52 to 53 kg dry matter (DM)/ha/day respectively). In summer and early autumn feed on offer (FOO) was consistently higher by between 0.5 to 2.0 tDM/ha in the perennial pasture. FOO accumulated in a similar fashion in both treatments throughout the growing season and by late spring had reached 3.4 tDM/ha. Sheep liveweights in summer and early autumn were maintained at around 44 kg on both pastures until April/May at which time liveweight fell on the annual sward at a rate of 149 gm/hd/day as a result of availability of feed limiting intake. Liveweight gain was similar at 133 gm/hd/day on both treatments during the growing season (gain for period 22 kg/hd). The results of this study suggest that a perennial pasture based on kikuyu grass would be similar to an annual sward during the growing season with the additional benefit of superior feed supply for livestock during summer and early autumn.

KEYWORDS
Kikuyu, annual pasture, perennial pasture, feed on offer, pasture growth, sheep, liveweight, grazing

INTRODUCTION
South west Australia is characterised by a mediterranean climate and infertile sandy soils. The traditional annual pasture base is typically a mixture of subterranean clover (*Trifolium subterraneum* L.) and annual ryegrass (*Lolium rigidum* Gaudin), yet over time other plant species have invaded these pastures, the most common being capeweed (*Arctotheca calendula* L.), barley grass (*Hordeum leporinum* Link), silver grass (*Vulpia bromoides* (L.) S.F. Gray), flatweed (*Hypochaeris radicata* L. (Asteraceae), sorrel (*Rumex acetosella* L.) and dock (*Rumex crispus* L.).

Annual pastures regenerate from a seed bank at the break of season in autumn/winter providing high quality green feed for stock until late spring. In summer and early autumn stock rely on dry pasture residues that were built up in the previous spring and conserved feed such as hay, silage or grain. Perennials grasses have the potential to provide a longer growing season and pasture production in summer which would raise stocking rate and/or reduce the amount of conserved feed fed out in summer. This investigation compares sheep production on an annual pasture to one containing the tropical perennial grass kikuyu (*Pennisetum clandestinum*).

MATERIALS AND METHODS
The study was conducted in 1994 at Manypeaks, Western Australia (34° 46' S., 118° 14' E.). Plots of perennial based pasture were established in 1991 by sowing kikuyu grass. In 1992 the annual pasture plots were resown to subterranean clover and annual ryegrass. Soil type was a grey sand of varying depth (10 to 35 cm) overlying a cemented lateritic layer over clay, pH (CaCl2) 0 to 10 cm was 4.3. In May 1994 a fertiliser mix of 60% DAP, 24% triple superphosphate, 15% elemental sulphur and 1% zinc was spread at 110 kg/ha on all plots. The experimental design consisted of 4 plots (0.5 ha) of annual pasture and 3 plots (0.5 ha) of perennial pasture all grazed continuously by 2.5 year old merino wethers at 11.5 dse/ha.

Experimental sheep were allocated after shearing on the 5th January 1994. Pasture composition was assessed visually in winter and spring. Pasture growth rates were estimated in autumn, winter and spring by measuring pasture accumulation in exclusion cages, feed on offer (FOO) was assessed at the same time. Pasture biomass was determined by the calibrated visual assessment technique of Campbell and Arnold (1973). Dry Matter Solubility (DMS) of pasture was measured using the pepsin-cellulase technique (Aufrere and Michalet-Dorreau, 1988). DMS was regressed against the dry matter digestibility (DMD) of standard feeds, calculated from total faecal collections from wethers fed the standard materials at a maintenance level. Sheep were weighed every 4 weeks using electronic scales and received no supplementary feed.

RESULTS AND DISCUSSION
Annual rainfall for the experimental year was 405 mm with 379 mm falling within the growing season, late May to November. Subterranean clover densities were similar in both the annual and perennial swards at 48 and 36% respectively (Table 1) demonstrating a compatibility between clover and kikuyu which is essential for the long term nitrogen fertility of a perennial grass pasture (Simpson, 1987). In contrast kikuyu displaced capeweed; only 2% remained in the perennial sward as opposed to 32% in the annual pasture (Table 1). Capeweed is a common weed in pastures of south west Australia and this finding demonstrates that it is possible to displace it with kikuyu grass.

During the dry summer (26 mm rainfall, typically 70mm) only kikuyu remained green, unfortunately growth was not assessed during this period, yet subsequent measurements have shown that kikuyu grows at less than 10 kgDM/ha/day under similar dry conditions (data not presented). Had the summer had been wetter we would have expected growth rates of between 80 and 160 kgDM/ha/day depending on nutrient and moisture availability (Murtagh, 1988). Growth rates for both pasture types were identical in autumn, winter and spring (Table 1). Kikuyu grew very little in winter due to its tropical nature, this however was not reflected in the pasture growth rates due to a strong annual component (Table 1).

The dry matter digestibility DMD values of kikuyu and clover (Table 1) in summer reflect the fact that kikuyu is still green (70% DMD) while subterranean clover exists only as dry residue (54% DMD). Both had similar DMD values in winter and spring at around 70 to 75% (Table 1). Kikuyu showed remarkable consistency in its digestibility throughout the experimental period, demonstrating its ability to provide highly digestible feed throughout the whole year. Feed on offer (FOO) profiles presented in figure 1 are typical of a pasture in a mediterranean environment, in summer levels decline

and in the growing season they rise. In summer and early autumn the perennial pasture consistently had between 0.5 and 2.0 tDM/ha more FOO than the annual. In late autumn, winter and spring the swards had identical growth rates at the same stocking rate, therefore it is not surprising that the FOO profiles were similar during this period (Fig. 1).

Sheep liveweight was maintained on both pasture types through summer and early autumn around 44 kg. However, in April/May liveweights on the annual pasture fell at 149 gm/hd/day as the quantity of feed available (Fig. 1) most likely limited animal intake (Feeding standards for Australian livestock. Ruminants, 1990). Liveweight on the perennial pasture held up right through this nutritionally demanding period as a result superior FOO and digestibility (Fig. 1 & Table 1). During the growing season liveweight gain was similar at 133 gm/hd/day on both treatments for an overall gain for the period of 22 kg/hd (Fig. 1).

The results of this study demonstrate that a balanced perennial kikuyu pasture is equal in production to an annual pasture in the growing season yet is able to improve livestock production during summer and late autumn. In a wet summer the productivity of kikuyu could be expected to be higher while conversely, dry residues in annual pastures would break down.

ACKNOWLEDGMENTS

We are indebted to Mike and Robyn Dovey of Manypeaks, Western Australia for their assistance and contribution of land and stock for this study. The study was funded the Meat Research Corporation, Australia and the Western Australian State Government.

REFERENCES

Aufrere, J., and B. Michalet-Doreau. 1988. Comparisons of methods for predicting digestibility of feeds. Anim. Feed Sci. Technol. **20**: 203-218.

Campbell, N.A., and G.W. Arnold. 1973. The visual assessment of pasture yield. Aust. J. Exp. Agr. Anim. Husb. **13**: 263-267.

Feeding standards for Australian livestock. Ruminants. 1990. Pages 209-225, CSIRO Melbourne Australia.

Murtagh, G.J. 1988. Factors affecting the growth of kikuyu. 1. Potential growth and nitrogen supply. Aust. J. Agric. Res. **38**: 31-42.

Simpson, J.R. 1987. Nitrogen nutrition of pastures. Pages 143-154 in J.L. Wheeler, C.J. Pearson and G.E. Robards, ed. Temperate Pastures; their production use and management CSIRO/Australian Wool Corporation: Melbourne.

Table 1

Pasture characteristics of a perennial and annual pasture at Manypeaks, Western Australia in 1994

	Perennial pasture	s.e.	n	Annual pasture	s.e.	n
Botanical Composition (%)[z]						
Kikuyu	19	4.2	6	0	-	-
Subterranean clover	36	7.5	6	48	4.0	8
Annual grasses[y]	43	5.1	6	20	2.3	8
Capeweed	2	0.3	6	32	5.4	8
Growth rate (kgDM/ha/day)[x]						
Autumn	25	1.0	3	29	0.2	2
Winter	24	4.0	9	26	6.0	6
Spring	52	7.7	6	53	8.8	4
Digestibility (%)[w]						
Summer	70	0.9	3	54	0.9	3
Autumn	75	0.9	4	-	-	-
Winter	69	1.9	2	71	1.5	2
Spring	69	0.5	2	75	0.3	2

z Average of assessments taken in winter and spring

y Includes barley grass, ryegrass and silver grass

x No growth measurements were taken in summer refer to results and discussion

w Values for samples of kikuyu and subterranean clover only

Figure 1

Sheep liveweight and pasture feed on offer (green + dry) for a perennial and annual pasture at the study site Manypeaks in 1994. Error bars are s.e. of mean.