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SHEEP PRODUCTION ON ANNUAL PASTURE/STUBBLE VERSUS LUCERNE

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SUMMARY

This research addressed the impact of lucerne in the traditional grazing system of stubble/annual pastures on animal production. One hundred and eighty Merino ewe weaners were allocated to 2 equal groups on a stratified weight basis. One group of animals was maintained on stubble/annual pastures and supplemented with hay and lupins as required. The second group was grazed rotationally on 4 lucerne paddocks. Food on offer was measured initially to establish stocking rates, which then changed as sheep moved from paddock to paddock. A crossover design was employed to estimate compensatory effects of grazing on lucerne during winter compared with annual pastures. To study wool production, 40 weaners were selected from each group. Dyebanding and mid-side patch clipping were used to measure wool growth and fibre diameter over the trial period. At shearing, fleeces from all sheep were sampled to determine wool quality characteristics. All animals gained weight, however, overall the lucerne sheep experienced greater liveweight gain over the trial period than the stubble/annual pasture sheep. During summer/autumn, the average liveweight gain of the lucerne group was significantly higher ($P<0.05$) than the group grazing stubbles. In contrast, those animals grazing annual pastures over winter gained weight at a significantly higher rate ($P<0.05$) than those grazing lucerne. Despite differences in nutritive value, the type of pasture the sheep grazed had no effect ($P>0.05$) on wool growth or wool characteristics. This may have been due, in part, to either the supplements provided to the sheep grazing stubbles during the summer/autumn period and/or to the relatively low stocking rates used in the trial, which potentially enabled the sheep to be highly selective in their grazing.

Keywords: sheep production, wool growth, lucerne

INTRODUCTION

In a Mediterranean environment, wool production and liveweight may fluctuate greatly over a year, due to variations in pasture quality and quantity. Typical grazing systems in the Mediterranean regions of Australia involve grazing cereal stubbles (with strategic supplementation) during summer/autumn and grass/legume pastures during winter/spring. It is in the interest of the producer to be able to anticipate how pastures (and feed supply) can vary within and between seasons. By preparing for a bad season, the producer is able to maintain their stock, or may still be able to produce a high quality wool and meat product.

The pasture resource may vary in quantity and nutritional value, both seasonally as well as between years. Stock may need to graze over greater distances to gain the quantity of nutrients required to live, while quality may drop so low that stock may barely hold condition. For farm managers, it means they must be able to predict these variations and, perhaps, look at ways to reduce the impact of poor seasonal conditions on liveweight change and wool quality. Other pastures may be required that have a higher nutritive value, and can be used as an alternate feed source during feed deficit periods. Lucerne is 1 such source of feed for sheep. It is high in protein, and has the ability to tap deep into the soil profile for water. Sheep may be able to utilise this resource, leading to improved performance as a result of improved nutrition during the poorer seasons of the year.

MATERIALS AND METHODS

The number of animals involved in this trial was based on food on offer (FOO), measured at the start of the trial. On this basis, 180 Merino ewe weaners (2002 lambing) were allocated on a stratified weight basis to 2 groups (90 animals per group). From each group, 40 weaners were selected at random for wool growth studies. Initial stocking rates for both groups of animals were based on the total number of animals available, and FOO at the beginning of the grazing period. Throughout the trial, as the groups moved from paddock to paddock, their stocking rates changed (0.6-0.8 sheep/ha for stubble/annual pastures; 0.3-1.0 sheep/ha for lucerne) as a result of varying paddock sizes.

The first group (A) was managed under the current production system of grazing predominantly cereal stubbles (with some summer weeds) during the summer/autumn period (27 Dec-16 Jun) and fed, as required, supplements of hay with either lupins or lupin/pea/wheat mix. The second group of sheep (L) grazed lucerne pasture (>95% lucerne) in a 4-paddock, 2-week rotation. After the break of season, when feed quantity increased (in response to rain), a follow-up mob of sheep was used so herbage was not wasted, and the quality of the feed remained high.

A crossover design was adopted at the break of season (16 Jun). The initial 2 groups were divided in 2, and half were swapped over. This enabled a comparison of the impact of continual versus restricted grazing of lucerne on animal performance. After reallocation was completed, 50% of the lucerne group continued to graze lucerne, becoming a sub group called LL. The other half of the lucerne group was transferred to the stubble/annual pasture group and became a sub-group called LA. Similar reallocation of sheep in the stubble/annual pasture group occurred (Table 1). During winter the annual pastures consisted predominantly of cape weed, with some subterranean clover, rye grass and barley grass. The reallocation of the initial 2 groups was completed on a stratified weight basis. The animals that were previously selected for the wool studies were equally reallocated to the new groups.

Table 1. Initial and reallocated treatments groups.

Summer/autumn 27 Dec – 16 Jun		Winter 16 Jun – 28 Aug
Stubble/pasture group (A)	50% stubble/pasture (AA) 50% lucerne (LA)	New stubble/pasture group
Lucerne group (L)	50% stubble/pasture (AL) 50% lucerne (LL)	New lucerne group

Data collection

Liveweight. Liveweight was measured each fortnight throughout the trial period (27 Dec – 28 Aug). The animals were weighed at the same time of day on each occasion to minimise the effects of variations in gut fill.

Wool growth. Linear wool growth was determined using dye bands. This involved applying dye to the wool follicles at skin level on the mid-side of the fleece according to the procedure of McCloghry (1997). The dye bands were applied at the commencement, and then every 6 weeks throughout the trial. Linear wool growth was determined by selecting 5 random staples from each wool sample and measuring the distance between each dye band using a steel rule.

Wool samples from an area of 100 cm^2 (10 cm x 10 cm) were removed by clipping at skin level from the mid-side of 40 sheep. Clippings were taken at 12-weekly intervals to determine the weight of wool grown per unit area. In addition, a mid-side patch was removed from all animals 2 weeks prior to shearing, and subsequently tested for fibre diameter, coefficient of variation of fibre diameter, and yield (to enable calculation of clean fleece weight). At shearing, all fleeces were weighed prior to skirting to determine greasy fleece weight.

Pastures and supplements. Before the commencement of the trial, and at fortnightly intervals thereafter, the available dry matter (DM) and herbage quality were determined. At each sampling, 30 herbage samples were collected from each paddock. The herbage was cut to ground level and everything within each 0.25 m^2 quadrat removed. For each sampling period, the samples were bulked (after drying and weighing) for each paddock, thoroughly mixed, and duplicate samples taken for subsequent analysis of nutritive characteristics (crude protein, DM digestibility and metabolisable energy). The amounts of supplements fed were recorded and their nutritive characteristics were also determined.

Statistical analysis

Statistical analyses involved the initial pasture groups (A or L) and the 4 sub-groups (LL, AL, LA, AA). Genstat® was used to determine if pre-trial wool growth had any significant effect (co-variant analysis) on wool growth during the trial period, or if there were any carry-over effects (F-tests) between periods. The SPSS® statistical package was used to compare treatment means, and undertake ANOVA for each variable measured. The P level of 0.05 was used when testing for significance.

RESULTS

During summer/autumn, the average liveweight gain of the lucerne group was significantly higher than the group grazing stubbles. In contrast, those animals grazing annual pastures over winter gained weight at a significantly higher rate than those grazing lucerne. Overall, grazing lucerne during summer/autumn, and annual pastures during winter, achieved higher liveweight gains than either grazing stubble/annual pastures continuously or cereal stubbles in summer/autumn and lucerne during winter. Grazing lucerne continuously produced the same results as grazing lucerne in summer/autumn and annual pastures over winter (Table 2).

Table 2. Average daily liveweight gains (± s.e.m.) of the 4 treatment groups during summer/autumn, winter, and for the whole trial (see text for details).

	AA	LL	AL	LA
Summer/autumn (g/d)	76 ± 3.1^{a}	118 ± 2.1^{b}		
Winter (g/d)	127 ± 14.2^{b}	42 ± 7.2^{a}	42 ± 8.8^{a}	143 ± 11.9^{b}
Overall (g/d)	90 ± 2.2^{a}	96 ± 3.1^{abc}	92 ± 2.8^{ab}	102 ± 2.7^{c}

Values within rows with different superscripts are significantly different ($P<0.05$)

The type of pasture the sheep grazed, in either summer/autumn or winter, had no effect on wool growth or fleece characteristics (Table 3). Food on offer was higher for the stubble/annual pasture during summer/autumn, but during winter, FOO was highest for lucerne. As shown in Table 4, the nutritive value of lucerne was higher than that of stubble in summer/autumn, and annual pastures in winter. During the period 13 February to 7 May, the sheep grazing stubble were fed supplements, which provided an average of 11 g crude protein and 1.34 MJ metabolisable energy per sheep per day during this period.

Table 3. Wool growth and fleece characteristics (± s.e.m.) of the 4 treatment groups (see text for details).

Wool growth and fleece characteristics	AA	LL	AL	LA
Clean fleece weight (kg)	2.07	2.18	2.06	2.04
Yield (%)	62.6	62.2	61.3	60.4
Fibre diameter (µm)	17.9	18.1	17.7	18.0
Coefficient of variation (%)	17.8	17.5	17.7	17.5
Linear wool growth (mm/d)				
Summer/autumn	0.36	0.38		
Winter	0.39	0.30	0.32	0.29
Total (mm)	65.8 ± 1.91	65.4 ± 2.08	64.6 ± 1.58	64.7 ± 2.25
Wool growth (g/100 cm^2/d)				
Summer/autumn	0.24	0.23		
Winter	0.09	0.07	0.09	0.08
Total (g/100 cm^2)	9.4 ± 0.26	9.6 ± 0.22	9.8 ± 0.32	9.1 ± 0.20

Table 4. Average nutritive value and feed on offer (FOO) of the 2 pasture types in summer/autumn and winter (see text for details).

Period	FOO (t/ha)	CP (%)	DMD (%)	ME (MJ/kg)
Summer/autumn				
Stubble/annual pasture	1.31	9.3	53.0	7.6
Lucerne	0.87	13.2	62.1	9.0
Winter				
Stubble/annual pasture	0.87	11.5	59.5	8.7
Lucerne	1.19	21.5	74.9	11.3

DISCUSSION

Liveweight is generally responsive to either the quality and/or quantity of pasture available to animals. Lloyd-Davies and Hindmarsh (1996) found liveweight gain was highest in sheep grazing lucerne in summer/early autumn in comparison to grasses. During summer/autumn, the average liveweight gain of the lucerne group was significantly higher than the group grazing stubbles. In contrast, those animals grazing annual pastures over winter gained weight at a significantly higher rate than those grazing lucerne. Sheep grazing lucerne during summer/autumn, and then annual pastures during winter, achieved superior overall liveweight gains compared with sheep continuously grazing stubbles/annual pasture, but similar liveweight gains to those grazing lucerne continuously. There was no evidence of compensatory growth following the transfer of animals previously grazing stubble to lucerne. Compensatory growth normally occurs following a period of nutrient restriction. Given the low stocking rates used in this trial, in addition to the provision of supplements, the positive weight gains suggest it is unlikely that the sheep grazing stubbles over summer/autumn experienced any significant nutrient/feed restriction.

In general, legume pastures are considered to be of higher quality than grass pastures and this is reflected in improved animal performance (Lloyd-Davies and Hindmarsh 1996). Whilst the results of this trial are in agreement for the summer/autumn period, the higher nutritive value of the lucerne to annual pastures in winter was not reflected in improved weight gain. During summer/autumn, FOO was higher for stubble/annual pasture than lucerne, while the reverse applied during winter. Purser (1981) suggests that, during winter, herbage availability is limiting animal production. In this trial, whilst the herbage availability and nutritive value of lucerne were higher than annual pastures in winter, liveweight gains were less than those achieved on annual pastures. With the stocking rates used in this trial, however, it is unlikely that herbage availability was a limiting factor. Further work is needed to determine the limiting factors to animal production when grazing lucerne in winter.

Despite the differences in the nutritive value of lucerne and stubble/annual pastures, this was not reflected in either wool growth or fleece characteristics. There were no variations in wool growth, either overall or between seasons. This is in contrast to Reed *et a*l (1972) who found that in summer, the growth rate of wool was greater for sheep grazing lucerne than those grazing grass dominant pastures. Other researchers, however, have shown that increased feeding of sheep during summer/autumn in a Mediterranean climate can have almost no effect on fibre diameter and fleece weight (Peterson *et al.* 1998). The lack of response in wool growth may have been due, in part, to either the supplements provided to the sheep grazing stubbles during the summer/autumn period and/or to the relatively low stocking rates used in the trial, which potentially enabled the sheep to be highly selective in their grazing, masking any effects of variations in pasture type.

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