Proc. Aust. Soc. Anim. Prod. 1996 Vol. 21

POTENTIAL VARIATION IN SHEEP PRODUCTION FROM DIFFERENT CULTIVARS OF SUBTERRANEAN CLOVER

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SUMMARY

Nine strains of subterranean clover were sown with 8 replicates and grazed at a 2-weekly interval by sheep. The feed on offer, dry matter digestibility and nitrogen content were measured in winter, spring and summer from samples cut to ground level. The results indicated a great variation in animal production potential among cultivars. The mean bodyweight gain of sheep predicted using Grazfeed in winter, spring and summer was 145-172, 133-179 and -71-39 g/day respectively. This variation indicates the potential for considerable differences among cultivars in their ability to support animal production when sheep are grazed on these cultivars as pure swards.

Key *words:* subterranean clover, sheep production

INTRODUCTION

Subterranean clover is one of the most important pasture legumes in southern Australia due to its wide distribution and high nutritive value. It has a dry matter digestibility of 80% and nitrogen content of 3-4% in winter and spring. However, within this species, cultivars perform differently in supporting animal production under grazing systems. Nicholas (1972) compared production of sheep grazing different cultivars and found that sheep lost bodyweight when grazing Dinninup, Dwalganup and Geraldton and gained weight when grazing Seaton Park and Daliak even though Dinninup and Dwalganup had greater feed on offer (FOO). This may have resulted from variation in any component of feeding value such as availability, palatability and nutrient concentrations and their utilisation. To assess strains of subterranean clover, Hume *et al.* (1968) compared the nutritive value of the early maturity cultivar Yarloop and the mid-season cultivar Woogenellup using pure ungrazed swards. The result showed Woogenellup had a higher nutritive value in terms of dry matter digestibility (DMD) and N content. Variation in intake among cultivars was also reported by Purser (1980), where he found Dinninup had a lower intake than Daliak. However, these comparisons were based on ungrazed swards or cultivars with different flowering times which suit different environmental conditions. There is limited information available on the variation in feeding value among cultivars suited to similar environmental conditions. Therefore, in this work 9 subterranean clover cultivars, with flowering times of about 110-130 days after sowing, were grazed at intervals to permit expression of variable sward structures through selective grazing and to then assess their potential feeding value.

MATERIALS AND METHODS

Nine genotypes of subterranean clover (Table 1) were sown in 2 blocks with 4 replicates at Shenton Park Field Station, Perth, Western Australia in May 1993. The sowing rate was about 30 kg/ha except for York which was sown at 20 kg/ha due to the seed shortage.

From 17 August, the plots were grazed by sheep at 2-weekly intervals until 12 October. At each grazing, 30 sheep were fasted overnight and introduced to the plots in the morning. The plots were grazed for about 2-6 hours, depending on the amount of herbage available, to generate a grazing intensity commonly occurring in the field. The amount of herbage grazed by animals, estimated visually according to the amount of herbage remained after grazing, were 60±3.9%, 53±3.4%, 63±2.4%, 71~2.2% and 58±1.8% respectively on the 5 occasions. In the middle of September, the plots were fertilised with super and potash at a rate of 200 kg/ha. Late in the growing season plots were irrigated until 9 November.

Plant samples were taken from each plot by cutting a quadrat (0.1 m^2) of herbage above ground level (Craig 1992; Dear *et al.* 1995) on 17 August (winter), 12 October (spring) and 20 December (summer). Weight was determined and 1 subsample was dried at 80 °C for 48 hours to estimate the dry matter (DM) content. Another subsample was freeze dried and ground for chemical analysis and estimation of DMD.

The DMD was estimated using the pepsin-cellulase method (Goto and Minson 1977), and nitrogen was analysed using a LECO-CHN 1000 combustion system.

The variation among cultivars was compared by analysis of variance using Systat (Wilkinson *et al.* 1992).

RESULTS

Variation in FOO among cultivars occurred in winter and spring, even though it was not significant ($P>0.05$) (Table 1). The dry residues in summer varied significantly among cultivars ($P<0.01$) and were higher for Woogenellup, Bacchus Marsh and Dinninup.

Table 1. The variation in FOO (g/m^2), DMD (%) and nitrogen content (%) among cultivars of subterranean clover in different seasons

Season	Bacchus Marsh	Dinninup	Enfield	Esperance	Green Range	Junee	Seaton Park	Woogen-ellup	York	LSD (P<0.05)
					FOO					
Winter	102.2	101.6	93.3	76.1	80.4	91.5	82.8	84.3	74.3	ns[A]
Spring	321.3	359.6	239.9	317.3	336.5	304.4	284.7	279.4	318.0	ns
Summer	521.4	548.3	326.9	496.6	457.2	496.2	357.7	577.4	360.7	100.0
					DMD					
Winter	77.5	77.0	78.0	76.6	75.7	79.4	77.8	80.0	76.8	2.1
Spring	67.2	68.2	67.9	65.5	67.7	70.2	66.4	70.9	65.5	1.8
Summer	53.0	47.4	49.4	48.4	46.7	50.1	51.7	51.4	41.6	5.5
					Nitrogen					
Winter	4.05	4.22	4.43	4.25	4.37	4.22	4.41	4.32	4.28	0.13
Spring	2.96	2.78	3.04	2.73	2.76	2.94	2.71	2.99	2.44	0.17
Summer	3.07	2.61	3.30	3.02	2.74	2.67	2.73	2.66	2.46	0.16

[A]no significant difference.

The DMD declined as plants matured and differed significantly ($P<0.01$) over all seasons among cultivars. In spring, Woogenellup and Junee had the highest DMD of 70% while York, Esperance and Seaton Park had a low DMD of 66%. In summer, the DMD of Bacchus Marsh and Woogenellup were higher, with that of York being the lowest. There was a variation in the decline rate of DMD from spring to summer among cultivars with a similar flowering time. For example, the cultivars Seaton Park, Dinninup and York, with a flowering time of 110 days, had 15%, 21% and 24% units decline respectively.

N content in winter was significantly lower ($P<0.05$) for Bacchus Marsh than Enfield, Green Range, Seaton Park and Woogenellup. In spring, York had lower, and Enfield had higher N content ($P<0.05$) than any other cultivars except Seaton Park. For dry residues, Bacchus Marsh, Enfield and Esperance had a nitrogen content over 3% while York had the lowest nitrogen content of 2.46%. Nitrogen content of Bacchus Marsh, Enfield and Esperance were higher in summer than in spring, presumably due to the contribution of some seed above-ground to the samples.

DISCUSSION

Variation in herbage availability and nutritive value among cultivars existed throughout the growing season. The average FOO of 9 cultivars were 87.4, 306.8 and 460.2 g/m^2 in winter, spring and summer respectively. Dinninup and Bacchus Marsh had higher FOO while Seaton Park and Enfield were lower in both spring and summer. This variation was partly, if not totally, a reflection of difference in growth rate. However, the low FOO of York was confounded by the low sowing rate (20 kg/ha). When cultivars were ranked on DMD in spring and summer they changed dramatically with maturation. For example, Seaton Park had lower DMD in spring and higher DMD in summer. This seasonal change in the rank of DMD was associated with increase of cell wall content and lignification, which was indicated by the performance of cultivar York which was consistently lower in DMD and N, and higher in fibre (Y.J. Ru, unpubl. data).

To compare the feeding value of the various cultivars, the data in Table 1 was used to estimate the potential production of animals grazing pure swards of these subterranean clover cultivars using Grazfeed (Anon. 1989) simulations. The predicted intake by mature Merino wethers with 48 kg

bodyweight showed there was no significant difference in forage intake among cultivars in both winter (1.38-1.47 kg DM/day) and spring (1.45-1.53 kg DM/day). However, the estimated intake in summer was significantly different among cultivars. Sheep grazing Bacchus Marsh, Junee, Seaton Park and Woogenellup were predicted to have a higher intake of 1.20-1.26 kg DM/day while those on York had the lowest of 0.97 kg DM/day. Sheep grazing other cultivars would have a intake close to the group means (1.16 kg DM/day). The low intake of York resulted from the low DMD and FOO of this cultivar. The difference in intake between Seaton Park and York with a similar FOO of 357-360 g DM/m^2 might be a result of variation in both chemical composition and DMD. The predicted intake declined by 22% from spring (1.49±0.03 kg DM/day) to summer (1.16±0.08 kg DM/day). This decline may have been due to the increase of fibre content affecting both digestibility and turnover of rumen fluid, and the decrease in bite dimensions that affect intake rate (Flores ***et al.*** 1993).

The predicted bodyweight gains were different among cultivars. The variation in animal production increased with the progress of season. In winter, animal production was limited mainly by herbage availability because the DMD and nitrogen contents were similar among cultivars. Sheep grazing Bacchus Marsh, Enfield, Junee and Woogenellup were predicted to have higher bodyweight gain (170±0.85 g/day) while those grazing York and Green Range were predicted to have lower (146±0.82 g/day).

In spring, animal production should not be limited by either quality or quantity of herbage (Purser 1980). However, the results of this experiment showed that variation in animal production was likely to be associated with the cultivar grazed. The predicted bodyweight gain of sheep grazing York, Esperance and Seaton Park was only 138±3.52 g/day, but the gain of those grazing Bacchus Marsh, Junee, Green Range and Woogenellup was 174±2.48 g/day in spring. For cultivars York and Junee with a FOO of 304-3 18 g DM/m^2, the predicted bodyweight gain of sheep grazing Junee would be 44 g/day more than those on York pastures due to the 5% unit difference in DMD and 0.5% unit in nitrogen (Table 1).

The variation in animal production was greater in summer. Sheep grazing York might lose bodyweight of 71 g/day and those grazing Enfield, Green Range and Dinninup cultivars could maintain their bodyweight. Sheep grazing Bacchus Marsh, Junee, Seaton Park or Woogenellup would be expected to have a gain of 27 g/day. This result further supported the potential contribution of cultivar choice to animal production in the dry summer.

In current subterranean clover breeding programmes, most breeders focus on the adaptation to environment, DM production and seed yield. However, DM production was not a good indicator of animal production, especially in summer when the pasture quality is the key factor limiting animal production. For example, sheep grazing Enfield and Green Range would seem likely to have similar production in summer even though the FOO of Green Range was about 130 g DM/m^2 higher. On the other hand, predictions of liveweight change for sheep grazing York were -71 g/day, while Seaton Park would be expected to offer gains of 19 g/day, even though these 2 cultivars had similar FOO about 360 g DM/m^2. The variation in predicted feed intake and its association with forage quality indicate the gains that might be possible if feed quality is a key selection criterion used in subterranean clover breeding programmes.

ACKNOWLEDGEMENTS

The authors thank Mr Les Cranfield for his assistance with the field trial. Y. J. Ru is in receipt of an AusAID scholarship from the Australian Government.

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