Use of novel spatial presentations of plant species to improve legume abundance

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Introduction The benefits of using white clover (Trifolium repens) in pasture grazed by sheep have been widely recognised. However, clover is considered inadequate and risky as the main source of nitrogen input, since its abundance in the pasture is patchy, low (typically less than 20%) and shows great year-to-year variation. This is thought to be due to the costs of nitrogen fixation, competition with grass, the preference for clover by sheep and patchy dung and urine deposition (Schwinning & Parsons, 1996). One possible solution may be the spatial separation of clover from grass, which would remove inter-specific competition, allowing clover to grow unimpeded in a greater abundance than previously observed. Spatial separation can occur over a range of spatial scales, from narrow strips of alternating clover and grass to complete separation, where half a pasture is clover while the other half is grass. This in turn may have a significant impact on the processes occurring within the pasture, such as plant growth and spread, nitrogen cycling and animal behaviour.

Materials and methods The following 4 treatments were used in a field site established in 2001, in 0.15 ha plots, grazed continuously by a Suffolk flock: (1) mixed pasture, and 50:50, by ground area, (2) alternating 1.5m strips of grass and clover monocultures (partial separation), (3) 3m strips (partial separation) and (4) adjacent monocultures (full separation). As part of a longer study, in spring 2004, herbage production using exclosure cages and sward surface height were measured as described by Frame (1993). Grazing behaviour was observed on 3 occasions to estimate intake.

Results Table 1 shows the mean herbage production. Analysis of variance showed that production of white clover in spatially separated plots was significantly greater ($F_{1,6}$=19.91, P<0.01), although overall herbage production was significantly greater in mixed plots than spatially separated plots ($F_{1,6}$=20.24, P<0.01). Combining observed grazing behaviour with sward surface height (SSH), as described by Rook *et al*., (2002), a selection coefficient was calculated (Figure 1).

Table 1 Mean herbage production (kg DM/ha/day)

Treatment	Total	Clover
Mixed	37.67	1.52
1.5m strips	22.71	4.75
3m strips	23.04	3.48
Adjacent monocultures	25.79	4.63

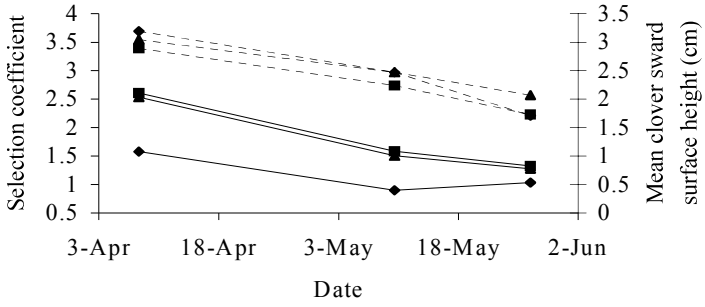

Figure 1 Mean clover SSH (- -) and selection coefficient (—) for clover by grazing sheep on 1.5m (▲), 3m (♦) strips and adjacent monocultures (■)

Conclusions The initial results of this study showed that spatially separating grass from clover produced higher dry matter content of clover in the sward, compared to mixed pastures. A selection coefficient of spatially separated treatments >1 (Figure 1) indicates that the sheep were actively selecting clover, despite the declining SSH. Further work with this system to estimate pasture composition through time and an economic evaluation of the method of spatial separation is expected to incorporate additional experimental work and a cellular automata-based model (Schwinning & Parsons, 1996).

References

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